Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

UNPROTECTED/NON PROTÉGÉ

REPLACEMENT/REMPLACEMENT

(Replaced on June 3, 2020/Remplacé le 3 juin 2020)

CMD : 20-M13.A

Date signed/Signé le JUNE 3-2020

Approve Regulatory Documents

REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*

REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*

REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2*

REGDOC-2.11.2, *Decommissioning*

REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed*

Approuver les documents d’application de la réglementation

REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur*

REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*

REGDOC- 2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour la gestion à long terme des déchets radioactifs, version 2*

REGDOC-2.11.2, *Déclassement*

REGDOC- 3.3.1, *Garanties financières pour le déclassement des installations nucléaires et*

e-doc 6099894 (WORD)
e-doc 6310942 (PDF)

Canada

Activities

la cessation des activités autorisées

Public Meeting

Réunion publique

Scheduled for:

June 18, 2020

Prévue pour le :

18 juin 2020

Submitted by:

CNSC Staff

Soumis par :

Le personnel de la CCSN

NOTE:

CMD 20-M13.A was filed to correct formatting errors. No changes were done to the content.

REMARQUE :

Le CMD 20-M13.A a été déposé pour corriger des erreurs de mise en page. Aucun changement n’a été fait au contenu.

e-doc 6099894 (WORD)
e-doc 6310942 (PDF)

Summary

This CMD pertains to a request to the Commission to approve the following draft regulatory documents:

- REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*
- REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*
- REGDOC-2.11.1, *Waste Management Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2*
- REGDOC-2.11.2, *Decommissioning*
- REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

For the draft regulatory documents listed above, the following associated documents are attached:

- draft REGDOC-1.2.1: Comments Disposition Table and the Consultation Report
- draft REGDOC-2.11.1, Volume I: Comments Disposition Table and the Consultation Report
- draft REGDOC-2.11.1, Volume III: Comments Disposition Table and the Consultation Report

Résumé

Ce document à l'intention des commissaires (CMD) concerne une demande de décision au sujet de :

- l'ébauche du document d'application de la réglementation REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur*
- l'ébauche du document d'application de la réglementation REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
- l'ébauche du document d'application de la réglementation REGDOC- 2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour la gestion à long terme des déchets radioactifs, version 2*
- l'ébauche du document d'application de la réglementation REGDOC-2.11.2, *Déclassement*
- l'ébauche du document d'application de la réglementation REGDOC- 3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées*

Les pièces suivantes sont jointes :

- l'ébauche du REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* avec le rapport de consultation et le tableau des réponses aux commentaires reçus
- l'ébauche du REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* avec le rapport de consultation et le tableau des réponses aux commentaires reçus
- l'ébauche du REGDOC-2.11.1, *Gestion*

- draft REGDOC-2.11.2: Comments Disposition Table and the Consultation Report
- draft REGDOC-3.3.1: Comments Disposition Table and the Consultation Report

des déchets, tome III : Dossier de sûreté pour la gestion à long terme des déchets radioactifs, *version 2* avec le rapport de consultation et le tableau des réponses aux commentaires reçus

- l'ébauche du REGDOC-2.11.2, *Déclassement* avec le rapport de consultation et le tableau des réponses aux commentaires reçus
- l'ébauche du REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* avec le rapport de consultation et le tableau des réponses aux commentaires reçus

Signed/signé le

June 3, 2020 / 3 juin 2020

6/3/2020

X

Brian Torrie

Signed by: Torrie, Brian

Director General

Regulatory Policy Directorate

Directeur général de la

Direction de la politique de réglementation

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EXECUTIVE SUMMARY

This Commission Member Document presents a suite of regulatory documents that set out requirements and guidance for waste management and decommissioning activities for relevant licensees and applicants.

The following documents are part of this suite:

- draft REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*
- draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*
- draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste,* Version 2
- draft REGDOC-2.11.2, *Decommissioning*
- draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

The purpose of these draft regulatory documents is to provide requirements and guidance to ensure: that radioactive waste is safely managed and disposed of, decommissioning is planned and executed safely and a fund for decommissioning is established and maintained.

CNSC staff developed these regulatory documents taking into account international regulatory best practices and modern codes and standards including the International Atomic Energy Agency's safety standards.

Given the high level of interest on the subjects of radioactive waste management and disposal, and on decommissioning of nuclear facilities, CNSC staff conducted extensive consultation during the development of these draft regulatory documents. Staff engaged in an ongoing exchange with stakeholders, starting with the 2016 publication of discussion paper DIS-16-03, *Radioactive Waste Management and Decommissioning*. In 2018 and 2019, the five draft regulatory documents underwent a public consultation process including workshops that were held with industry, interested members of the public and civil society organizations. After each round of consultations, the documents were revised, as appropriate, to address the feedback raised.

Section 2 of this Commission Member Document presents a list of the key comments received during public consultation. The attached detailed comment disposition tables provide all the comments received on the suite of draft regulatory documents as well as CNSC staff's dispositions of each comment.

These draft regulatory documents are intended to form part of the licensing basis for waste management and decommissioning activities for applicable CNSC licences. If the regulatory documents are approved by the Commission, implementation plans for each document containing requirements will be established through discussions and consultations between CNSC staff and licensees, in accordance with the CNSC's process

for the implementation of regulatory documents. As part of the implementation plans, licensees will adopt the requirements expressed in the regulatory documents as part of their licensing basis, thereby providing the CNSC with the legal authority to enforce these requirements.

The International Atomic Energy Agency's Integrated Regulatory Review Service mission to Canada in 2019 commented that the CNSC has "a comprehensive and robust regulatory framework". Their comments regarding waste and decommissioning framework were considered in revising the regulatory documents.

1 OVERVIEW

1.1 Background

The CNSC is committed to maintaining a waste management and decommissioning regulatory framework that is modern and aligned with national and international standards and best practices. To that end, this Commission Member Document (CMD) presents five draft regulatory documents (REGDOCs) related to waste and decommissioning for Commission approval to enhance and improve the existing framework.

In 2016, CNSC staff issued a discussion paper, DIS-16-03, *Radioactive Waste Management and Decommissioning* to solicit stakeholder feedback regarding the CNSC's regulatory framework for waste management and decommissioning. Following this consultation, CNSC staff proceeded to codify existing regulatory requirements and guidance and develop new draft REGDOCs.

As part of the development of these draft REGDOCs, CNSC staff extensively reviewed the applicable international safety standards and publications. Through this work, staff ensured that the CNSC regulatory framework is aligned with international guidance and best practices as well as Government of Canada policies.

These REGDOCs are complemented by CSA Group standards such as N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* and N294 *Decommissioning of Facilities Containing Nuclear Substances*, which together set out the CNSC's expectations for waste and decommissioning activities.

Once approved by the Commission, the following draft REGDOCs would be part of the CNSC's waste management series of regulatory documents, which also covers decommissioning:

- REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*
- REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2
- REGDOC-2.11.2, *Decommissioning*

The following draft REGDOCs would supplement the waste management series:

- REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*
- REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

1.2 Highlights

CNSC staff are presenting five draft REGDOCs on waste management and decommissioning to the Commission for its approval. These documents clarify and codify regulatory expectations, leveraging previous publications, operational experience and incorporating national and international guidance and best practices while taking into account the Canadian context. These draft REGDOCs contribute to a modern framework that enhances the effective regulatory oversight of waste management and decommissioning facilities and activities to ensure safety.

As part of the development of these draft REGDOCs, CNSC staff conducted a benchmarking exercise with International Atomic Energy Agency (IAEA) safety standards. A breakdown of the IAEA safety standards used to develop these draft REGDOCs can be found in appendix A. Comments from the 2019 Integrated Regulatory Review Service (IRRS) mission regarding the regulatory framework and waste and decommissioning were also considered in the drafts.

These draft REGDOCs are a result of the CNSC's initiative to modernize the regulatory framework in the areas of radioactive waste management and decommissioning. Table 1 shows which documents would be superseded by these draft REGDOCs, should they be approved by the Commission.

Table 1: Modernized documents

REGDOC Title:	**Supersedes:**
REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*	R-72, *Geological Considerations in Siting a Repository for Underground Disposal of High-Level Radioactive Waste* (1987)
REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*	Not applicable
REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2	REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste* Management (2018)
REGDOC-2.11.2, *Decommissioning*	G-219, *Decommissioning Planning for Licensed Activities* (2000)
REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*	G-206, *Financial Guarantees for the Decommissioning of Licensed Activities* (2000)

1.2.1 Highlights for REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*

Draft REGDOC-1.2.1 establishes guidance on site characterization for a deep geological repository (DGR) facility for radioactive wastes. While the collection of site characterization information begins prior to licensing, site characterization information is integral for federal impact assessments and licence applications for DGR facilities. Site characterization information should inform the design of a DGR facility, and be updated and/or re-evaluated over the lifecycle of a DGR facility. This includes CNSC licensed phases for site preparation, construction, operation, decommissioning and closure.

A DGR is an engineered facility where radioactive wastes are emplaced in a deep, stable, geological formation designed to isolate and contain radioactive wastes over the long-term. Site characterization involves detailed technical investigations to increase the state of knowledge about a particular site. Regional and site-specific information is used to gain an understanding of a potential site, and the features and processes that might affect the long-term performance of a DGR facility at that site. These processes involve a number of scientific disciplines (hydrogeology, rock mechanics, geochemistry, etc.) that are integrated and interpreted together.

1.2.2 Highlights for REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*

Draft REGDOC-2.11.1, Volume I provides requirements and guidance for licensees who manage radioactive wastes. Furthermore, this document clarifies CNSC regulatory expectations for licensed facilities and activities that are required to have a waste management program.

More specifically, the draft REGDOC provides requirements and guidance on:

- Waste management programs
- Radioactive waste classification, waste characterization and waste acceptance criteria
- Steps in the management of radioactive wastes
- Waste packages
- Radioactive waste storage facilities
- Radioactive waste disposal facilities

1.2.3 Highlights for REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste,* Version 2

Draft REGDOC-2.11.1, Volume III provides requirements and guidance for the development of a safety case and supporting safety assessment for the post-closure phase of disposal facilities, locations or sites for all classes of radioactive wastes. This document also applies to long-term radioactive waste management facilities where there is no intention to retrieve the wastes.

For the post-closure safety case, the emphasis is on the performance of the disposal facility and its assessment after closure. The post-closure safety case considers information from the pre-closure phase (site preparation, construction, operation, decommissioning) insofar as this information impacts post-closure safety.

The safety case is the main tool used to document and demonstrate that a disposal facility will adequately protect people and the environment during its entire lifecycle for perpetuity. The safety case is a structured framework for documenting and presenting all of the safety-related information for a disposal facility in a consolidated manner.

1.2.4 Highlights for REGDOC-2.11.2, *Decommissioning*

Draft REGDOC-2.11.2 provides requirements and guidance regarding the planning, preparation, execution and completion of decommissioning. This document applies to Class I and Class II nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices licensees who are required to have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their licence. For all other licensees, the information in this regulatory document may be used as guidance.

The CNSC defines decommissioning as the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, used, possessed or stored. Decommissioning actions are the procedures, processes and work activities (e.g., decontamination, dismantling or cleanup) that are taken to retire a facility from service with due regard for the health and safety of people and the environment.

The revised document addresses the IRRS's final report suggesting that the CNSC revise its decommissioning requirements to better align with the IAEA guidance concerning entombment. REGDOC-2,11,2 now clarifies that *in-situ* decommissioning is not considered a reasonable approach to existing nuclear power plants, or for future nuclear facilities and situations where removal is possible and practicable.

1.2.5 Highlights for REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

Draft REGDOC-3.3.1 provides requirements and guidance to applicants and licensees regarding the establishment and maintenance of financial guarantees for decommissioning of nuclear facilities or activities authorized under Class IA, Class IB, Class II, uranium mines and mills and waste nuclear substance licences. It also applies to the termination of licensed activities, such as for nuclear substances and radiation devices and prescribed equipment.

Applicants and licensees are required to make adequate provision for the safe decommissioning of existing or proposed new nuclear facilities by ensuring that sufficient financial resources are available to fund all planned decommissioning activities. The REGDOC provides the criteria for acceptance of the financial guarantees and examples of acceptable financial instruments. In all cases the financial guarantees must be accepted by the Commission or, where a designated officer has issued a licence, by the designated officer.

A financial guarantee does not relieve licensees of compliance with regulatory requirements for decommissioning of nuclear facilities or termination of licensed activities. The financial guarantees ensure that, if licensees are unable to carry out decommissioning or termination of activities, funds are available to the CNSC to arrange for safe decommissioning or termination of activities. Financial guarantees must be sufficient to cover the cost of decommissioning or termination of licensed activities authorized by a licence.

2 CONSULTATION

Discussion Paper

CNSC staff have extensively engaged with many stakeholders on modernizing the waste management and decommissioning framework. In 2016, DIS-16-03 was issued for public consultation for 120 days. The comments received fell into general themes including waste classification, waste minimization and waste management program requirements. Comments received were posted on the CNSC website for feedback for 20 days, followed by a *What We Heard Report* published in 2017. Feedback received on discussion paper DIS-16-03 was considered in the development of the draft REGDOCs in this suite.

Draft REGDOCs

The draft REGDOCs in this suite of documents were issued individually and separately for public consultation, each for a minimum period of 60 days (see the consultation reports for more details on the dates and length of consultation period for each REGDOC).

Throughout the consultation periods for these draft REGDOCs, starting in the fall of 2018, until the fall of 2019, 476 comments were received from 24 respondents. CNSC staff thank each and every individual and group who took the time to review and provide comments on these documents. Each comment received was considered and responded to, and changes were made to the documents as appropriate. Active engagement by all stakeholders allows for a better product and information that is better informed from a variety of different perspectives.

Table 2 shows the consultation dates and number of comments received for each draft REGDOC in this suite. The list of commenters is available in the attached comment disposition tables.

Table 2: Public Consultation Periods for Each REGDOC and List of Commenters

	REGDOC-1.2.1	REGDOC-2.11.1, Vol. I	REGDOC-2.11.1, Vol. III	REGDOC-2.11.2	REGDOC-3.3.1
Public consultation	Oct. 19 to Dec. 17, 2018	Mar. 29 to Jun. 30, 2019	May 24 to Sep. 16, 2019	Jul. 16 to Oct. 16, 2019	Jul. 26 to Sep. 24, 2019

	100 comments	117 comments	126 comments	102 comments	33 comments
Feedback on comments	Jan. 18 to Feb. 8, 2019 78 comments	Jul. 18 to Aug. 1, 2019 42 comments	Oct. 19 to Nov. 5, 2019 14 comments	Dec. 2 to Dec. 20, 2019 31 comments	Nov. 6 to Nov. 26, 2019 No comments were received

Workshops

During public consultation members of the public, Civil Society Organizations (CSOs) and industry expressed interest for the CNSC to host workshops in order to review how comments were dispositioned and engage on a common understanding of the documented information. In response, CNSC staff hosted a workshop for industry on February 5th, 2020 and a webinar with members of the public and CSOs on February 26. The latter session was not very successful, due to technical difficulties and a lack of adequate engagement; therefore, a second webinar with members of the public and CSOs was held April 23rd, 2020. Topics discussed included waste classification, definitions, the CNSC's regulatory role, of *in-situ* decommissioning and alignment with IAEA requirements and guidance. Full comments and CNSC staff responses can be found in the attached detailed comments tables.

Table 3: Workshops Participants after Public Consultation

Workshop with Industry	**Webinar with CSOs**
February 5, 2020	April 23, 2020
• Bruce Power • BWXT • Cameco • Canadian Nuclear Association • Canadian Nuclear Laboratories • CANDU Owners Group • Hydro-Québec • Kinetrics • New Brunswick Power • NWMO • OPG • Orano	• Canadian Environmental Law Association • Concerned Citizens of Renfrew County and Area • Dr. Sandy Greer • Gordon Edwards • Dodie LeGassick • Northwatch • Ralliement Contre la Pollution Radioactive • Regional Municipality of Durham • Michael Stephens

Targeted Consultation

Draft REGDOC-1.2.1 and draft REGDOC-2.11.2 underwent an additional round of targeted consultations.

In the case of REGDOC-1.2.1, the Independent Geoscience Advisory Group (IAG) had not made any submissions during the consultation period and their request to review the document, after the close of consultation, was granted by CNSC staff. The IAG review occurred between June 14 and August 5, 2019. Comments received by members of the IAG are included in the attached detailed comments table for REGDOC-1.2.1.

After public consultations were performed for REGDOC-2.11.2, the scope was clarified to explicitly list Class II facilities. CNSC-Canadian Radiation Protection Association-Canadian Organization of Medical Physicists, a working group representing Class II licensees in the commercial, medical and industrial sectors from across Canada, was directly consulted between January 27 to March 2, 2019. No comments were received from this targeted consultation.

Key Themes

The following key themes were raised during public consultation for this suite of draft REGDOCs:

- Clarity of definitions and terminology
- The role of CSA standards in the CNSC regulatory framework
- Alignment with international and national safety standards
- Scope and the applicability of REGDOCs to various types of licensees
- Use of the graded approach
- Waste characterization and classification
- *In-situ* decommissioning strategy
- Public engagement in planning for and licensing of waste management and decommissioning activities

Several comments were also received related to the Government of Canada’s radioactive waste policies, which are beyond the mandate of the CNSC. CNSC staff responded by explaining that the CNSC's role is to ensure safety and that Natural Resources Canada is the government agency responsible for developing policy. These comments were directed to Natural Resources Canada for future consideration.

The consultation reports for each of the REGDOCs specifies CNSC staff responses to key themes raised during consultation for each document. The full responses to stakeholder feedback on the draft REGDOCs can be found in their detailed comments tables included as part of the CMD package.

3 IMPLEMENTATION

Should the Commission approve the publication of this suite of REGDOCs, each would be published on the CNSC’s website and made available to licensees and stakeholders.

If approved by the Commission:

- REGDOC-1.2.1 will supersede R-72, *Geological Considerations in Siting a Repository for Underground Disposal of High-Level Radioactive Waste*
- REGDOC-2.11.1, Volume III, Version 2 will supersede REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management*
- REGDOC-2.11.2 will supersede G-219, *Decommissioning Planning for Licensed Activities*
- REGDOC-3.3.1 will supersede G-209, *Financial Guarantees for Decommissioning of Licensed Activities*

REGDOC-2.11.1, Volume I, REGDOC-2.11.1, Volume III, REGDOC-2.11.2, and REGDOC-3.3.1 are intended to form part of the licensing basis for applicable Class I facilities, Class II facilities, uranium mines and mills, and other licensees as appropriate. REGDOC-1.2.1 will not be considered in a licensing basis because it consists of guidance only.

After publication, CNSC staff would contact licensees who should implement the REGDOCs and formally request implementation plans and gap analyses. Once the request is sent, licensees are typically given 6 months to address the request. Specific implementation plans and associated timelines are established through follow-up discussions between CNSC staff and individual licensees. REGDOC implementation status is reported in ongoing basis to the Commission through the appropriate Regulatory Oversight Report.

4 OVERALL CONCLUSIONS AND RECOMMENDATIONS

4.1 Overall Conclusions

These draft REGDOCs were developed through extensive consultation with multiple stakeholders. These documents communicate and formalize the CNSC's requirements and guidance related to waste management and decommissioning activities. The draft REGDOCs align with domestic and international best practices and Canadian policies.

CNSC staff conclude that this suite of REGDOCs is ready for final approval by the Commission for publication.

4.2 Overall Recommendations

CNSC staff recommend that the Commission approve:

- REGDOC-1.2.1 , *Guidance on Deep Geological Repository Site Characterization*;
- REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*;

- REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2;
- REGDOC-2.11.2 *Decommissioning*; and
- REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*.

APPENDIX A:

CNSC use of IAEA waste safety standards in the development of the draft REGDOCs:

REGDOC	IAEA Safety Standards Referenced or Influenced By
1.2.1, *Guidance on Deep Geological Repository Site Characterization*	SSR-5, *Disposal of Radioactive Waste* (2011) SSG-14, *Geological Disposal Facilities for Radioactive Waste* (2011)
2.11.1, *Waste management, Volume I: Management of Radioactive Waste*	GSR-5, *Predisposal Management of Radioactive Waste*, (2009) GSG-1, *Classification of Radioactive Waste* (2009) SSG-40, *Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors* (2016) SSG-41, *Predisposal Management from Nuclear Fuel Cycle Facilities* (2016) WSG-6.1, Storage of Radioactive Waste (2006) SSR-5, *Disposal of Radioactive Waste* (2011) SSG-15, *Storage of Spent Fuel* (2012) SSG-29, *Near Surface Disposal Facilities for Radioactive Waste* (2014) SSG-31, *Monitoring and Surveillance of Radioactive Waste Disposal Facilities* (2014) SSG-14, *Geological Disposal Facilities for Radioactive Waste* (2011)
2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2	GSR-5, *Predisposal Management of Radioactive Waste*, (2009) SSR-5, *Disposal of Radioactive Waste* (2011) SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, (2012) GSG-3, *The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste*, (2013)
2.11.2, *Decommissioning*	GSR-6, *Decommissioning of Facilities*, (2014) GSR-4, *Safety Assessment for Facilities and Activities*, (2016) WS.G-2.4, *Decommissioning of Nuclear Fuel Cycle Facilities* (2001) WS-G-2.1, *Decommissioning of Nuclear Power Plants and Research Reactors* (1999) WS-G-5.2, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities*, (2018)
3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*	GSR-6, *Decommissioning of Facilities*, (2014)

Canada's Nuclear Regulator

CNSC CCSN

Class IB Facilities

Guidance on Deep Geological Repository Site Characterization

REGDOC-1.2.1

May 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Guidance on Deep Geological Repository Site Characterization
Regulatory document REGDOC-1.2.1

Cat. No. NNNNN
ISBN NNNNN

Également publié en français sous le titre : Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur

Document availability
This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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Facebook: facebook.com/CanadianNuclearSafetyCommission
YouTube: youtube.com/user/cnscccsn
Twitter: @CNSC_CCSN
LinkedIn: linkedin.com/company/cnsc-ccsn

Publishing history
[Month year] Version x.0

Preface

This regulatory document is part of the CNSC's regulated facilities and activities series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*, sets out guidance on site characterization for a deep geological repository (DGR) facility for radioactive waste. Information gathered for site characterization may be used in subsequent licence applications.

This document supersedes R-72, *Geological Considerations in Siting a Repository for Underground Disposal of High-Level Radioactive Waste*, published in September 1987.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization

1. Introduction

A deep geological repository (DGR) is an engineered facility where radioactive waste is emplaced in a deep, stable, geological formation designed to isolate and contain radioactive waste over the long term. Site characterization involves detailed technical investigations to increase the state of knowledge about a particular site. Regional and site-specific information are used to gain an understanding of a potential site, and the features and processes that might affect the long-term performance of a DGR facility at that site. These processes involve a number of different scientific disciplines (such as hydrogeology, rock mechanics and geochemistry) that are integrated and interpreted together.

1.1 Purpose

This regulatory document provides guidance for site characterization for a DGR facility for radioactive waste.

Site characterization information is integral to licence applications for DGR facilities. Site characterization information should be taken into account during the design of a DGR facility and re-evaluated over the lifecycle of the facility, which includes site preparation, construction, operation, decommissioning and closure.

1.2 Scope

This document describes the elements of a site characterization program for a DGR facility.

Note that this document does not:

- provide guidance on finding or selecting a site; site selection is not an activity regulated under the *Nuclear Safety and Control Act* (NSCA)
- apply to surface and near-surface waste management facilities, including waste from uranium mines and mills
- provide guidance on long-term waste management strategies
- provide requirements for safety analysis of the operational phase of DGR facilities
- provide requirements for a post-closure safety case for geological disposal
- provide guidance for environmental protection, including environmental assessment (see REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*)

In this document, the pre-closure period of a DGR encompasses site preparation, construction and operation of the DGR and the decommissioning of ancillary facilities. The post-closure (or long-term) period is the period that follows the closure of a DGR facility [5]. This long post-closure time period is a feature of DGR projects, necessitating extensive geological site characterization activities (section 3 this document) and a long-term safety case as outlined in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management*.

1.3 Relevant legislation

Facilities for the long-term management of radioactive waste, such as a DGR, are generally licensed under Class I Nuclear Facilities Regulations. A DGR would meet the definition of a

Class IB nuclear facility under Section 1(e) of the Class I Nuclear Facilities Regulations as a facility for the disposal of a nuclear substance. There is no regulatory process identified in this regulation for selecting a site. The regulatory process is not triggered until an application for a licence to prepare site or combined licence to prepare/construct site is received. The Nuclear Safety and Control Act (NSCA) applies once site preparation activities begin.

The following provisions of the NSCA and its associated regulations are relevant to this document:

- Section 26 of the NSCA
- Class I Nuclear Facilities Regulations, paragraphs 4(a) and 4(c)

The following provisions of the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it are most relevant to this document:

- *NSCA*
- *Class I Nuclear Facilities Regulations*, paragraphs 4(a) and 4(c)

2. Background

Site characterization data is used to evaluate the suitability of a possible site, inform the design of a DGR facility, and support the safety case for any potential DGR project. This information is necessary for detecting potential short- and long-term environmental impacts at various stages and for tracking what information is used (and how it is used) throughout the CNSC's licensing lifecycle for a DGR. Baseline data provides initial information for evaluating safety at the siting stage and during initial facility design, and also contributes to determining the effect of features, events and processes associated with the DGR system. Data needs include relevant regional- and site-scale information.

Early in the site selection process for a DGR facility, the project proponent should consider whether the characteristics of a site used for a DGR:

- could affect the environment
- could adversely affect an Indigenous group's potential or established Indigenous and/or treaty rights, such as the ability to hunt, trap, fish or gather, or conduct cultural ceremonies, as described in REGDOC-3.2.2, *Indigenous Engagement*

This information would be submitted with a licence application and feed into any impact assessment.

Early dialogue with the regulator for clarity on regulatory expectations and requirements is recommended. Included in this process is the identification of site characterization activities that may not require a licence from the CNSC. This can be formalized through a service arrangement between the regulator and the proponent.

2.1 Environmental reviews

The CNSC has the mandate to protect the environment. The CNSC assesses the environmental effects of all nuclear facilities or activities at every phase of their lifecycle. The CNSC requires that the environmental effects of all licensed activities be evaluated and considered when licensing decisions are made. Environmental reviews are based on the scale and complexity of the environmental risks associated with a nuclear facility or activity. Early in the process, CNSC staff determine which type of environmental review applies by reviewing the information provided by the applicant or licensee in their application and supporting documentation.

One form of environmental review is an impact assessment. Impact assessments are carried out in accordance with federal environmental legislation the *Impact Assessment Act* and its regulations). The impact assessment is led by the Impact Assessment Agency of Canada, with CNSC participation. An impact assessment decision must be rendered before a licensing decision can be made under the NSCA.

Site characterization information is an important consideration for all environmental reviews. The CNSC reviews this information during the assessment of all licence applications in the facility's lifecycle.

For more information on the CNSC's environmental review and licensing processes, see:

- REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*
- REGDOC-3.5.1, *Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills*

2.2 Public and Indigenous engagement

Potentially interested Indigenous groups should be engaged early during the site characterization phase in order to discuss project plans, gather Indigenous knowledge / land use information and address any concerns, as appropriate, early on in the site characterization and project development process.

Conducting engagement activities with the public and Indigenous groups early in the site characterization process is expected to lead to more effective and efficient consultation practices, strengthen relationships with Indigenous communities, assist the Crown in meeting its obligations regarding any potential duty to consult, and reduce the risk of delays in the regulatory review process.

Early in the site evaluation process, the applicant should develop and implement a public information and disclosure program, per REGDOC-3.2.1, *Public Information and Disclosure*. Furthermore, as set out in REGDOC-3.2.2, *Indigenous Engagement*, the applicant should identify and engage with potentially interested Indigenous groups. Information on these activities would be submitted to the CNSC as part of a licence application.

2.3 Overview of site characterization

Site characterization begins before the applicant submits a licence application to the CNSC and continues throughout the lifecycle of the DGR facility. The proponent will review and update this site characterization information, to reflect changes in the vicinity of the site and to incorporate new scientific data and knowledge. Characterization activities also support the engineering design.

Information from site characterization should be considered throughout the lifecycle of the proposed facility, to ensure that the facility's design basis and safety case remain current with changing environmental conditions or modifications to the facility itself. The site characterization information is presented in this document as follows:

- **Site characterization:** Section 3 describes the application of site characterization information in all lifecycle phases, and describes activities to include in a site characterization program:
  - section 3.1 describes the role of site characterization in the CNSC's regulatory process
  - section 3.2 provides guidance on site characterization for the geological environment
  - section 3.3 provides guidance on site characterization for the surface environment
- **Human activities and land use:** Section 4 describes information gathering on past, present and potential future human activities at or near the site
- **Data acquisition and verification activities:** Section 5 describes information that would demonstrate, in a licence application, that the results of site characterization activities are accurate, complete, reproducible, traceable and verifiable
- **Verification and site characterization:** Section 6 provides information about potential approaches to verification of site characteristics

Appendix A describes the siting process for a DGR facility, including the progress and importance of site characterization activities in the pre-application period.

3. Site Characterization for DGR Facilities

The characteristics of the host rock and geological system (that is, natural barriers) will be unique to the site chosen. The geological system refers to the characteristics influencing groundwater flow, rock mineralogy and structure, the location and properties of discontinuities, and geochemical processes. The characteristics of the surface environment provide baseline information for future environmental monitoring and potential mitigation activities.

Specific criteria provided for the collection of characterization data are not exhaustive. Guidance is presented in no specific order or priority; nor is it limited to the elements, approaches and techniques identified. Relative relevance of specific criteria will, in some cases, be site specific.

Note 1: Data and analysis results from site characterization may be used to satisfy information needed in subsequent licensing phases, as specified in the NSCA and associated regulations.

Note 2: The applicant should reject any unacceptable or inappropriate site before applying for a licence, without requiring CNSC involvement.

3.1 Role of site characterization in the CNSC regulatory process

Figure 1 shows where site characterization fits within the site selection process, and the role of site characterization in the CNSC's regulatory process. Site characterization should be part of the information gathering and initial regulatory submission activities for the proposed DGR facility.

Site characterization data plays a role in detecting potential short- and long-term environmental impacts at various stages. This information is used throughout the licensing lifecycle.

The site characteristics are used to demonstrate how the radioactive waste would be adequately contained and isolated from the environment for an extended period known as the assessment time frame [4]. Information on the assessment time frame and the requirements for the long-term safety case needed for licensing are provided in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management*. As such, site characterization is an essential component in site selection for gathering evidence on whether site attributes will meet expectations as part of a post-closure safety case. Internationally, assessment time frames associated with DGRs span tens of thousands of years or more.

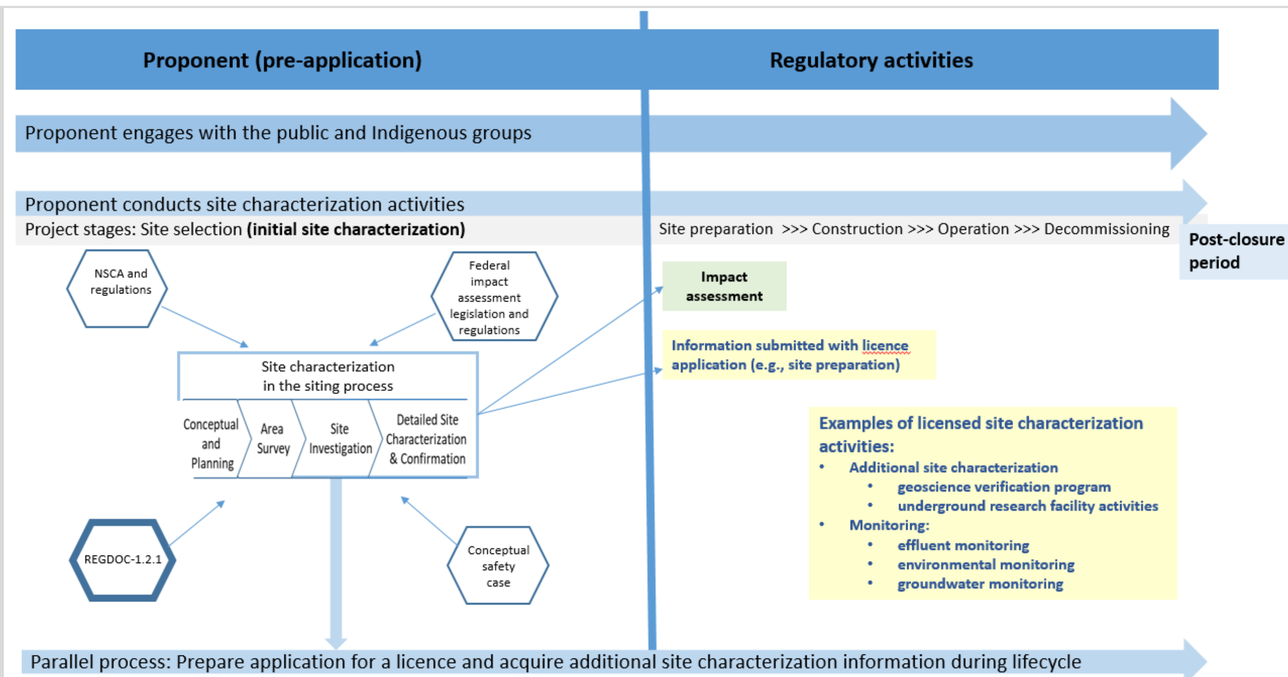
Examples of site characterization activities that would be licensed under the CNSC include:

- verification of information gathered and analyzed in earlier phases
- establishment of an adequate baseline for future monitoring
- information used in updates to the DGR facility post-closure safety case

Characterization activities that would continue until closure may be part of a geoscience verification plan.

Further information on the siting process for a DGR, including geological considerations, is available in appendix A and in international guidance documents.

Figure 1: Site characterization in the CNSC regulatory process



Site characterization data gathered during site selection should inform impact assessments and may be included in the initial licence application to the CNSC. Site characterization activities begin in a pre-application period, and would carry through to subsequent facility lifecycle phases.

3.2 Site characteristics I: Geological environment

The characteristics of the geological environment are necessary for assessing the post-closure safety of a DGR and should be considered in the engineering design. An investigation of a potential DGR site should evaluate a number of characteristics, including:

- containment and isolation characteristics of the host rock and geological system
- past and expected/projected future geological stability of the site, including the impacts of orogeny, seismicity, glaciation and volcanism
- sufficient extent of suitable host rock at the repository depth
- ability of the host rock and geological system to withstand stresses without significant breaching
- location relative to geological discontinuities
- demonstrated isolation of groundwater at selected repository depth from shallow groundwater systems
- characteristics favourable for limiting contaminant release and transport away from the DGR
- low natural resource potential, which would limit the likelihood of inadvertent future human intrusion by subsequent generations of resource explorers

For licence applications, an applicant should provide quantitative data in addition to qualitative descriptions where possible.

The key geological factors that could be used to assess the suitability of a DGR site should be evaluated using the following characteristics.

3.2.1 Geological setting

The geological characteristics, in combination with the engineered barriers and the design of the DGR, should indicate that the proposed DGR at the chosen site would remain safe for the entire period of concern (that is, including the post-closure period).

This information should include:

- tectonic setting
- structural geology
- stratigraphy
- chosen host rock type and extent
- fracture characteristics: frequency, orientation, mineralogy and spacing
- history of glacial cycles
- petrology
- geomechanical properties
- natural resource potential

Natural resource potential should be assessed quantitatively, and should include historical and current data.

3.2.2 Hydrogeological setting

Similar to the geological setting, hydrogeological setting characteristics should be used to evaluate site suitability. Information should include the following data:

- definition of regional hydrogeological regime and/or units
- regional and site-specific groundwater flow conditions (such as flow rate, flow direction, hydraulic heads and hydraulic gradients)
- hydrogeology of major rock units
- hydrogeological properties (such as porosity and hydraulic conductivity)

- recharge and discharge areas
- water budget
- location of existing and predicted future significant water-use areas (such as groundwater wells)

This data will help identify preferential pathways, velocities, residence times and other parameters.

3.2.3 Geochemistry

Together with geological and hydrogeological data, the geochemical conditions provide essential information for predicting how contaminants could migrate from a DGR to the biosphere. Special emphasis should be placed on geochemical properties that can affect the migration of radionuclides in groundwater.

Information should include:

- mineralogy, including petrography
- groundwater/porewater geochemistry
- redox conditions
- movement of radionuclides (including, but not limited to, information on diffusion, solubility, speciation and sorption)
- movement of non-radioactive species (such as lead, arsenic, chromium and copper)
- geochemical impact of groundwater on engineered barriers
- microbiology
- potential for gas generation
- water–rock interaction

Any process that can be shown to demonstrate the potential for radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented.

3.2.4 Geological stability

The site should be located in a seismically stable region, demonstrated by an assessment of the potential for seismic or volcanic events. It should be demonstrated that any credible geological event that could occur during the assessment time frame would not impact the isolation and containment capability of a DGR.

The information that should be collected for the site and region includes:

- evidence of recent or historic active tectonic processes (neotectonics) – for example, information on Quaternary faulting and movement, soil liquefaction and volcanism
- record of seismicity at the site, including documentation of historical earthquakes, their epicentres, magnitude and intensity, and recurrence (link with regional tectonics, structural geology)
- the effect of past glaciation events on the site as a basis for assessing the impact of future glacial events (in the post-closure period considered in the safety case, per REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste*

Management), linking hydrogeological, geochemical and geomechanical rock properties with glacial history

3.2.5 Geomechanical characteristics

Geomechanical characteristics should be collected and used to assess the pre-closure and long-term stability of the underground excavations, and the evolution of the damage zone around those excavations.

Geomechanical characteristics should include:

- the magnitude and orientation of the *in situ* stress
- the stress-strain-strength properties of the intact rock, fractures and rock mass
- the influence of time, temperature, scale, anisotropy, pore fluid pressure and other relevant factors on stress-strain-strength properties
- potential to withstand glacial events

3.3 Site characteristics II: Surface environment

Baseline environmental data is used to assess and predict the effects of a project on the environment. Surface processes at the site should be sufficiently characterized to ensure that natural hazard events, such as flooding, landslides and erosion, would not impact the ability of the radioactive waste disposal system to function safely.

3.3.1 Climate

The site area meteorological conditions should be adequately characterized and considered in the design of a DGR facility. Meteorological conditions should be determined from onsite and nearby meteorological stations where possible. This data should also be used as baseline data to evaluate the transport of potential airborne releases during the pre-closure period of the DGR facility. The applicant should justify the minimum meteorological data (that is, number of years of site-specific data) and demonstrate that it is commensurate with the type of project and the chosen site. Climate normal data (that is, 30 years of climate data) should also be included.

Specific information that should be collected includes:

- local and regional climatic history and expected future trends at both the regional and more global scale
- meteorological data, which should be collected at the site, local and regional scales to adequately capture future meteorological conditions that could occur over the time scales of the project
- regional and local precipitation characteristics
- extreme and average data on temperature, precipitation, wind speed and any other relevant phenomena on a regional basis
- wind and atmospheric dispersion characteristics for potential atmospheric releases
- potential for rare and extreme weather phenomena, such as hurricanes, tornadoes and severe winter storms
- ground frost and snow cover
- evapotranspiration (that is, evaporation and transpiration from soils, water bodies and plants)
- ice dynamics on lakes and streams

- air quality

The potential for climate change to impact processes relevant to the characteristics listed above over the lifecycle of the project should be considered.

3.3.2 Aquatic and terrestrial environment

The ecosystem components should be characterized in sufficient detail to enable the assessment of their importance, potential interaction with the project, and the potential for environmental effects arising from the project activities.

The elements of the aquatic ecology that should be characterized in the area of interest include:

- surface water characteristics – physical, chemical and biological properties
- sediment characteristics – physical, chemical and biological properties
- phytoplankton communities
- aquatic macrophytes
- zooplankton communities
- benthic macroinvertebrates
- fish
- fish habitat
- species designated as “at risk”

The elements of the terrestrial ecology that should be characterized in the area of interest include:

- soil quality
- vegetation
- wildlife
- terrestrial habitat
- species designated as “at risk”

The level of detail in the description of each of the above components should be in proportion to the potential for interactions with the DGR (more interaction means more detail).

3.3.3 Surface water hydrology

The drainage systems in the area should be assessed, to determine the nature of site drainage during the pre-closure DGR period. The importance of this information for a specific site, including the detail of information needed, should be assessed in a site-specific context. Stream, lake, pond and wetland networks in the vicinity of the planned facility should be characterized to evaluate potential for flooding, erosion, sediment transport and associated consequences.

Information that should be collected and evaluated includes:

- topography of the site and drainage features, including contributing drainage basin limits (extent, shape)
- regional and local precipitation characteristics, including extreme events
- size and location of surface water bodies
- gradient of the land surface
- density of the drainage network

- slope of the major stream channels
- identification and characterization of groundwater recharge areas and discharge areas (including receiving water bodies)
- drainage basins' water balance
- water table characteristics and seasonality
- magnitude and frequency of floods in the region

Flood-causing mechanisms that should be considered include:

- local intense precipitation
- flooding
  - in rivers and streams
  - from upstream dam breaches or failures
  - from storm surges or seiches
  - from tsunamis, tidal and wind waves
  - from snow-melting and ice-induced events
  - from channel diversions toward the site

The potential for climate change to impact processes relevant for the characteristics listed above over the lifecycle of the project should be considered.

3.3.4 Geomorphology characterization

The existing geomorphology of a site will permit an understanding of the Quaternary geological history of an area relevant for siting a DGR. It will also contribute to the geotechnical characterization. Characterization includes:

- distribution of landforms and thickness of surficial material (depth to bedrock)
- documentation of surface deposits and any existing or potential aggregate resources
- Quaternary geological history

3.3.5 Geotechnical characterization of surficial deposits

Geotechnical characterization of surficial deposits is important, as the integrity of the surface infrastructure could be affected by geotechnical properties of overburden materials during the pre-closure period of a DGR facility. Areas of concern include slope stability, excavation activities, physical stability and degradation of material stockpiles, stability of facility foundations, quality of human-made barriers constructed using overburden or other materials, waste settlement, settlement and damage of the facility covers, or any issue that could cause water infiltration and contaminant migration.

Geotechnical studies should include standard geotechnical sampling, field investigations and laboratory studies to assess:

- past occurrence of landslides and other potentially unstable slopes in the area
- the soil's physical and index properties (typically grain size, plasticity, dispersion and cohesive properties)
- shear strength parameters
- bearing capacity of foundation material
- liquefaction potential of loose granular material

- compaction properties
- hydraulic conductivity
- other site or facility design-specific properties

4. Human Activities and Land Use

Information on past, present and potential future human activities at or near the site should be collected, and the likelihood of whether these activities could have an impact should be assessed.

To limit adverse impacts on human activities and land use, the following information should be considered:

- valuable natural resources (such as groundwater, minerals, surface water or petroleum)
- potential for competing land-use activities at the proposed site; surface water use (such as access, recreation or hydroelectricity generation)
- Indigenous knowledge and historical and current land use by Indigenous communities and the public
- current and historical mineral exploration and mining activities – records of boreholes, shafts and other features or activities that could represent or cause potential instabilities or radionuclide migration pathways (such as fracking)
- potential impact of climate change

5. Data Acquisition and Verification Activities

The proponent should demonstrate in their licence application that the results of site characterization activities are accurate, complete, reproducible, traceable and verifiable.

5.1 Management system

In accordance with the *General Nuclear Safety and Control Regulations*, section 3(1)(k), the licence applicant is expected to describe the organizational management structure, including the internal allocation of functions, responsibilities and authority. Section 3(d) of the *Class I Nuclear Facilities Regulations* specifies that the applicant proposes the management system, including measures to promote and support safety culture for the activity to be licensed. The adequacy of the management system is assessed by CNSC staff. By implementing a management system, the organization would demonstrate compliance, ensure consistency in meeting requirements, set priorities and continuously improve the site characterization activities.

The licence applicant should develop and implement a management system for site characterization activities that are part of siting the facility in accordance with the requirements specified in CSA N286-12, *Management System Requirements for Nuclear Facilities*, and aligned with CNSC REGDOC-2.1.1, *Management System*.

Topics covered under the management system governance documentation are expected to include the generic and specific requirements for site characterization processes and practices.

5.2 Data management program

The integrity, accuracy and completeness of the information and data generated as a result of the site characterization activities are of utmost importance. The proponent should ensure the consistency and quality of the data used to develop the safety case submitted in support of any formal licence application.

The proponent should establish quality assurance and quality control programs to ensure high data quality and traceability. The programs should be focused on the production of documentary evidence to demonstrate that the required data quality has been achieved. Data should be collected, presented, stored and archived in a suitably standardized controlled fashion. Data should be compiled in a format that facilitates examination, comparison, identification of information gaps and independent review. For each site characterization component, the documentation should clearly indicate the properties being investigated, the data collection and investigation methods used, the results, and the associated assumptions and uncertainties.

The process of data evaluation and establishment of the site-related parameters involves technical and engineering analyses and judgments, which require extensive experience and knowledge. In many cases the parameters and analyses may not lend themselves to direct verifications through inspections and tests, or by other techniques that can be precisely identified and controlled. Therefore, these evaluations should be reviewed and verified by independent individuals or groups (that is, third-party review) that are separate from those who initially did the work. The reviews should be carried out at the different stages of the siting process in accordance with the work instructions and procedures.

5.3 Sampling and testing procedures

Site characterization information is necessary to first develop interpretations, and to later confirm, refine and adapt interpretations based on data acquired from earlier characterization activities. Activities that may serve to obtain the data necessary to guide later development phases and updates to safety assessments and the safety case include:

- geoscientific data compilation
- airborne geophysical (such as magnetic or gravity) surveys and seismic surveys
- shallow seismic techniques and drilling (which may be used to characterize the overburden)
- geological mapping
  - bedrock mapping
  - surficial mapping (that is, landforms, depth to bedrock, surface deposits or aggregate resources, Quaternary geological history)
- environmental characterization
- topographical mapping
- aerial photograph interpretation
- soil sampling to assess soil deposition and transportation processes
- geochemical rock property testing
- borehole drilling

5.3.1 Procedures for underground investigation using borehole drilling

Site characterization for DGRs involves the collection of reliable information on the subsurface conditions. In the pre-application stage (figure 1), much of the data is collected from various tests conducted in and between boreholes drilled specifically for this purpose. Accordingly, the site characterization program should describe the following:

- number, locations and types (that is, diamond drill vs. air percussion) of boreholes to be drilled on the site
- purpose of each borehole and its intended orientation, length and diameter
- types of drilling lubricants and drilling fluid tracers that will be used during drilling
- types of and schedule for borehole deviation monitoring to control orientation
- core recovery specifications, sampling intervals, and core logging and storage procedures, or chip sampling, logging and storage procedures
- number and types of physical tests to be done on core samples or chip samples
- schedule for drilling and testing
- types of hydrogeologic testing (such as drill stem shut-in testing, pulse testing or tracer testing) to be performed during the drilling program
- groundwater samples that will be collected during drilling and the types of analyses of the groundwater that will be done
- record of the types of analysis performed, analytical instrumentation used, and the time between sampling and analysis
- borehole development and completion procedures (flushing, casing and grouting)
- borehole sealing procedures that will be followed should a borehole require abandonment

A borehole quality assurance and quality control program should be used to ensure that the objectives of the drilling program are achieved and controlled, and should include the following:

- maintenance of a drilling journal by a qualified drill-site geologist who records drilling and relevant drilling-related activities such as:
  - the cleaning of drill rods before drilling starts
  - surface casing installation and grouting procedures
  - drilling penetration rates
  - core recovery
  - presence of water-producing intervals and flow rates
  - amount of drilling fluid added and zones of water loss
  - measurements of tracer concentrations in drilling fluid and return water
  - additions of drilling lubricants
  - borehole development related to the removal of residual drill cuttings and drilling fluid, and core or chip sample information
- recording of static water-level information during shutdowns in drilling operations and the field chemistry of groundwater that is airlifted to the surface during the drilling of air percussion boreholes, and the procedures followed to collect and preserve such water samples
- post-drilling borehole surveys to confirm that the borehole has been drilled to the prescribed depth, diameter and orientation
- establishment of an electronic record that documents all borehole drilling activities and measurements

Other regulators will have jurisdiction over site characterization activities carried out before a site is selected and before an applicant engages in activities that would require a licence from the CNSC (see section 3.1). The applicant should conduct site characterization activities in consultation with the relevant regulatory bodies early in the process, to ensure that regulatory expectations, permitting, licensing or other requirements are clearly understood, and that potential issues associated with data acceptance are identified and mitigated.

5.4 Integration and interpretation

Site characterization should lead to a detailed conceptual understanding of the site, through the analysis of a large number of physical and environmental components that interact with each other. This results in several independent systems of related components, where the components in each system can be interpreted to develop a conceptual site model. For example, the stratigraphy, lithology and spatial distribution of *in situ* stress can be interpreted to give a conceptual model of both the current and evolutionary structural geology of the site, while the distribution of mineralogy in the rock matrix and in fracture infilling can be interpreted to give a separate model of the site's geological evolution.

Different site models developed from different surveys and disciplines should be integrated into a single, consistent conceptual model of the site's geological and hydrogeological history, current conditions and expected (unperturbed) evolution.

The model of current conditions at a site provides the necessary information for design purposes. The history of the site should inform how the site has responded to past perturbations; extrapolating historical site information through to current site conditions can provide a model of how the site is expected to evolve in the future. Applying estimates of the perturbations imposed by the planned facility and the site response to past perturbations to the model of undisturbed site evolution should provide a model of the anticipated evolution of the site with the facility.

The applicant should amalgamate the results of site characterization integration and interpretation in a site model, which would constitute important supporting information to the post-closure safety case.

6. Facilities for Verification and Characterization Activities

An underground research facility (URF) is a facility typically constructed at a depth that provides a representative environment to acquire knowledge and provide training, to further characterize the geology, conduct experiments, test equipment and designs, and help demonstrate feasibility of a DGR.

Geoscientific characteristics of the subsurface cannot be obtained from surface-based activities alone (such as geophysical surveys, mapping, and deep borehole drilling), which are limited simply because they are surface-based observations of features that exist at depth. Therefore, verification and characterization activities (such as underground excavation and research) in a URF are considered as an international best practice for DGRs for high-level radioactive waste, including used nuclear fuel [8]. These activities reduce uncertainties, by providing more data to include in a safety case, and may be carried out at a generic and/or site-specific URF [2].

Setting up a URF is time consuming. There may be a significant time lapse between selection of a potential site and construction of a URF at that site. It also takes time to build research and support capacity by participating in URF activities in other countries. Therefore, a best practice is to plan for URF activities as early as possible in the siting process.

It is important for the licence applicant to discuss plans for verification with the CNSC at an early stage. This would include plans for a URF or similar facility. Early discussions help clarify the regulatory approval process and identify site characterization activities related to verification. This dialogue is also necessary to identify those site characterization activities that may be conducted before a CNSC licence may be obtained to prepare a site and/or licence to construct.

Appendix A: The Role of Site Characterization in the Siting Process

The process for selecting a site and the decision to choose a particular site are the responsibility of the licence applicant.

The International Atomic Energy Agency (IAEA) identifies four stages to the siting process for a DGR [4]:

1. conceptual and planning stage

2. area survey stage

3. site investigation stage

4. detailed site characterization and site confirmation stage

Site characterization begins at stage 1 during the investigation of a site and is expected to become more intensive as the siting process progresses through to confirmation of the site. The transition from one stage to the next is somewhat arbitrary owing to the inevitable overlap in siting activities. Characterization activities also support the engineering design.

Characterization activities would be expected to continue through the various CNSC licensing phases – site preparation, construction, operation, decommissioning and closure – should a project obtain regulatory approvals.

A.1 Conceptual and Planning stage

An overall plan for the site selection process is developed at this stage. Activities include desktop data compilation and interpretation. They include the identification of desirable features as a basis for the second stage, as well as the conceptualization of a generic facility design based on the type, volume and radionuclide content of the radioactive waste to be managed. (For guidance, see REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management* [5] and CSA N292.0-14, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*). Site screening criteria should be developed for selecting or rejecting potential sites and, eventually, identifying a preferred site.

A.2 Survey Stage

The survey stage involves the screening of identified potential siting areas and regional geological mapping and other regional-scale characterization activities (such as airborne geophysical surveys). Engineering design may evolve based on acquired site information. The goal of activities carried out at the surveying stage is to inform the screening process, which may narrow down potential sites.

A.3 Site Characterization Stage

The site characterization stage involves extensive field work and laboratory studies, usually to gather site-specific data on a range of site conditions, including a site’s geology, geochemistry and geomechanical suitability.

Early-stage site characterization activities involve scientific studies and desktop data compilation work, and include activities such as geophysical surveys and borehole drilling, though such activities would stop short of breaking the ground to excavate a shaft.

A preliminary post-closure safety case (including long-term models) should be completed at this time to test the site's suitability to host a DGR facility, as well as to guide further characterization and confirmation activities. A preliminary safety case may also form part of a comparative analysis of remaining sites (if applicable), which would lead to the next stage of site confirmation, in which detailed, extensive work would focus on one or more sites.

A.4 Site Confirmation Stage

Site confirmation generally consists of detailed field and laboratory studies at the selected site. At this stage it may be necessary to evaluate whether sinking a shaft or constructing an underground research facility (URF) are needed to obtain more information.

A post-closure safety case should be prepared based on all of the data gathered during prior siting stages and in combination with information such as geology and hydrogeology, and information about other barriers such as the engineered barrier system, canister design, and radioactive waste characteristics. This information may be used to develop the safety case for licensing.

Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

The following terms are either new terms being defined, or include revisions to the current definition for that term. Following public consultation, the final terms and definitions will be submitted for inclusion in the next version of REGDOC-3.6, *Glossary of CNSC Terminology*.

containment
The function of the barrier to prevent or control releases of radioactive or hazardous wastes. For deep geological disposal, this refers to the functions of both the natural barrier (such as the host rock) and the engineered barrier to limit radionuclide releases.

isolation
The physical separation of radioactive waste from people and the environment to make accessing the waste difficult. For deep geological disposal, isolation is provided mainly by the depth of the repository.

References

1. IAEA, IAEA Safety Standards Series, No. SSG-14, *Geological Disposal Facilities for Radioactive Waste*, Vienna, 2011.

2. CNSC, REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*, Ottawa 2017.

3. CNSC, REGDOC-3.2.2, *Indigenous Engagement*, Ottawa, 2019.

4. CSA Group, CSA N286-12, *Management System Requirements for Nuclear Facilities*, 2012.

5. IAEA, IAEA Safety Standards Series, No. SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, Specific Safety Guide, Vienna, 2012.

6. IAEA, IAEA Safety Standards Series, No. GSG-1, *Classification of Radioactive Waste*, Vienna, 2009.

Additional Information

The CNSC may recommend additional information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC web page "How to gain free access to all nuclear-related CSA standards".

The following documents provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- Western European Nuclear Regulators' Association, *Report: Radioactive Waste Disposal Facilities Safety Reference Levels*, 2014.
- CSA Group, CSA N292.0-14, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, Mississauga, 2014.
- WM2015 Conference, March 15–19, 2015, *Need for and Use of Generic and Site-Specific Underground Research Laboratories to Support Siting, Design and Safety Assessment Developments – 15417*. Phoenix, Arizona, USA.
- Canadian Nuclear Safety Commission (CNSC), REGDOC-2.11.1, *Waste Management, Volume II: Assessing the Long Term Safety of Radioactive Waste Management*, Ottawa, 2018.
- IAEA, IAEA Safety Standards Series, No. SSR-5, *Disposal of Radioactive Waste*, Vienna, 2011.
- International Atomic Energy Agency (IAEA), *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection,* 2007 Edition, Vienna, 2007.

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Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

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L'organisme de réglementation
nucléaire du Canada

Installations de catégorie IB

Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur

REGDOC-1.2.1

Mai 2020

ÉBAUCHE

Commission canadienne de sûreté nucléaire
Canadian Nuclear Safety Commission

Canada

Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur
Document d'application de la réglementation REGDOC-1.2.1

Nº de cat. NNNNN
ISBN NNNNN

Also available in English under the title: Guidance on Deep Geological Repository Site Characterization

Disponibilité du document
Les personnes intéressées peuvent consulter le document sur le site Web de la CCSN. Pour obtenir un exemplaire du document en français ou en anglais, veuillez communiquer avec :

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Historique de publication
[mois, année] Version x.0

Préface

Le présent document fait partie de la série de documents d'application de la réglementation de la CCSN portant sur les activités et installations réglementées. La liste complète des séries figure à la fin du document et peut être consultée sur le site Web de la CCSN.

Le document d'application de la réglementation REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur*, sert de guide pour la caractérisation de l'emplacement pour un dépôt géologique en profondeur (DGP) de déchets radioactifs. L'information recueillie pour la caractérisation de l'emplacement peut être employée dans de futures demandes de permis.

Le présent document remplace le document R-72, *Considérations géologiques pour le choix d'un emplacement de dépôt souterrain de déchets hautement radioactifs*, publié en septembre 1987.

Pour en savoir plus sur la mise en œuvre des documents d'application de la réglementation et sur la méthode graduelle, veuillez consulter le REGDOC-3.5.3, *Principes fondamentaux de réglementation*.

Le terme « doit » est employé pour exprimer une exigence à laquelle le demandeur ou le titulaire de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites du présent document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucun élément du présent document ne doit être interprété comme libérant le titulaire de permis de toute autre exigence pertinente. Il incombe au titulaire de permis de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et de s'y conformer.

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REGDOC-1.2.1, Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur

1. Introduction

Un dépôt géologique en profondeur (DGP) est une installation artificielle aménagée dans une formation géologique stable et profonde afin d'y enfouir des déchets radioactifs dans le but de les isoler et de les confiner à long terme. La caractérisation de l'emplacement implique des investigations techniques détaillées visant à accroître les connaissances quant à un emplacement particulier. Les informations régionales et propres à l'emplacement sont utilisées pour connaître un emplacement potentiel et les caractéristiques et processus qui pourraient avoir une incidence sur le rendement à long terme d'une installation de DGP à cet emplacement. Ces processus font appel à une variété de disciplines scientifiques (comme l'hydrogéologie, la mécanique des roches et la géochimie) qui sont combinées et interprétées ensemble.

1.1 Objet

Le présent document d'application de la réglementation est un guide pour orienter la caractérisation de l'emplacement d'une installation de DGP de déchets radioactifs.

L'information sur la caractérisation de l'emplacement fait partie intégrante de la demande de permis pour les installations de DGP. Elle doit être prise en compte pendant la conception de l'installation et réévaluée au cours du cycle de vie de l'installation, ce qui comprend la préparation du site, la construction, l'exploitation, le déclassement et la fermeture.

1.2 Portée

Le présent document décrit les éléments d'un programme de caractérisation de l'emplacement d'une installation de DGP.

Veuillez noter que le présent document :

- ne donne pas de conseils sur la façon de trouver ou de sélectionner un site; le choix d'un emplacement n'est pas une activité régie par la *Loi sur la sûreté et la réglementation nucléaires* (LSRN);
- ne s'applique pas aux installations de gestion des déchets en surface ou près de la surface, y compris les déchets des mines et usines de concentration d'uranium;
- ne donne pas de conseils sur les stratégies de gestion des déchets à long terme;
- ne donne pas d'exigences pour l'analyse de la sûreté de la phase d'exploitation des installations de DGP;
- ne donne pas d'exigences pour le dossier de sûreté post-fermeture pour l'évacuation dans des formations géologiques;
- ne donne pas de conseils sur la protection de l'environnement, y compris l'évaluation environnementale (voir le document REGDOC-2.9.1, *Protection de l'environnement : Principes, évaluations environnementales et mesures de protection de l'environnement* [1]).

Dans le présent document, la période précédant la fermeture d'un DGP comprend la préparation du site, la construction et l'exploitation du DGP et le déclassement des installations auxiliaires. La période post-fermeture (ou à long terme) est la période qui suit la fermeture d'une installation de DGP. Cette longue période après la fermeture est un élément distinctif des projets de DGP, qui nécessitent d'importantes activités de caractérisation géologique de l'emplacement (section 3 du présent document) et un dossier de sûreté à long terme tel que décrit dans le document REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [2].

1.3 Législation pertinente

Les installations de gestion à long terme des déchets radioactifs, telles que les DGP, sont généralement autorisées en vertu du *Règlement sur les installations nucléaires de catégorie I*. Un DGP répondrait à la définition d'une installation nucléaire de catégorie IB au sens de l'alinéa 1e) du *Règlement sur les installations nucléaires de catégorie I* comme étant une « installation d'évacuation ou de stockage permanent de substances nucléaires ». Ce règlement ne prévoit aucun processus réglementaire pour le choix d'un emplacement. Le processus réglementaire n'est pas déclenché tant qu'une demande de permis de préparation de l'emplacement ou qu'une demande de permis combinés de préparation de l'emplacement et de construction n'est pas reçue. La *Loi sur la sûreté et la réglementation nucléaires* (LSRN) s'applique dès que les activités de préparation de l'emplacement débutent.

Les dispositions suivantes de la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et de ses règlements s'appliquent au présent document :

- article 26 de la LSRN
- alinéas 4a) et 4c) du *Règlement sur les installations nucléaires de catégorie I*

2. Contexte

Les données de caractérisation de l'emplacement servent à déterminer si un site potentiel est adéquat, à éclairer la conception d'une installation de DGP et à étayer le dossier de sûreté de tout projet éventuel de DGP. Ces données sont nécessaires pour détecter les effets environnementaux potentiels à court et à long termes à différentes étapes du projet et pour faire un suivi de l'information utilisée (et la façon dont elle est utilisée) tout au long du cycle de vie d'autorisation de la CCSN pour un DGP. Les données de référence fournissent l'information de base pour évaluer la sûreté au stade de sélection d'un emplacement et durant la conception initiale de l'installation, et contribuent aussi à déterminer l'incidence des caractéristiques, événements et processus associés au système de DGP. Les données doivent inclure des renseignements pertinents à l'échelle de la région et à l'échelle de l'emplacement.

Tôt dans le processus de sélection d'un emplacement pour une installation de DGP, le promoteur du projet devrait évaluer si les caractéristiques d'un emplacement utilisé pour un DGP :

- pourraient avoir une incidence sur l'environnement
- pourraient avoir un effet néfaste sur les droits ancestraux ou issus de traités, potentiels ou établis, d'un groupe autochtone comme la capacité de chasser, de piéger, de pêcher, de faire la cueillette, de se rassembler ou de mener des cérémonies culturelles, tel qu'il est décrit dans le document REGDOC-3.2.2, *Mobilisation des Autochtones* [3].

Ces renseignements seraient présentés dans la demande de permis et pris en compte dans toute évaluation d'impact.

Il est recommandé d’entamer tôt le dialogue avec l’organisme de réglementation au sujet des attentes et des exigences réglementaires. Ce processus comprend la détermination des activités de caractérisation de l’emplacement qui n’ont peut-être pas besoin d’un permis de la CCSN. Cela peut être officialisé par une entente de service entre l’organisme de réglementation et le promoteur.

2.1 Examens de l’environnement

La CCSN a un mandat de protection de l’environnement. La CCSN évalue les effets environnementaux de toutes les installations et activités nucléaires à chaque étape de leur cycle de vie. La CCSN exige que les effets environnementaux de toutes les activités autorisées soient pris en compte et évalués lorsque des décisions relatives aux permis sont prises. Les examens de l’environnement sont basés sur l’ampleur et la complexité des risques environnementaux liés à une installation ou à une activité nucléaire. Au début du processus, le personnel de la CCSN détermine le type d’examen de l’environnement qui s’applique en étudiant l’information fournie par le demandeur ou le titulaire de permis dans leur demande et les documents à l’appui.

Un type d’examen de l’environnement est l’évaluation d’impact. Les évaluations d’impact sont faites conformément à la législation fédérale en matière d’environnement et à la *Loi sur l’évaluation d’impact* et ses règlements. L’évaluation d’impact est menée par l’Agence d’évaluation d’impact du Canada, avec la participation de la CCSN. Une décision sur l’évaluation d’impact doit être rendue avant qu’une décision d’autorisation puisse être prise en vertu de la LSRN.

L’information sur la caractérisation de l’emplacement est importante pour tous les examens de l’environnement. La CCSN examine cette information lors de l’évaluation de toutes lesdemandes de permis effectuées pendant le cycle de vie d’une installation.

Pour plus d’information sur les processus d’examen de l’environnement et d’autorisation de la CCSN, voir :

- REGDOC-2.9.1, *Protection de l’environnement : Principes, évaluations environnementales et mesures de protection de l’environnement* [1]
- REGDOC-3.5.1, *Processus d’autorisation des installations de catégorie I et des mines et usines de concentration d’uranium* [4]

2.2 Mobilisation du public et des Autochtones

Les groupes autochtones possiblement concernés devraient être mobilisés tôt dans la phase de caractérisation de l’emplacement pour discuter des plans du projet, recueillir des savoirs autochtones et des renseignements sur l’utilisation du territoire et, le cas échéant, aborder toute préoccupation, dès le début du processus de caractérisation de l’emplacement et de conception du projet.

Réaliser, tôt dans le processus de caractérisation de l’emplacement, des activités de mobilisation avec le public et les groupes autochtones devrait résulter en des pratiques de consultation plus efficientes et efficaces, en un renforcement des relations avec les collectivités autochtones, par un appui à l’État dans la réalisation de ses engagements liés à son éventuelle obligation de consulter, et en la baisse du risque de retard dans le processus d’examen réglementaire.

Tôt dans le processus d'évaluation du site, le demandeur devrait élaborer et mettre en œuvre un programme d'information et de divulgation publiques, conformément au document REGDOC-3.2.1, *L'information et la divulgation publiques* [5]. De plus, comme l'énonce le document REGDOC-3.2.2, *Mobilisation des Autochtones* [3], le demandeur devrait identifier les groupes autochtones possiblement concernés et entamer le dialogue avec eux. Les renseignements sur les activités de mobilisation seraient présentés à la CCSN dans le cadre d'une demande de permis.

2.3 Aperçu de la caractérisation de l'emplacement

La caractérisation de l'emplacement débute avant que le demandeur présente une demande de permis à la CCSN et se poursuit tout au long du cycle de vie de l'installation de DGP. Le promoteur examinera et mettra à jour cette information sur la caractérisation de l'emplacement pour tenir compte des changements aux alentours du site et d'y incorporer de nouvelles données et connaissances scientifiques. Les activités de caractérisation étayent également la conception technique.

L'information provenant de la caractérisation de l'emplacement devrait être prise en compte tout au long du cycle de vie de l'installation proposée afin de s'assurer que le dimensionnement et le dossier de sûreté de l'installation demeurent valides en cas de changements dans les conditions environnementales et de modifications apportées à l'installation. L'information sur la caractérisation de l'emplacement est présentée dans ce document comme suit :

- **Caractérisation de l'emplacement :** la section 3 décrit l'utilisation de l'information sur la caractérisation de l'emplacement à toutes les phases du cycle de vie ainsi que les activités à inclure dans un programme de caractérisation de l'emplacement :
  - la section 3.1 décrit le rôle de la caractérisation de l'emplacement dans le processus réglementaire de la CCSN
  - la section 3.2 vise à orienter la caractérisation de l'emplacement pour l'environnement géologique
  - la section 3.3 vise à orienter la caractérisation de l'emplacement en fonction de l'environnement en surface
- **Activités humaines et utilisation du territoire :** la section 4 décrit la collecte d'information sur les activités humaines passées, présentes ou possibles dans le futur à l'emplacement ou à proximité.
- **Acquisition de données et activités de vérification :** la section 5 décrit l'information qui permettrait de démontrer, dans une demande de permis, que les résultats des activités de caractérisation de l'emplacement sont exacts, complets, reproductibles, traçables et vérifiables.
- **Vérification et caractérisation de l'emplacement :** la section 6 donne de l'information sur les méthodes possibles pour vérifier les caractéristiques d'un emplacement.

L'annexe A décrit le processus de sélection d'un site pour une installation de DGP, y compris le processus et l'importance des activités de caractérisation de l'emplacement au cours de la période précédant la demande.

3. Caractérisation des emplacements pour les installations de DGP

Les caractéristiques de la roche hôte et du système géologique (les barrières naturelles) sont uniques à l'emplacement choisi. Le système géologique renvoie aux caractéristiques qui ont une incidence sur l'écoulement des eaux souterraines, la composition minéralogique et la structure de la roche, l'emplacement et les propriétés des discontinuités, ainsi que les processus géochimiques. Les caractéristiques de l'environnement en surface apportent de l'information de référence pour une future surveillance environnementale et d'éventuelles activités d'atténuation.

Les critères précis fournis pour la collecte de données sur la caractérisation ne sont pas exhaustifs. Les conseils sont présentés sans ordre particulier ou priorité et ne se limitent pas aux éléments, méthodes et techniques mentionnés. La pertinence relative de critères précis sera, dans certains cas, propre à l'emplacement.

Remarque 1 : Les données et les résultats d'analyse provenant de la caractérisation de l'emplacement peuvent apporter les renseignements nécessaires aux étapes suivantes du processus d'autorisation, conformément à la LSRN et aux règlements connexes.

Remarque 2 : Le demandeur devrait rejeter, sans qu'une intervention de la CCSN soit nécessaire, tout emplacement inacceptable ou inapproprié avant de faire une demande de permis.

3.1 Rôle de la caractérisation de l'emplacement dans le processus réglementaire de la CCSN

La figure 1 montre la place qu'occupe la caractérisation de l'emplacement dans le processus de sélection d'un site ainsi que son rôle dans le processus réglementaire de la CCSN. La caractérisation de l'emplacement devrait faire partie des activités de collecte d'information et de présentation réglementaire initiale pour un projet d'installation de DGP.

Les données sur la caractérisation de l'emplacement jouent un rôle pour détecter les effets environnementaux potentiels à court et à long termes à différentes étapes du projet. Ces données sont utilisées tout au long du cycle de vie d'autorisation.

Les caractéristiques de l'emplacement sont utilisées pour montrer la façon dont les déchets radioactifs seraient adéquatement confinés et isolés de l'environnement pour une longue période appelée « période d'évaluation ». Des renseignements sur la période d'évaluation et les exigences relatives au dossier de sûreté à long terme nécessaire pour obtenir un permis se trouvent dans le document REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [2]. Ainsi, la caractérisation de l'emplacement est une composante essentielle du processus de sélection du site, permettant de recueillir des données probantes pour déterminer si les caractéristiques de l'emplacement répondront aux attentes dans le cadre d'un dossier de sûreté post-fermeture. À l'échelle internationale, les périodes d'évaluation associées aux DGP s'étendent sur des dizaines de milliers d'années ou plus.

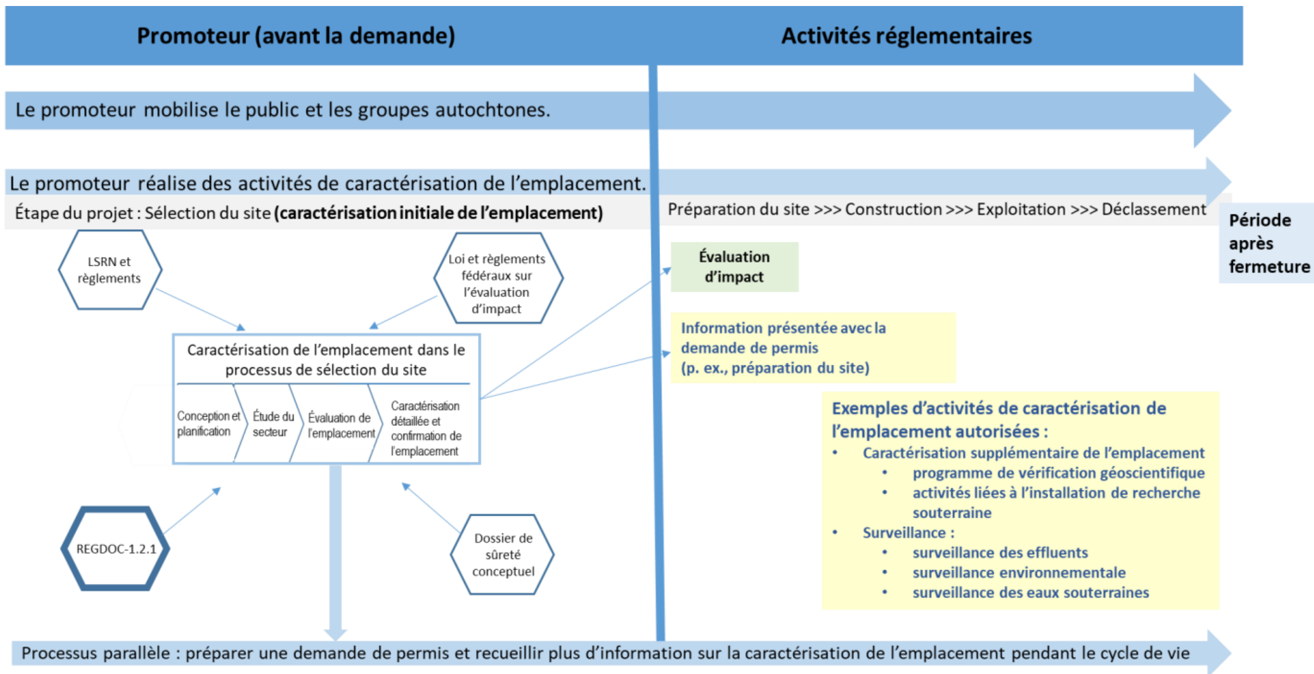
Voici des exemples d'activités de caractérisation de l'emplacement requièrent une autorisation de la CCSN :

- la vérification de renseignements recueillis et analysés au cours d'étapes antérieures
- la définition d'une situation de référence adéquate pour la surveillance future
- l'utilisation d'information pour mettre à jour le dossier de sûreté post-fermeture de l'installation de DGP

Les activités de caractérisation qui se poursuivraient jusqu'à la fermeture peuvent faire partie d'un plan de vérification géoscientifique.

De plus amples renseignements sur le processus de sélection d'un site pour un DGP, y compris les facteurs géologiques à considérer, sont présentés à l'annexe A et dans des documents d'orientation d'organismes internationaux.

Figure 1 : Caractérisation de l'emplacement dans le processus réglementaire de la CCSN



Les données sur la caractérisation de l'emplacement recueillies durant le processus de sélection du site devraient éclairer les évaluations d'impact et peuvent être intégrées à la demande initiale de permis déposée à la CCSN. Les activités de caractérisation de l'emplacement débutent avant la demande et se poursuivent tout au long des phases subséquentes du cycle de vie de l'installation.

3.2 Caractéristiques de l'emplacement I : environnement géologique

Les caractéristiques de l'environnement géologique sont nécessaires pour évaluer la sûreté après la fermeture d'un DGP et elles devraient être prises en compte dans la conception technique. L'investigation d'un emplacement potentiel de DGP devrait évaluer plusieurs caractéristiques, y compris :

- les caractéristiques de confinement et d'isolement de la roche hôte et du système géologique
- la stabilité géologique passée et future prévue ou projetée de l'emplacement, y compris les effets de l'orogenèse, de la sismicité, de la glaciation et de l'activité volcanique
- l'étendue suffisante de roche hôte convenable à la profondeur du dépôt
- la capacité de la roche hôte et du système géologique à résister au stress sans se fissurer de façon importante
- la position relative aux discontinuités géologiques
- l'isolement démontré des eaux souterraines à la profondeur choisie du dépôt de tout réseau peu profond d'eaux souterraines
- les caractéristiques favorables pour limiter les rejets et le transport de contaminants hors du DGP

- le faible potentiel de ressources naturelles, ce qui réduirait la probabilité d'intrusion humaine par inadvertance par les explorateurs des générations futures à la recherche de ressources.

Pour les demandes de permis, le demandeur devrait fournir des données quantitatives en plus des descriptions qualitatives, dans la mesure du possible.

Les facteurs géologiques clés qui pourraient servir à évaluer le caractère convenable d'un emplacement de DGP devraient être évalués à l'aide des caractéristiques suivantes.

3.2.1 Cadre géologique

Les caractéristiques géologiques, combinées aux barrières artificielles et à la conception du DGP, devraient indiquer qu'un projet de DGP à l'emplacement choisi demeurerait sécuritaire pendant toute la période de référence, y compris la période post-fermeture.

Ces renseignements cadre devraient comprendre :

- le cadre tectonique
- la géologie structurale
- la stratigraphie
- le type de roche hôte choisie et son étendue
- les caractéristiques de fracture : fréquence, orientation, minéralogie et espacement
- l'histoire des cycles glaciaires
- la pétrologie
- les propriétés géomécaniques
- le potentiel de ressources naturelles

Le potentiel de ressources naturelles devrait être évalué quantitativement et comprendre des données historiques et actuelles.

3.2.2 Cadre hydrogéologique

Comme pour le cadre géologique, les caractéristiques du cadre hydrogéologique devraient servir à évaluer le caractère convenable de l'emplacement. Les renseignements devraient comprendre les données suivantes :

- la définition du régime ou des unités hydrogéologiques régionaux
- les conditions régionales et celles qui sont propres à l'emplacement d'écoulement des eaux souterraines (comme le débit, l'orientation, les charges et les gradients hydrauliques)
- l'hydrogéologie des grandes unités rocheuses
- les propriétés hydrogéologiques (comme la porosité et la conductivité hydraulique)
- les zones d'alimentation et d'évacuation
- le bilan hydrique
- l'emplacement des principales zones d'utilisation d'eau, actuelles et futures (comme les puits d'eaux souterraines)

Ces données aideront à identifier les voies préférentielles, vitesses, temps de séjour et autres paramètres.

3.2.3 Géochimie

Jumelées aux données géologiques et hydrogéologiques, les conditions géochimiques apportent une information essentielle pour prédire la façon dont les contaminants pourraient migrer d'un DGP vers la biosphère. Une attention particulière devrait être accordée aux propriétés géochimiques qui peuvent affecter la migration des radionucléides vers les eaux souterraines.

L'information devrait inclure:

- la minéralogie, y compris la pétrographie
- la géochimie des eaux souterraines et des eaux interstitielles
- les conditions d'oxydoréduction
- le déplacement des radionucléides (y compris l'information sur la diffusion, la solubilité, la spéciation et la sorption)
- le déplacement d'espèces non radioactives (comme le plomb, l'arsenic, le chrome et le cuivre)
- les effets géochimiques des eaux souterraines sur les barrières artificielles
- la microbiologie
- le potentiel de production de gaz
- l'interaction eau-roche

Tout processus pour lequel on peut montrer un potentiel démontré de migration ou de retardement du déplacement des radionucléides à partir d'une installation de DGP artificiel vers l'environnement géologique doit être documenté.

3.2.4 Stabilité géologique

L'emplacement devrait être situé dans une région stable sur le plan sismique, tel que démontré par une évaluation du potentiel d'événements volcaniques ou sismiques. Il faudrait montrer que tout événement géologique réaliste pouvant survenir lors de la période d'évaluation n'aurait pas d'incidence sur la capacité d'isolement et de confinement du DGP.

L'information qui devrait être recueillie sur l'emplacement et pour la région comprend :

- des preuves de processus tectoniques actifs récents ou anciens (néotectonique) — p. ex., information sur des failles et des mouvements, liquéfaction du sol et activité volcanique, remontant au Quaternaire
- les antécédents de sismicité à l'emplacement, y compris la documentation des séismes historiques, leur épicentre, magnitude et intensité et leur récurrence (lien avec les données tectoniques de la région et la géologie structurale)
- l'effet de glaciations passées sur l'emplacement, pour servir de base pour évaluer l'incidence de glaciations futures (dans la période post-fermeture prise en compte dans le dossier de sûreté, conformément au documentREGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [2]) et reliant les propriétés hydrogéologiques, géochimiques et géomécaniques de la roche à l'histoire glaciaire.

3.2.5 Caractéristiques géomécaniques

Les caractéristiques géomécaniques devraient être recueillies et utilisées pour évaluer la stabilité, avant la la fermeture et à long terme des excavations souterraines, ainsi que l’évolution de la zone de dommages autour de ces excavations.

Les caractéristiques géomécaniques devraient comprendre :

- la magnitude et l’orientation du stress *in situ*
- les propriétés de résilience aux contraintes et aux déformations de la roche intacte, des fractures et de la masse rocheuse
- l’influence du temps, de la température, de l’échelle, de l’anisotropie, de la pression du fluide interstitiel et d’autres facteurs pertinents sur les propriétés de résilience aux contraintes et déformations
- la capacité potentielle de résister aux événements glaciaires

3.3 Caractéristiques de l’emplacement II : environnement en surface

Des données environnementales de référence servent à évaluer et à prédire les effets d’un projet sur l’environnement. Les processus en surface à l’emplacement doivent être assez bien caractérisés pour garantir que des aléas naturels comme les inondations, les glissements de terrain et l’érosion n’auront aucune incidence sur la sûreté du fonctionnement du système d’évacuation des déchets radioactifs.

3.3.1 Climat

Les conditions météorologiques à l’emplacement devraient être caractérisées adéquatement et prises en compte dans la conception d’une installation de DGP. Les conditions métérologiques devraient être mesurées à l’emplacement et aux stations météorologiques voisines, si possible. Ces données devraient aussi servir de référence pour évaluer le transport de rejets atmosphériques potentiels lors de la période précédant la fermeture d’une installation de DGP. Le demandeur devrait justifier les données météorologiques minimales (soit le nombre d’années de données propres à l’emplacement) et démontrer que cela adéquat pour le type de projet et l’emplacement choisi. Les données climatiques normales (30 années de données climatiques) devraient également être incluses.

Les renseignements particuliers qui devraient être recueillis comprennent :

- l’histoire climatique locale et régionale et les tendances futures prévues à des échelles régionale et plus globale
- les données météorologiques, qui devraient être recueillies à l’emplacement ainsi qu’aux échelles locale et régionale afin d’enregistrer adéquatement les conditions météorologiques futures qui pourraient se manifester pendant la durée de vie du projet
- les caractéristiques des précipitations locales et régionales
- les données, sur une base régionale, sur les extrêmes et les moyennes de température, de précipitations et de vitesse du vent et sur tout autre phénomène naturel pertinent
- les caractéristiques du vent et de la dispersion atmosphérique des rejets possibles dans l’atmosphère;
- le potentiel de phénomènes météorologiques rares et extrêmes, comme les ouragans, les tornades et les graves tempêtes hivernales

- le gel du sol et la couverture de neige
- l'évapotranspiration (soit l'évaporation et la transpiration des sols, des plans d'eau et des plantes);
- la dynamique des glaces sur les lacs et cours d'eau
- la qualité de l'air.

Le potentiel pour que les changements climatiques aient une incidence sur les processus pertinents aux caractéristiques susmentionnées tout au long du cycle de vie du projet devrait être pris en compte.

3.3.2 Environnement aquatique et terrestre

Les composantes de l'écosystème devraient être caractérisées suffisamment en détails pour permettre de mesurer leur importance, leur interaction possible avec le projet et le potentiel d'effets environnementaux découlant des activités du projet.

Les éléments de l'écologie aquatique qui devraient être caractérisés dans la zone d'intérêt comprennent :

- les caractéristiques des eaux de surface (propriétés physiques, chimiques et biologiques)
- les caractéristiques des sédiments (propriétés physiques, chimiques et biologiques)
- les communautés phytoplanctoniques
- les macrophytes aquatiques
- les communautés zooplanctoniques
- les macroinvertébrés benthiques
- les poissons
- l'habitat des poissons
- les espèces désignées « en péril »

Les éléments de l'écologie terrestre qui devraient être caractérisés dans la zone d'intérêt comprennent :

- la qualité du sol
- la végétation
- la faune
- l'habitat terrestre
- les espèces désignées « en péril »

Le degré de détail des descriptions de chacune des composantes ci-dessus devrait être proportionnel au potentiel d'interactions avec le DGP (des interactions plus nombreuses signifient des descriptions plus détaillées).

3.3.3 Hydrologie des eaux de surface

Les réseaux hydrographiques de la région devraient être évalués pour déterminer la nature du drainage du site pendant la période préalable à la fermeture du DGP. La valeur de cette information pour un site précis, y compris le degré de détail requis de l'information, devrait être évalué dans un contexte propre à l'emplacement. Le réseau des ruisseaux, lacs, étangs et terres humides à proximité de l'installation prévue devrait être caractérisé pour évaluer le potentiel d'inondation, d'érosion et de transport de sédiments, et les répercussions connexes.

L'information qui devrait être recueillie et évaluée comprend :

- la topographie du site et de ses caractéristiques hydrographiques, notamment les limites des bassins hydrographiques récepteurs (étendue, forme)
- les caractéristiques des précipitations locales et régionales, y compris les phénomènes extrêmes
- la taille et l'emplacement des plans d'eau en surface
- le gradient de la surface terrestre
- la densité du réseau hydrographique
- la pente des principaux cours d'eau
- l'identification et la caractérisation des zones d'alimentation et d'évacuation des eaux souterraines (y compris les plans d'eau récepteurs)
- le bilan hydrique des bassins hydrographiques
- les caractéristiques et les cycles saisonniers de la nappe aquifère
- la magnitude et la fréquence des inondations dans la région.

Les mécanismes à l'origine des inondations qui devraient être évalués comprennent :

- les précipitations locales intenses
- les inondations :
  - survenant dans les rivières et les cours d'eau
  - causées par des ruptures ou défaillances de barrages en amont
  - causées par des ondes de tempête ou des seiches
  - causées par des tsunamis, des ondes de marée et des vagues de vent
  - causées par la fonte des neiges et les événements liés à la glace
  - causées par les dérivations de canaux vers l'emplacement.

Le potentiel pour que les changements climatiques aient une incidence sur les processus pertinents aux caractéristiques susmentionnées au long du cycle de vie du projet devrait être pris en compte.

3.3.4 Caractérisation de la géomorphologie

La géomorphologie existante d'un emplacement permet de comprendre l'histoire géologique du Quaternaire dans la région pertinente à la sélection d'un site pour un DGP. Elle contribue également à la caractérisation géotechnique et comprend :

- la distribution des formes de relief et l'épaisseur du matériau de surface (profondeur jusqu'au substrat rocheux)
- la consignation des dépôts de surface et de toute ressource en granulats, existante ou potentielle
- l'histoire géologique du Quaternaire.

3.3.5 Caractérisation géotechnique des dépôts de surface

La caractérisation géotechnique des dépôts de surface est importante, puisque l'intégrité de l'infrastructure de surface pourrait être compromise par les propriétés géotechniques des matériaux sus-jacents pendant la période préalable à la fermeture d'un DGP. Les sujets à prendre en compte comprennent la stabilité de la pente, les activités d'excavation, la stabilité physique et la dégradation des dépôts de déchets, la stabilité des fondations de l'installation, la qualité des barrières artificielles construites au moyen de matériaux prélevés dans la couverture sus-jacente ou d'autres matériaux, le tassement des déchets, le tassement et l'endommagement des couvertures de l'installation ou tout autre problème qui pourrait entraîner une infiltration d'eau et la migration de contaminants.

Les études géotechniques devraient inclure des échantillonnages géotechniques, investigations sur le terrain et études en laboratoire pour évaluer :

- les cas antérieurs de glissements de terrain et d'autres pentes potentiellement instables dans la région
- les propriétés physiques et caractéristiques du sol (granulométrie, plasticité, dispersion, propriétés cohésives)
- les paramètres de résistance au cisaillement
- la capacité portante du matériau de fondation
- le potentiel de liquéfaction du granulat libre
- les propriétés de compactage
- la conductivité hydraulique
- d'autres propriétés propres au site ou à la conception de l'installation.

4. Activités humaines et utilisation du territoire

De l'information sur les activités humaines passées, actuelles et futures à l'emplacement ou à proximité devrait être recueillie et la probabilité que ces activités aient une incidence devrait être évaluée.

Pour limiter les effets néfastes de l'activité humaine et de l'utilisation du territoire, il faut tenir compte de ce qui suit :

- les ressources naturelles ayant une valeur économique (comme les eaux souterraines, les minéraux, les eaux de surface ou le pétrole)
- le potentiel pour qu'il y ait d'autres activités d'utilisation du territoire à cet emplacement; utilisation des eaux de surface (comme l'accès, les activités récréatives ou la production d'hydroélectricité)
- les savoirs autochtones et utilisation du territoire historique et actuelle par des collectivités autochtones et le public
- les activités minières ou d'exploitation minière passées et actuelles – forages, puits et autres caractéristiques ou activités qui pourraient entraîner de l'instabilité ou ouvrir des voies de migration pour les radionucléides (comme la fracturation hydraulique)
- les effets potentiels des changements climatiques.

5. Acquisition de données et activités de vérification

Le promoteur devrait montrer dans sa demande de permis que les résultats des activités de caractérisation du site sont exacts, complets, reproductibles, traçables et vérifiables.

5.1 Système de gestion

Conformément à l'alinéa 3(1)k) du *Règlement général sur la sûreté et la réglementation nucléaires*, on s'attend à ce que le demandeur de permis décrive sa structure organisationnelle de gestion, y compris la répartition interne des fonctions, des responsabilités et pouvoirs. L'alinéa 3d) du *Règlement sur les installations nucléaires de catégorie I* précise que le demandeur doit présenter le système de gestion pour l'activité visée, y compris les mesures qui seront prises pour promouvoir et appuyer une culture de sûreté. Le caractère adéquat du système de gestion est évalué par le personnel de la CCSN. En instaurant un système de gestion, l'organisation ferait la preuve de sa conformité, s'assurerait de se conformer aux exigences de façon uniforme, fixerait des priorités et améliorerait continuellement les activités de caractérisation de l'emplacement.

Le demandeur de permis devrait élaborer et instaurer un système de gestion pour les activités de caractérisation de l'emplacement qui font partie du processus de sélection du site, conformément aux exigences énoncées dans la norme du Groupe CSA N286-12, *Exigences relatives au système de gestion des installations nucléaires* [6] et au document REGDOC-2.1.1, *Système de gestion* [7].

Les sujets abordés dans la documentation encadrant le système de gestion devraient inclure les exigences générales et particulières pour les processus et pratiques de caractérisation de l'emplacement.

5.2 Programme de gestion des données

L'intégrité, l'exactitude et l'exhaustivité de l'information et des données résultant des activités de caractérisation de l'emplacement sont de la plus haute importance. Le promoteur devrait garantir l'uniformité et la qualité des données utilisées pour élaborer le dossier de sûreté étayant toute demande officielle de permis.

Le promoteur devrait instaurer des programmes d'assurance et de contrôle de la qualité pour garantir la grande qualité des données obtenues et leur traçabilité. Les programmes devraient viser la production de preuves documentaires servant à montrer que le degré de qualité requis a été atteint. Les données devraient être recueillies, présentées, stockées et archivées d'une façon convenablement normalisée et contrôlée. Les données devraient être compilées dans un format qui facilite leur examen, leur comparaison, la détection des lacunes et un examen indépendant. Pour chaque composante de la caractérisation de l'emplacement, la documentation devrait clairement indiquer les propriétés étudiées, les méthodes de collecte de données et d'investigation employées, les résultats ainsi que les hypothèses et incertitudes qui y sont associées.

Le processus d'évaluation des données et de détermination des paramètres liés à l'emplacement comprend des analyses et des évaluations techniques et d'ingénierie qui exigent une vaste expérience et des connaissances approfondies. Dans de nombreux cas, les paramètres et les analyses peuvent ne pas se prêter à une vérification directe par des inspections, des essais ou d'autres techniques qu'il est possible de définir et de contrôler de façon précise. Par conséquent, ces évaluations devraient être examinées et vérifiées par des particuliers ou des groupes indépendants (examen par un tiers) distincts de ceux qui ont exécuté le travail initial. Les examens devraient être effectués aux différentes étapes du processus de sélection de sites, conformément aux instructions et procédures de travail.

5.3 Procédures d'échantillonnage et d'essai

L'information sur la caractérisation de l'emplacement est nécessaire d'abord pour élaborer des interprétations, puis pour confirmer, préciser et adapter les interprétations initiales en fonction de données obtenues lors d'activités antérieures de caractérisation. Les activités qui peuvent servir à obtenir les données nécessaires pour guider les phases ultérieures d'élaboration et de mises à jour des évaluations et du dossier de sûreté comprennent:

- la compilation de données géoscientifiques
- les levés géophysiques aériens (magnétiques ou gravimétriques) et levés sismiques
- les techniques sismiques et forages peu profonds (pouvant servir à caractériser les matériaux sus-jacents)
- la cartographie géologique :
  - la cartographie du substrat rocheux
  - la cartographie de la surface (formes de relief, profondeur jusqu'au substrat rocheux, dépôts de surface ou ressources en granulats, histoire géologique du Quaternaire)
- la caractérisation environnementale
- la cartographie de la topographie
- l'interprétation de photographies aériennes
- l'échantillonnage des sols pour analyser les processus de dépôt et de transport dans le sol
- les essais des propriétés géochimiques de la roche
- les trous de forage

5.3.1 Procédures d'investigation souterraine par le forage de trous de forage

La caractérisation des emplacements de DGP comprend la collecte de données fiables sur les conditions souterraines. Durant la période précédant la demande de permis (figure 1), la plupart des données sont recueillies en effectuant divers essais entre les trous de forage spécifiques à cette fin. Par conséquent, le programme de caractérisation de l'emplacement devrait décrire ce qui suit :

- le nombre, l'emplacement et le type (foreuse à diamant ou à percussion d'air) des trous à forer à l'emplacement
- la fonction de chaque trou de forage et son orientation, sa longueur et son diamètre prévus
- les types de lubrifiants et de traceurs fluides de forage qui seront employés durant le forage
- les types et le calendrier de surveillance de déviation des puits afin d'en diriger l'orientation
- les paramètres de prélèvement de carottes, intervalles d'échantillonnage et procédures de diagraphie et d'entreposage de carottes, ou procédures d'échantillonnage, de diagraphie et d'entreposage d'éclats
- le nombre et le type d'essais physiques à effectuer sur les échantillons de carottes ou d'éclats;
- le calendrier de forage et d'essai
- les types d'essais hydrogéologiques (comme les essais en cours de forage, les essais par impulsion ou les essais de traçage) à effectuer dans le cadre du programme de forage
- les échantillons d'eaux souterraines à recueillir lors du forage et types d'analyses à effectuer
- les documents présentant les types d'analyses effectuées, les instruments d'analyse employés et le délai écoulé entre le prélèvement et l'analyse des échantillons
- les procédures d'aménagement et de réalisation de trous de forage (évacuation, coffrage et scellage)
- les procédures de scellage du trou de forage à suivre s'il doit être abandonné.

Un programme d'assurance et de contrôle de la qualité des trous de forage devrait être instauré pour garantir que les objectifs du programme de forage sont atteints et contrôlés, et devrait donc comprendre :

- la tenue d'un journal de forage par un géologue qualifié, sur le lieu du forage, qui consigne les activités de forage et autres activités connexes pertinentes, comme :
  - le nettoyage des tiges de forage avant le début du forage
  - l'installation de coffrage de surface et les procédures d'injection de coulis
  - le taux de pénétration de forage
  - l'extraction des carottes
  - les intervalles de production d'eau et leur débit
  - la quantité de fluide de forage ajouté et les zones de pertes d'eau
  - les mesures de concentration des traceurs dans le fluide de forage et l'eau de retour
  - les ajouts de lubrifiants de forage
  - l'aménagement du puits par rapport à l'enlèvement des déblais de forage résiduaires et du fluide de forage, et l'information sur les échantillons de carottes ou d'éclats
- la consignation de renseignements sur le niveau d'eau statique lors des arrêts de forage et la composition chimique des eaux souterraines ramenées à la surface lors du forage de puits par percussion d'air, et les procédures suivies pour recueillir et conserver ces échantillons d'eau
- la réalisation de levés de puits après le forage pour confirmer que le puits respecte la profondeur, le diamètre et l'orientation établis
- la création d'un dossier électronique qui consigne toutes les activités et mesures de forage et les mesures.

D'autres organismes de seront impliqués dans les activités de caractérisation de l'emplacement menées avant que le site soit choisi et qu'un demandeur réalise des activités nécessitant un permis de la CCSN (voir section 3.1). Le demandeur devrait, tôt dans le processus, réaliser les activités de caractérisation de l'emplacement en collaborant avec les organismes de réglementation concernés, afin de garantir qu'il comprend bien les attentes réglementaires, les exigences en matière d'autorisation, de délivrance de permis et autres exigences, et que les problèmes potentiels liés à l'acceptation de données sont connus et atténués.

5.4 Intégration et interprétation

La caractérisation de l'emplacement devrait permettre de connaître le site de façon détaillée et conceptuelle grâce à l'analyse d'un grand nombre de composantes physiques et environnementales interagissant mutuellement. Cette analyse aboutit à plusieurs systèmes indépendants de composantes liées, où les composantes de chaque système peuvent être interprétées pour produire un modèle conceptuel du site. Par exemple, la distribution stratigraphique, pétrologique et spatiale du stress *in situ* peut être interprétée pour obtenir un modèle conceptuel de la géologie structurelle actuelle et historique du site, tandis que la distribution minéralogique de la matrice rocheuse et du remplissage de fractures peut être interprétée pour générer un modèle distinct de l'évolution géologique du site.

Les différents modèles de site produits à partir de divers levés et disciplines devraient être intégrés dans un modèle conceptuel unique et cohérent de l'histoire géologique et hydrogéologique du site, de ses conditions actuelles et de son évolution prévue (sans perturbation).

Le modèle des conditions actuelles d'un site fournit les renseignements nécessaires au travail de conception. L'histoire du site devrait renseigner sur la façon dont le site a réagi aux perturbations antérieures; extrapoler les données historiques sur l'emplacement aux conditions actuelles du site peut permettre d'obtenir un modèle de la façon dont le site devrait évoluer dans le temps. L'application au modèle évolutif du site sans perturbation des estimations des perturbations causées par l'installation prévue et de la réaction du site aux perturbations antérieures devrait permettre de générer un modèle de l'évolution prévue du site et de son installation.

Le demandeur devrait colliger les résultats de l'intégration et de l'interprétation des caractéristiques de l'emplacement dans un modèle du site, ce qui constituerait de l'information importante permettant d'étayer le dossier de sûreté post-fermeture.

6. Installations pour les activités de vérification et caractérisation

Une installation de recherche souterraine (IRS) est une installation généralement construite à une profondeur telle qu'elle constitue un environnement représentatif permettant de recueillir de l'information et de donner de la formation, définir davantage la composition géologique, mener des expériences, mettre les équipements et les concepts à l'essai, et à aider à démontrer la faisabilité d'un DGP.

Les caractéristiques géoscientifiques du sous-sol ne peuvent être obtenues uniquement au moyen d'activités menées depuis la surface (comme les levés géophysiques, la cartographie et le forage de puits en profondeur), lesquelles sont limitées simplement parce qu'elles constituent des observations à la surface de caractéristiques qui existent en profondeur. Par conséquent, les activités de vérification et de caractérisation (comme l'excavation et la recherche souterraines) effectuées dans une IRS sont considérées comme une pratique exemplaire à l'échelle internationale en ce qui a trait aux DGP destinés aux déchets radioactifs de haute activité, y compris le combustible nucléaire usé. Ces activités réduisent les incertitudes en produisant plus de données à inclure dans le dossier de sûreté et peuvent être menées dans une IRS générale ou propre à l'emplacement.

L'aménagement d'une IRS prend du temps. Il peut s'écouler une longue période entre la sélection d'un site potentiel et la construction d'une telle installation à cet emplacement. Il faut aussi du temps pour renforcer les capacités de recherche et de soutien en réalisant des activités liées à l'IRS dans d'autres pays. Par conséquent, une pratique exemplaire consiste à planifier les activités liées à l'IRS le plus tôt possible dans le processus de sélection d'un site.

Il est important que le demandeur de permis discute de ses plans avec la CCSN rapidement aux fins de vérification. Ceci comprendrait les plans d'une IRS ou d'une installation semblable. Entamer le dialogue rapidement aide à clarifier le processus d'approbation réglementaire et à déterminer les activités de caractérisation de l'emplacement associées à la vérification. Ce dialogue est également requis pour déterminer les activités de caractérisation pouvant être réalisées avant l'obtention d'un permis de la CCSN pour la préparation du site ou pour la construction.

Annexe A : Le rôle de la caractérisation de l’emplacement dans le processus de sélection d’un site

Le demandeur de permis est responsable du processus de sélection d’un site et de la décision de choisir un site en particulier.

L’Agence internationale de l’énergie atomique (AIEA) distingue quatre stades pour le processus de sélection d’un site pour un DGP:

1. le stade de la conception et la planification

2. le stade d’étude du secteur

3. le stade de l’évaluation de l’emplacement

4. le stade de la caractérisation détaillée et de la confirmation de l’emplacement

La caractérisation de l’emplacement débute à la première étape pendant l’évaluation d’un site et devrait s’intensifier à mesure que le processus de sélection se poursuit jusqu’à la confirmation de l’emplacement. La transition d’une étape à l’autre est quelque peu arbitraire, étant donné le chevauchement des activités de sélection d’un site. Les activités de caractérisation appuient également la conception technique.

Les activités de caractérisation devraient se poursuivre tout au long des différentes étapes d’autorisation de la CCSN — préparation de l’emplacement, construction, exploitation, déclassement et fermeture — si un projet obtient les approbations réglementaires.

A.1 Stade de conception et planification

À ce stade, un plan global pour le processus de sélection du site est élaboré. Les activités comprennent la compilation et l’interprétation des données. Cela comprend la détermination de caractéristiques souhaitées à titre de référence pour la deuxième étape et l’élaboration d’un concept général d’installation basé sur le type, le volume et le contenu en radionucléides des déchets radioactifs à gérer. (Pour plus d’informations, consulter les documents REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l’évacuation des déchets radioactifs* [2] et CSA N292.0-14, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié* [8].) Les critères de présélection du site devraient être mis au point pour permettre de sélectionner ou rejeter des sites potentiels et, à terme, désigner un emplacement privilégié.

A.2 Stade d’étude du secteur

Le stade d’étude du secteur comprend la présélection de zones potentielles ciblées et la cartographie géologique régionale et d’autres activités de caractérisation à l’échelle régionale (comme les levés géophysiques aériens). La conception technique peut évoluer en fonction de l’information recueillie sur l’emplacement. Le but des activités menées au stade d’étude du secteur est d’éclairer le processus de présélection, ce qui peut permettre de restreindre le nombre de sites potentiels.

A.3 Stade de caractérisation de l’emplacement

Le stade de caractérisation de l’emplacement comporte d’importants travaux sur le terrain et études en laboratoire, habituellement pour recueillir des données propres au site sur une variété de conditions de l’emplacement, y compris sa géologie, sa géochimiques et sa conformité sur le plan géomécanique.

Les activités de caractérisation de l’emplacement réalisées en début de stade comprennent des études scientifiques, des travaux de compilation de données et des activités comme les levés géophysiques et le forage de trous de forage, bien que de telles activités prendraient fin avant le perçage du sol pour le forage d’un puits.

Un dossier de sûreté « post-fermeture » préliminaire (comportant des modèles pour le long terme) devrait être complété à ce stade pour évaluer si l’emplacement est convenable pour accueillir une installation de DGP aussi bien que pour orienter des activités plus poussées de caractérisation et de confirmation. Un dossier de sûreté préliminaire peut aussi être intégré à une analyse comparative des sites restants (le cas échéant), qui mènerait au prochain stade de confirmation de l’emplacement, au cours duquel des travaux importants et poussés seraient menés sur un ou plusieurs sites.

A.4 Stade de confirmation de l’emplacement

La confirmation de l’emplacement consiste habituellement en la réalisation d’études approfondies sur le terrain et en laboratoire sur l’emplacement sélectionné. À stade, il peut être nécessaire d’évaluer si on a besoin de creuser un trou de forage ou de construire une installation de recherche souterraine (IRS) pour obtenir davantage d’information.

Un dossier de sûreté post-fermeture devrait être préparé à partir de toutes les données recueillies pendant les stades antérieurs de sélection du site, combinés avec de l’information quant à la géologie et à l’hydrogéologie et de l’information concernant d’autres barrières comme le système artificiel de barrières, la conception des silos de stockage et les caractéristiques des déchets radioactifs. Ces renseignements peuvent servir à constituer un dossier de sûreté aux fins d’autorisation.

Glossaire

On peut trouver les définitions des termes employés dans le présent document, dans le REGDOC-3.6, *Glossaire de la CCSN*. Ce document comprend les termes et les définitions employés dans la *Loi sur la sûreté et la réglementation nucléaires* et son règlement, ainsi que les documents de réglementation de la CCSN. Le REGDOC-3.6 est mentionné à titre de référence et d'information.

Les termes suivants sont de nouveaux termes définis ou des termes existants dont la définition a été révisée. À la suite d'une consultation publique, la version définitive des termes et des définitions sera présentée aux fins d'inclusion dans la prochaine version du REGDOC-3.6, *Glossaire de la CCSN*.

Confinement
Fonction d'une barrière destinée à prévenir ou limiter les rejets de déchets radioactifs ou dangereux. Dans le cas d'évacuation dans des formations géologiques profondes, le confinement renvoie à la fonction de la barrière naturelle (comme la roche hôte) et de la barrière artificielle pour limiter les rejets de radionucléides.

Isolement
Séparation physique des déchets radioactifs de la population et de l'environnement afin de rendre difficile l'accès aux déchets. Dans le cas d'évacuation dans des formations géologiques profondes, l'isolement découle surtout de la profondeur du dépôt.

Références

1. CCSN. REGDOC-2.9.1, *Protection de l'environnement : Principes, évaluations environnementales et mesures de protection de l'environnement*, Ottawa, 2017.

2. CCSN. REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* (ébauche), Ottawa, à déterminer.

3. CCSN. REGDOC-3.2.2, *Mobilisation des Autochtones*, Ottawa, 2019.

4. CCSN. REGDOC-3.5.1, *Processus d'autorisation des installations de catégorie I et des mines et usines de concentration d'uranium*, Ottawa, 2017.

5. CCSN. REGDOC-3.2.1, *L'information et la divulgation publiques*, Ottawa, 2018.

6. Groupe CSA. CSA N286-12, *Exigences relatives au système de gestion des installations nucléaires*, Toronto, 2012.

7. CCSN. REGDOC-2.1.1, *Système de gestion*, Ottawa, 2019.

8. Groupe CSA. CSA N292.0-14, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié*, Toronto, 2014.

9. Agence internationale de l'énergie atomique (AIEA). Collection Normes de sûreté, nº SSG-14, *Geological Disposal Facilities for Radioactive Waste*, Vienne, 2011.

Renseignements supplémentaires

La CCSN peut recommander des documents supplémentaires sur les pratiques exemplaires et les normes comme ceux publiés par le Groupe CSA. Avec l'autorisation de l'éditeur, le Groupe CSA, l'ensemble des normes de la CSA associées au nucléaire est accessible gratuitement par la page Web de la CCSN intitulée « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au nucléaire ».

Les documents suivants donnent des renseignements connexes pouvant être pertinents et utiles pour comprendre les exigences et l'orientation donnés dans le présent document d'application de la réglementation :

- Association des responsables des autorités de sûreté nucléaire des pays d'Europe de l'Ouest. *Report : Radioactive Waste Disposal Facilities Safety Reference Levels*, 2014.
- Conférence WM2015, du 15 au 19 mars 2015, *Need for and Use of Generic and Site-Specific Underground Research Laboratories to Support Siting, Design and Safety Assessment Developments — 15417*. Phoenix, Arizona, États-Unis.
- CCSN. REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour la gestion à long terme des déchets radioactifs*, Ottawa, 2018.
- Agence internationale de l'énergie atomique (AIEA). Collection Normes de sûreté de l'AIEA, Prescription de sûreté particulières n° SSR-5, *Stockage définitif des déchets radioactifs*, Vienne, 2011.
- AIEA. *Glossaire de sûreté de l'AIEA : terminologie employée en sûreté nucléaire et radioprotection*, édition 2007, Vienne, 2007.
- AIEA. Collection Normes de sûreté, nº SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, Guide de sûreté particulier, Vienne, 2012.
- AIEA. Collection Normes de sûreté, nº GSG-1, *Classification of Radioactive Waste*, Vienne, 2009.

Série de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la CCSN. En plus de respecter la *Loi sur la sûreté et la réglementation nucléaires* et ses règlements d'application, ces installations et activités peuvent devoir se conformer à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Les documents d'application de la réglementation de la CCSN sont classés selon les catégories et séries suivantes :

1.0 Installations et activités réglementées

Série 1.1 Installations dotées de réacteurs
1.2 Installations nucléaires de catégorie IB
1.3 Mines et usines de concentration d'uranium
1.4 Installations de catégorie II
1.5 Homologation d'équipement réglementé
1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Série 2.1 Système de gestion
2.2 Gestion de la performance humaine
2.3 Conduite de l'exploitation
2.4 Analyse de la sûreté
2.5 Conception matérielle
2.6 Aptitude fonctionnelle
2.7 Radioprotection
2.8 Santé et sécurité classiques
2.9 Protection de l'environnement
2.10 Gestion des urgences et protection-incendie
2.11 Gestion des déchets
2.12 Sécurité
2.13 Garanties et non-prolifération
2.14 Emballage et transport

3.0 Autres domaines de réglementation

Série 3.1 Exigences relatives à la production de rapports
3.2 Mobilisation du public et des Autochtones
3.3 Garanties financières
3.4 Délibérations de la Commission
3.5 Processus et pratiques de la CCSN
3.6 Glossaire de la CCSN

Remarque : Les séries de documents d'application de la réglementation pourraient être modifiées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste des documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*

Rapport de consultation: REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur*

Introduction

REGDOC-1.2.1 describes the elements of a site characterization program for a deep geological repository (DGR) facility for radioactive waste. The document provides guidance only and contains no requirements.

Site characterization information is integral for licence applications for DGR facilities. Site characterization information is used to inform the design of the DGR facility in the pre-licensing phase. This information is re-evaluated over the lifecycle of the DGR facility (that is, site preparation, construction, operation, decommissioning/closure and post-closure). Additional site characterization information acquired over the lifecycle of the DGR facility would also inform the long-term safety assessments and safety case.

While site characterization activities begin before the CNSC's regulatory process, the methods and processes used, and the data collected in the pre-application period may form part of future licence applications and undergo formal review for quality and adequacy.

If approved by the Commission, REGDOC 1.2.1 will supersede R-72, *Geological Considerations in Siting a Repository for Underground Disposal of High-Level Radioactive Waste*.

Introduction

Le REGDOC-1.2.1 décrit les éléments d'un programme de caractérisation des emplacements de dépôts géologiques en profondeur (DGP) destinés aux déchets radioactifs. Il fournit de l'orientation seulement et ne contient aucune exigence.

L'information sur la caractérisation de l'emplacement fait partie intégrante des demandes de permis pour les DGP. Elle contribue à étayer la conception du DGP au cours de la phase préalable à l'autorisation. Cette information est réévaluée au cours du cycle de vie du DGP (c'est-à-dire, préparation du site, construction, exploitation, déclassement/fermeture et période post-fermeture). L'information additionnelle sur la caractérisation de l'emplacement acquise au cours du cycle de vie du DGP servirait également à étayer le dossier de sûreté et les évaluations de la sûreté à long terme.

Bien que les activités de caractérisation de l'emplacement débutent avant le processus de réglementation de la CCSN, les méthodes et processus utilisés et les données recueillies durant la période préalable à la demande peuvent étayer de futures demandes de permis et faire l'objet d'un examen officiel aux fins de vérification de la qualité et de la pertinence.

S'il est approuvé par la Commission, le REGDOC-1.2.1 remplacera le document R-72, *Considérations géologiques* *pour le choix d'un emplacement de dépôt souterrain de déchets hautement radioactifs.*

Consultation process

CNSC staff have extensively engaged with stakeholders on the waste management and decommissioning framework.

REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* was posted for comments from October 19 to December 17, 2018.

A total of 100 comments were received from 12 respondents: Algonquin Eco Watch, Anna Tilman, Canadian Nuclear Laboratories (CNL), Dr. Sandy Greer, Dodie LeGassick, Inverhuron Committee, New Brunswick Power, Northwatch, Nuclear Waste Management Organization (NWMO), Ontario Power Generation (OPG), Saskatchewan Environmental Society and Society of United Professionals.

Consultation submissions were posted for feedback on comments from January 18 to February 8, 2019. The CNSC received 78 comments from 7 respondents: Dr. Michael Stephens, Dr. Sandy Greer, Environment Canada, Jaro Franta, Métis Nation of Ontario, Saint John Citizens Coalition for Clean Air and University of Ontario Institute of Technology.

Subsequently CNSC staff were contacted by members of the Independent geoscience Advisory Group (IAG) to the CNSC on used nuclear fuel disposal in a DGR – who requested additional time to review the document. As a resulted, a targeted consultation limited to members of the IAG was held from June 14 to August 5, 2019. IAG members submitted a total of 41 comments.

Processus de consultation

Le personnel de la CCSN a mobilisé de manière exhaustive les parties intéressées à l'égard du cadre de gestion des déchets et de déclassement.

Le REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* a été affiché aux fins de commentaires du 19 octobre au 17 décembre 2018.

En tout, 100 commentaires ont été reçus de 12 répondants, soit : Algonquin Eco Watch, Anna Tilman, les Laboratoires Nucléaires Canadiens (LNC), Sandy Greer, Ph. D., Dodie LeGassick, le Comité Inverhuron, Énergie du Nouveau-Brunswick, Northwatch, la Société de gestion des déchets nucléaires (SGDN), Ontario Power Generation (OPG), la Saskatchewan Environmental Society et la Society of United Professionals.

Les mémoires relatifs à la consultation ont été affichés du 18 janvier au 8 février 2019 aux fins de rétroaction sur les commentaires. La CCSN a reçu 78 commentaires de 7 répondants, soit : Michael Stephens, Ph. D., Sandy Greer, Ph. D., Environnement Canada, Jaro Franta, la Nation des Métis de l'Ontario, la Saint John Citizens Coalition for Clean Air et l'Institut universitaire de technologie de l'Ontario.

Par la suite, des membres du Groupe consultatif indépendant (GCI) en géosciences auprès de la CCSN sur l'évacuation ou le stockage définitif du combustible nucléaire usé dans un DGP ont communiqué avec le personnel de la CCSN pour demander davantage de temps pour examiner le document. Par conséquent, des consultations

Civil society organizations (CSOs) and industry requested workshops to discuss REGDOCs from the waste management and decommissioning series, including this one.

CNSC staff held a workshop with industry on February 5, 2020 and a webinar with CSOs on February 26. Due to technical difficulties, a second webinar with members of the public and CSOs was held April 23rd, 2020. The purpose of the workshops was to explain the changes made to the document following public consultation and to discuss outstanding issues and how comments were dispositioned.

The following organizations participated for the February 5 workshop with industry:

- Bruce Power
- BWX Technologies
- Cameco
- Canadian Nuclear Association
- CNL
- CANDU Owners Group
- Hydro-Québec
- Kinetrics
- New Brunswick Power
- Nuclear Waste Management Organization
- OPG
- Orano

The following commenters participated in the CSO webinar, either in person or through written submissions:

- Algonquin Eco Watch
- Canadian Environmental Law Association
- Concerned Citizens of Renfrew and Area
- Dr. Frank Greening
- Dr. Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Regional Municipality of Durham
- Concerned Citizens of Renfrew County and Area

ciblées limitées aux membres du GCI ont été tenues du 14 juin au 5 août 2019. Les membres du GCI ont présenté 41 commentaires.

Les organisations de la société civile (OSC) et l'industrie ont demandé la tenue d'ateliers afin de discuter des REGDOC relatifs à la gestion des déchets et au déclassement, y compris celui-ci.

Le personnel de la CCSN a organisé un atelier avec l'industrie le 5 février 2020 ainsi qu'un webinaire avec les OSC le 26 février. En raison de difficultés techniques, un deuxième webinaire à l'intention des membres du public et des OSC a eu lieu le 23 avril 2020. Ces ateliers avaient pour but d'expliquer les modifications apportées au document à la suite de consultations publiques et de discuter des problèmes non résolus et de la manière dont les réponses aux commentaires ont été données.

Les organisations suivantes ont participé à l'atelier du 5 février à l'intention de l'industrie :

- Bruce Power
- BWX Technologies
- Cameco
- l'Association nucléaire canadienne
- les LNC
- le Groupe des propriétaires de CANDU
- Hydro-Québec
- Kinetrics
- la Société d'énergie du Nouveau-Brunswick
- la Société de gestion des déchets nucléaires
- OPG
- Orano

Les commentateurs suivants ont participé au webinaire à l'intention des OSC, en personne ou au moyen de mémoires :

- Coalition for Nuclear Responsibility
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

The full responses to stakeholder feedback on individual REGODCs, including comments received during public consultation or in advance of the workshops, can be found in the associated detailed comments table included as part of the Commission Member Document package.

- Algonquin Eco Watch
- l'Association canadienne du droit de l'environnement
- les Citoyens concernés du comté et de la région de Renfrew
- Frank Greening, Ph. D.
- Sandy Greer, Ph. D.
- Northwatch
- Dodie LeGassick
- Michael Stephens
- la municipalité régionale de Durham
- les Citoyens concernés du comté et de la région de Renfrew
- le Regroupement pour la surveillance du nucléaire
- la Saskatchewan Environmental Society
- le Ralliement contre la pollution radioactive

Les réponses complètes à la rétroaction des parties intéressées pour chaque REGODC, y compris les commentaires reçus durant les consultations publiques ou avant les ateliers, peuvent être consultées dans le tableau détaillé des commentaires connexe inclus dans la trousse de documents à l'intention des commissaires.

Key comments

The following summarizes the key comments received during the consultation period and provides the CNSC's responses:

Principaux commentaires

Les principaux commentaires reçus lors de la période de consultation sont résumés ci-après, accompagnés des réponses de la CCSN.

Comment 1 :

Commenters opined that the role of site characterization and site selection in the CNSC regulatory process required further clarity.

Commentaire 1

Les commentateurs se sont dits d'avis qu'il fallait clarifier le rôle de la caractérisation de l'emplacement et de la sélection du site au sein du processus de réglementation de la CCSN.

CNSC staff response:

A new figure has been added to provide clarity to site characterization in the CNSC regulatory

Principaux commentaires

Une nouvelle figure a été ajoutée afin de clarifier la caractérisation de l'emplacement au process. Text throughout the document was revised to focus on site characterization and a new background section added.

Guidance on site selection information has been removed from the body of the revised REGDOC. This information (also revised) is now an appendix that is consistent with international guidance.

Comment 2:

There was confusion on whether the document included requirements, specifically between guidance for site characterization and requirements for long-term post closure safety.

CNSC staff response:

The scope was clarified to outline that this is a guidance document and that it does not set out any requirements. For long-term post closure safety requirements, the document now references REGDOC 2.11.1 , *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management,* Version 2.

Comment 3:

Commenters thought the REGDOC did not adequately identify where the public could participate in the regulatory process.

CNSC staff response:

The document was revised to include information on public and indigenous engagement.

sein du processus de réglementation de la CCSN. La formulation de l'ensemble du document a été révisée afin de mettre l'accent sur la caractérisation de l'emplacement, et une nouvelle section a été ajoutée afin d'établir le contexte.

De l'orientation sur la sélection du site a été retirée du corps du REGDOC révisé. Cette information (également révisée) fait maintenant partie d'une annexe qui respecte l'orientation internationale.

Commentaire 2

On s'interrogeait sur la question de savoir si le document comportait des exigences, en particulier en ce qui concerne l'orientation relative à la caractérisation de l'emplacement et les exigences relatives à la sûreté à long terme post-fermeture.

Réponse du personnel de la CCSN

La portée a été clarifiée pour souligner qu'il s'agit d'un document d'orientation qui n'établit aucune exigence. En ce qui concerne les exigences relatives à la sûreté à long terme post-fermeture, le document cite maintenant en référence le REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation ou le stockage définitif des déchets radioactifs, version 2*

Commentaire 3

Les commentateurs estimaient que le REGDOC n'indique pas clairement comment le public peut participer au processus de réglementation.

Réponse du personnel de la CCSN

Le document a été révisé de sorte d'y inclure de l'information sur la mobilisation du public et des Autochtones.

Comment 4:

Commenters expressed concern that some of the terms used in the document were not always well-defined.

CNSC staff response:

Deep geological disposal-specific definitions for "containment" and "isolation" were added to the REGDOC.

Concluding remarks

This project has undergone extensive stakeholder consultations. CNSC staff have listened to concerns and the document has been modified, as appropriate.

Commentaire 4

Les commentateurs ont exprimé des préoccupations selon lesquelles certains termes utilisés dans le document ne sont pas toujours bien définis.

Réponse du personnel de la CCSN

Des définitions propres à l'évacuation et au stockage définitif dans des dépôts géologiques en profondeur pour les termes « confinement » et « isolation » ont été ajoutées au REGDOC.

Mot de la fin

Ce projet a fait l'objet de vastes consultations auprès des parties intéressées. Le personnel de la CCSN a entendu les préoccupations et a modifié le document, au besoin.

REGDOC-1.2.1, ***Guidance on Deep Geological Repository Site Characterization***
REGDOC-1.2.1, ***Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur***
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

e-Doc 5724515

NOTE: Draft REGDOC-1.2.1 has gone through an iterative consultation process with stakeholders involving four distinct phases and four separate draft versions of the document being created. Therefore changes noted in Tables A, B and C reflect document modifications that were used for further stakeholder comments in Table D. As a result, only the changes noted in the final table (Table D) are reflected in the final draft version of the document submitted to the Commission for approval.

Comments received:
- Table A: on the Request for Information document: No comments received
- Table B: public consultation period (October 19 to December 17, 2018): 100 comments from twelve (12) reviewers
- Table C: feedback period (January 18 to February 8, 2019): 77 comments from seven (7) reviewers
- Table D: targeted consultation with the Independent geoscience Advisory Group (IAG) (June 14 to August 5): 42 comments received
- Table E: workshop with industry and civil society organizations on February 5, 2020 and April 23, 2020: 11 comments received from 13 participants

Commentaires reçus :
- Tableau A : sur le document Demande d'information : Aucun commentaire reçu
- Tableau B: période de consultation publique (19 octobre au 17 décembre 2018) : 100 commentaires reçus de douze (12) examinateurs
- Tableau C: période des observations (18 janvier au 8 février 2019) : 77 commentaires reçus de sept (7) examinateurs
- Tableau D: consultation ciblée avec le Independent geoscience Advisory Group (IAG) (14 juin au 5 août 2019): 42 commentaires reçus
- Tableau E: atelier avec l'industrie et avec des organisations de société civile du 5 février 2020 et du 23 avril 2020 : 11 commentaires reçus de 13 participants

Table A: Comments on the "Request for Information" / Tableau A : Sur le document Demande d'information

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
	No comments received.		

Table B : Comments received on the draft document / Tableau B: période de consultation publique

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	General	Saskatchewan Environmental Society	1. So "After closure there is no intention to retrieve...the radioactive waste". Earlier discussions held open the option of retrieving fuel waste for re-processing. Does this mean that 'closure' could be indefinitely delayed to maintain this option? If, during the pre-closure period, wastes were retrieved for reprocessing, would this be covered by a separate regulatory system? Would selection for a waste disposal site include evaluating the suitability of the site for an associated reprocessing plant? 2. Will baseline data include microbiological data at the depth at which waste would be stored?	1. Reference to retrieval has been removed from the document. The cited CSA standard has been moved to “additional information”. The project applicant may or may not include retrieval as an option during a phase (e.g. construction, operation, closure). This is consistent with the CSA standard cited. Any nuclear project (including retrieval or reprocessing) would be regulated by CNSC – however retrieval and reprocessing is outside the scope of this document. The selection of a waste disposal site is not covered by the Nuclear Safety and Control Act (NSCA). Information on site selection is provided in IAEA SSG-14, *Geological Disposal Facilities for Radioactive Waste*, Appendix 1. The relationship between site characterization and site selection is illustrated in the new Figure 1 of the revised document. 2. Microbiology has been included in the revised REGDOC in section 3 under geochemistry.
2.	General	Algonquin Eco Watch	To comment in this regard is to seemingly acknowledge that sufficient knowledge exists as to which of several “proven choices” will provide safe storage facilities for all types of nuclear waste. I do not believe that such knowledge exists and therefore should not comment, since by doing so unfortunately implies that I accept your assumption and am willing to “play by your rules”. However, by not commenting I would be sending the same message – a typical Catch 22. Therefore, I will comment. Ideally, now is the time to institute a moratorium	This comment is beyond of the scope of REGDOC-1.2.1. A safety case would be part of the documentation required to support a licence application for a DGR. This document does not detail all of the information that would be required to support an application to licence a DGR For information, documentation of decades of research carried out in Canada can be found here: http://nuclearsafety.gc.ca/eng/resources/educational-resources/feature-articles/deep-geological-repositories-DGR.cfm

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			regarding the development of permanent storage facilities for nuclear waste in Canada – at least until we are reasonably certain regarding the probability of success for the next 100,000 years – a goal that presently is far beyond our reach. Up to this point the nuclear industry, at least in Ontario, has been making assumptions that Hydro One is knowledgeable regarding the best location to construct a permanent storage location for low and medium risk nuclear waste. That was obviously a pipe dream. Now we are asked to provide knowledgeable suggestions regarding the permanent storage of (presumably) all levels of nuclear waste. It is unreasonable to expect average members of the public to provide knowledgeable input to such a complex problem – but now you will be able to say that "we welcomed public input through all phases of this program". The following quote is from the August, 2016, Vol. 12, Number 4, p.233, issue of Elements (attached), (a well-respected international magazine of Mineralogy, Geochemistry and Petrology): - "After more than 50 years of effort, there are at present no operating nuclear waste repositories for the spent nuclear fuel from commercial nuclear power plants or for the high-level waste from the reprocessing of spent fuel." Intuitively, sedimentary rock, one of our 2 apparent choices here in Ontario, should not be considered, owing to its long-term solubility, which can lead to the formation of water-bearing karst, ultimately leading to the invasion of radioactivity in the event of	

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			containment failure. While other countries, such as Sweden, appear to be far ahead of Canada researching possible site-types, crystalline rock, such as the granitic (igneous/metamorphic) types found in the Precambrian Shield seems to be our only viable alternative, and it comes with certain inherent problems such as the occurrence of abundant ground water, the presence of which in purest form will be critical for the viability of life on earth within the foreseeable* future. The introduction of radioactivity into groundwater is indeed our “worst case scenario”. Underground storage facilities can never be certified as “forever-safe”, owing to the inherent variability and instability of in-ground conditions. If “permanent” sites develop future containment problems, repairs will be insurmountable owing to the presence of emigrating radioactive waste. My suggestion would be to develop interim above ground facilities, which could be monitored and repaired in the event of structural problems, until a satisfactory method for permanent storage can be perfected. Realistic concerns already exist regarding the breaching of facilities by terrorists, since containment facilities already emerge above ground, so why the paranoia regarding above ground storage?	

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			Realistically, it's time to acknowledge the fact that "the cart is presently far ahead of the horse"; i.e. we seem to be prepared to proceed with unperfected storage facilities, without the proof of knowledge necessary to guarantee "forever safe". If Canada expects to ever become a world leader in nuclear power, we had better be prepared to fund massive research programs, beginning immediately. "Out of sight – out of mind" will only be applicable if/when we have adequately researched the problem objectively; not with the assumed stance that "we are almost there." We are not! *I apologize for the use of the phrase "foreseeable future", an obvious oxymoron, but it seemed appropriate in light of these rather unrealistic circumstances.	
3.	General	Northwatch	We have the following general observations with respect to the draft REGDOC: 1. The documents is frequently overly general or ambiguous 2. The document varies between providing general descriptions of various topics and providing regulatory guidance 3. The document lacks sufficient footnotes or references; many statements would benefit from a supporting reference or explanation 4. The document conveys a sense, overall, that if a proponent brings forward a proposal for a deep geological repository it will be licensed; it lacks the impartiality or neutrality that would convey that such projects would only be licensed if the proponent had demonstrated performance, i.e. that the repository	1-3. We have aimed to reduce ambiguity in the document during the revision period, especially with respect to the role of site characterization in the CNSC's regulatory process (new Figure 1 for the revised REGDOC) 4. If a proponent wishes to obtain a licence from the CNSC, they will need to demonstrate how they followed guidance (e.g. this document) and meet all applicable regulatory requirements. This document does not detail all of the information that would be required to support and application to licence a DGR. Figure 1 delineates activities carried out relative to the licence application process and provides additional clarity. For licensing decisions, the independent Commission functions as a quasi-judicial administrative tribunal. Commission members are independent, and make decisions with respect to licensing (and

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			could effectively isolate radionuclides placed at depth into perpetuity 5. The document is inconsistent in its approach, varying from one section to the other; for example, Section 3.2.5 provides a brief introduction and explanation of why geotechnical characterization is important, but most sections do not; while there are some problems with the content of this introductory paragraph, we note it here to illustrate the inconsistency of approach throughout the document	EA) based on the evidence brought before them. Commission hearings are public. 5. Each section was written with the subject matter in mind – the writing is not standardized to length, but varies according to topic.
4.	General	Northwatch	1. The review notice described draft REGDOC-1.2.1 as one which supercedes R-72. Without any endorsement of the substance of R-72, upon comparison we would note that R-72 does succeed, at least structurally, in three areas where the draft REGDOC fails: - It sets out what the elements of a successful long term management system for high level nuclear fuel waste would be, and - It sets out the fundamental requirements that must be considered in evaluating a proposal - It sets out actual criteria against which a potential deep geological repository will be judged While we are not arguing in defence of R-72 and would readily acknowledge that this regulatory document requires review and revision, the 1987 document does serve to illustrate some of the gaps in its proposed replacement. Notably, REGDOC-1.2.1 fails in that it provides no direction or means by which applications, concepts or proposals are to be measured and deemed to be successful or “approvable”. As already stated, there is a disturbing and recurring message that approval is the only	The detail provided in REGDOC-1.2.1 is specific for actually carrying out a site characterization program. The enumerated bulleted points are addressed in the REGDOC series 2.11- Waste Management. In particular REGDOC-2.11.1 volume III provides more information related to concerns on direction and how the safety case for a project will be evaluated. All of the specific elements in section 3 of R-72 have been incorporated into the site characterization section of REGDOC-1.2.1. Section 2 of R-72 lays out in general descriptive terms, fundamental objectives and requirements. Higher level fundamental requirements for any disposal project are found in REGDOC-2.11.1 volume I. Requirements specific for long-term safety are found in REGDOC-2.11.1 volume III. 2. Agreed. The comment table will be provided and a workshop will be organized.

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			possible outcome, and this is coupled with the absence of any actual criteria to assess applications. 2. We request that Northwatch and other commenters on draft REGDOC-1.2.1 be provided with a full dispositioning of their comments.	
5.	General	Dr. Sandy Greer	As a concerned citizen engaged with the regulatory processes directed to two proposed deep geologic repositories (DGRs) through the past six years, why cannot an `ecosystem approach' be recognized? This more advanced regulatory vision is named and recognized by the International Commission for Radiological Protection (ICRP), the latter fully honest that this approach requires continuing development.	The comment is beyond the scope of the document. The detail provided in REGDOC-1.2.1 is specific for actually carrying out a site characterization program.
6.	General	Dr. Sandy Greer	Foremost on my mind at this political moment is the ill-informed trajectory of Ontario Premier Doug Ford's reduction, even elimination, of a range of significant programs and government roles across several sectors from education to culture and the environment. We have not seen such politically – and ecologically – backward thinking in Ontario - and subsequent undermining of human and environmental wellbeing - since the days of former Premier Mike Harris. For example, Premier Ford seeks to terminate the position of Ontario's Environmental Commissioner. What related environmental regulations also might be reduced or removed as well, most particularly those which pertain to nuclear energy?	This comment is beyond the scope of this document.
7.	General	Dr. Sandy Greer	To sum up so abruptly, with apologies, given the pending deadline, I simply would like to emphasize that our human assumptions and worrisome	This comment is beyond the scope of this document.

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			dependability upon technology as the panacea for the planetary challenges we confront today and in the future is misguided, most specifically as related to the pursuit of deep geological repositories for radioactive waste.	
8.	General	Inverhuron Committee	The Inverhuron Committee is pleased to see REGDOC-1.2.1 developed. We would like to have seen this document, as it is now presented, applied to the OPG project where some of the guidance was not put into action i.e. The underground facility. We also hope that the Federal Government will step forward and create their own specific guidelines on the site selection process, which would eliminate the bias created to date on this project i.e. Financial compensation, political interference.	Comment noted. Site selection is not regulated under the NSCA. REGDOC-1.2.1 refers to (and remains consistent with) international guidance on the site selection process in IAEA SSG14 Appendix 1: Siting of geological disposal facilities which was used to evaluate the OPG DGR project.
9.	General	Society of United Professionals	The Regulator has created this REGDOC assuming that the safety of a DGR cannot be ascertained until closure takes place. As such, the license to approve a site and license construction appears to be a conditional license that depends on further research work until closure is granted. Such an approach creates the impression that certainty of design cannot be achieved and therefore increases the uncertainty and the risk of escalating costs when building a DGR.	Comment noted. The safety case is addressed in REGDOC-2.11.1 volume III. REGDOC-1.2.1 has been revised to include information on the role of site characterization in the CNSC's regulatory process (Figure 1. and section 3.1).
10.	General	Dodie LeGassick	REGDOC-1.2.1. repeats many of the concerns from 1987 and many of the concerns expressed by environmental groups such as Gene Watch, Northwatch and my group, Environment North. The question is ultimately can a safety case be made that can predict what may or may not occur over the next tens of thousands or millions of years. The following are our shared concerns about the proposed dgr: 1. Will the excavation damage adjacent zones of rock	This comment is beyond the scope of this document. These comments deal with scenarios that are part of the post-closure safety case addressed in REGDOC-2.11.1 volume III.

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			that in time become routes for escaping radionuclides? Couldn't fractures and faults release radionuclides into groundwater? 2. Could the formation of colloids and other compounds speed up the transport of radioactive elements? Can we not expect a buildup of gas pressures within the repository over time? 3. Will the intense heat that comes with radioactive decay compromise the backfill material and the cannisters? 4. Can any computer model/program safely predict the longevity of the steel and copper canister cladding to say that it will definitively last tens of thousands of years? 5. Can we honestly predict the effects of future glaciations, earthquakes and earth tremours? 6. Can a dgr exist that will be safe from human intrusions? It is often said that this process is guided by the directions of Canadians. Just who are these Canadians? How many Canadians in Northwestern Ontario are even aware that this project is in process? The host communities chosen were economically depressed and now with NWMOs funding of a variety of programs and the employment created these communities have become economically dependent on NWMO. If this is truly a fair and transparent process then to be fair to the people NWMO should precede any further surveys with studies of the socio economic impact on the affected people and make it their goal to educate those people about the concerns listed in your past and present reports .And to be clear about the contingency plan to	

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			perhaps have shallow rock repositories on the central site for decades before the building of the dgr. To conclude, I have noted our concerns but in addition I feel it necessary to ask again that there be much greater transparency and improved communications not only with the host communities but with the general public in the entire region of Northwestern Ontario.	
11.	General	Anna Tilman	**Summary** While this draft guidance regulation deals with various types of technical studies to ascertain the safety the safety of containment of high-level radioactive waste, the very long-term safety is, of necessity, based on expectations and predictions of numerous variables. The factors that one can anticipate now and/or predict far into the future that could result in a disturbance of the DGR resulting in the migration of radioactive waste to the biosphere are not or cannot be definitive at this stage or ironclad. That remains the unsolved dilemma and challenge of "isolating" radioactive waste, if that is even possible. What would happen if containment fails, and radioactive contaminants are released to the biosphere? Who is in charge? Who is the "caretaker"? Even if the DGR would isolate the waste for long periods, it would eventually be abandoned, no guardians, stewards, to watch over the site and pass that information on.	Comment noted. This is a guidance document on site characterization, where site characterization activities begin in a pre-licensing period. REGDOC-2.11.1 volume III sets out requirements for developing the long-term safety case.

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			In conclusion, given the overriding issues of storing high-level radioactive waste in a DGR, this draft regulation fails to capture the essence of the problem of abandoning this waste, while anticipating it would be safely contained for at least tens of thousands of years. The mindset that it is possible to safely isolate this waste in a DGR speaks to attempts to achieve an immediate solution to a current and future problem and removes responsibility from the generation emplacing the wastes, transferring any problems to future generations. CNSC's mandate is to protect the health and safety of Canadians, as well as our environment. Rather, as evidenced by this draft regulatory document, the issue of storing radioactive waste safely has not merited the necessary scrutiny warranted as this mandate would indicate.	
12.	General	OPG, NB Power, CNL, NWMO	The CNSC is clear, in both the title of this draft REGDOC and in its Purpose clause, that this is a guidance-only document for a DGR's site characterization process. Yet this draft uses language (the "shall-should-may" convention) that is normally associated with codes, standards and REGDOCs that define requirements. The extensive use of words like "should" and "recommended" could unintentionally lead readers to confuse guidance for requirements. To ensure the intent of this guidance-only document remains clear, industry urges the CNSC to substitute	No change was made as a result of this comment.. There are no "shalls" in the document. The use of "should" is appropriate.

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			the word "**may**" for "**should**" and "**recommended**" throughout the REGDOC. MAJOR Unclear guidance could lead to inefficient planning and unnecessary expenditures by potential DGR proponents.	
13.	General	OPG, NB Power, CNL, NWMO	1.Discussion of the siting process throughout this draft distracts from the document's intended focus on site characterization. 2. To keep the document's focus clearly on site characterization, industry urges the CNSC to: a. Remove Section 2. b. Remove all references to the siting process in other sections or amend where necessary to keep the focus on site characterization. For example, revise: c. The last sentence of the Purpose to read, " ... aspects that may be considered during the site characterization ~~stage of the siting process~~ for a DGR facility ... " d. The opening sentence of the 4th paragraph of Section 3.1 to read,, "As ~~siting~~ work progresses, more extensive geological information would be gathered …" e. The opening sentence of Section 3.1.1 to read, "The geological characteristics, in combination with the engineered barriers and the design of the DGR, should indicate that a DGR at the chosen site would remain safe for the entire time period of concern ~~– for tens of thousands to millions of years."~~ f. Delete the opening sentence of Section 4: " ~~The siting process will collect information that will eventually be included in the safety case for a DGR.~~ "	1. As a result of this comment, the document has been edited throughout to focus on site characterization. Readers are referred to IAEA SSG-14 (Appendix 1) for information on the siting process for DGRs. The role of site characterization in the regulatory process – including data collected by a proponent in the pre-application stage – is depicted in Figure 1. 2.a. As a result of this comment, the text previously found in Section 2 has been removed. In the newly-revised document section 2 now provides background information. b. Each use of "siting" has been revisited and revisions made to ensure document is within scope. c. As a result of this comment, the document has been revised as proposed. d. As a result of this comment, the document has been revised as proposed. e. Agreed. Timeframes are not the focus of the document. However, the need for extensive site characterization (and thus, this document) for a DGR arises because of this extended timeframe. The link to assessment timeframes has been moved to a new section on the role of site characterization in the CNSC regulatory process and international context provided. f. As a result of this comment, the document has been revised as

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			g. Delete the first three paragraphs of Section 6, starting with the section with the sentence, "It is important for the licence applicant…"	proposed. g. Comment noted. It is international best practice to carry out verification / further characterization in a URF. This does not need to be a site specific URF; it could be a generic URF and the text has been updated.
14.	General	OPG, NB Power, CNL, NWMO	Some phraseology in the document is not clearly aligned with the Class I regulations. For example, in the 3rd paragraph of Section 2.3, Site characterization stage, the reference to "preliminary safety assessments" at this stage could be confused with the "preliminary safety analysis report" needed for the licence to construct, per the Class I regulations. Additionally, the reference to "final safety assessment" in Section 2.4, Site confirmation stage, could be confused with the "final safety analysis report" needed for the licence to operate, per Class I regulations. Jt also suggests this is needed for the "initial licence application," which may only be a licence to prepare the site. This section also refers to the possibility of sinking the shaft and constructing an Underground Research Facility. These activities are also at odds with the environmental assessment process and licensing since it suggests this could happen beforehand. Ensure alignment with the Canadian regulatory framework. MAJOR Potential for proponents to be misaligned with the regulatory framework.	Comment noted. As a result of this comment, the text previously found in Section 2 has been removed, section 2 now provides background information.

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15.	Preface	Northwatch	1. Regulatory document REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization, self describes in the preface as being a document which "sets out guidance for the site characterization stage of the siting process for a deep geological repository (DGR) facility for radioactive waste, as information gathered for site characterization may be used in subsequent licence applications. In several instances the document is ambiguous in its use of terms such as "site characterization stage" and "siting process"; the document should be clear in its terminology, and particularly in its distinctions – if any – between the site search, site evaluation, site investigation, site characterization, and site confirmation, all of which might – or might not – be within the "siting process"; while Canadian proponents have been vague and varied in their use of these terms, the regulator should not be 2. The draft document states that "This document supersedes R-72, Geological Considerations in Siting a Repository for Underground Disposal of High-Level Radioactive Waste, published in September 1987." Presumably, the document is intending to convey that this regulatory document would supercede R-72 if and when this REGDOC is finalized. The document should provide a clearer explanation of the relationship between "R" documents, such as R-72, "P" documents, such as P-290 "Management Radioactive Waste", the CNSC suite of REGDOCs,	1. As a result of this comment, the text previously found in Section 2 has been removed, section 2 now provides background information. The newly-added Figure 1 illustrates the regulatory context of this document, described in a new section (section 3.1 in revised document). 2. As currently stated on CNSC's website, REGDOC-1.2.1 will supersede R-72. http://www.nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/index.cfm R and P documents form part of an older suite of CNSC documents that have been superseded as part of the CNSC's Regulatory Framework renewal.

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			regulations, and any related guidelines.	
16.	1	Northwatch	The draft document states that "A deep geological repository (DGR) is an engineered facility where radioactive waste is emplaced in a deep, stable geological formation (usually several hundred metres or more below the surface) designed to isolate and contain radioactive waste to provide the long-term isolation of nuclear substances from the biosphere [1]. After closure there is no intention to retrieve or transfer the radioactive waste [2]." 1. It is of ongoing and great frustration that the CNSC references CSA documents which are not generally available to the public (reference #2, CSA Group, CSA N292.0-14, General principles for the management of radioactive waste and irradiated fuel, Mississauga, 2014). Despite its general non-availability, we have reviewed CSA N292.0-14, General principles for the management of radioactive waste and irradiated fuel and outside of the definition section, we found no statement or requirement that "After closure there is no intention to retrieve or transfer the radioactive waste" 2. In several sections, including the Introduction section, it is unclear when the document is being very generally descriptive and when it is actually setting out a requirement; the statement "After closure there is no intention to retrieve or transfer the radioactive waste" is a case in point; the CNSC should clarify how this statement fits within the CNSC regulatory	1. Reference to retrieval has been removed from the document. The cited CSA standard has been moved to "additional information". The notion that CSA standards are not generally available to the public is not accurate. The public can access all CSA Nuclear standards free of charge and can review them as they see fit. Each year the CNSC provides additional funding to the CSA to facilitate public complimentary view access to all of the CSA's nuclear standards. Any member of the public can gain access by signing up for a free account at the CSA website to become a public member. Public members can share the links to the sites that hosts the published standards. Complimentary view access, although not downloadable, allows access to the entire published standard page by page. This includes the ability to zoom in to the document and search key words. All CSA nuclear documents that are posted on the view access site provide the identical content as found in the original published PDF copies which are presented to the Commission to consider for use as licence conditions. Specific information on how to obtain free view access to the standards can be found on the CNSC site at: https://community.csagroup.org/community/nuclear/nuclear-standards---view-access-#_blank. In addition, the information can be found on the CSA website at: https://www.csagroup.org/standards/areas-of-focus/nuclear/view-nuclear-standards/. 2. This is a guidance document only and does not set out any

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			requirements and Canadian government policy: is waste to remain retrievable, as in some other jurisdictions, or is the intention to plan on permanent closure?	requirements. The scope has been clarified to reflect this.
17.	1	Northwatch	The draft document states that "Site characterization involves detailed technical site investigations undertaken to increase the state of knowledge about a particular site. Site characterization involves desktop and both regional and site-specific investigations to identify and provide an understanding of particular features and processes. These processes are typically studied in different disciplines (hydrogeology, rock mechanics, geochemistry, etc.) but should be understood in an integrated manner." And that "The data gathered in the preliminary stages of the site characterization may be used to support the initial Canadian Nuclear Safety Commission (CNSC) licence application (i.e., licence to prepare site or a combined licence to prepare site and construct) and form part of the safety case." As per earlier comments, in several instances the document is ambiguous in its use of terms such as "site characterization stage" and "siting process"; the document should be clear in its terminology, and particularly in its distinctions – if any – between the site search, site evaluation, site investigation, site characterization, and site confirmation, all of which might – or might not – be within the "siting process"; while Canadian proponents have been vague and varied in their use of these terms, the regulator should not be	Throughout, the document has been edited to focus on site characterization. In the newly-revised document, section 2 now provides background information. The newly-added Figure 1 illustrates the regulatory context of this document, described in a new section (section 3.1 in revised document).

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			The regulator should clarify if it has any expectations / requirements with respect to site characterization activities and information collected at sequential stages in site investigations.	
18.	1	OPG, NB Power, CNL, NWMO	The term "several hundred metres or more below the surface" in the Introduction could lead to confusion on how deep a DGR is expected to be. Revise the sentence to read, "A deep geological repository (DGR) is an engineered facility where radioactive waste is emplaced in a deep, stable geological formation ~~(usually several hundred metres or more below the surface)~~ designed to isolate and contain radioactive waste to provide the long-term isolation of nuclear substances from the biosphere."	As a result of this comment, the document has been revised as proposed.
19.	1	Society of United Professionals	The requirement to work with municipalities and provincial agencies is laudable. However, there is a need to balance an inclusive process with one that is effective. The requirement to ensure the proponent works through all identified issues with municipalities and provincial agencies may cause undue delay and create more complications than expected.	Paragraph has been removed from the introduction. Relevant information incorporated into section 5.3.
20.	1	Dr. Sandy Greer	Meanwhile, regarding one example of vagueness throughout this CNSC draft, it states: "Other regulators will have jurisdiction over activities carried out for site characterization before the site is selected and before an applicant engages in activities that would require a licence from the CNSC." This draft would have been much more helpful to	This comment is beyond the scope of this document. Information on when other regulators would be consulted has only been included where specifically relevant (section 5.3.1 in the revised REGDOC-1.2.1). Engagement in the regulatory process has now been clarified in the revised REGDOC-1.2.1. Section 2.2, Public and Indigenous

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			citizens who want to participate more fully in publicly expressing their concerns if the CNSC had specifically identified each and every of the related regulators, both provincial and federal. For more citizens to become engaged in these regulatory processes, please do not assume that everyone is equipped with knowledge about all of the political levels of players, in order for citizens, in turn, be sufficiently aware to whom they can voice their concerns as well as communicate their own special expertise.	engagement, has been added, and also points to further information available in REGDOC-3.2.1 *Public Information and Disclosure* and REGDOC-3.2.2 *Aboriginal Engagement.* REGDOC-3.5.1, *Information Dissemination: Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills* section 3.1 provides guidance on pre-licensing communications with stakeholders. REGDOC-3.5.1 section 3.2 provides guidance on public involvement in the regulatory process.
21.	1.2	Northwatch	The draft document states that "The CNSC uses a comprehensive licensing system that covers the lifecycle of a DGR – from site preparation to construction, operation and decommissioning (closure and post-closure), and finally, release from the CNSC licence. This approach requires a licensing authorization at each phase, although the site preparation and site construction licence may be combined." 1. If, as stated, the CNSC "comprehensive" licensing system is from site preparation forwards, the REGDOC should explicitly set out what the pre-licensing requirements are with respect to siting processes and all stages of site characterization 2. In both practical and technical terms, site characterization activities for a potential Deep Geological Repository would begin well before the first stage of licensing (application to prepare the site); the REGDOC should clearly set out requirements for the pre-licensing activities,	1. The revised section 2 explains the need for this type of REGDOC in the pre-licensing stage. This is consistent with international guidance and best practice consulted and listed in reference materials. 2. This document provides guidance only. The relationship between site characterization and site selection (that occurs in the pre-licensing period) is illustrated in the new Figure 1 of the revised document. Section 2.1 sets out when this information will be reviewed by the CNSC during the environmental assessment and licence application process.

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			including requirements for transparency, traceability, documentation, and data accessibility	
22.	1.2	Dr. Sandy Greer	IMPORTANCE FOR MORE CLARITY IN YOUR GUIDANCE I understand that this draft document is to provide "guidance" to create better regulations. Even so, I find the CNSC tendency to use the verb "may" instead of "ought to" or "strongly advocate" very weak and allowing too much interpretative leeway. For example, on page 1, the bottom paragraph acknowledges that "site characterization activities will begin before CNSC's regulatory process," and then adds: "the methods and processes that are used and the data that are collected may form part of future licence applications and will be formally reviewed for quality and adequacy. For clarity to ensure due diligence by a proponent, why not stipulate "will form"? [my bold and my italics] There are other similar examples of language in the draft document, when vague, and potentially interpreted to give too much lenience to proponents who could feel obliged only to comply with minimum requirements, spelled out in follow-up regulations.	Comment noted. The language used is consistent with CNSC guidance documents. Information on the language conventions for CNSC REGDOCs has been included in the revised preface of REGDOC-1.2.1. Figure 1 and section 3.1 has been added to provide clarity on the role of site characterization in the CNSC's regulatory process.
23.	1.3	Northwatch	The draft document states that "The extent of these pre-licensing activities should be discussed with the regulator to avoid initiating activities that require a licence. The purpose for collecting the site-specific data will determine the requirements for data quantity and quality that the site characterization plan should meet."	This is a guidance-only document and contains no requirements. Guidance in the pre-licensing period is part of providing advice to the proponent on best practices. This information has now been included the revised section 2. Requirements are available in CNSC's regulatory document series 2.11.1.

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			1. CNSC requirements should be clearly set out so they can be understood and adherence to them evaluated by all parties, not just the licensee or potential licence applicant; accordingly, understanding what is required should not entail (private) discussions between a licence applicant and the regulator. 2. It is unclear under what circumstances variability in the quality of data would be encouraged or even acceptable.	
24.	1.3	OPG, NB Power, CNL, NWMO	Section 1.3 on Relevant Legislation refers to both the current environmental assessment process and the new proposed legislation on impact assessment. It also speculates on the trigger for the new process. Section 1.3 should simply refer to the current legislation or note that a new process is under review.	Agreed. Text has been revised to point to the current *Impact Assessment Act.*
25.	1.3	Dr. Sandy Greer	Under this CNSC draft's section **1.3 Relevant legislation**, on page 2, it states: *"The* Nuclear Safety and Control Act (NSCA) *applies once site preparation activities begin. Accordingly,* ***it is important to be aware of legislation other than the NSCA, such as provincial laws, that might apply to site characterization activity.***[my bold] *..."* Given the role of the CNSC, in part: "to protect the health, safety and security of Canadians and the environment," I urge the CNSC to work with both Natural Resources Canada and the Environmental and Climate Change Canada ministries to do everything necessary, using current federal legislation – and also creating new federal legislation if necessary – to	This comment is beyond the scope of this document.

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			ensure that neither Ontario nor any other province can reduce or remove legislation provincially for which currently existing regulations have been created specifically to ensure safety of human life and the environment, as related to any nuclear energy projects, past, present and future.	
26.	1.4	Northwatch	The draft document states that "The extent of consultation between the applicant and the regulator should be balanced in order to preserve the independence of the regulator while providing adequate guidance to the applicant. It is recommended that a service agreement be established between the regulator and the applicant." Discussions between any potential licence application and the regulator should be documented in detail and the records of such exchanges – in person, by telephone, in writing or through informal contacts such as at meetings or conferences – should be included in a public registry established for the purpose of bringing transparency to interactions between the CNSC and its licensees and potential license applicants (while not a full design match, the federal government's registry of lobbyists provides a generalized model of such a registry) To preserve and enhance both its practice of independence and the public perception of the independence of the CNSC, the CSNC must limit its interactions with potential licensees so those which can be undertaken within a system of openness and transparency	As a result of this comment, the text has been revised and moved to section 2.
27.	1.4	Northwatch	The draft document states that "The CNSC may choose to observe activities or request information.	As a result of this comment, the text has been revised and moved

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			Prior to a formal application being submitted, CNSC staff may also request data, results and materials from the site characterization activities in order, for example, for the CNSC to conduct independent research." 1. To preserve and enhance both its practice of independence and the public perception of the independence of the CNSC, the CSNC must limit its interactions with potential licences so those which can be undertaken within a system of openness and transparency 2. Northwatch would encourage the CNSC to request data, results and materials from the site characterization activities and would support the CNSC conducting independent research and evaluation, but only within a system of openness and transparency, with the data, results and materials from the site characterization activities becoming part of the public record; this record should be public throughout the site investigations – i.e. from earliest stages of site identification and investigation – and not reserved and them made available as a data dump during a formal public review process (which frequently occur only at the very end of a long period of site investigation)	to section 2. Early engagement with proponents for DGRs is an international best practice and does not impact the CNSC's independence or fetter the Commission's decision making ability. For information, documentation of decades of research carried out in Canada can be found here: http://nuclearsafety.gc.ca/eng/resources/educational-resources/feature-articles/deep-geological-repositories-DGR.cfm
28.	1.4	OPG, NB Power, CNL, NWMO	The last paragraph is suggesting the CNSC should have access to applicants' materials/data "to conduct independent research." Such research may not be perceived as independent. Change the last sentence to read, **"**Prior to a formal application being submitted, CNSC staff may also request data, results and materials from the site characterization activities ~~in order, for example, for~~	As a result of this comment, the text has been revised and moved to section 2. .

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			~~the CNSC to conduct independent research~~."	
29.	1.4	Inverhuron Committee	"the extent of consultation between the applicant and the regulator should be balanced in order to preserve the independence of the regulator…." Through our participation in the Joint Review Panels of 2013 and 2014, we perceived that the Canadian Nuclear Safety Commission was very supportive and vested in the proposal being discussed. The CNSC staff often answered questions on behalf of OPG and argued in their favour when questions were asked by Intervenors. Every day of the Joint Review Panel Hearing, the CNSC had the opportunity to present supportive information to the Panel. This process was, definitely, perceived as a bias to the situation. The CNSC should be present for clarification only. This perception on behalf of Intervenors was only heightened by the newspaper articles which appeared during the time of the Hearings wherein the President of the CNSC was discovered to be meeting behind closed doors with local Bruce County Councillors and indicated to them that he would see them at the ribbon-cutting ceremony. This is not only bad form on the part of the CNSC but in the Document up for Consultation REGDOC-1.2.1, it is very clear that an arms-length relationship is important to the process.	As a result of this comment, this text has been removed from the document. For communicating regulatory expectations in a manner that is consistent with international guidance and best practice, this text is included in the revised REGDOC in section 5.3: "Other regulators will have jurisdiction over site characterization activities carried out before a site is selected and before an applicant engages in activities that would require a licence from the CNSC (see section 3.1). Site characterization activities should be conducted in consultation with the relevant regulatory bodies early in the process, to ensure that regulatory expectations, permitting, licensing or other requirements are clearly understood, and that potential issues associated with data acceptance are identified and mitigated." The objective dissemination of scientific information is part of CNSC's mandate. Early engagement with proponents for DGRs is an international best practice and does not impact the CNSC's independence or fetter the Commission's decision making ability. REGDOC-3.5.1, *Information Dissemination: Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills* section 3.1 provides guidance on pre-licensing communications with stakeholders. REGDOC-3.5.1 section 3.2 provides guidance on public involvement in the regulatory process.
30.	2	Society of United	It is crucial that siting be guided by science and facts rather than unfounded opinions. The four stages to	Comment noted.

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		Professionals	the siting process for a DGR are stated as: 1. a conceptual and planning stage: desktop data compilation and interpretation 2. a survey stage: regional mapping and screening 3. a site characterization stage 4. a site confirmation stage These appear reasonable and logical and provide a good process to work through to get to the right answer.	REGDOC-1.2.1 now refers to the source IAEA document. IAEA SSG-14, Appendix 1.
31.	2	Northwatch	The draft document states that “The objective of the siting process, which includes site characterization, should be to select a site that, along with a proper design and engineered barriers, has properties that provide adequate containment and isolation of radionuclides and hazardous substances from the accessible environment for the desired period of time, usually the assessment timeframe [4].” 1. The REGDOC – and CNSC more generally – should be more quantitative in its discussion of DGR requirements; for example, we find no record of clarity from the CNSC on the following: 2. What is a “proper design” or the criteria by which such a judgement would be made? 3. What is “adequate” containment? 4. What is the “desired period of time? 5. What is the “assessment timeframe”?	1. REGDOC-1.2.1 is a guidance only document. Relevant requirements are provided in REGDOC-2.11.1 volume III. This scope of REGDOC-1.2.1 has been clarified in revised REGDOC-1.2.1 section 1.2. 2-5. As a result of this comment, this text has been removed from REGDOC-1.2.1. The information referred to is available from IAEA SSG-14.
32.	2	Northwatch	The draft document states that “The data gathered in the preliminary stages of the siting process may form part of the initial licence application and part of the safety case. Information gathered at this stage may be used as baseline information to support the demonstration of safety throughout the lifecycle of the DGR facility.”	This comment is beyond the scope of this document. REGDOC-3.5.1 section 3.1 provides guidance on pre-licensing communications with stakeholders. REGDOC-3.5.1 section 3.2 provides guidance on public involvement in the regulatory process

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			The data and results site from all stages of site characterization activities should be part of the public record; this record should be public throughout the site investigations – i.e. from earliest stages of site identification and investigation – and not reserved and them made available as a data dump during a formal public review process (which frequently occur only at the very end of a long period of site investigation)	
33.	2	Northwatch	The draft document states that "Following confirmation of the site and the initial phases of licensing, characterization activities are normally expected to continue into the site preparation, construction and operational phases. The characterization activities continue through these phases in order to contribute further to an adequate baseline for future monitoring, as well as to help confirm assumptions made in earlier safety cases and reduce any residual uncertainties in the safety case [4]. Those characterization activities that continue until closure of the DGR are usually defined in a geoscience verification program. The safety case and associated safety assessment should identify uncertainties and assess the robustness of the facility so that the geoscience verification program can be developed and a research program designed and executed to address these uncertainties throughout the lifecycle of the DGR." There are a number of problematic ambiguities with the paragraph above, including: 1. It suggests an assumption on the part of the REGDOC authors that site confirmation is inevitable,	1 and 3. Site selection is not regulated under the NSCA. As a result of this comment, Section 1.2 has been revised to clarify this.Site confirmation is part of site selection. All information on site selection has been removed from the body of the revised REGDOC. It is now included as an appendix, for information that is consistent with international guidance. 2. Figure 1 in the revised REGDOC-1.2.1 illustrates how site characterization that begins before CNSC's regulatory activities will be reviewed in CNSC's licenced stages. Figure 1 and section 3.1 have been added to provide clarity on the role of site characterization in the CNSC's regulatory process.

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			i.e. that there can be no inappropriate sites, i.e. there are no candidate sites, just sites 2. It is unclear as to the timing of license issuance relative to the sequence of site characterization activities 3. In neither this or other sections of the draft REGDOC are there any clear guidelines, standards, or even expectations set out as to what would qualify a site as a potential location for a DGR	
34.	2	Dr. Sandy Greer	One further example is confusing and I recommend that you rewrite or remove it, on page 3, in reference to baseline information: "The data gathered in the preliminary stages of the siting process **may** form part of the initial licence application and part of the safety case. Information gathered at this stage **may** be used as baseline information to support the demonstration of safety throughout the lifecycle of the DGR facility." [my bold] The reason is that the CNSC draft does, in fact, clearly spell out the vital importance of `baseline information' on pages 5 and 8, noting that such initial data does impact upon the entire trajectory of a project from site characterization through to mapping cumulative effects. Here is a quote from my 2014 OPG DGR public hearing oral presentation and power point: "A majority of interviewees believe that monitoring change to aquatic and landscape environments at project and watershed scales facilitates scientifically rigorous cumulative impact predictions, but that the	As a result of this comment, this text has been deleted.

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			CEA baselines, indicators and thresholds necessary to do so are rarely available." 2 [my bold] 2 "Institutional considerations in watershed cumulative effects assessments and management," ***IAIA, Vol.31, No.1, March 2013,p.74-84***	
35.	2	Inverhuron Committee	"characterization activities continue….to help confirm assumptions… and reduce any residual uncertainties in the safety case.." Throughout the Hearings and via documentation regarding the project sited at the Bruce Nuclear site, we, as Intervenors, felt a tremendous amount of uncertainty was present in those documents provided by OPG. There was a lot of mitigation cited and information yet to be confirmed. The word "reduce" in this phrase needs to be replaced by the word "eliminate". As local citizens, we cannot take heart in plans that need mitigation, experimentation or reduction. All of the uncertainties need to be certain by the time that the site is characterized and presented at a Hearing or a Consultation with the public.	As a result of this comment, this text has been deleted.
36.	2	Anna Tilman	As stated, "The objective of the siting process, which includes site characterization, should be to select a site that, along with a proper design and engineered barriers, has properties that provide adequate containment and isolation of radionuclides and hazardous substances from the accessible environment for the desired period of time, usually the assessment timeframe."	As a result of this comment, the text has been deleted. Containment and isolation characteristics of the host rock and geological system would be assessed according to site characteristic, as indicated in the revised REGDOC-1.2.1 section 3.2.

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			"The data gathered in the preliminary stages of the siting process may form part of the initial licence application and part of the safety case. Information gathered at this stage may be used as baseline information to support the demonstration of safety throughout the lifecycle of the DGR facility."[p.3] Site characterization activities are normally expected to continue into the site preparation, construction and operational phases until closure of the DGR "in order to contribute further to an adequate baseline for future monitoring, as well as to help confirm assumptions made in earlier safety cases and reduce any residual uncertainties in the safety case". "The safety case and associated safety assessment should identify uncertainties and assess the robustness of the facility so that the geoscience verification program can be developed and a research program designed and executed to address these uncertainties throughout the lifecycle of the DGR." [p.3, 4] Comments/Questions 1. What constitutes "adequate containment and isolation" of radionuclides? Does adequacy imply that there is no breach whatsoever in the containment of the waste? 2. While mention is made of reducing uncertainties, it is doubtful if not impossible as to whether one could completely identify and eliminate these uncertainties.	
37.	2	Dr. Sandy Greer	WHY NO EXPLICIT NAMING OF \`ENVIRONMENTAL IMPACT STATEMENT'? Again, as per the lack of specific identifiers in sections of this draft, you do outline, within section 2.	As a result of this comment, section 2.1 now provides background on federal environmental assessment. Figure 1 in the revised REGDOC-1.2.1 provides an illustration of how site characterization information could support an environmental

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			Overview of Siting Process, four specific stages yet omit the original identifier which encompassed them – namely, the `Environmental Impact Statement (EIS)'. On page 3, you even point out that the International Atomic Energy Agency (IAEA) identifies four stages. But why is naming the EIS now omitted, at the same time that you identify four stages in the siting process? This CNSC draft names them as follows: Conceptual and planning stage; Survey stage; Site characterization stage; and Site confirmation stage, on page 4. These four stages are outlined in a table titled "Figure 2. The Process of Environmental Impact Assessment for a Geological Repository," in what probably is a 1999 paper (but the date is missing) archived online by the IAEA. The latter paper is authored by two professors in the Department of Geography at the University of Guelph, Ontario.[1] The important point is that EIS guidelines have been pertinent to guide the proponent Ontario Power Generation (OPG) for its licence application to construct a DGR for low and intermediate level radioactive waste. Yet OPG's failure to demonstrate due diligence in its EIS and related responses caused repeated requests from the Joint Review Panel at the two OPG DGR public hearings in 2013 and 2014, respectively. Since then requests from the Saugeen Ojibwa Nation (SON) for further information from OPG has caused delay on the final decision regarding whether what is known as `DGR1' will go forward at all.	assessment. The description of the site selection stages (Section 2) has been removed, and reference is made to IAEA SSG-14 appendix 1.

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			[1] www.iaea.org/inis/collection/NCL/CollectionStore/_Public/31/016/31016477.pdf	
38.	2.1	Inverhuron Committee	Not only should there be "the development of an overall plan for the site selection process" but also "site screening criteria should be developed for selecting or rejecting potential sites". From the perspective of the public, the site selection process was very political. It was based on a willing-host concept with communities being heavily recompensed for their interest. This created a false impression of willingness. No referendum was held, as promised, for the deep geologic repository for low and intermediate-level waste. This type of selection targets communities suffering from pecuniary difficulty. The site selection process needs to be very definitive, clear and without financial compensation. In fact, it is the opinion of The Inverhuron Committee that the Federal Government should be the entity to develop a clear process for site selection. Of course, the other aspects of site selection can be delineated by the CNSC such as geomorphology and hydrology BUT the actual initial process must be guided by the Federal Government in conjunction with our closest neighbor, the United States.	This comment is beyond the scope of this document. Site selection is not regulated under the NSCA. Figure 1 and section 3.1 have been added to provide clarity on the role of site characterization in the CNSC's regulatory process. This includes linking site characterization with EA.
39.	2.2	Inverhuron Committee	During our interactions with OPG and the CNSC, The Inverhuron Committee raised a concern that merely six boreholes were taken at the Bruce site. This project has a very large footprint and, therefore, boreholes need to be taken at every length, corner and at various depths. The deep geologic repository	This comment is beyond the scope of this document. Site selection is not regulated under the NSCA. The OPG DGR file has been the subject of extensive assessments and public hearings. The decision on the EA rests with the Minister of the Environment.

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			proposed at the Bruce site is the first of its kind in Canada and an overabundance of caution is required. It was interesting to note that the search for a deep geologic repository site for the second of the proposed projects was cancelled in Saugeen Shores with the Nuclear Waste Management Organization citing that the geology was not suitable. This location is only 25 to 30 kilometres from the Bruce site. Part of the process for siting a deep geologic repository should be to present research and to document reasons why a studied site has been eliminated. This clarifies the rationale for the remaining locations.	
40.	2.3	Northwatch	The draft document states that "Preliminary safety assessments should be completed at this time to test the site's suitability to host a DGR facility, as well as to guide further characterization and confirmation activities. These safety assessments may also form part of a comparative analysis of the remaining site (if applicable), which would lead to the next stage of site confirmation, in which detailed, extensive work would be focused on one site." 1. What are the methods and requirements for the preliminary safety assessments to be undertaken? If these requirements are not to be set out in this REGDOC, at minimum the REGDOC should include clear references to where these methods and requirements are set out 2. What is the criteria for testing the site's suitability? 3. Does the REGDOC either assume or require a comparison of sites? 4. At which stage and for what reasons in the sequence of site investigation / characterization activities would a proponent shortlist from several to a few to a single site?	As a result of this comment, Section 2 has been removed. 1. As a result of this comment, this has been clarified in the revised REGDOC-1.2.1 section 1.2 (scope). REGDOC-1.2.1 is guidance only. REGDOC 2.11.1 volume III provides the requirements of a post-closure safety case. 2. In the revised REGDOC-1.2.1, section 3.2 provides guidance on the attributes of the geological environment that should be investigated during site characterization activities. 3– 5. This comment is beyond the scope of this document. Site selection is not regulated under the NSCA. Section 2 has been removed from the document.

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			5. What are the requirements of the comparative analysis of candidate or potential sites?	
41.	2.4	Northwatch	The draft document states that "Site confirmation generally consists of detailed, extensive field and laboratory studies at the selected site. It is at this stage that evaluation of whether sinking a shaft or construction of an underground research facility (URF) may be necessary to obtain more information." - This section is overly vague and provides little to no actual direction with respect to these activities and their carrying out. For example: 1. Is the descriptor of this activity "generally" consisting of certain activities meaning this is generally the case internationally, generally the case in domestic experience to date, or "generally" in some other context or sense? 2. Given that the section is very general, where and how will the CNSC provide actual direction or set out requirements for the site confirmation stage? 3. Does the site characterization program (Section 3) include all the stages set out in Sections 2.1 to 2.4, or is the characterization program separate and different from these stages and if so, how so? And if not, how specifically do they relate to each other? 4. What would be the basis for a decision for "sinking a shaft" versus "construction of an underground research facility"? What would the Commission or CNSC staff's role be in that decision point? 5. What are the CSNC license requirements for "sinking a shaft" versus "construction of an underground research facility"?	As a result of this comment, Section 2 has been removed. Site selection is not regulated under the NSCA.

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42.	2.4	Northwatch	The draft document states that "A final safety assessment should be prepared based on all of the data gathered during prior siting stages and in combination with geological and hydrogeological information, and information about other barriers such as the engineered barrier system, canister design and radioactive waste characteristics. This information may be used to develop the safety case that will be submitted in the initial licence application (i.e., licence to prepare site or combined licence to prepare site and construct)." 1. The REGDOC should clearly set out linkages to other regulatory, policy and licensing guidance related to development, operation and closure / decommissioning of a Deep Geologic Repository; it may not be appropriate to include the methods and criteria for a "final safety assessment" in a REGDOC about site characterization, but the linkages need to be in place, and these methods and criteria need to be available prior to finalizing this REGDOC, as there are clear linkages and interdependencies; for example 2. if the above statement by the REGDOC authors that "A final safety assessment should be prepared based on all of the data gathered during prior siting stages and in combination with geological and hydrogeological information, and information about other barriers such as the engineered barrier system, canister design and radioactive waste characteristics" is valid, the specifics about the "geological and hydrogeological information" that will be required for	1. Comment noted. Linkages between licensing and site characterization have been made, and the scope clarified in the revised REGDOC-1.2.1 sections 1 and 2. 2. As a result of this comment, Section 2 has been removed.

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			the safety assessment must be known prior to development of the site characterization program and carrying out the site characterization activities	
43.	2.4, 3.2	Dr. Sandy Greer	At the bottom of page 4 in the CNSC guidance draft, it reads that “a final safety assessment” is required to include data on “radioactive waste characteristics,” in order “to develop the safety case that will be submitted in the initial licence application.” I applaud this inclusion. However, again, more details about what this characterization data will tell us would clarify this statement. Is such characterization limited to naming the range of radionuclides in the fuel bundles, or does the characterization go further to reveal how various exposures could impact on humans as well as other species and environmental media (sediment, water and air)? I do read, on page 9, under **3.2.2 Aquatic and terrestrial environment**: “consideration is to be given to both radiological and non-radiological aspects of a given medium, e.g. soil quality. Such studies are still in early years, according to the International Commission for Radiological Protection (ICRP), to determine the multiple ways that each and every radionuclide could impact different organisms and, moreover, various organs within a single species. The challenge is tremendous, and it may be humanly impossible to ever fully comprehend the effects. Nevertheless, of course, we must keep trying to do so. The lack of this knowledge internationally, nevertheless, and the huge task of research still ahead, remains one of the foremost reasons why I do not	Comment noted. The document does not cover characterization of the fuel bundle and therefore the comment is beyond the scope of this document. Information on requirements related to waste management and long term safety assessment can be found in the 2.11 series for REGDOCs.

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			support the pursuit of giving licences for DGRs in Canada, because I consider them still to be an experiment, regardless of how many decades the conceptual designs have existed. The ICRP continues to develop its initiatives as per `radiological protection of the environment,' most recently by integrating human and environmental protection frameworks. But this continuing project is much too complex to explain here, except to say that there are multiple layers of research to investigate through many years to come. The European Radioecology Alliance (Alliance) similarly is engaged in ongoing research. One of its papers published in 2017 ICRP Proceedings, for example, explores "Radiosensitivity and transgenerational effects in non-human species," and points out: "Differences in radiation sensitivity across species and phyla are poorly understood" – indeed, as are a multitude of other environmental factors. As for the CNSC draft guideline, it is encouraging to see, on page 7, this due diligence: *"Any process that can be shown to demonstrate the potential for radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented."*	
44.	3	Society of United Professionals	The Society agrees with the requirements in Section 3 for good baseline data to allow for future measurement against this baseline to ensure appropriate monitoring that prevents negative outcomes. Moreover, the Society agrees with the importance of the geological environment work required through this process and the factors	Comment noted.

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			identified in sections 3.1.1 to 3.1.5.	
45.	3	Northwatch	The draft document states that "As part of the siting process, the licence applicant should prepare and implement a program for site characterization for the proposed site for a DGR facility. The program should provide information sufficient to support a general understanding of the site in its current state and how it is expected to evolve over extended time frames associated with the safety case [6]. The site characterization program should establish baseline conditions for the site and environment in its present condition; support the understanding of the normal evolution; identify any events and processes associated with the site that might disturb the normal evolution of the DGR system; and support the understanding of the effect on safety of any features, events and processes associated with the DGR system [6]." The REGDOC should clearly set out its definition of site characterization program and its definition of siting stages and of the siting process, and discuss interrelationships between these three aspects.	As a result of this comment, a new Figure 1 in the revised REGDOC-1.2.1 links site characterization that begins during site selection with activities that are regulated by the CNSC. Site selection is not regulated under the NSCA.
46.	3	Northwatch	The draft document states that "Data collected during site characterization will form the basis of descriptive site models and geological, hydrogeological, geochemical and geomechanical frameworks that will be relied on to evaluate long-term safety. The data will provide baseline data for detecting potential short- and long-term environmental impacts at various stages and for tracking throughout the CNSC's licensing lifecycle for a DGR. Data needs include relevant regional- and site-scale information."	1. As a result of this comment, terms have been revised and clarity added to section 3. Instead of referencing specific models and framework – the revised document refers to the geological system, and the characteristics that would be the focus of characterization activities. 2. The guidance in this document focuses on which elements should be part of a characterization program for a DGR facility. This isn't the only opportunity to obtain data, should a project enter the CNSC's regulatory process – this is illustrated in Figure

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			1.This REGDOC includes numerous terms which are undefined and which have linkages to DGR licensing aspects (such as the site models, and geomechanical frameworks) which Northwatch expects will be the subject of other REGDOCs but which require at least contextual descriptions and clear definitions in this document 2. Data needs should be more explicitly identified than the broad statement that they must include "relevant relevant regional- and site-scale information"; what is the criteria for determining relevance? What will be the basis for the regulator's determination that more information is needed, or that sufficient information has been provided? 3. The data and results site from all stages of site characterization activities should be part of the public record; this record should be public throughout the site investigations.	1 in the revised REGDOC-1.2.1. Specific data needs will vary according to the site, as it is not possible to standardize the geosphere. The attributes that should be evaluated during site characterization are listed in the revised REGDOC-1.2.1 section 3.2. 3. This is beyond the scope of this document.
47.	3	Northwatch	The draft document states that "Baseline data include the biosphere and geosphere, and support an understanding of current conditions at the site, its geological history, and its likely future evolution over the safety case time frame. These data provide the initial information for safety assessments at the conceptual stage and during initial facility design. They will serve as the basis for the first iteration of the full safety case and any initial geoscience verification program at the site once it has been selected. As well as in the event that development (at any phase) is licensed to proceed." 1. This REGDOC includes numerous terms which are undefined and which have linkages to DGR licensing	1. As a result of this comment, this text has been revised, and a linkage to REGDOC-2.11.1 volume III, which does discuss those aspects, has been made in the revised text. 2. This is beyond the scope of this document. 3. This is beyond the scope of this document. REGDOC-2.11.1 volume III addresses the safety case.

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			aspects (such as the safety case, safety assessments, and/or the geoscience verification program) which Northwatch expects will be the subject of other REGDOCs but which require at least contextual descriptions and clear definitions in this document 2. If other REGDOCs are going to be developed related to aspects of repository design, development and performance other than site characterization a timeline for their development and a schematic for their interlinkages should be presented in this REGDOC (and in each of the REGDOCs related to DGRs) 3. This REGDOC should set out criteria and methods for development of the safety case and the geoscientific verification program; while the details of the safety case and the geoscientific verification program maybe be finalized in a project-specific context – with public and peer review – the regulatory framework requires the establishment of program direction for the development and evaluation of these two important license and project assessment components	
48.	3	Northwatch	The draft document states that “The order of the criteria described herein does not imply priority of one element of characterization over another; relative relevance of specific criteria will in some cases be site specific. Specific criteria provided for the collection of baseline data may not be exhaustive and may constitute recommendations. Alternative approaches and innovative techniques that address additional elements of site characterization are also valid.”	As a result of this comment, these sentences have been revised to provide further clarity.

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			It is unclear if the "criteria described herein" is referring to the very general descriptions included in later subsections of Section 3, but given that there are no actual criteria presented anywhere (else) in the document, we surmise that might be the intent, to which we would comment: the "criteria described herein" are overly general and do not provide sufficient direction for either the development of a site characterization program (by a potential licensee) or its evaluation (by CNSC, the public, and others).	
49.	3	Northwatch	The draft document states that "In this document, the pre-closure period of a DGR encompasses site preparation, construction, operation and decommissioning. The post-closure or long-term period is the period that follows the closure of a DGR facility, with a time frame of tens of thousands of years or more [3]." It is very unclear why this undated referenced document "IAEA, Draft TECDOC, Managing integration of pre-closure activities and post-closure safety in the Safety Case for Geological Disposal" was selected as the reference for this particular very general statement	As a result of this comment, this reference has been deleted.
50.	3	Dr. Sandy Greer	Also reassuring in the third paragraph of the CNSC draft document, on page 5, is the statement, under section **3. Site Characterization Program**: *"Data needs [to] include relevant regional-*and *site-scale information."* 1. What would be even better, again for more clarity, is to elaborate on what the requirement of "regional	1. Comment noted. The exact needs from regional-scale (and site scale) information depends on the nature of the site, and varies from site to site. Information submitted to the CNSC as part of a licence application will be reviewed by CNSC staff, as depicted in figure 1 in the revised document.

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			scale" information actually includes. A further description in the final CNSC guidance document would demonstrate that CNSC is aware of the wider geographic impact of a future deep geological repository. This would be a substantial improvement on the very limited circumscribed boundaries for the DGR being proposed for low- and intermediate-level radioactive waste near the shore line of Lake Huron. The EIS for that project only required local and site-specific studies, considered to be one of the major flaws in OPG's EIS. The flaw, however, originated in the regulation mandated, which influenced the liberties taken in OPG's incomplete data. A fuller description would indicate that the CNSC is more in step with various research published a number of years ago in several journal editions of ***Impact Assessment and Project Appraisal***, two more excerpts cited in my 2014 OPG DGR presentation: *"In Canada, there is now a collective understanding that EA must go beyond the evaluation of site-specific direct and indirect project impacts to include issues of broader regional cumulative and higher-tiered policy, plan, and program (PPP) development significance."3* *"The Auditor General's fourth review of SEA [Strategic Environmental Assessment] practice in Canada reported the SEA directive has yet to be consistently applied across federal departments and agencies, and that SEA has not been undertaken for some proposals where significant environmental effects could result."* 4	2. This comment is beyond the scope of this document.

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			2. As for the Strategic Environmental Assessment quote, I include it here because one of the most offensive failures of the OPG DGR hearings as well as the final Joint Review Panel report was to conclude that no significant environmental effects could be identified. But the types of studies done were sorely inadequate to make any viable factual determination. For starters, the Canadian Environmental Assessment Agency did not even provide a definition of "significant environmental effects," which left the door wide open to ignore it and/or minimize the possibilities. More honesty would communicate the unspeakable truth that one or more major accidents, or yet unknown climate events, or other emergency situation could enable massive radionuclide releases into watersheds, the Great Lakes system and the air far beyond the DGR location. And those possibilities are aside from eventual corrosion of containers at some unknown future date; henceforth, environmental contamination. [3] (Dube, 2003; Duinker and Grieg, 2006; Harrison and Noble, 2008) cited in ***IAIA, 27 (4), December 2009, pages 258-270*** [4] (Auditor-General of Canada 2008) cited in ***IAIA, Vol.30, No.3, September 2012, pages 139-147***	
51.	3	OPG, NB Power, CNL, NWMO	The 4th paragraph, 2nd sentence, says, "Specific criteria ... may constitute recommendations." This is not clear.	As a result of this comment, the text has been deleted.

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			Industry suggests this sentence be removed.	
52.	3	OPG, NB Power, CNL, NWMO	The 5th paragraph is a repeat of earlier text from Section 1.2. Industry suggests the 5th paragraph be deleted from Section 3.	As a result of this comment, the text has been deleted.
53.	3.1	Northwatch	In the interest of brevity, for the remainder of Section 3 and for following sections this commentary will provided comments by subsection without repeating the text within this document; readers are encouraged to refer to the relevant section of REGDOC-1.2.1 while considering these comments. Section 3.1. 1. The document should provide a description of or reference to a document with descriptions of “containment and isolation characteristics” 2. The document should provide a discussion of how those “containment and isolation characteristics” are measured or estimated, the extent of the physical investigations related to these characteristics, the manner in which these characteristic are quantified, and the consequence of the abundance or scarcity of these characteristics in terms of the geological formation serving as a barrier to radionuclides 3. The document should describe the relationship between the extent of the suitable host rock at depth and repository performance; the document should clearly state how or why “size requirements” are established, or why they are not established, as part of the regulatory framework 4. The regulatory document should identify which site characteristics would allow the development of a	1. As a result of this comment, additional information is proposed to be added to CNSC’s glossary, linked to in the regdoc. While containment is currently defined in CNSC’s glossary (REGDOC-3.6 *Glossary of CNSC terminology)* referred to in the document isolation is not. Owing to their importance in long-term radioactive waste disposal projects the following definitions have been added: **Containment and isolation with respect to radioactive waste disposal** **Containment** The function of the barrier to prevent or control releases of radioactive or hazardous wastes. • For deep geological disposal, this refers to the functions of both the natural barrier (such as the host rock) and the engineered barrier to limit radionuclide releases. **Isolation** The physical separation of radioactive waste from people and the environment.

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			robust safety case and which site characteristics would disallow the development of a robust safety case 5. The document should quantify the meaning of "low" in the context of potential for human intrusion, and should expand on its very general statements with respect to this risk set 6. The document should clearly set out how the "extensive geological information (that) would be gathered to verify the initial safety case and to update the safety case iteratively" will be managed within an information system that is transparent and traceable and which makes data publicly available in a timely manner throughout the siting process and various stages of site characterization	•To make accessing the waste difficult •For deep geological disposal, isolation is provided mainly by the depth of the repository. 2 - 4. These comments are beyond the scope of this document. Further information on the degree of, and period of time for containment and isolation, is available under waste classification in REGDOC-2.11.1 *Waste Management, Volume 1 Management of Radioactive Waste* 5. As a result of this comment, the bullet containing this term has been expanded for clarity in revised REGDOC-1.2.1 section 3.2.1. Natural resource potential should be quantified. 6. This is beyond the scope of this document.
54.	3.1	Society of United Professionals	The last bullet in the first paragraph states: "low potential for inadvertent future human intrusion." It is unclear as to why only "inadvertent" human intrusion is specified. Premeditated and planned nefarious human intrusion will have more serious consequences. Much of the consequences will depend on site location, geology and DGR design. If properly located and designed with such an incident in mind, the incentive for nefarious human intrusion may be minimized or eliminated.	By design, depth is the prime factor to limit nefarious human intrusion in deep geological repositories. Inadvertent human intrusion is predicated on the assumed loss of institutional memory. The potential that a DGR would be inadvertently breached at some point in the future is thus tied to natural resource potential at the site, at the repository depth. This is the rationale behind guidance on quantification of that potential. As a result of this comment, the bullet has been expanded for clarity: • low natural resource potential to limit inadvertent future human intrusion by subsequent generations of resource explorers

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55.	3.1	Society of United Professionals	In Section 3.1, Para. 4, where it stated that: "As siting progresses, more extensive geological information would be gathered to verify the initial safety case and to update the safety case iteratively….it should be noted that data collection would continue until closure of the DGR, and possibly for some time after closure, in order to verify and update the safety case, and, demonstrate long-term safety is maintained." This kind of approach reinforces the inappropriate perception that nobody can guarantee the safety of a site and that safety can only be achieved by iteration of the safety case ad infinitum. This lack of confidence in the site characterization process undermines the process of siting a DGR. The Society believes that the CNSC should state criteria for Site Characterization that must be met to achieve safety of a DGR.	As a result of this comment, Section 3.1 of REGDOC-1.2.1, has been revised to address the role of site characterization in CNSC's regulatory process. REGDOC-2.11.1 volume III addresses the safety case.
56.	3.1	OPG, NB Power, CNL, NWMO	A minor revision is suggested to the 2nd bullet to clarify that future stability can only be expected or projected. Revise the 2nd bullet to read, "• past and <u>expected/projected</u> future geological stability of the site, including orogeny, seismicity, glaciation and volcanism"	As a result of this comment, the document has been revised as proposed.
57.	3.1	Anna Tilman	**Geological Environment (Section 3.1)** Key characteristics include: 1. containment and isolation characteristics of the	Comment #2 – As a result of this comment, this bullet has been modified to state that the "past and expected/projected future geological stability…".

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			host rock: geological, hydrogeological, mineralogical, chemical and mechanical; 2. past and future geological stability of the site, including orogeny, seismicity, glaciation and volcanism; 3. sufficient extent of suitable host rock at the repository depth; 4. site characteristics that would allow the development of a robust safety case; 5. demonstrated isolation of groundwaters at selected repository depth from shallow groundwater systems; 6. characteristics favourable for sorption, precipitation or other mechanisms to limit contaminant release and transport away from a DGR; 7. Low potential for inadvertent future human intrusion. **Comments/questions** # 2- The "determination" of future geological stability is not or is unlikely, given the time frames, to be definitive. # 3 - What does "sufficient" imply? This is too vague a term. # 5- How can the "isolation of groundwaters" be demonstrated in the very long-term? # 6 - It is essential to "avoid" any releases of contaminants, not merely "limit" them. # 7 - The term "low potential" in the context of human intrusion is inappropriate. Clearly, the point is that human intrusion must be avoided.	Comment #3 –The characteristics of the host rock and geological system are unique to a site. In the same way, it is not possible to present a standard list of characteristics to determine sufficiency. This would form a component of CNSC's review of all information submitted in support of an Environmental Assessment or licence application. Comment # 5 – This important aspect of site characterisation can be evaluated using site specific information, and a variety of scientific and analytical tools. Comment # 6 – Comment noted. No change made. Comment # 7 – As a result of this comment, this bullet has been clarified. Natural resource potential should be evaluated to assess the likelihood of inadvertent future human intrusion from future generations of resource explorers. That scenario should form part of the post-closure safety assessment (please see REGDOC-2.11.1 volume III), and be informed by data collected during site characterization.
58.	3.1	Anna Tilman	Each of these sections highlight the use of qualitative, rather than quantitative data, as is required by the draft regulation. The draft regulation notes that: [p.6] Quantitative data should be provided in addition to	Comment noted. The site characterization data is quantitative, qualitative, and descriptive – it is not based on predictions. Models make

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			qualitative descriptions where possible. An iterative approach to gather and verify data would continue until closure of the DGR and possibly after closure, to verify and update the safety case and demonstrate that long-term safety is maintained. The geological characteristics, the engineered barriers and the design of the DGR must indicate that a DGR at a particular site would remain safe of "tens of thousands to millions of years. 4 **Comments** It is absolutely essential to have quantitative data on characteristics of the geological environment, and not just "where possible". In fact, if such data is not available or possible to obtain, then that would imply that the only information available would be descriptive in nature. This is not a scientific or robust process, especially considering the consequences if containment is breached **at any time**. Much of the information is, of necessity, based on predictions. While it is acknowledged that not all factors can be determined with certainty, given the length of time that a DGR is intended to provide safe long-term storage of this waste with no release to the environment, the matter of the degree of uncertainty is the critical issue.	predictions, and should use and/or be informed by site specific data, as appropriate.
59.	3.1	Anna Tilman	**Site Characteristics – Surface Environment – Climate Change** (Section 3.1 p.8) As stated in the draft guidance: Baseline environmental data is needed to ensure that the environment will be adequately protected and any potentially adverse effects mitigated. Surface processes at the site should be sufficiently	Comment noted. Scenario development and inter-relatedness of models/systems are part of post-closure safety assessment. CNSC's requirements on post-closure safety assessment are found in REGDOC-2.11.1 volume III.

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			characterized to ensure that natural hazard events such as flooding, landslides and erosion would not impact the ability of the radioactive waste management system to function safely during the pre-closure of a DGR facility. The site area climate should be characterized in such a way that the effect of unexpected extreme meteorological conditions can be adequately identified and considered in the design of the DGR facility. **Comments** It cannot be assumed that "natural hazardous events" or earthquakes, volcanoes, climate instability, etc., can be "adequately identified" and would not impact the function of the DGR or that adequate protection would be able to mitigate any potentially adverse effects. Climate change will change ecosystems significantly, including drastic changes from aquatic to terrestrial systems and vice versa as water levels rise or fall at a particular location. None of the current models on climate change take into account all of the effects that that climate change could have throughout the ecosystem. These models are being continuously refined as more experimental data becomes available. We now know that climate change is accelerating at rates that exceed predictions. How can one expect that the stability and safety of a DGR would not or could not be affected, and within a relatively short time compared to the projected life of a DGR? Collecting information, geomorphology	

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			characterization, updating climate change models and predictions is of course necessary, but this information gathering exercise depends on assumptions that could well turn out to be faulty, potentially biased and thus seriously limited. Furthermore, it cannot be assumed that mitigation would abate any breach of containment. These comments also apply to the aquatic and terrestrial environment as well as topography (hydrology and flooding). [3.3.2 - 3.3.5] All of these systems are interdependent, and must not be considered as single entities. Above all, chaotic events cannot necessarily be predicted or prevented.	
60.	3.1	Anna Tilman	**Breach of Containment - additional factors** The following outlines specific items that could compromise the containment resulting in releases of radioactivity and other hazardous material to the environment that need to be considered in site characterization. For example; **Corrosion** Over time, the containers of this waste will corrode. Microbial activity within the repository could also have a number of adverse effects on the safety of a nuclear waste repository, including corrosion of waste containers. This could result in the release of gases into the repository (e.g., hydrogen gas, carbon dioxide or methane). The build-up of gas pressure in the repository and the degradation of organic material, could damage natural barriers, allowing radionuclides to escape through rock fractures or pores. The chemical and physical disturbances due to	The evolution and performance of the engineered barrier system (e.g. corrosion) and the long-term evolution of the natural barrier system (e.g. glaciation, earthquakes) are beyond the scope of this document. The potential for Human intrusion would be evaluated as a safety assessment scenario, depending on the natural resource potential of the site (section 3.2.1); Safety assessment is beyond the scope of this document. REGDOC-1.2.1 provides guidance for site characterization activities, only. REGDOC-2.11.1 volume III sets out the CNSC's requirements on long term post-closure safety.

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			corrosion, gas generation and bio-mineralization, along with heat generated by radioactive decay, could impair the ability of backfill material to contain some radionuclides. **Permeability and Rock Stability** Any degree of permeability of the rock formation within the repository cannot necessarily provide an impervious barrier that would block the migration of radionuclides in the very long term. Unidentified fractures and faults, or lack of understanding as to how water and gas will flow through fractures and faults, could lead to the release of radionuclides in groundwater much faster than expected. The excavation of the repository can damage adjacent zones of rock and thereby create fast routes for radionuclide escape. Rock bursts can occur due to the high pressure deep underground in the repository. **Glaciation** The effects of future glaciations pose one of the greatest long-term threats to the integrity of deep repositories. The next glaciation could occur 10,000 to 1,000,000 years in the future. This is the period where the greatest damage could occur to the repository. The long-term adverse effects could include faulting of the rock, rupture of containers, and penetration of surface waters or permafrost to the repository depth, which would, in turn, lead to failure of the barriers and faster dispersion of the waste. **Earthquakes** During the lifetime of the repository, inactive faults could be reactivated. An earthquake could severely damage the entire containment system, including the backfill and host rocks. Even if the site is located in an area of low seismic activity, and historical records	

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			of earthquakes in the area of the proposed DGR indicate this to have been so at least from the 1800s, the length of recorded earthquake data has little relevance to earthquake hazard assessment over periods of hundreds of thousands of years. It is not possible to assume that large earthquakes are very unlikely or will not occur. **Human Intrusion** As stated in the draft regulation, "Information on past, present and potential future human activities at or near the site should be collected, and the likelihood of whether these activities could have an impact should be assessed." (Activities and Land Use, p. 11) This is very vague and extremely limited. While it is absolutely essential to be apprised of "current and historical mineral exploration and mining that could represent potential instabilities or radionuclide migration pathways", at the same time, there is no mention of the impact of the DGR on local communities, not only while under construction, but long afterwards. Mining for oil and gas by fracking, for example, could occur near the DGR, as is happening near the WIPP site in New Mexico. An analysis of the impact of such activities, among others, needs to be quantified beforehand and not left to be responded to afterwards. 7 Additionally, human error and/or deliberate intrusion in the future could adversely and unintentionally affect the safety of the repository. This is one of the most difficult, if not impossible factors to assess.	
61.	3.1	Inverhuron Committee	1. The consultation document indicates the chosen site must have "characteristics favourable for sorption, precipitation and the mechanisms to limit	1. This comment is beyond the scope of this document. Site selection is not regulated under the NSCA.

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			containment release and transport away". We would submit, at this point, that one of the site characteristics should, therefore, be that the proposed site be away from populations and away from waterways. The word "favourable" needs to be replaced by "to allow for safe sorption…". 2. In addition, The Inverhuron Committee would firmly support that "quantitative data should be provided in addition to qualitative descriptions where possible". One of the Intervenors at the Joint Review Panel was a retired Nuclear Engineer from the Bruce Power Plant and he would have been able to provide quantitative date on the cylinders inside the tubing of the reactor but, instead, OPG used computer-based data for the information on cylinder wear. The gentleman indicated that his data did not support the computer-data which was developed. We would not only recommend that quantitative data be used whenever available, but also, that this data be gathered before a model is created. This recommendation links with Item 6.0 of the REGDOC-1.2.1 where an underground facility be created to test data and to collect important data before a project is finalized and proposed.	2. Quantitative information is preferred over qualitative information, and is recommended in REGDOC-1.2.1. No change.
62.	3.1.1 to 3.1.5	Anna Tilman	**Geological Setting** (Sections 3.1.1-3.1.5) These sections list information to be included in the determination of the suitability of a specific DGR site with respect to geological and hydrogeological settings, geochemistry, geological suitability and geomechanical characteristics. As stated in the draft regulation: 1.Any process that can be shown to demonstrate the	1. Site specific characterization data is used to determine the history of geological events to have affected an area. 2. As a result of this comment, the text has been revised to "The site should be located in a seismically stable region, demonstrated by an assessment of the potential for seismic or volcanic events." 3. The range of these concerns are beyond the scope of this document. However, any evaluation of radionuclide migration and retardation from a DGR requires site specific information (site

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			potential for radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented. 2.Geological Stability: The site should be located in a seismically stable region, with low potential for seismic or volcanic events. It should be demonstrated that any credible geological event that could occur during the assessment time frame would not impact the isolation and containment capability of a DGR. **Comments:** 1. How is it possible to demonstrate that any geological event, be it seismic, volcanic, etc., would not or could not occur and result in failure to isolate the waste? 2. What is considered to be "low potential" for seismic or volcanic events? Can this be clarified or quantified? 3. If the potential for migration or retardation of this waste from the DGR is demonstrated and documented, will that result in exclusion of that site? 4. How would wastes already emplaced be retrieved if the waste packages themselves have not been designed to be retrievable at least to the pre-closure of the site?	characteristics – the topic of this document). 4. The project applicant may or may not include retrieval as an option during a phase (e.g. construction, operation, closure). Any nuclear project (including retrieval or reprocessing) would be regulated by CNSC – however retrieval and reprocessing are outside the scope of this document.
63.	3.1.1 to 3.1.5	Northwatch	1. Throughout the subsections in Section 3.1, the document should discuss how an understanding of these aspects of a site may be different in an undisturbed site versus a disturbed site, i.e. how site disturbance may alter the observations	1. This is beyond the scope of the document. Site selection (including comparison of sites) is not regulated under the NSCA. The information listed in Sections 3.2.1 to 3.2.5 applies to all sites whether they have been disturbed in the past or are undisturbed. If the geological characteristics of a site have been influenced by

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			2. Throughout the subsections in Section 3.1, the document should describe the basis for a licensee's selection of data, the methods of data analysis and now conclusions of data analysis are to be traceable, 3. Throughout the subsections in Section 3.1, the document should discuss how uncertainties are to be clearly documented in the analysis of data and drawing of any conclusions based on data collected	disturbances this will be reflected in the data gathered to characterize the site and the impact on safety considered. 2 +3. These comments are beyond the scope of this document. However, this would form part of a licensee's management system, which is regulated by the CNSC. Please see REGDOC-2.1.1 *Management System*.
64.	3.1.3	OPG, NB Power, CNL, NWMO	Industry seeks clarification that the final sentence applies only to processes that are credible or significant. Revise the sentence to read, "Any process that can be shown to demonstrate the potential for <u>credible and/or significant</u> radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented."	Comment noted. The relevant processes will be documented. There is no need to qualify them. No change.
65.	3.1.4	OPG, NB Power, CNL, NWMO	The qualification of a seismically stable region should be clarified. Amend the first sentence to read, "The site should be located in a seismically stable region, with low potential for <u>large magnitude</u> seismic or volcanic events."	As a result of this comment, the following change has been made: "The site should be located in a seismically stable region, **demonstrated by an assessment of the** potential for seismic or volcanic events."
66.	3.1.4	Northwatch	1. The direction in Section 3.1.4 to collect data for the site and region lacks clarity; future drafts should state that two data sets will be collected, one local and one regional The document should define "regional" and "local" in the context of Section 3.1.4 2. The REGDOC should include a requirement for comparative regions and comparative (local) sites	1. Comment noted. Defining regional and local in terms of the type of information that should be collected, or the scales of information would artificially limit a characterization program. The site characterization program for any potential site would be based on site specific information. 2. Comparison of sites (or activities that may relate to site selection) is not an activity that is regulated under the NSCA.
67.	3.2	Northwatch	1. The document does not adequately describe the requirements for data collection and analysis related	1. This is beyond the scope of the document. As written, expected future climate trends encompasses events related to climate

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			to climate, and particularly related to climate change and related phenomena of extreme weather events, rising temperatures, changed hydrological regimes, etc. 2 The document is overly imprecise in its terminology; for example, it repeated refers to "precipitation and snow"	change. 2. As a result of this comment, this terminology has been revised.
68.	3.2	Society of United Professionals	The items identified in Section 3.2 are all reasonable and important issues that are required to help confirm the suitability or the non-suitability of a site. All of the technical items listed in Sections 3 are important and these should be carried out by professionals trained in each of these areas.	Comment noted.
69.	3.2	OPG, NB Power, CNL, NWMO	The section on surface environment covers aspects of environmental considerations for a waste management facility during the pre-closure phase of the DGR. The relationship between section 3.2 and the impact assessment legislation should be clarified.	As a result of this comment, REGDOC-1.2.1, in particular sections 2.1 and 3.1, have been revised.This required clarification for the document is addressed in the revised REGDOC-1.2.1 particularly in
70.	3.2	Dr. Sandy Greer	**THE LIMITS OF HOW TECHNICAL ASPIRATIONS CAN BE RESOLUTIONS** Meanwhile, under section **3.2 Site characteristics II: surface environment**, the CNSC draft guideline suggests, on page 8: *"Baseline environmental data is needed to ensure that the environment will be adequately protected and any potentially adverse effects mitigated."* But, once again, this technologic focus and unjustifiable assumption about what future technological mitigation can accomplish is nothing less than human hubris. Similarly:	This comment is beyond the scope of the document.

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			"The site area climate should be characterized in such a way that the effect of unexpected extreme meteorological conditions can be adequately identified and considered in the design of the DGR facility. …" *"Climate normal data (30 years of climate data) should also be included."* But we are no longer living in what formerly was considered to be normal and predictable seasonal patterns, and believing we can know everything important to know, for example, regarding global hydrological patterns and other natural phenomena. And who can know what may befall us in the coming years. The planetary life support system is at a tipping point. Large percentages of species are disappearing, while the large majority of the human population mindlessly carries on business as usual, and I refer to those people who ought to know better but prefer to remain in denial because their fear of losing what is familiar blinds them to the imperative for societal transformation. The oil and gas sector, and its thousands of workers in Alberta, sadly, are a case in point.	
71.	3.2.1	OPG, NB Power, CNL, NWMO	This section suggests that 30 years of climate normal data is needed without any context. Also, clarification is required to acknowledge: • The term precipitation includes rain and/or snow events. • Extreme and average data may not be available for a	As a result of this comment, the document has been revised as proposed. Climate normal is defined by the average of 3 decades of data by Environment and Climate Change Canada - https://climate.weather.gc.ca/climate_normals/.

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			specific site so extreme and average data on a regional basis should be considered. Industry suggests the CNSC: • Make it clear that regional data addresses the first point. • Revise the 3rd and 4th bullets to read: • regional and local precipitation characteristics ~~(precipitation and snow)~~ • extreme and average data on temperature, precipitation, ~~snow,~~ wind speed and any other relevant phenomenon ~~for the chosen site~~ on a regional basis.	
72.	3.2.2	Northwatch	Section 3.2.2. used different terminology than previous sections when describing the same or similar concepts; for example, it uses the descriptor “area of interest” whereas previous sections used the descriptors “local” and “regional”; if there is a purpose in using a different descriptor, its relationship to early similar (but different) descriptors should be made clear	Comment noted. The language used is appropriate for this section. The area relevant for a given site, for the elements listed should be site specific. No change.
73.	3.2.2 and 3.2.3	Dr. Sandy Greer	**1. 3.2.2 Aquatic and terrestrial environment** on page 9, despite the gallant effort by CNSC to try and identify environmental species and elements inclusively that potentially could be effected, our planetary dilemma at this historic moment tosses a huge wrench into how accurately we can address the dynamics of the environment even if an ecosystem approach authentically were attempted. Climate change is the wild card that transcends characterization. For example, one aspect of site characterization is the identification of `Valued Ecosystem Components	1. As a result of this comment, the text has been updated. Valued Components in environmental assessment are discussed in REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.1*, and have been removed from REGDOC-1.2.1. 2. Comment noted.

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			(VECs)' "that will be used as environmental assessment end points." But, climate change, most especially in far-reaching extreme weather events, can alter populations, migrations, interactions across various species, organisms and environmental media (sediment, water, air). 2. Similarly, yet unknown alterations can happen to drainage systems, such as stream, lake, pond and wetland networks, as outlined under section **3.2.3 Topography, hydrology and flooding**. `Webinar on Great Lakes Coastal Wetlands: How Do We Reverse the Trends to Achieve Net Habitat Gain?', online December 19th, 2018 - hosted by the International Joint Commission on the Great Lakes subcommittees – pointed out, even aside from climate change, given the constant flux of the natural world: "Establishing a baseline map of wetland type and extent is challenging because the wetlands are dynamic both seasonally and interannually… Each map has limitations due to types of imagery and timing of imagery, and all are static conditions at a given point of time." This example illustrates how our human tools such as computer models, etc. are inherently different from in their applications from the actual continual fluctuations of the natural world.	
74.	3.2.3	Northwatch	The document should clearly set out the basis for evaluation of the information to be collected, including that identified for collection and evaluation in Section 3.2.3	Comment noted. CNSC staff will evaluate this data if submitted as part of a licence application. This is generally depicted in Figure 1 in the revised REGDOC-1.2.1.
75.	3.2.3	OPG, NB Power, CNL,	1. Clarity is sought on the opening sentence, which reads, "The drainage systems in the area should be	1. Site characterization continues as a regulated activity as shown

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		NWMO	assessed to determine the confining capacity of the site during the pre-closure period of the DGR facility." Information on regional water table characteristics, including seasonality, may not be important to the site, or needed in detail; this would need to be assessed in site-specific context. CNL–specific text: Also, data on the seasonality of regional and local water table may not be available. Confirm that this applies only to surface water along with flooding and storm water management capacity. 2. Revise the final bullet to read: "~~regional and local~~ water table characteristics, and seasonality	on Figure 1 in the revised REGDOC-1.2.1. As a result of this comment, new text has been added, to highlight the need to assess the importance of information based on characteristics that would be specific to any site being investigated: "The importance of this information for a specific site, including the detail of information needed, should be assessed in a site-specific context." 2. As a result of this comment, the document has been revised as proposed.
76.	3.2.4	Northwatch	Section 3.2.4, when taken literally, suggests that one of topographical mapping, aerial photograph interpretation, soil sampling to assess soil deposition and transportation processes is sufficient to characterize the geomorphology of a site; we do not believe this to be the case and in fact doubt that this was the REGDOC authors' intention, but is an example of the ambiguities through that document that require correction.	As a result of this comment, text has been revised and moved to section 5.
77.	3.2.5	Northwatch	The document is confused as to whether Section 3.2.5 is focussed on geotechnical characterization of a candidate site, or identifying issues with the management of overburden and waste rock during DGR development; in general, it appears to be	Comment noted. This section describes the role of geotechnical site characterization. No change.

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			intended to address the former, but discussion moves into the latter subject, and the latter subject is not addressed elsewhere.	
78.	4	Inverhuron Committee	The Inverhuron Committee would like to add “fracking” to the list created under this Item.	As a result of this comment, fracking has been added as an example of land use activity that could cause instability.
79.	4	Northwatch	This section lacks sufficient depth and breadth; for example: 1. A definition of “economically valuable” resources is lacking 2. The section lacks a temporal boundary or recognition of the temporal extremes of a DGR project 3. The section omits activities such as fracking which can cause changes at both a local and regional scale 4. It does not address uncertainties related to a changing climate 5. It does not directly identify the risk of human intrusion	1. As a result of this comment, the text has been revised to: “valuable natural resources”. 2. This comment is beyond the scope of this document. Recognition of the long-term nature of this project is provided in the revised document in the preface, sections 3. and section 3.1 3. As a result of this comment, fracking has been added as an example of land use activity that could cause instability. 4. As a result of this comment, a bullet identifying “potential impact of climate change” has been added. 5.As a result of this comment, this is now directly identified in the revised REGDOC in section 3.2
80.	4	Society of United Professionals	The use of the site by humans in Section 4 is reasonable and important as part of the requirements for a site.	Comment noted.
81.	4	OPG, NB Power, CNL, NWMO	It is not clear what could be considered “known and potential for competing land-use activities at the proposed site” from the geological perspective and beyond resource potential. The 2nd bullet in the 2nd paragraph should be removed since resource potential has already been addressed in this section.	As a result of this comment, the bullet has been simplified to read: “potential for competing land use activities”.

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82.	5	Society of United Professionals	The description of management systems in Section 5 are an important part of this REGDOC. The Society supports producing high-quality data through this process and proposes that this data should be made available to other parties to review and challenge to ensure an open and transparent process. The Society also supports data sampling that is conducted by professional workers to ensure a high quality of work. Further, we support making the results of this work available to experts to review and confirm it is correct. The Society agrees that it is important that the interpretation of the data and results is conducted by professionals with appropriate credentials and expertise to ensure a high-quality result.	Comment noted.
83.	5	Northwatch	1. We strongly support the provision that "The licence applicant would demonstrate in their licence application that the results of site characterization activities are accurate, complete, reproducible, traceable and verifiable." 2. In addition, the data and information, the evaluation of that data and information, and conclusions arrived at based on that data / information and subsequent evaluation are transparent and are made available for peer and public review. 3. In addition, exchanges of information, evaluation, advice or direction from the CNSC to the licence application should be available for peer and public review.	1. Comment noted. 2. Comment noted. 3. This comment is beyond the scope of this document.
84.	5.1	Northwatch	Data management systems must include means by which reviewers and researchers accessing the data over time can understand now the methods and	Comment noted. As indicated in the document Section 5.1 identifies the role of independent (third party) review.

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			conclusions were traceable and replicable, and must remain accessible to the public, peer reviewers, and other researchers over time	As a result of this comment, a reference To REGDOC -2.1.1 *Management System*, has been added to REGDOC-1.2.1 in section 5.1.
85.	5.1	Northwatch	The statement in section 5.1 that "Topics covered under management system governance documentation are expected to include the generic and specific requirements for site characterization processes and practices" lacks sufficient strength and clarity	CNSC REGDOC-2.1.1 Management Systems provides more information. As a result of this comment, this document is now referred to in the revised REGDOC-1.2.1.
86.	5.2	Northwatch	1. The statement in section 5.2 that "Wherever possible, data should be collected, presented, stored and archived in a suitably standardized controlled fashion" is of concern; what is the purpose of the qualifier "wherever possible"? This statement should be directive, and should state that "Data will be collected, presented, stored and archived in a suitably standardized controlled fashion"; additional direction should address methods to avoid the loss of data over time due to changes in storage methods, and provisions for public access and full transparency, during all states of pre-development and development and during operations and post-operation (should a DGR be established); 2. information needs to remain available for those DGRs which are proposed but not approved or not developed and/or put into operation for other reasons	1. This is a guidance-only document and contains no requirements. Information on the management system, including issues raised in this comment are dealt with in REGDOC-2.1.1 *Management System.* 2. This is beyond the scope of the document. However, members of the public, Indigenous groups and other stakeholders can formally participate in public hearings during the environmental assessment and licensing phase of a project. Information management is recognized as an important aspect of DGRs given the anticipated long timeframes associated with those projects.
87.	5.2	Northwatch	The possible intentions of the statement that "the process of data evaluation and establishing site-related parameters involves technical and engineering analyses and judgments, which requires extensive	Comment noted. The document as written reflects international best practices. No change made.

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			experience and knowledge" in that they suggest a possible approach which is DIFFERENT from one which is transparent, traceable, and verifiable. The notion that "parameters and analyses may not lend themselves to direct verifications through inspections and tests, or by other techniques that can be precisely identified and controlled" is equally troubling, for the same reasons The supposition that "evaluations should be reviewed and verified by independent individuals or groups (e.g., peer review) that are separate from those who initially did the work" should be standard practice, and should not be suggested only in the case of this troubling notion that evaluations which are subjective and unverifiable would form part of the decision-making process	
88.	5.2	Northwatch	In addition to being "separate from those who initially did the work", independent /peer reviews must be organizationally separate; in addition, there should not be a single peer review group, and the peer review pool should have sufficient resources and capacity to undertake detailed and diligent reviews. Northwatch agrees that reviews should be carried out at the different stages of the siting process in accordance with the work instructions and procedures; these reviews should be open and transparent, and include opportunities for public and peer review and engagement with both development and application of the review method, and with review and reflection on the review results.	As a result of this comment, thedocument has been revised. "Peer" review" has been changed to "third party" review.
89.	5.3	Northwatch	Section 5.3 should clearly state that the information collected and stored as part of the borehole quality assurance and quality control program will be available for public and peer review and access	This document focusses on guidance for the proponent pre-licensing. If the information is part of a licence application, it will become available to the public.

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				Members of the public, Indigenous groups and other stakeholders can formally participate in public hearings during the environmental assessment and licensing phase of a project.
90.	5.3	Inverhuron Committee	This section on borehole quality assurance reaches back to Item 2.2 where we expressed a concern about the minimum number of boreholes drilled for the OPG project, considering its physical size, level of experimentation and lack of available quantitative data. We question whether there might be an International Standard on this type of activity?	Comment noted. The number of boreholes needed will depend on the specific site. No change made.
91.	5.3	OPG, NB Power, CNL, NWMO	There is a detailed list in this section of what should be in the site characterization program and it is focused on boreholes. It is unclear why these items are listed in the section on sampling and testing procedures. Move the list to Section 3 and consider clarifying the focus on boreholes.	As a result of this comment, this section has been revised for content and clarity.
92.	5.3	Northwatch	1. It is unclear in Section 5.3 (Sampling and testing procedures) whether this section of the REGDOC encompasses shaft sinking and/or establishment of an underground research laboratory 2. The document should clarify: under what circumstances would a borehole not require sealing as part of abandonment, and/or under what circumstances would a borehole established as part of site characterization not be "abandoned"?	1. Comment noted. The document does not include guidance on shaft sinking. Facilities for verification and characterization, which could include an underground research facility, are described in section 6. Section 5.3 is focused on site characterization activities that begin in a pre-licensing period (outside of CNSC's regulated activities). Please consider Figure 1 in the revised document. 2. Comment noted. Other regulators are involved in the review/acceptance of borehole drilling applications. As a result of this comment, section 5.3.1 now includes this information.

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93.	5.4	Northwatch	The use of the term “perturbed” is somewhat confusing; initially, given the context, we assumed it to be used in the same manner as “disturbed” is frequently used to discuss geological rock formations and the impact of excavation on those formations, but are also aware that the term perturbed is more generally used to refer to soil conditions, as in: Perturbation (from Latin: perturbare "to confuse, disorder, disturb", from per- "through" + turbare "disturb, confuse," from turba "turmoil, crowd") is a set of pedology (soil study) and sedimentary geology processes relating to changes in the nature of water-borne alluvial sediments and in situ soil deposits over time. For clarification, we referred to REGDOC-3.6, Glossary of CNSC Terminology, but found that neither the term “perturbed” or “disturbed are included in that glossary.	Comment noted. The term is used in its regular dictionary sense. No change made.
94.	5.4	Anna Tilman	Limitations to Models Many of the complex processes and interactions that could take place in the repository over hundreds of thousands to millions of years are completely unknown. Computer models used to predict the safety of the repository for the timescale needed would have to take into account all the complex processes and interactions that could occur over this period. As these computer models are not complete or accurate, they have no predictive value. In fact, the verification and validation of numerical	This comment is beyond the scope of the document. Site data should inform any descriptive model of the site. Both the data, and the site model, along with numerous other lines of evidence – should together be used in support of a post-closure safety case. Post-closure safety is captured in REGDOC-2.11.1 volume III and safety during the operational phase of a DGR is captured in draft REGDOC-2.4.4.

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			models of natural systems is impossible because natural systems are never closed.[1] Computer models can only be validated by the demonstration of agreement between observation and prediction. This is not possible when it depends on observations so far into the future. As a result, computer models that would be used in the safety case involve numerous subjective, choices and assumptions which can lead to overconfidence in a particular computer model and its underlying assumptions, without verification or validation. Such models must be seen to be providing qualitative data rather than quantitative data.	
95.	6	Inverhuron Committee	"many geoscientific characteristics cannot be obtained from above-ground activities". The recommendation under this item is that an underground research facility be built in order to test various characteristics in real time. The CNSC has not required OPG to build such a facility to test various scientific real data. [1]Oreskes, N., Schrader-Frechette, K., Belitz. K. 1994. Verification, validation and confirmation of numerical models in the Earth sciences. Science 263: 641-646.	Comment noted. Data from other URFs (e.g. generic ones) could be used for this purpose. Site specific URFs are not prescribed. No change made.
96.	6	Anna Tilman	Facilities for Verification and Characteristic Activities - Underground Research Laboratory (URF) (Section 6 p.4; 14) As the draft regulation indicates, many geoscientific characteristics cannot be obtained from above-ground activities. In light of the nature of the waste planned to be stored in a DGR, that is, high-level radioactive waste, an underground research facility (URF) could	Comment noted. Data from other URFs (e.g. generic ones) could be used for this purpose. Site specific URFs are not prescribed. No change made. The present document provides guidance on site characterization activities that would begin in a pre-licensing period. Should a URF be developed by the proponent, this would be regulated by the

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			conduct verification and characterization activities which could purportedly reduce uncertainties. “Setting up an underground research facility is a very time-consuming process, and there may be a significant time lapse between the selection of a potential site and the availability of such a facility at that site. Therefore, it is best practice to start planning for this facility as early as possible in the siting process, and build support and expertise by using available underground research facilities.”(p.14) Comments While an underground research facility (URF) may provide additional information on characterizing the geology, conducting experiments, etc., which may not be obtainable from above-ground activities to assist with demonstrating the feasibility and safety of a DGR, there does not appear to be a requirement for such a facility, even though mention is made of such facilities in other countries. In fact, the draft states that: “It is important for the licence applicant to discuss its plans with the CNSC early for verification of site characteristics, such as an underground research facility or similar facility, to clarify the regulatory approval process and to identify those site characterization activities. These consultations are also necessary to identify those site characterization activities that may not require a CNSC licence to prepare site and/or licence to construct.”[p.12] If a URF is seemingly important, why would it not be a requirement in constructing a DGR and subject to a CNSC licence?	CNSC as illustrated in Figure 1 of the revised document.

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97.	6	OPG, NB Power, CNL, NWMO	Given the document's focus on site characterization (see comment #2), this section should address the site characterization and/or regulatory approval process for an underground research facility rather than a discussion of the attributes of URFs. Remove the first three paragraphs of this section and clarify whether the discussion is strictly with respect to URF or, applicable to all: • Licence applicants' plans for verification of site characteristics. • Early discussions with the CNSC on those plans.	As a result of this comment, the first three paragraphs have been revised. URFs are international best practice. Verification activities using some type of URF are recommended. A sentence has been added to clarify that URF activities may be carried out at a generic and / or site specific facility. The last paragraph on discussing URF verification activities has been clarified.
98.	6	Northwatch	1. Section 6 is largely occupied with providing a very general description of underground research facilities and their function in site characterization and "demonstrating feasibility" of a DGR; as in other instances throughout the document (such as the last sentence of the previous section) the tone of the document is one that wholly assumes that the conclusion of site characterization activities will be approval of the site for construction and operation of a deep geological repository; we would strong encourage a more impartial tone to regulatory documents, and an approach that describes how these activities contribute to an understanding of the site, versus how they demonstrate the site's acceptability (because the research may or may not "demonstrate feasibility") 2. The final paragraph of text for this draft regulatory document raises concerns similar to those noted earlier: that the pre-application process may lack independence and impartiality: *It is important for the licence applicant to discuss its*	1. Data from other URFs (e.g. generic ones) could be used for this purpose. Site specific URFs are not prescribed by the CNSC. No change made. 2., 4, 5 Pre- licensing engagement of the regulator with the proponent is an international best practice. The CNSC has a signed special project service arrangement with the Nuclear Waste Management Organization to provide regulatory guidance for implementing the APM approach. The arrangement identifies the terms under which the CNSC provides services to the NWMO prior to the submission of a licence application. These services include pre-project design reviews of APM DGR concepts, identifying regulatory requirements for a geological repository, and participating in public meetings to provide information on the CNSC's role. The conclusions of any reviews do not bind or otherwise influence the decisions made by the Commission. The service arrangement and summaries of CNSC pre-licensing reviews are posted on the CNSC website. 3. This is a guidance document that does not contain any

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			plans with the CNSC early for verification of site characteristics, such as an underground research facility or similar facility, to clarify the regulatory approval process and to identify those site characterization activities. These consultations are also necessary to identify those site characterization activities that may not require a CNSC licence to prepare site and/or licence to construct. 3. CNSC requirements should be clearly set out so they can be understood and adherence to them evaluated by all parties, not just the licensee or potential licence applicant; 4. Discussions between any potential licence application and the regulator should be documented in detail and the records of such exchanges – in person, by telephone, in writing or through informal contacts such as at meetings or conferences – should be included in a public registry established for the purpose of bringing transparency to interactions between the CNSC and its licensees and potential license applicants (while not a full design match, the federal government's registry of lobbyists provides a generalized model of such a registry). 5. To preserve and enhance both its practice of independence and the public perception of the independence of the CNSC, the CSNC must limit its interactions with potential licensees so those which can be undertaken within a system of openness and transparency.	requirements. No change made.
99.	References	OPG, NB Power, CNL, NWMO	Reference 6 from the European regulator group WENRA is only used in one place in this REGDOC to support a general statement about site	As a result of this comment, the reference has been removed from the text and added to a section on additional information.

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			characterization program. This WENRA report is about overall safety expectations for a disposal facility; site characterization is only mentioned at a very general level (p.42) and the report does not offer any more detail than is already included in the draft REGDOC. Furthermore, much of this document is referenced to IAEA standards such as SSG-23. Recommend deleting Reference 6 from this REGDOC since it offers no particular insight on the topic of site characterization that is not already covered by IAEA documents.	
100	6	Society of United Professionals	The Regulator has shown its preference for the DGR to have an Underground Research Facility (URF) for the purpose of obtaining verification of the Safety Report. The Society believes that the Regulator should not prescribe the DGR design to have an URF. Rather, it should set criteria for the design to meet the safety requirements and leave the proponent to demonstrate whether an URF is required. In the AECL conceptual design for a DGR (Nuclear Waste Management Program), the design did not have an URF and was found to meet safety requirements by the Review Panel in 1996. The URF was not a requirement to prove safety. The Society contends that sufficient information can be gathered through site characterization and facility engineering design to meet the facility safety requirements. Also, the CNSC should consider other approaches for a DGR design that are not currently formulated and can do without an URF.	Data from other URFs (e.g. generic ones) could be used for this purpose. Site specific URFs are not prescribed by the CNSC. Post-closure safety is captured in REGDOC-2.11.1 volume III and safety during the operational phase of a DGR is captured in draft REGDOC-2.4.4. No change made.

Table C: Feedback on comments / Tableau C: Période des observations

101.	General	Dr. Michael Stephens	Thank you for the opportunity to comment on the comments you received on REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization. From 1985 to 1992 I was on the AECL team studying the anticipated performance of a deep geological disposal repository for Canada's nuclear fuel waste. I retired in 2011. The comments you received on REGDOC- 1.2.1 remind me very much of the issues we (i.e. 300 people or so) looked into for fifteen years back then. I think we generated a good, well-supported, workable proposal. The results of our work are on the public record and should be accessible to anyone who wants to see them. I think it is a shame we Canadians have wasted 25 years in getting on with the job of putting into place a workable solution to the issue of what to do with our nuclear fuel waste, and with other long-lived radioactive wastes. It doesn't matter whether the Canadian nuclear industry is shut down tomorrow or continues for the indefinite future, we still need to deal with the accumulated waste that exists (in safe storage) now. As far as I know, most of our world-class team in the 1990's that was capable of making it happen has now dispersed. The Scandinavian countries (Sweden, Finland) face a situation much like Canada and are well on the way to putting into place a solution. I have visited their facilities to see for myself. Are there other possible solutions to deep disposal? Yes. Can we <u>guarantee</u> <u>exactly</u> how a repository will behave to the n^{th} degree? – of course not. We don't have to, and we shouldn't let Canada be stopped from advancing due to "paralysis by analysis".	This comment is beyond the scope of this document.

			I do find it interesting that several industry bodies submitted exactly the same comments to you. It shows they do talk to one another – but why not just submit one joint letter?	
102.	General	Dr. Sandy Greer	My feedback focuses on the nuclear industry template of comments regarding the CNSC draft for REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization. The subsequent sections in this feedback will address each comment chronologically, in a methodological approach. The reader might want to printout the template to read the full industry comments, beside my feedback, for greater clarity. To begin, I am disturbed by the `lock step' group mindset evident in the same template being submitted by four nuclear industry responders: Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, and Ontario Power Generation. Interestingly, most of these nuclear players submitted a covering letter. The exception is Ontario Power Generation (OPG), which provokes me to assume that personnel at OPG composed the letter, which then was sent out to the other players. Aside from the lack of courtesy of submitting a covering letter to identify itself, what is worse is the incorrect OPG's pdf heading, which reads: "Industry comments on RD 360 'Life Extension of Nuclear Power Plants.' " Discovering the OPG template with a heading that refers to another regulation reveals a careless arrogance when an accurate heading does not accompany a document. (Other players corrected the heading.) What disturbs me most of all, as a Canadian citizen, is	This comment is beyond the scope of this document.

			witnessing promotion of a nuclear waste repository, based on a specific conceptual design promoted through decades, yet which still has not been constructed anywhere in the world. Meanwhile, no independent thinking appears to exist within the Canadian nuclear industry, at least not as per full honesty to the wider public in regard to identifying technical and environmental issues that still are in the process of being understood, and improved upon. That is why those of us, sadly too few, who have done broader international research, are not able to trust the Canadian nuclear industry because of its lack of transparency in communications. Instead, the Canadian nuclear industry looks arrogant and self-serving, in its belief that only its recognized experts know what is important, and repeatedly disregards the legitimacy of authentic independent research. The Canadian nuclear industry also seems to assume that regulations exist only for its own purposes, rather than what I hope is the larger intention by any regulator, that regulations are there - not just to guide industry so that people and the environment are protected - yet, moreover, to demonstrate its industry oversight to the wider public. The final REGDOC-1.2.1 offers an opportunity for the Canadian Nuclear Safety Commission (CNSC) to strengthen public trust by demonstrating that its oversight upon the nuclear industry is not dictated by industry self-interest. Instead, the CNSC has the responsibility to stay up-to-date with the continuing improvements acquired through international research, in regard to technical processes and environmental awareness that will minimize the deleterious multiple	

			impacts of radionuclides, through time, upon the occurrence of any unforeseen accidents, extreme weather events and human interventions that inevitably will happen. The following sections in this sequential feedback might show some repetition, which I have tried to minimize except where "repetition" in fact happens intentionally, to highlight the pattern of industry critique regarding the CNSC draft of REGDOC-1.2.1. Each "COMMENT" refers to the sequence of `Comments' in the industry template.	
103.	General	Dr. Sandy Greer	The industry template opens with criticism of CNSC's "extensive use of words like "should" and "recommended," arguing that such terms "could unintentionally lead readers to confuse guidance for requirements. The industry's `Suggested Change' basically "urges the CNSC to substitute the word `may' for `should' and `recommended' throughout the REGDOC." I totally disagree with industry and, in fact, requested in my own initial comments that CNSC, instead, tighten up its guidance because its current wording sounds too lenient. Interestingly, I discovered another CNSC document, "REGDOC-2.4.1 Deterministic Safety Analysis," in which it explains its use of the aforementioned terminology: *"The licencing basis sets the boundary conditions for acceptable performance at a regulated facility or activity and establishes the basis for the CNSC's compliance program for that regulated facility or activity.*	Comment noted.

			Where this document is part of the licencing basis, the word "shall" is used to express a requirement, to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability" (page ii). To sum up, CNSC has precise meanings attached to its chosen terms. Industry appears to want more leeway on the guidance, whereas I, as a concerned citizen, prefer more accountability from industry, which begins with CNSC guidance documents.	
104.	General	Dr. Sandy Greer	Industry identifies its second comment as "Minor," even though the implications of its list of requests, from my perspective, point to several major alterations to the guidance. The industry's narrow-minded interpretation of the guidance document's theme of `site characterization,' is perhaps the most regressive among all of the industry's suggestions for changes to the CNSC draft regarding guidance on deep geological repository (DGR) site characterization. Industry writes: "Discussion of the siting process [my bold] throughout this draft distracts from the document's intended focus on site characterization." Under "Suggested Change," industry next "urges the CNSC to: (1) Remove Section 2 [titled `Overview of Siting Process'] and also (2) Remove all references to the siting process in other sections…," followed by further suggested deletions. Section 2, however, in the CNSC draft recognizes what	Comment noted. Revisions to the document aim to clarify the scope, and situate the purpose of this document – to provide guidance to a proponent on activities that begin during site selection. While site selection is not regulated under the NSCA, this information is retained in the document as Appendix A (previously section 2). This information is consistent with international guidance (IAEA SSG 14 Appendix 1).

			ought to be obvious, all four stages of an inclusive siting process are essentially interconnected from: \`conceptual and planning' to a thorough \`survey,' to do\` site characterization' and arrive at a fulsome \`site confirmation'. In contrast, the industry comment illustrates a worrisome piecemeal and disconnected perspective in regard to numerous technical processes which must be interrelated to determine the range of possible deleterious human and environmental impacts as well as ways to reduce them. Another deletion suggested by industry in Comment #2 refers to the "opening sentence of Section 3.1.1." in which the suggested change is to remove "for tens of thousands of years" in reference to the period in which the DGR would remain safe. Here is the first time that I have seen industry indicate the human impossibility of trying to guarantee the safety of a DGR through such a long period into the future. This suggested deletion exhibits a refreshing bit of honesty, albeit fleeting. The next suggested deletion again is problematic: "Delete the opening sentence of Section 4: \`The siting process will collect information that will eventually be included in the safety case for a DGR." Why cannot industry understand the wisdom of the more inclusive meaning of "siting process," as I mentioned above? The final suggested change by industry in its Comment #2 is to delete the first three paragraphs of Section 6, in which the purpose of the "underground research facility" (URF) is outlined. Most importantly, the CNSC points out that – in the passages suggested for deletion by industry – URFs "have been conducted by other countries as a best practice for DGRs for high-level radioactive waste, including used nuclear fuel."	

			Given the repeated declarations by the nuclear industry in its public literature that it follows `international best practices,' why does it request deleting a pertinent description about a facility (URF), whose "activities reduce uncertainties and therefore provide a stronger safety case"?	
105.	General	Dr. Sandy Greer	Here is an industry comment designated as "MAJOR," which goes so far as to suggest that, unless the current phraseology is changed, the `Impact on Industry" will result in "Potential for proponents to be misaligned with the regulatory framework. Yet, here, as elsewhere later, the nuclear industry's criticism is premature when the Canadian regulatory framework is currently in flux, moving forward from the existing Environmental Assessment Act into an upcoming Impact Assessment Act which still is in draft phases. More specifically, I disagree with the industry quibbling that the CNSC draft document has phraseology that is "not clearly aligned with the Class 1 regulations." For example, the industry comment reads: *"…the reference to `preliminary safety assessments' at this stage could be confused with the `preliminary safety analysis report' needed for the licence to construct… Additionally, the reference to `final safety assessment' in Section 2.4, Site confirmation stage, could be confused with the `final safety analysis report' needed for the licence to operate…".* The industry comment adds to the above, in reference to "initial licence application," that the latter "may only be a licence to prepare the site." But, if I recall correctly, the licence application for the DGR proposed for low-	Comment noted.

			and-intermediate level radioactive waste near the shoreline of Lake Huron, combined two licences, preparation and construction respectively. But more to the point, in reading pages 1 to 3 of the Class 1 Nuclear Facilities Regulations, both the \`preliminary’ and also \`final’ safety analysis reports refer only to “the adequacy of the design of the nuclear facility,” apparently exclusive of other factors essential for a safety case. Therefore, logically speaking, CNSC references for both \`preliminary’ and \`final’ “safety assessments” are much more inclusive, as they ought to be. Interestingly, in the 2014 reference document titled “Western European Nuclear Regulators’ Association [WENRA], Report: Radioactive Waste Disposal Facilities Safety Reference Levels, a deeper reading of various pages reveals, first of all, a wonderful definition of \`Safety assessment’ on page 13: “Safety assessment entails evaluating the performance of a disposal system and quantifying its potential radiological impact on human health and the environment,” followed by a full page or more, at page 78, providing a long list of factors to consider in a fulsome safety assessment. Noteworthy is that the industry template, in later comments, dismisses the validity of CNSC including the 2014 WENRA publication, suggesting that it merely reiterates what already is published by the IAEA. But, my interpretation is that the CNSC is attempting to demonstrate the necessity to be aware of, and cite from, the latest international documents because of the ongoing improvements to tech and environmental processes.	

106.	General	Métis Nation of Ontario	The Métis Nation has Aboriginal rights in the lands, waters and natural resources across the traditional territories of Ontario. The rights are held as collective rights, by the regional rights-bearing Métis community, as represented by the MNO. As you know, the Métis are one of three distinct Aboriginal peoples in Canada, whose rights, interests and way of life are constitutionally protected under Section 35 of the *Constitution Act, 1982.* Accordingly, the Crown has the duty to consult with the Métis before making a decision, taking an action or issuing an approval that could impact the rights, interests or way of life of the Métis community. The MNO's main comments are regarding the lack of recommendations in relation to consultation with the Métis. The inclusion of Métis traditional knowledge and land use information in the Deep Geological Repository (DGR) site characterization process is required for the identification of potential adverse impacts on Métis rights. The Duty to Consult and Accommodate is held by the Crown as a whole and each federal department or agency, including the CNSC must support the Crown's efforts in meeting this obligation. The current Guidelines for Federal Officials to Fulfill the Duty to Consult's Guiding principles instruct Federal departments and agencies to ensure that consultations are initiated early in the planning, design, or decision making processes. Site characterization is an early step in the design and planning process. Métis traditional knowledge and land use must be taken into account in this key step by all Federal departments and agencies in order to ensure the Crown's Duty to Consult is fulfilled and Métis rights are protected.	The scope of REGDOC-1.2.1 is to provide guidance specific to site characterization to entities who are wishing to develop a DGR facility. Other regulators will have jurisdiction over site characterization activities carried out for site characterization, including any potential Duty to Consult obligations, before a site is selected and before an applicant engages in activities that would require a licence from the CNSC. As a result of this comment, a sentence in revised section 2, (section 2.2) has been added to draft REGDOC-1.2.1 that states: In addition, it is recommended that potentially interested Indigenous groups be engaged early during the site characterization phase in order to discuss project plans, gather Indigenous Knowledge/land use information and address any concerns as appropriate early on in the site characterization and project development process. For more information on the CNSC's expectations and guidance regarding a Licensee's or new project applicant's role in early and on-going Indigenous engagement please see REGDOC-3.2.2, *Aboriginal engagement*. REGDOC-3.2.2 provides requirements and guidance for licensees and new licence applicants. It outlines both the licensee and applicants' engagement activities with Aboriginal groups, including guidance specific to early engagement with potentially affected Indigenous groups, prior submitting a licence application to the CNSC, which would include the site characterization phase. It also provides details on the CNSC's approach to Indigenous consultation and how the CNSC fulfills its duty to consult and accommodate, when it receives a licence application or project description for any new proposed nuclear project that could potentially impact Indigenous and/or treaty rights.

107.	General	Métis Nation of Ontario	There is no mention in the document of the Duty to Consult and Accommodate, Aboriginal Land Use, or Traditional Knowledge. The Crown as a whole has the Duty to Consult and Accommodate. This includes the Canadian Nuclear Safety Commission (CNSC) which has a role to play in assisting in fulfilling this duty. This document does not reflect this requirement. Add to the text acknowledging the Duty to Consult and that consultation should integrated early on into the planning and design process.	The scope of REGDOC-1.2.1 is to provide guidance specific to site characterization to entities who are wishing to develop a DGR facility. Other regulators will have jurisdiction over site characterization activities carried out for site characterization, including any potential Duty to Consult obligations, before a site is selected and before an applicant engages in activities that would require a licence from the CNSC. However, as a result of this comment, a sentence in S. 2.2 has been added to draft REGDOC-1.2.1 that states: "In addition, it is recommended that potentially interested Indigenous groups be engaged early during the site characterization phase in order to discuss project plans, gather Indigenous Knowledge/land use information and address any concerns as appropriate early on in the site characterization and project development process. For more information on the CNSC's expectations and guidance regarding a Licensee's or new project applicant's role in early and on-going Indigenous engagement please see REGDOC-3.2.2: *Aboriginal engagement*." REGDOC-3.2.2 provides requirements and guidance for licensees and new licence applicants. It outlines both the licensee and applicants' engagement activities with Aboriginal groups, including guidance specific to early engagement with potentially affected Indigenous groups, prior submitting a licence application to the CNSC, which would include the site characterization phase. It also provides details on the CNSC's approach to Indigenous consultation and how the CNSC fulfills its duty to consult and accommodate, when it receives a licence application or project description for any new proposed nuclear project that could potentially impact Indigenous and/or treaty rights.

108.	General	Jaro Franta	NWMO should in fact publish an APM report, that provides some information on the tomography procedures and interpretation studies that they intend to use. That would help CNSC to specify, as part of REGDOC-1.2.1, a reasonable or acceptable range in level of detail (resolution), after computer processing of raw tomography instrument data collection.	Comment noted.
109.	General	Saint John Citizens Coalition for Clean Air	The CNSC is going to have to do much more to facilitate and engage the public and is public review of the important early regulatory developments such as this one. Thankfully, the interventions from Anna Tilmans, Northwatch, Algonquin and Ecowatch have been submitted providing the CNSC with such important feedback on this Regulatory Document.	Comment noted.
110.	General	Saint John Citizens Coalition for Clean Air	The participant funding program needs to be expanded to allow more group and interested parties in the public domain to access their own experts to help them to understand and provide comments on these proposed regulations and other public regulatory reviews.	Comment noted. This document provides guidance for the proponent on activities that would begin in the pre-licensing stage. The provisions in REGDOC-1.2.1 are not CNSC regulatory requirements. The CNSC's Participant Funding Program (PFP) provides reasonable funding support to eligible recipients to more meaningfully participate in and bring value-added information to the Commission. The PFP is flexible and is offered for a range of different regulatory activities and processes. Typically all publicly available funding opportunities are announced on the CNSC's PFP webpage. However, should any member of the public and Indigenous communities be interested in applying for funding for other CNSC related activities such as for the review of REGDOCs and proposed regulations, CNSC staff encourages interested parties to contact the PFP Administrator: cnsc.pfp.ccsn@canada.ca with a proposal for consideration.

				Funding for these activities will be considered on a case by case basis. For information on the CNSC's PFP, please see: https://www.cnsc-ccsn.gc.ca/eng/the-commission/participant-funding-program/index.cfm
111.	General	Dr. Sandy Greer	My own final suggestion to CNSC is to request that it identify the years and page numbers for its respective referenced citations, which would help readers look up the fuller context of the information. In other words, provide footnotes as well as the bibliographic references.	Citations are consistent with CNSC practice and the REGDOC Framework. No change made.
112.	1	Saint John Citizens Coalition for Clean Air	Normally when one reads CNSC regulations that are legally binding it's usually abundantly clear that your regulations are mandatory and, non-discretionary or voluntary in compliance expectations in this Draft REGDO-1.2.1, the title Guidance gives the public the impression that these proposed regulations are just a guide and not a legally binding requirement. It is my understanding that once approved this regulation will set out requirements on Deep Geological Repository site characterization and the regulation should use language that clearly states there are requirements expected. Again, such language such as "may be used to support the initial Canadian Nuclear Safety Commission (CNSC) licence application (i.e. licence to prepare site and form part of the safety case) is an example. This use of "may" undermines public confidence in the nuclear regulator that has rigorous legally binding strong regulatory oversight in these preparatory nuclear facilities DGR.	This document provides guidance for the proponent on activities that would begin in the pre-licensing stage. The provisions in REGDOC-1.2.1 are not CNSC regulatory requirements. Figure 1 in the revised document illustrates how and when site characterization data provided in support of a licence application and/or environmental assessment would be evaluated by CNSC.
113.	1	Dr. Sandy Greer	The industry comment reads: "The term `several hundred metres or more below the surface' in the introduction could lead to confusion on how deep a DGR is expected to be." Unless industry is requesting more specific depth ranges	Comment noted.

			(doing so not evident above), the problem is that DGRs, indeed, are not appropriately distinguished from `Near Surface Facilities.' The lack of suitable measurements of depth is what can confuse not just industry but, also importantly, the wider public. Unfortunately, even on the CNSC web page focused on DGRs, the CNSC similarly refers to the underground facility as "usually at a depth of several hundred metres or more below the surface." It took a lot of research to find a document that distinguished the depth of a DGR from the depth of a `Near Surface Facility.' My research was done a couple of years ago to challenge the misinformation given to the Canadian public by OPG's CEO at that time, who declared nationally on CTV's W5 episode aired April 1, 2017, that nine DGRs were operating in the world – totally untrue then and now. This misinformation, not interrogated by investigative journalists, sadly indicates the crisis in Canadian journalism. But I digress. In emails immediately after the TV broadcast with one of the OPG communications personnel, he tried to justify the CEO's public statement, which I strongly challenged. More to the point of my feedback on the industry comments for REGDOC-1.2.1, I recently looked up the web page of the World Nuclear Association, which has been updated as of October 2018, which distinguishes the respective depths as follows: "*Near-surface disposal at ground level, or caverns below ground level (at depths of tens of metres)"* *"Deep geological disposal (at depths between 230m and 1000m for mined repositories, or 2000m to 5000m for boreholes)"* See http://www.world-nuclear.or/information-	

			library/nuclear-fuel-cycle/nuclear-wastes/storage-and-disposal-of-radioactie-wastes.aspx To finish my feedback on industry comment #4, I totally disagree with its suggestion to omit the vague CNSC depth measurement altogether, and not replace something more specific. If industry seeks clarity then, in turn, it ought to aspire to communicating more accurate information itself to the larger public.	
114.	1	Saint John Citizens Coalition for Clean Air	I object to the term recommended. It should be clearly stated that site characterization activities are required. These future licensees need to clearly state what they need to do in respect to any preparations for future licence applications.	This is a guidance-only document. Information on the words used to express guidance have been added to the preface, in the revised REGDOC. Activities that begin in a pre-licencing period would be not regulated under the NSCA. However, the data gathered during this time would be evaluated by CNSC staff if (and when) a licence application is received by CNSC. Please see Figure 1 in the revised document.
115.	1	Saint John Citizens Coalition for Clean Air	I fully concur with NB Power's first comment in respect to this issue of using words such as may that is unclear in terms of CNSC's requirements expected of licencee's.	This document provides guidance on activities that would be begin in a pre-licencing period, and thus not be regulated under the NSCA. However, the data gathered during this time would be evaluated by CNSC staff should a licence application be submitted. Please see Figure 1 in the revised document.
116.	1	Saint John Citizens Coalition for Clean Air	In Section I, the Draft Regulation pre-judges the anticipated depth of this deep geological repository DGR that is an engineered facility where radioactive waste is placed in a deep, stable geological formation usually several hundred meters or more below the surface. The guidance should not pre determine specific outcome information until the licence has carried out the required studies data collection identified later in regulatory document. The analogy of the cart before the horse comes to mind.	As a result of this comment, the reference to anticipated depth has been deleted.

117.	1.2	UOIT	This statement is overly restrictive and not necessarily pertinent to site characterization. The isolation time frame is related to the hazard of the waste and it is this hazard that should define the timescale for which site post-closure characteristics need to be examined. This time-frame would be shorter for low level waste (as the OPG DGR project) than for high level waste (the NWMO DGR). A statement of time must be included as guidance for site characterisation, but it should be related the hazard of the waste to be isolated and not be a blanket statement for low, intermediate, and high levels of waste.	As a result of this comment, the section associated with this comment has been revised, and references to isolation timeframe removed from the scope. The requirements for the post-closure safety case are provided in REGDOC-2.11.1 volume III. The long time frame associated with DGRs relates to hazard, but also to the long-lived component of the hazard. This is one of the reasons CNSC is providing guidance on site characterization activities that would provide data to inform predictive models of the site and post-closure safety assessment models.
118.	1.3	Dr. Sandy Greer	Briefly here, as I stated previously, the industry suggestion that CNSC's Section 1.3 "should simply refer to the current legislation or note that a new process is under review" is not relevant to the reality that Canada is in a transition of legislation. Moreover, the wider public needs to be aware that this CNSC guidance is one document in a series of regulations that currently are being updated. The either/or industry proposition, to refer either to existing regulation or upcoming, does not make sense.	Comment noted.
119.	1.3	Saint John Citizens Coalition for Clean Air	In carefully reviewing this Draft Regulation Document 1.2.2, on overriding limitations presented itself to this writer, namely, the lack of references to public participation, information sharing and engagement that is established within the overarching Canadian legislation. The Nuclear Safety and Control Act (NSCA) is overseeing Federal legislation. It places high value in public transparency and information sharing. There are several examples where the public may not be privy to the research, data, collation, reports that will	As a result of this comment, the document has been revised to include a new Section 2.2. on Public and Indigenous engagement. The CNSC has a signed special project service arrangement with the Nuclear Waste Management Organization to provide regulatory guidance for implementing the APM approach. The arrangement identifies the terms under which the CNSC provides services to the NWMO prior to the submission of a licence application. These services include pre-project design reviews of APM DGR concepts, identifying regulatory requirements for a geological repository, and participating in public meetings to provide information on the CNSC's role. The conclusions of any reviews do not bind or otherwise influence the decisions made by

			be generated as a result of activities on the Deep Geological Repository Site Characterization work. Specifically, in Section 5.2 Data Management Program has a positive aspect in that "these evaluations should be reviewed and verified by independent individuals or groups (e.g. peer review) that are separate from those who initially did the work. That part is positive; however, what is missing is the requirement to have a public record mechanism process available to the public. For example, in New Brunswick the Public Environment Impact Assessment Registry is available online to permit the public to access all the registration documents, studies generated for a particular project under the review. Even this early stage, a public information sharing process prior to the application for a licence to prepare a site is needed. The Regulatory Document 1.2.2 omits this. The public and interested parties such as Northwatch who identified this omission in their submission recommended a public registry. This writer would fully support Northwatch's recommendation in that regard. The way this Draft reads, the public's need to know and to be informed is missing. Reading the Draft Regulatory Document 1.2.2, we the public are shut out at this stage of the guidance identified on the DGR site characterization preparations and activities by future licence applicants. These future applicants need to be given clear message that by CNSC that you expect them to have a process or mechanism in place to place their preparation activities, data and studies in the public record. This appears to be missing in the current draft. I do understand that once a licence application is made, there is a full public disclosure within the public review process. By sharing information in advance of an	the Commission. The service arrangement and summaries of CNSC pre-licensing reviews are posted on the CNSC website.

			application progress, it can only contribute to the public interest and desire to be informed especially at this early and important process.	
120.	1.4	UOIT	The requirement for N286 is unnecessary, even if it was meant as an example, because it suggests a need to follow that standard. The standard is not appropriate, and it is not appropriate for the CNSC to indicate that an "informal inspections and assessments" would use the N286 standard. For the purposes of site characterisation, any acceptable QA system, even ISO9001, should be acceptable. The activities associated with site characterisation will, generally, not be nuclear in nature (the exception would be radiological studies of fractures and hydrogeology), so implying a need to follow a nuclear QA management structure is unreasonably onerous and may not be possible.	Comment noted. N286-12 is applicable for all nuclear facilities, including waste management. Clause 9.2 'Site selection' is also applicable for a Deep Geological Repository. The N286-12 generic requirements (records and document control, change control, assessing the experience, taking in account safety for the future site etc.) and some specific requirements of N286-12 such as purchasing requirements, verification of services, control of research and development activities are also applicable for site characterization activities. No change.
121.	1.4	Dr. Sandy Greer	I do not understand why industry questions the CNSC statement in the final paragraph of this section - which reads in part "CNSC staff may also request data, results and materials from the site characterization activities, in order, for example, for the CNSC to conduct independent research – by the industry comment stating: "Such research may not be perceived as independent." What I disagree with more explicitly is, under the comment segment `Suggested Change,' when industry suggests the deletion of the concluding phrase in the CNSC sentence "in order, for example, for the CNSC to conduct independent research."  The CNSC, as a regulator, has every right to conduct whatever `independent research' that it sees fit to carry out, even though sometimes the public might question how genuinely "independent from industry" certain	Comment noted. As a result of industry's comment, the text has been revised and moved to section 2.

			research has been done. I recall two public hearings on the DGR proposed for low-and-intermediate-level radioactive waste, in which the Joint Review Panel repeatedly made requests to the OPG to provide pertinent data which was missing, and which ought to have been collected prior to the two needed public hearings on environmental assessment. The second hearing was called to gather as much of the previously missing data as possible. As a closing remark about the significance of "independent review," I will quote from IAEA's "The Safety Case and Safety Assessment for the Disposal of Radioactive Waste (SSG-23), 2012: "*Peer review should entail a formally documented examination of a technical programme or specific aspect of work by a suitably qualified expert or group of experts who have not been directly involved in the development of the safety case and have no direct interest (e.g. financial or political interest) in the outcome of the work (PDF page 58).*" The above excerpt can be found in "IAEA, Safety Standards Series, No. SsG-23, *The Safety Case andSafety Assessment fro the Disposal fo Radioactive Waste*, Specific Safety Guide, Vienna, 2012" which is reference number 8 in this CNSC draft.	
122.	1.4	Saint John Citizens Coalition for Clean Air	In respect to the last sentence of the last paragraph "Prior to a formal application being submitted, CNSC staff may also request data results and materials from the site characterization activities in order for example, for the CNSC to conduct independent research". I fully concur as the regulator overseeing a proponent's site	Comment noted. As a result of industry's comment, the text has been revised and moved to section 2..

			characterization work and activities, it is important for the CNSC to have this opportunity to conduct independent research if it sees appropriate or complete enough. This should be done in an open and transparent manner to ensure that the public's perception of the CNSC remains an independent regulatory body versus being too closed to potential licencees. There is some perception out there that the nuclear industry and its regulatory body are too close in its relationship and interaction. This has to be avoided.	
123.	2	UOIT	This is an important section that should provide context to the site characterization process. However, the section appears to be more of a cut-and-paste of a guidance document on siting, not site characterization. The main point of this section should be to provide the reader with the context for the site characterization process and data, an indication of the end-use of the characterization data. For example, in the conceptual and planning stage, section 2.1, the last sentence is with regard to establishing criteria, but you have not stated what characteristics are needed. In terms of site characterization, the identification of desirable site characteristics *within the context of a desired generic facility* should be the point of the planning stage. Similarly, the survey and characterisation stages (sections 2.2 and 2.4) should inform the reader of the increasing rigor in the characterization program and the use of site characterization data in decision making.	As a result of this comment, this section has been moved, and is now Appendix A, consistent with IAEA SSG-14 appendix 1. Section 3.1 and Figure 1 of the revised document provide context on the role of site characterization in the CNSC’s regulated activities.
124.	2.2	Jaro Franta	In their comments on section 2.2 Borehole Drilling, The Inverhuron Committee state that “During our interactions with OPG and the CNSC, The Inverhuron Committee raised a concern that merely six boreholes	This comment is beyond the scope of this document. Site selection is not regulated under the NSCA. The OPG DGR file has been the subject of extensive assessments and public hearings. The decision

			were taken at the Bruce site. This project has a very large footprint and, therefore, boreholes need to be taken at every length, corner and at various depths.”	on the EA rests with the Minister of the Environment.
125.	3	Dr. Michael Stephens	I think the NWMO is following a wise developmental path that incorporates the lessons learned from our experience. It is disheartening to see the same “what-if” questions coming up again as if they haven’t been thought about before. I guess that’s inevitable for a multi-generational endeavour. I understand that indigenous peoples argue that you should always consider your planned actions in the light of the foreseeable impact on the next seven generations. I agree - but in this case that is only a good start. Fortunately, examples from nature are available that confirm that humans do know enough about how such a disposal system would behave. One is not simply “rolling the dice” in the abstract about the future. That’s why you build in resilience and redundancy in your design, and you establish multiple lines of evidence that what you expect to happen in the future is credible.	Comment noted.
126.	3	Dr. Sandy Greer	The industry’s suggested change is to remove a sentence in this section of the CNSC draft, a sentence which industry suggests is not clear, in reference to the second sentence of the fourth paragraph which reads: “*Specific criteria provided for the collection of baseline data may not be exhaustive and may constitute recommendations.”* I totally disagree with this suggested removal, again based upon my aforementioned witnessing of the numerous requests for missing information by the Joint Review Panel (JRP) at two public hearings, the second hearing called as an attempt by the JRP to enable OPG to	Comment noted. The sentence has been retained in the document and the link to assessment timeframes has been moved to a new section 3.1 that sets out the role of site characterization in the CNSC regulatory process and provides international context.

			fill the numerous gaps in information. My interpretation, therefore, of this sentence inclusion by the CNSC, is to avoid the same pitfall of numerous requests for belated information at future public hearings which ought to have been provided much earlier in the environmental assessment process by industry.	
127.	3	Dr. Sandy Greer	As a citizen, I partly disagree with industry suggesting the removal of all of paragraph five, within Section 3, because it is beneficial to remind everyone, from time to time, that the entire trajectory of a DGR project encompasses a sequence of processes through an extended time period. However, as I stated earlier, CNSC does insert “a time frame of tens of thousands of years or more” in reference to the long-lasting `post-closure’ period. I do agree with industry that this forever time frame is unrealistic as per any guarantee of safety and, therefore, needs to be deleted from any DGR documents, henceforth.	Comment noted. The link to assessment timeframes has been moved to a new section 3.1 that sets out the role of site characterization in the CNSC regulatory process and provides international context The importance of the long safety assessment timeframe is retained in section 3.1 of the revised document. A link is explicitly made to REGDOC-2.11.1 volume III which sets out requirements for the post-closure safety case – this also includes regulatory expectations around establishing the assessment timeframe. The long timeframe associated with DGRs is one of the reasons CNSC is providing guidance on site characterization activities that would provide data to inform predictive models of the site and post-closure safety assessment models. The following text has been added in section 3.1 of the revised REGDOC-1.2.1: “Information on the assessment timeframe and the requirements for the long-term safety case needed for licensing are provided in: REGDOC-2.11.1 volume III...” “As such, site characterization is an essential component in site selection, for gathering evidence on whether site attributes will be expectations as part of a long-term safety case. Internationally, assessment timeframes associated with DGRs span tens of thousands of years or more.”

128.	3	UOIT	This is a useful definition, but it is out of place in this section. It does not close the section, and it does not introduce sections 3.1 and 3.2. This paragraph would probably be better in section 2, the overview section. Section 3.1 and 3.2 are not introduced. It would be useful to have a sentence/paragraph here that points out 1) 3.1 will discuss geological siting characteristics, and 2) 3.2 will discuss surface siting characteristics.	As a result of this comment, Section 2 has been replaced with relevant background information, including section 2.3 which directly addresses this comment. An introduction to the site characterization sections has been provided in section 3. Section 3.1 has been inserted to provide context for site characterization.
129.	3.1	Dr. Sandy Greer	Here I agree with industry, as per its suggested change "to clarify that future [geologic] stability can only be expected or projected – although "expected" might be stretching it. The current sentence in the CNSC draft, that requests inclusion of factors related to **"past and future geological stability** [my bold] of the site" is simply not realistic, given climate change and yet unknown consequences from extreme weather events through time. Industry's suggestion to change that phrase to read "expected/projected" in order to replace the existing "future" reference is an improvement. Nevertheless, such a long time frame, in my view, is beyond what human prognostications ever can know.	As a result of this comment, this bullet has been modified to state that the "past and expected/projected future geological stability…"
130.	3.1	UOIT	"site characteristics that would allow..." This is vague. The section is "key characteristics" not a comprehensive list of characteristics. Subsequent wording in this section allows the user to develop other characteristics that would be useful for the case. If other authorities (e.g., EMR) have identified these "other" characteristics that can be investigated, then they should be listed. This bullet should be removed.	As a result of this comment, this bullet has been removed.

131.	3.1	UOIT	1. Characteristics "favorable" for... The favorable should not be a factor in characterization – the program should characterize features regardless of their favorable or unfavorable properties. 2. Similarly, "low" potential for... The characterization for human intrusion should be independent of the probability for the event.	1. As a result of this comment, "favorable" has been removed. 2. As a result of this comment, this bullet has been clarified to state:. "low natural resource potential, which would limit the likelihood of inadvertent future human intrusion by subsequent generations of resource explorers"
132.	3.1	UOIT	This note is vague. What quantitative information should be provided? What point are you making that will help guide the reader to develop a robust characterization program?	Comment noted. The REGDOC does not specify the types of quantitative information that should be provided but only that providing quantitative information is preferable. No change.
133.	3.1.1	UOIT	The opening sentence is written as a design statement, not as a guidance statement. The statement establishes that the information is to support the engineering design, but the guidance should be to develop the program to provide the data and setting to characterize the site. The data could either prove or disprove the suitability of the site. This is an important point of the characterization program.	As a result of this comment, this sentence was removed.
134.	3.1.1	Saint John Citizens Coalition for Clean Air	In my view the statement "The geological characteristic in combination with the engineered barriers and design of the DGR, should indicate that a DGR a the chosen site would remain safe for the entire time period of concern for tens of thousands to millions of years" is unrealistic and impossible to determine with our current level of knowledge, expertise and engineering know how. The regulations should have a basis of realism and not lead the public or licence applicant on an impossible task or totally unrealistic expectations.	Comment noted. The very long timeframe associated with a DGR safety case is one essential reason why extensive characterization of the host rock is needed. No change.
135.	3.1.1	Saint John Citizens	In the list under 3.1.1, no reference to asteroid physics analysis with the potential impact of an asteroid	This comment is beyond the scope of the document.

		Coalition for Clean Air	striking the earth 'within 5000 km radius of proposed DGR site. Where is the expertise to study that type of impact in this regulation? There is a lot of scientific expertise and studies that needs to be accessed and reviewed.	. Asteroid impacts are not related to site characterization.
136.	3.1.1	Saint John Citizens Coalition for Clean Air	Another area that is not covered is the possibility that a future society will have developed the expertise to neutralize and/or remove the radioactive properties of the nuclear waste buried in this DOR. If that is the case, the DRG will be inaccessible and such advanced future technologies will not be able to be applied There are various futuristic scenarios that need to be recognized and reflected in the DGR sites characterization Regulatory Document 1.2.1 which appear to be missing in this Draft Regulation.	This comment is beyond the scope of the document. REGDOC-2.11.1 volume III provides requirements of post closure safety assessments, which includes the development of scenarios.
137.	3.1.3	Dr. Sandy Greer	1. Industry critiques the current text of the CNSC draft in this section, as per the final sentence which reads: "*Any process that can be shown to demonstrate the potential for radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented.*" I totally disagree with industry's suggested change so strongly that I also cite it here: *Revise the sentence to read, `Any process that can be shown to demonstrate the potential for credible and/or significant radionuclide migration or retardation from the DGR engineered facility through the geological environment should be documented."* The integrity of the existing CNSC sentence needs to be retained, for several reasons. First of all, no definition in	1. Comment noted. The sentence has been retained as is. No change. 2."Cumulative effects" are beyond the scope of the document.

			Canadian regulations yet exists to define `significant adverse effects,' which enabled OPG to be permitted to overlook potential future impacts and neglect the proper identification of potentially problematic impacts. 2. Secondly, the mention of "cumulative effects" is totally missing in the CNSC draft, which I suggest needs to be inserted. The fact remains – a fact that I repeatedly have identified in almost every submission through the past six years about DGRs – that the eventual, and inevitable, multiple impacts of a range of radionuclides upon various aspects of an ecological system, from single organisms and their respective internal organs to the interactions between toxins and across environmental media, are still in the early years of being scientifically understood. In other words, even what might be assumed by industry to be negligible amounts of released radionuclides can increase through time in so many ways. `Cumulative effects' need much better acknowledgment both by industry as well as by the CNSC.	
138.	3.1.3	UOIT	The specific limitation of diffusion, speciation, solubility, and retardation of radionuclides is unnecessarily restrictive. The movement of other non-radioactive species should also be considered in the site characterisation, e.g., Pb, As, Cr, Cu. I would suggest that this statement be generic without examples.	As a result of this comment, the document has been revised as proposed.
139.	3.1.3	UOIT	1. The redox environment and chemistry of the prospective site should also be considered, and in particular, the ability of the site environment to return to pre-excavation redox conditions. 2. Microbiological potential has not been included in the list of possible factors. 3. "Buffering" the effects of engineered barrier	1. Redox conditions have been included in the list. The ability of a site to return to pre-excavation conditions (and how this would be considered in a long-term safety case) would be considered as part of a post-closure safety case, described in REGDOC-2.11.1 volume III. No change. 2. As a result of this comment, Microbiology has been added 3. This document is focussed on site characteristics – interactions of site characteristics (including site geochemistry) with design

			components – the resiliency of the geochemistry to contact with grouts, cements, etc.	elements would be evaluated as a part of the post-closure safety case. No change.
140.	3.1.4	Dr. Sandy Greer	I disagree with the industry's suggested amendment to the original CNSC sentence which reads: "The site should be located in a seismically stable region, with low potential for seismic or volcanic events." The industry 's suggested change to the above-written CNSC statement reads: *"The site should be located in a seismically stable region, with low potential for* ***large magnitude*** *[my bold] seismic or volcanic events."* It is publicly known, through increasing seismic events in recent years globally, that such events are accompanied by several aftershocks. Whether a seismic event happens in and of itself, or also accompanied by aftershocks, even the initial occurrence could cause the initiation of fractures in rocks which, in turn, could cause accessibility of water which, ultimately, could rupture manmade containers in DGRs. The original CNSC sentence addresses this fuller possibility more realistically.	As a result of this comment, the sentence has been changed to: "The site should be located in a seismically stable region, demonstrated by an assessment of the potential for seismic or volcanic events".
141.	3.1.5	UOIT	The impact resistance, and brittle and micro-fracture behaviour of the rock, particularly as a result of excavation damage should also be considered.	Comment noted. This suggestion would be too detailed for this document, as these factors (related to excavation damage) would depend on the rock type. The list of characteristics provided is very general and not exhaustive. No change.
142.	3.2	Dr. Sandy Greer	Briefly, the industry criticism, as earlier, is nitpicking and premature, in suggesting that: "The relationship between section 3.2 and the impact assessment legislation should be clarified."	Comment noted, The document has been revised for clarity. The regulatory context is clarified in the new section 2.1 of REGDOC-1.2.1.

			The possible caveat in my own criticism is to interpret the industry comment as a request for clarification from CNSC to spell out more clearly that the Canadian legislation is in flux as per regulations pertaining to the proposed DGRs.	
143.	3.2	UOIT	This is a vague statement that does not provide any clarification as an example. What “potential interactions” and “potential... associated effects”? This should be specific if you are using it as an example.	As a result of this comment, the section has been revised. The first 2 sentences have been simplified to: “Baseline environmental data is used to assess and predict the effects of a project on the environment”. Information on the use of environmental baseline data in environmental assessments is provided in other documents, including REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*.
144.	3.2	UOIT	“during pre-closure”; are the surface environment conditions pertinent for safe operation during *any* stage of the DGR facility lifetime? Restricting it to the pre-closure stage seems unnecessary.	As a result of this comment, the reference to post closure has been deleted.
145.	3.2.1	Dr. Sandy Greer	I agree with industry in its suggestion to remove “snow” in CNSC’s references to “precipitation and snow,” because the definition of `precipitation’ includes snow.  But, I disagree in regard to the industry suggested change to eliminate mention of the site, and instead the revised text to refer only to “regional” phenomena that include extreme and average data on temperature, precipitation, wind speed, and more.  `Local data’ as well as `regional data,’ the former which includes a potential site, needs to be included in all	As a result of this comment, the text has been updated, “snow” has been removed. The text referring to local and regional information is retained.

			relevant studies and tracking changes particularly in climate phenomena, because the site could exist where anomalies are possible as per the overall ecosystem functioning and, more so, given how ecosystems will transform through time to present yet unknowable alterations at, and surrounding, the DGR site.	
146.	3.2.1	Environment Canada	We suggest adding the word “rare” in association with “extreme” in the section where appropriate. Typically extreme meteorological events are also rare events and statistically the rare extreme events are distinct from extreme events that are not rare.	As a result of this comment, ”rare” has been added in association with “extreme” in this section.
147.	3.2.1	Environment Canada	The meteorological data that needs to be collected to inform a model to adequately predict extreme and rare precipitation events needs to consider maximum probable precipitation demonstrated with IDF (intensity, duration frequency) statistics including an extreme value analysis to ensure extreme rare events are not missed. My addition/modification: “for data base much shorter than the lifetime of the project, in addition to IDF calculations, methods based on Extreme Value Theory should also be employed”	As a result of this comment, this sentence has been added to the document: “When baseline data is acquired over a much shorter time period than the envisioned project lifetime, in addition to intensity, duration, and frequency (IDF) calculations, methods based on Extreme Value Theory should also be employed”
148.	3.2.2	UOIT	The quality of the surface water and sediment should not be assessed in the characterisation program, but the general characteristics should be enumerated. The evaluation should be specific and include the physical properties, chemical properties, and biological properties of the water and sediment.	As a result of this comment, the text has been modified to surface and sediment “characterization” instead of quality.
149.	3.2.2	Métis Nation of Ontario	The site characterization process lacks inclusion of aboriginal traditional knowledge and valued ecosystem components. The Site Characterization process should include and identify elements of the environment important to the Metis. Add to the first paragraph language that communicates	As a result of this comment, a sentence in s. 2.2 has been added to draft REGDOC-1.2.1 that states: In addition, it is recommended that potentially interested Indigenous groups be engaged early during the site characterization phase in order to discuss project plans, gather Indigenous Knowledge/land use information and address any concerns as appropriate early on in the site characterization and

			that Metis Traditional Knowledge and Land Use should be utilized when selecting ecosystem components to be characterized.	project development process. For more information on the CNSC's expectations and guidance regarding a Licensee's or new project applicant's role in early and on-going Indigenous engagement please see REGDOC-3.2.2, *Aboriginal engagement*.
150.	3.2.2	Métis Nation of Ontario	Add a bullet to the first and second lists to read: •Species of significance to the Metis	As a result of this comment, this section has been revised. Valued Ecosystems Components, referred to in REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures* as valued components, for a DGR project would not be specific to terrestrial and aquatic characteristics. Indigenous input into Valued Ecosystem Components is part of REGDOC-2.9.1. A sentence in S. 2.2 has been added to draft REGDOC-1.2.1 that states: In addition, it is recommended that potentially interested Indigenous groups be engaged early during the site characterization phase in order to discuss project plans, gather Indigenous Knowledge/land use information and address any concerns as appropriate early on in the site characterization and project development process. For more information on the CNSC's expectations and guidance regarding a Licensee's or new project applicant's role in early and on-going Indigenous engagement please see REGDOC-3.2.2, *Aboriginal engagement*.
151.	3.2.3	Dr. Sandy Greer	Industry seems at times to contradict itself, when as above looking to regional data, yet here dismissing the validity of certain types of regional data where, in my perspective, it is highly pertinent to collect it – namely, in reference to the water table. I disagree with the industry suggestion that "Information	Comment noted.

			on regional water table characteristics, including seasonality, may not be pertinent to the site, or needed in detail; this would need to be assessed in site-specific context." I also disagree on industry's suggested change that references to drainage systems be applied only to "surface water along with flooding and storm water management." Looking back once again to what I witnessed in the two public hearings for the proposed DGR for low-and-intermediate-level radioactive waste, one of the major flaws by the OPG was to focus only on local and site studies, with no regard for the interrelated larger ecosystems and bioregion, thus exhibiting no comprehension about the interrelatedness of a functioning interwoven fabric of ecosystems in the larger bioregion and beyond. I add, however, that OPG was enabled to overlook such pertinent environmental data because of inadequate regulations. Therefore, CNSC as well as the upcoming Impact Assessment Act, must carry out more rigour in creating improved regulations.	
152.	3.2.3	Environment Canada	the bullet referring to the magnitude and frequency of floods in the region, should either include the word "extreme" or else add another bullet in this list to add "magnitude and frequency of extreme meteorological related events such as rainfall, flooding and severe wind' My suggestion: "regional and local precipitation characteristics (precipitation and snow), including extreme events"	As a result of this comment, this bullet has been added: "regional and local precipitation characteristics, including extreme events."
153.	3.2.4	UOIT	This list of methodologies is not consistent with the rest of the document. You have not provided similar lists of methods. For consistency, this should be deleted and the	As a result of this comment, the list has been removed. Those methodologies have been added to a (non-exhaustive) list of data gathering activities in section 5.

			choices left to the reader.	
154.	3.2.2	Métis Nation of Ontario	Aboriginal traditional knowledge and land use is not considered in this section. Site characterization should include traditional knowledge and land use studies to best capture aboriginal land use practices and the past history of land use in the area. This is needed to ensure aboriginal land use is protected and the Duty to Consult and Accommodate is fulfilled. Add a bullet to the first list to read: •Metis Traditional Knowledge and Land Use Studies	As a result of this comment, a sentence in section 4 regarding the importance of gathering Indigenous knowledge and historic and current land use by Indigenous communities has been added.
155.	4	Dr. Sandy Greer	I disagree with the industry comment that “known and potential for competing land-use activities at the proposed site” would be unclear, when you simply can look at existing land uses. For example, in mid-western Ontario where two municipalities are competing for the proposed DGR delegated to contain used fuel bundles, a primary land use is agricultural, the latter one of three drivers of economic activity regionally. Further north, where three other rural municipalities still compete as well for the same proposed DGR, I am assuming that current hunting and trapping grounds, especially designated for Indigenous traditional use, could be impacted, aside from the question about nearby areas where previous types of mining activity existed, with the prospect of future explorations not yet on record. (As per the latter, industry does recognize “resource potential” in its comment.) Therefore, the second bullet in the second paragraph of the CNSC draft of Section 4 ought to be retained.	Comment noted. The bullet has been simplified to read: “potential for competing land use activities”.
156.	5	Saint John Citizens Coalition for Clean Air	This commenter fully agrees and supports the following statement in this Section: "The licence applicant would demonstrate in their licence application that the results of site	Comment noted.

			characterization activities are accurate, complete, reproducible, traceable and verifiable." Further, such information available in a public access record would demonstrate to the public that both the regulator and the future licence applicant that there is nothing to hide. Having such information available in some kind of public record base would allow those community members and ENGOs and others with specialized technical knowledge and expertise to be able to raise issues or alarms that could enhance the data collected. The public depnds on these interested parties and ENGOs with their professional and through analysis of these applications and regulatory developments to analyze the information.	
157.	5.1	UOIT	This appears to be boiler-plate text for nuclear facility management. Since the characterization program may not (and if the site is rejected, never will) be performed as part of a licensed activity, the management restriction is unnecessary. It is important to require a QA program and the possibility of needing the information for a nuclear license submission should be explained, but the text does not help guide a site characterization program. This would be better if rewritten to reflect the non-nuclear nature of the site-characterization program.	Comment noted. The guidance is written to inform a characterization program being carried out in preparation for its development as a DGR facility. Such a facility would be regulated as a Class 1b nuclear facility under the NSCA and its regulations. As such, existing regulatory documents and standards are appropriate for DGR site characterization, even at an early stage where no nuclear materials are yet involved. Site characterization is a fundamental step in site selection. Site characterization fits within the site selection process as specified in Figure 1 of the revised REGDOC. N286-12 is applicable for all nuclear facilities, including waste management. Clause 9.2 'Site selection' is also applicable for Deep Geological Repository. The N286-12 generic requirements (records and document control, change control, assessing the experience, taking in account safety for the future site etc.) and some specific requirements of N286-12 such as purchasing requirements, verification of services, control of research and development activities are also applicable for site characterization activities. Section 5.1 has been revised as follows: "By implementing a management system, the organization would

				demonstrate compliance, ensure consistency in meeting requirements, set priorities and continuously improve the site characterization activities. The licence applicant should develop and implement a management system for site characterization ~~of~~ activities that are part of site selection, in accordance with the requirements specified in CSA N286-12, *Management system requirements for nuclear facilities* [7].”
158.	5.1	UOIT	See previous comments (2&16) – N286 does not apply.	Comment noted. This is a guidance document, and N286-12 contains valuable information for site characterization activities. Citing N286-12 in this document is in line with IAEA, Safety Standard Series No SSG-14 Geological Disposal Facilities for Radioactive waste, 2011; Section 6.78 states: *The operator’s management system should comply with national standards on management systems and internationally recognized codes, regulations and standards should be used whenever possible [25–27]. An appropriate management system that integrates safety, health, environmental, security, quality and economic elements contributes to confidence that the relevant requirements and criteria for site characterization, design, construction, operation, closure and post-closure safety are met.* N286-12 meets the above. No change.
159.	5.2	Saint John Citizens Coalition for Clean Air	This writer questions the conditionality of date collected, presented, stored and archived in a suitable standardized controlled fashion with the provision "wherever possible". The regulation should be more definitive such as data will be collected. In reading this Draft Regulatory Document 1.2.1, this writer worries about escape hatch language along with fussy and unclear language that would give the licence applicant too much discretion and leeway as far as I can determine even as this early stage. This needs to be avoided.	As a result of this comment, the text “wherever possible” has been deleted. All data collection, presentation, storing, controlling etc., should be done under a management system documentation to ensure quality of data.

160.	5.3	Dr. Sandy Greer	I do not understand the industry comment that says "It is unclear why these items are listed in the section on sampling and testing procedures," in reference to a subsection within Section 5 which is titled "Data Acquisition and Verification Activities." Instead, the detailed description about `borehole drilling' is self-explanatory as per its location in a separate subsection of Section 5, rather than be located under Section 3, which is the suggested change by industry. For further clarification about the extensive attention given to boreholes, however, perhaps the CNSC could add a bibliographic reference about `borehole drilling and testing' thoroughly provided on the Nuclear Waste Management Organization's web pages dedicated to that topic at https://www.nwmo.ca/en/Site-selection/Steps-in-the-Process/Step-3-Preliminary-Assessments-of-Suitability/Step-3-Phase-2-Field-Studies-and-Engagement/Borehole-Drilling-and-Testing.	Comment noted.
161.	5.3	Jaro Franta	Similarly, they state regarding section 5.3 that "This section on borehole quality assurance reaches back to Item 2.2 where we expressed a concern about the minimum number of boreholes drilled for the OPG project, considering its physical size, level of experimentation and lack of available quantitative data."	Comment noted. We have included guidance on the procedures for borehole drilling, as it is an important aspect of initial subsurface site characterization. No change.
162.	5.3	Jaro Franta	Indeed, CNSC's list of "Sampling and testing procedures" in section 5.3 is deficient. Specifically, the procedure of inter-borehole tomography is not mentioned. This procedure is used to minimise the number of boreholes, each of which is a potential future leak path, requiring high quality sealing. The procedure uses technology similar to what was tested at the	As a result of this comment, that list has been expanded. It is also not exhaustive, which has now been indicated in the text.

			Grimsel rock laboratory operated by Switzerland's NAGRA (their equivalent of our NWMO).	
163.	5.3	UOIT	Either the section is incorrectly named, or the information is not complete. Environmental characterization records have not been included in this section – climate, flood, etc. that are part of section 3.2 have not been included in this section. It is important that this information is also catalogued correctly.	As a result of this comment, that list has now been expanded and includes environmental characterization. It is also not exhaustive, which has now been indicated in the text.
164.	5.3	UOIT	Recording field chemistry information is appropriate, but it is also important to record the types of analysis performed, the analytical instrumentation used to perform the analysis, and the time between sampling and analysis.	As a result of this comment, a bullet has been added to that section: "record of the type of analysis performed, analytical instrumentation used, and time between sampling and analysis"
165.	5.4	UOIT	This paragraph is not suitable for a characterisation program. It specifically refers to consistency of models. If the point is that characterization data may be used in more than one model, that should be stated, but it should not point to the result of the model, but the need for consistency in the input, or the consistency in verifying model output with characterization data.	Comment noted. This paragraph emphasizes the importance of data integration. A significant investment in characterization is necessary for informing models and ultimately the safety case, which rely heavily on the geosphere characteristics because of the long post closure period. As a result of this comment, this section has been revised significantly for clarity.
166.	5.4	UOIT	This paragraph has no link to characterization. It does not show how the characterization data could be used. If this is desired, it could be incorporated into a single paragraph (see comment 20). As it is, this paragraph has no place in this document.	As a result of this comment, this section has been significantly revised based in part on this comment, to focus on the link to characterization.
167.	5.4	Saint John Citizens Coalition for Clean Air	The first sentence cites the interpretation of a large number of physical and environmental components that interact with each other to a greater or lesser degree.	Comment noted.

168.	5.4	Saint John Citizens Coalition for Clean Air	In respect to the environmental ones, I did not see referenced to people in particular to the indigenous people or others who interact or will be impacted bot in the short term with the research are and longer term.	As a result of this comment, revisions made throughout the document address these concerns. Figure 1, and sections 2 and 4 have been revised to reflect the importance of indigenous and other stakeholders. This sentence in section 5.4 has been added, and clarifies the need for the extensive characterization because of the long timeframe associated with post closure DGR safety. “Site characterization should lead to a detailed conceptual understanding of the site, through the analysis of a large number of physical and environmental components that interact with each other”. For environmental components, please refer to CNSC REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.1*.
169.	5.4	Saint John Citizens Coalition for Clean Air	In respect to the environmental ones, I did not see referenced to people in particular to the indigenous people or others who interact or will be impacted bot in the short term with the research are and longer term.	As a result of this comment, revisions made throughout the document address these concerns. Figure 1, and sections 2 and 4 have been revised to reflect the importance of indigenous and other stakeholders. This sentence in section 5.4 has been added, and clarifies the need for the extensive characterization because of the long timeframe associated with post closure DGR safety. “Site characterization should lead to a detailed conceptual understanding of the site, through the analysis of a large number of physical and environmental components that interact with each other”. For environmental components, please refer to CNSC REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.1*.
170.	5.4	Saint John Citizens Coalition for	There is an array of the geological environment components including hydrogeological, mineralogical, chemical and mechanical as well as	Comment noted. The potential for inadvertent human intrusion because of the potential for natural resources at the repository depth would be assessed during the development of the safety case

		Clean Air	geology and stability of the site including orogeny, seismicity, glaciation, volcanism all with specialized expertise to study a potential site. What is missing are the specialized studies and expert analysis on the potential for human intrusion that is cited in the draft.	(as a safety assessment scenario). Please refer to CNSC draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2* for requirements and guidance on the safety case. This particular scenario relies on the site characteristics (and so is included in section 3). No change.
171.	5.4	Saint John Citizens Coalition for Clean Air	There should be specialized studies on the impact on the planet from long term climate change patterns. It is beyond human understanding what the state of the planet and this future site will be ten thousand years from now let alone a hundred thousand years. For examples, could there be another ice age twenty thousand years from now? There needs to be much more data, analysis and expertise applied to this subject.	This comment is beyond the scope of this document. These factors would be considered as part of the post-closure safety case. Please refer to CNSC draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management* for requirements and guidance on the safety case.
172.	5.4	Saint John Citizens Coalition for Clean Air	There are futurists with professional expertise who study and predict what the plant will be like thousands of years from now. Apart from looking at the geological environment to study the low potential for inadvertent future human intrusion, there needs to be other expertise brought forward to assess the possibility that five hundred years from now there may be specialized know how available to access the deep geological repository. These kind of specialized risk analysis studies need to be written into this Regulatory Document 1.2.1 not just focus on geology assuming no intrusion will occur or a very low preferably of such. There should be zero potential inherent future human intrusion in and ideal world but with unknown advances well into the future this may not be realistic. This entire are noted in 3.1 needs very extensive study and another whole set of expertise to assess this potential.	This comment is beyond the scope of this document. The potential for inadvertent human intrusion would be assessed during the development of the safety case (as a safety assessment scenario). Please refer to CNSC draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management*for requirements and guidance on the safety case.

173.	6	Dr. Sandy Greer	1. Briefly, I again disagree with the industry making a second suggestion – the first made in its Comment #2 – to delete the first three paragraphs shown in Section 6.0 that outline “underground research facilities”(URFs). In my feedback submission, go back to the two bottom paragraphs on page 3 and also read the conclusion on the top of page 4, in which I explain my disagreement. 2. I will add here, however, that it would be reasonable for CNSC to be more direct, as per its detailed reference to URFs, in spelling out whether it is willing to work with industry and discuss the pros and cons of setting up a Canadian URF. Such a discussion could explore the benefits and problems of already-existing URFs in other countries, as well as determine regulatory protocols if a Canadian URF were agreed upon.	1. This information was retained in the document. 2. Comment noted. The interaction between the industry and the regulator is described in Section 2 of the revised document. The CNSC is also a member of several international working groups that share URF information and best practices.
174.	6	Saint John Citizens Coalition for Clean Air	I agree with the comments on page 12 from Northwatch submission where there is an assumption that the conclusion of site characterization activities will end up with an approval of this DGR by the CNSC. The regulatory language leaves one with this impression. It should not be that way. There appears to be the potential for a lack of impartiality. The purpose is not to assume the sites acceptability because after all the studies and research, it may not be determined a proposed site has not demonstrated the site's feasibility.	Comment noted. Any potential DGR site would be subject to a detailed regulatory and technical review, and would require a licence from the Commission to be issued following a public hearing before any licensed activities at the site could take place. Please refer to REGDOC-3.5.3, *Regulatory Fundamentals* for more information on the CNSC’s licensing process
175.	6	Saint John Citizens Coalition for Clean Air	I could not agree more with Northwatch's conclusion on the point that the pre application process may lack independence and impartially as the so aptly state in their comments on this document.	Comment noted. Figure 1 of the revised document illustrates the involvement of the CNSC in the pre-application stage. Section 2 of the revised documents describes how the early involvement of the regulator is

				an international best practice.
176.	6	UOIT	This section is largely a narrative on the benefits of and difficulties with underground research labs, but does not provide guidance on using the URL for site characterization. The last paragraph is useful in the context of guidance and regulatory approval, but the preceding three paragraphs are not helpful in developing a characterization program to gather new information and verify other programmatic data necessary to justify site selection.	As a result of this comment, the section has been retained and revised.
177.	Referen ces	Dr. Sandy Greer	The industry comment here is incorrect in identifying only one location in the CNSC text where WENRA is cited. In fact, reference to WENRA is cited twice in Section 3, the Site Characterization Program. Bibliographic references usually are cited only once, as is the case for all other listed references in this guidance document. Furthermore, contrary to what industry suggests, the WENRA publication – whose full name is “Western European Nuclear Regulators’ Association, Report: Radioactive Waste Disposal Facilities Safety Reference Levels, 2014” – does have relevance as a citation source in this CNSC draft guidance on DGR site characterization, for reasons that I identified earlier, in the bottom two paragraphs of page 4 and top of page 5 in this feedback submission. My browsing discovered more than what industry noted. I am left wondering whether the nuclear industry personnel who wrote the template even read the full WENRA document. Why I wonder is the fact that industry’s criticism of WENRA appears to be based on WENRA’s `Table of Contents,’ which locates Site Characterization solely on page 42. Under Comment #18	Comment noted. The WENRA reference was removed from the text in Section 3 and is now included in a section on additional information in the revised document.

			here, the industry template reads: "site characterization is only mentioned at a very general level (p. 42)."	

Table D: Targeted consultation with the Independent geoscience Advisory Group (IAG) / Tableau D: Consultation ciblée avec le Independent geoscience Advisory Group (IAG)

178.	General	IAG	In general, the document lacks focus and clarity and is in need of significant editing to correct run-on sentences, redundancies and reconcile inconsistencies. The purpose and scope are not well defined and therefore, several questions arise as one reads the document. There is a lack of flow in the presentation, as the reader is unsure why certain sections exist and how they are related to the scope of the document. The technical content is general in nature without specifics; however, this may be the goal of the document.	As a result of this comment, the document has been extensively revised and edited. The purpose and scope have been further clarified and focused. Throughout, the document has been edited to focus on site characterization. Finally, the document has also been re-structured.
179.	General	IAG	The level of guidance provided by the document is inconsistent in detail. Section 5.3 presents more detailed guidance (on borehole drilling) than the rest of the document. The other sections in the document identify disciplines and topics that should be addressed in site characterization, but offer little guidance on how to do this. For example: 1. Section 5.2 (Data Management) does not explicitly deal with data QA/QC, with no mention of measurement reproducibility, instrument calibration and standards, use of sample blind duplicates, etc.; 2. Section 3.1.2 lists parameters to characterize the hydrogeology of the site, but does not offer guidance on what to measure and how to interpret the data to evaluate groundwater flow rates and directions, hydraulic conductivity, hydraulic heads and gradients, porosity, etc.; 3. Section 3.1.3 lists geochemical characteristics that	Comment noted. guidance on the procedures for borehole drilling is included, as it is an important aspect of initial subsurface site characterization. 1. With respect to data management, the revised document points to REGDOC-2.1.1, *Management System*, which sets out the type of management system CNSC expects licensees to implement. This information includes data management and data QA/QC for site characterization data (collect from, for example, borehole drilling). 2 and 3. Comments noted. Section 5.4 includes general information on the application (integration and interpretation) of characterization data to the site.

			should be investigated, but offers no guidance what to measure and how to interpret the data to characterize the groundwater chemistry, radionuclide solubility, speciation and retardation, radionuclide diffusion rates, etc.	
180.	Title	IAG	Suggest the title be reworded to "Guidance on Characterizing a Site for a Deep Geological Repository" or "Guidance on Site Characterization for a Deep Geological Repository". Similar terminology is contained in the body of the document and should be changed as well.	Comment noted. No change made.
181.	Preface	IAG	If this is a "guidance" document, should include the term "guidance" in the initial statement and reduce the use of the term regulatory (used four times) if possible. The use of "site characterization stage of the sitting process" is not appropriate given how the siting process is defined in Section 2 as four stages; the third being the "site characterization stage". This relates to the focus and clarity of the document. Suggested rewording might include "Information gathered to characterize a site for a deep geological repository may be used in subsequent licence applications. Accordingly, regulatory document REGDOC-1.2.1 sets out regulatory guidance for the site characterization."	As a result of this comment, the preface has been revised, and repetition reduced. The use of "site characterization stage" has been removed. Site characterization would indeed continue throughout the DGR facility lifecycle. This is now reflected in a new section (section 2 in the revised document) and illustrated in Figure 1.
182.	1	IAG	The introduction should use clear and concise terminology that is consistent with the purpose and scope. Sections of the introduction would benefit from rewording. Vague terms like "several" in "several hundred metres" should be avoided. There is a need to be consistent throughout the document; e.g. why doesn't geology appear alongside "hydrogeology, rock mechanics, geochemistry, etc." in the second paragraph when it does later in the document. Why single out the "preliminary stages" in the third paragraph when the guidance document applies to the siting process? This creates confusion for the reader in terms of where this	As a result of this comment, the document has been revised throughout for consistency and the use of concise terminology. The scope has been revised to reduce confusion and more clearly define the actual scope of the document.

			guidance should be used. The third and fourth paragraphs create confusion as to the scope of the document as it not clearly defined in the introduction. May want to remove the term "early" in the fourth paragraph to convey that the consultation is ongoing throughout the process.	
183.	1 4th par.	IAG	The goal of this paragraph is unclear and the wording awkward. Suggested rewording might include "Regulatory agencies other than the CNSC will have jurisdiction over site characterization activities that are undertaken before a licence from the CNSC is required. It is recommended that site characterization activities be conducted in consultation with the relevant regulatory bodies early and throughout the process to ensure that regulatory expectations, permitting, licensing or other requirements are clearly understood and complied with, and potential issues associated with data acceptance are identified and mitigated"	As a result of this comment, this section has been removed and the information has been captured in a new section 2 in the revised document that states as follows: "Early dialogue with the regulator for clarity with respect to regulatory expectations and requirements is recommended. Included in this process is the identification of site characterization activities that may not require a licence from CNSC. This can be formalized through a service arrangement between the regulator and the proponent."
184.	1.1	IAG	The purpose of the document should be clear to the reader. Suggestion to replace "the site characterization stage of the siting process" with "site characterization". It is unclear as to what exactly is included in the "siting process" at this stage in the document. In addition, does this guidance only refer to the site characterization stage (stage 3 noted in Section 2) of the siting process?	As a result of this comment, this text has been removed.
185.	1.2	IAG	The scope of the document should be clear from the outset and provide the overall structure and layout of the content that follows. It should state that the document provides guidance on site characterization during all stages of the siting process as defined in section 2. Section 1.2 should provide an overview of the sections that follow. For example, Section 1.3 places the guideline in the context of relevant legislation. Section 1.4 emphasizes the need for regulatory involvement early and throughout the process. Section 2 provides an overview of the siting process to which this guidance	As a result of this comment, the scope has been revised for greater clarity. Sections 1.3 and 1.4 and section 2 have been restructured and rewritten to provide more clarity.

			applies; i.e. from the desk-top study through data obtained via a potential underground research facility (URF) and the construction of the DGR. Section 3 outlines the site characterization that should be considered in assessing the geological or subsurface environment and the surface environment. Section 4 … etc.	
186.	1.2	IAG	To improve clarity and highlight the quality of the data, the fourth paragraph of Section 1.2 could be reworded as follows "This document does not provide guidance on finding or selecting a site. Its guidance is intended to ensure that site characterization will provide sufficient data and information of adequate quality to confirm the technical suitability of a site and be fit to be used in a licence application."	As a result of this comment, this section (scope) has been revised: "This document describes the elements of a site characterization program for a DGR facility. Note that this document does not: • provide guidance on finding or selecting a site; site selection is not regulated under the NSCA • apply to surface and near-surface waste management facilities, including waste from uranium mines and mills • provide guidance on long-term waste management strategies • provide requirements of safety analysis for the operational phase of DGR facilities • provide requirements of a post-closure safety case for geological disposal (see REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management*) • provide guidance for environmental protection, including environmental assessment (see REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*) Further explanation on the application of site characterization information is provided in section 2." Some of this information is now included in section 2 in the revised document as background information, including this sentence:

				"This information would be submitted with a licence application and feed into any environmental assessment." This information is also illustrated in Figure 1 in the revised document.
187.	1.2	IAG	In the fifth paragraph, should refer to "tens or hundreds of thousands of years" or reflect the regulatory requirement.	As a result of this comment, this wording has been removed from the document. CNSC requirements are reflected in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2*.
188.	1.3	IAG	Section 1.3 does not provide a clear overview of how this guidance document fits within the regulatory framework.	As a result of this comment, this information has now been added as a new section 2 in the revised document.
189.	2 1st para.	IAG	What is the "accessible environment"? Proper terms exist to describe this.	As a result of this comment, this paragraph has been removed.
190.	2 5th para.	IAG	Replace "begins at the earliest stage of the investigation of a site" with "begins at stage 1" as this is clearly defined in the previous paragraph.	As a result of this comment, the document was revised as proposed. This information is now in Appendix A.
191.	2	IAG	Replace "from one stage to another" with "from one stage to the next".	As a result of this comment, the document was revised as proposed. This information is now in Appendix A.
192.	2 7th para.	IAG	The characterization activities also support the engineering design.	As a result of this comment, this sentence has been added to the document in appendix A and section 2.3 (overview of site characterization).
193.	2.1	IAG	Clarify or reference the "desktop data compilation and interpretation" referenced earlier in the numbered list (paragraph four). This will remove the confusion regarding the term screening in Section 2.2.	As a result of this comment, this section has been clarified, and is now in Appendix A.
194.	2.2	IAG	Reword the second sentence or remove it as the terms "engineering concerns and environmental constraints" are not clear or defined elsewhere.	As a result of this comment, the sentence has been deleted and replaced with: "engineering design may evolve based on acquired site information"
195.	2.3	IAG	Final statement of this section should be clarified and/or the term "site" made plural. Does the NWMO's APM process suggest a comparative analysis of the preliminary safety assessments for different sites as a means to identify the desired site or to identify additional	As a result of this comment, this information has been revised to apply to one or more sites. It is also now found in Appendix A.

			site characterization needed to identify the desired site?	
196.	2.4 2nd para.	IAG	Replace “in combination with geologic and hydrogeologic information” with “in combination with information such as geology and hydrogeology” as there are other sources of important information.	As a result of this comment, the text has been updated, and moved to Appendix A.
197.	3 1st para.	IAG	Shouldn’t the site characterization program provide more than a “general understanding” of the site; a detailed elucidation or detailed conceptual understanding of the site.	As a result of this comment, the section has been revised, and that particular statement removed. The suggested statement that “ site characterization should lead to a detailed conceptual understanding of the site” in section 5.4
198.	3 3rd para.	IAG	The baseline data “will describe the biosphere and geosphere” not “include”. Again the term “understanding” is vague and too general.	As a result of this comment, this section has been replaced. In the revised section 3 baseline information is described in these sentences: “The characteristics of the surface environment provide baseline information for future environmental monitoring and potential mitigation activities” “Baseline data provide the initial information for evaluating safety at the siting stage and during initial facility design, and also contribute to determining the effect of any feature, event, and process associated with the DGR system”
199.	3 4th para.	IAG	Fourth paragraph is unclear. Site characterization is not done only to collect “baseline” data. The document doesn’t define “criteria”? Reword to reflect that the guidance provided is in no specific order or priority and is not limited to the elements, approaches and techniques identified.	As a result of this comment, the paragraph has been revised: “Specific criteria provided for the collection of characterization data is not exhaustive. The guidance provided is in no specific order, or priority, and is not limited to the elements, approaches, and techniques identified.”
200.	3	IAG	Final paragraph is not needed as the exact same paragraph appears in Section 1.2.	As a result of this comment, the document has been revised to eliminate repetition.

201.	3.1	IAG	A list of key characterization factors is provided in bullet form but it should state that this list is not exhaustive. For example, add " and any other information deemed pertinent" to the first bullet and " and any other potential perturbation" to the second bullet. For the second bullet, replace "orogeny" with "the impacts of orogeny". For the sixth bullet, should the mechanisms be identified as this may limit them; in addition, this would this imply the host rock should have reactive properties. Suggest rewording as "characteristics favorable for limiting contaminant release and transport away from a DGR".	As a result of this comment, the text in this section has been updated. The introductory material now states: "The characteristics of the geological environment are necessary to assess the post-closure safety of a DGR. An investigation of a potential DGR site should evaluate these geological attributes (a non-exhaustive list):" The first bullet has been changed to "containment and isolation characteristics of the host rock and geological system. The second bullet has been changed to "past and expected/projected future geological stability of the site, including the impacts of orogeny… " The sixth bullet is now the seventh bullet in the revised document, and now states "characteristics favourable for limiting contaminant release and transport away from a DGR" as suggested.
202.	3.1	IAG	Should clarify what is meant by "geological environment", "geological information" "geological factors" indicating the "geological" includes …	As a result of this comment, the section has been extensively revised for clarity, including these sentences: "The characteristics of the geological environment are necessary to assess the post-closure safety of a DGR. An investigation of a potential DGR site should evaluate these characteristics".
203.	3.1.1	IAG	Should clarify "predictability" and how this should be assessed or measured. In addition, this list is not exhaustive and maybe should include "etc." as the final bullet. In the final statement, remove "preferably" and state "quantitatively".	Predictability was meant relative to the extent of the selected host rock – the word predictability has been removed from that bullet. As a result of this comment, the final statement on natural resource potential has been changed to "natural resource potential should be assessed quantitatively".
204.	3.1.2	IAG	Shouldn't the list include the identification of preferred pathways and estimates of velocities and residence times? It is not ideal to include a list of attributes some of which are a subset of others. Alternative would be to add a statement at the end to identify that these data will help identify preferential pathways, velocities, residence	As a result of this comment, a sentence has been added: "These data will help identify preferential pathways, velocities, residence times, etc."

			times, etc. or is this part of the interpretation and integration?	
205.	3.1.3	IAG	First bullet replace "petrographic study" with "petrography"; fifth bullet should read "Geochemical impact of groundwater on engineered barriers"; add a bullet for "microbiology".	As a result of this comment, the document was revised as proposed.
206.	3.1.4	IAG	How is the "resistance of the site" assessed – clarify?	As a result of this comment, the bullet has been modified: "the effect of past glaciation events on the site as a basis for assessing the impact of future glacial events (in the post-closure period considered in the safety case – the topic of REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2*"
207.	3.1.5	IAG	Add "potential to withstand glacial events" and "etc." to list.	As a result of this comment, potential to withstand glacial events has been added to the list.
208.	3.2	IAG	First statement – baseline data will not ensure anything but is needed to be able to assess impacts – reword.	As a result of this comment,the sentence has been reworded to: "baseline environmental data is used to assess and predict the effects of a project on the environment…"
209.	3.2.1	IAG	Should include a reference to the impacts of climate change on these processes; note snow is a form of precipitation.	As a result of this comment, "Snow" has been removed. A sentence has been added : "the potential for climate change to impact processes relevant for the characteristics listed above should be considered" The potential impact of climate change has also been added to section 4.
210.	3.2.2	IAG	What are the radiological aspects of soil quality? Purpose of the final statement is unclear; if a component is important but doesn't involve a lot of interactions then the level of detail needed is less?	As a result of this comment, this section has been clarified. The sentence referring to radiological and non-radiological components has been deleted (these components are no different than any other characterization component). The last sentence has been clarified: The level of detail in the description of each of the above components should be in proportion to the potential for interactions with a DGR (more interaction – more detail).

211.	3.2.3	IAG	What is meant by the "confining capacity" of a site?	As a result of this comment, the sentence has been changed to: "The drainage systems in the area should be assessed, to determine the nature of site drainage during the pre-closure DGR period."
212.	3.2.4	IAG	May want to include shallow seismic techniques and drilling to characterize the overburden.	As a result of this comment, this has been added as a bullet in section 5.3 – a non exhaustive list of sampling and testing procedures.
213.	4	IAG	First bullet should include surface water resources and petroleum resources; second bullet should include surface water use (recreation, hydro, etc.)	As a result of this comment, surface water and petroleum resources have been included with the first bullet. The section bullet has been revised to: "potential for competing land-use activities at the proposed site; surface water use (e.g. access, recreation, hydro) should also be considered"
214.	5	IAG	First statement should state "should" rather than "would". Does "traceable" mean documented with proper QA/QC?	As a result of this comment, the text in section 5 has been updated to "should". The management system requirements (such as QA/QC) are laid out CNSC REGDOC-2.1.1 and are now referred to in the revised REDOC 1.2.1 section 5.1.
215.	5.2	IAG	Second paragraph – should the data be available to the public?	As a result of this comment, , section 2.2 has been revised to link to CNSC REGDOC-3.2.1, *Public Information and Disclosure*. This document sets out the CNSC's requirements for public information programs and disclosure protocols.
216.	5.4	IAG	The integration and interpretation of the site characterization data are extremely important. The language and terminology used in this section needs to be tightened up to improve clarity. Should these tasks be included in the guidance on site characterization and are they addressed in other documents; e.g. safety	As a result of this comment, the section has been revised according to this comment.

			assessment? The final statement references a "geosynthesis report"; is there a guidance document for this? In the first paragraph reference is made to a conceptual model (or understanding); should clarify that this is not a numerical model. The third paragraph discusses models and it is not clear if these are numerical models or conceptual models supported by data? Later in the paragraph, model appears to refer to a numerical model used to predict evolution with time and in response to future events. Geosynthesis should be defined and used early in this discussion rather than mentioned at the end. What about analogues?	
217.	6 1st para.	IAG	To provide "a representative environment".	As a result of this comment, the document was revised as proposed
218.	6 3rd para.	IAG	Clarify what is meant by "available underground research facilities"; should this statement read "build support and research capacity by participating in international programs at URL facilities (e.g. …)".	As a result of this comment, the paragraph has been revised as follows: "Setting up a URF is a time-consuming process. There may be a significant time lapse between when a potential site is selected and when a URF is constructed at that site. It also takes time to build research and support capacity by participating in URF activities in other countries. Therefore, it is best practice to plan for URF activities as early as possible in the siting process."
219.	6 4th para.	IAG	Replace "early" with "well in advance of initiating research activities". Not clear what is meant by "those site characterization activities". Isn't one objective of the URF to verify, support and confirm the conceptual model developed based on the site characterization activities to date? Should "identify those site characterization activities" be "identify the site characterization activities to be conducted"?	As a result of this comment, this paragraph has been revised as follows: It is important for the licence applicant to discuss plans for verification with the CNSC at an early stage. This would include plans for a URF or similar facility. Early discussions would clarify the regulatory approval process and to identify site characterization activities related to verification. This dialogue is also necessary to identify those site characterization activities that may not require a CNSC licence to prepare site and/or licence to

				construct.

Table E: workshop with industry and civil society organizations / Tableau E: Atelier avec l'industrie et avec des organisations de société civile

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
220.	General	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**MAJOR** While Industry is grateful for the opportunity to review and provide feedback on draft REGDOCs, it is difficult to establish all of the licensees to which this REGDOC applies and how close this version is to its final form. **Suggested change:** Industry realizes that the CNSC will address editorial and minor items in the final version. However, it is difficult to determine how close this REGDOC is to a final version with items such as an incomplete scope and applicability for some facilities. For example, there is an incomplete listing of legislation provided as background (e.g., Impact Assessment Act and its associated regulations). **Impact on industry:** With incomplete sections, it is difficult to determine its applicability for some facilities and to provide a final review. This REGDOC should highlight the extensive review and public processes that DGR facilities are subject to by way of background.	This comment was made based on an earlier version of the REGDOC that did not incorporate the extensive revisions made following public comments. The current revised document clarifies the applicability of the REGDOC in section 1.2, Scope, and has updated the relevant legislation in section 1.3. A new background section was added in section 2, which highlights the importance of environmental reviews (section 2.1) and of public and indigenous engagement (section 2.2).
221.	General and	Bruce Power, BWXT,	**MAJOR** This REGDOC is titled "Guidance" but it also	There are no requirements in this document, only guidance.

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
	applies to various sections	Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	describes requirements which creates confusion about which aspects are considered guidance. For example, Section 3.1 and Figure 1 cover things like the safety case, EA/IA aspects and licensing. Section 5.1 describes the requirement to have a management system. **Suggested change:** The REGDOC should be clear about the aspects that are considered guidance. **Impact on industry:** The clarity on requirements versus guidance provides the regulatory certainty that is needed for licensing and compliance activities.	The language in the document is consistent with language conventions applied to all CNSC regulatory documents. This is now clearly described in the preface. For example, there are no "shall" statements, commonly used to express requirements, in REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*. The revised REGDOC only contains language consistent with expressing guidance.
222.	Section 3.1, Figure 1 and Appendix A, Section 4	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**MAJOR** The REGDOC should be clear that the level of detail and information supporting a given licence progressively increases with each licensing phase. It should not suggest that the same requirements apply to different licences. For example, there would be more information/evidence available from site characterization to support a construction licence application than a licence to prepare site application (which could be requested earlier). **Suggested change:** Similar to the Class I regulations, Section 3.1, Figure 1 and Appendix A, Section 4 should be clear that there are different requirements that apply depending on the licence being considered. The initial licence application referred to in the last sentence of Appendix A, Section 4 will be very different if the	There are no requirements in this document. The revised document was carefully evaluated for consistency with the NSCA and associated Class I regulations. Revisions to the document were undertaken to provide clarity. This was done by addressing and incorporating comments from industry, civil society organizations, and other stakeholders. The revision and drafting of Section 3, 3.1 and Figure 1 in REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* addressed many of those comments. Requirements for a post-closure safety case (including safety assessment) are not addressed or defined in this document (section 1.2, bullet 5). Similarly, safety analysis is not referenced in this document, except to say that it is not within the scope of the document (section 1.2 bullet 4). Section 1.2 (scope) in the revised REGDOC indicates that these topics are addressed in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal*

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			initial application is for a licence to prepare site as opposed to a combined licence for site preparation and construction. Appendix A should also be clear that Section 4 activities occur under a licence given that it makes reference to sinking the shaft. This point is also at odds with the one above. **Impact on industry:** This REGDOC needs to remain consistent with the NSCA and its associated regulations as well as standard definitions. This comment also applies to the reference to draft REGDOC-2.11.1 Vol III used in this REGDOC and that is being revised at the same time. Reference is made to “safety assessment”, “safety analysis” and “safety case” with specific licensing phases in this REGDOC and in the 2.11.1 Series. These terms are used in regulations and are defined in REGDOC-3.6 but they appear to be used differently (and sometimes interchangeably) in the waste REGDOCs.	*of Radioactive Waste*, Version 2. Reference to the initial licence application (whether for site preparation or construction or both) have been removed from the Appendix, section A.4.
223.	3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, all of 3.3 and 4.0	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	This REGDOC appears to duplicate other legislation and guidance. **Suggested change:** This REGDOC appears to duplicate other legislation and guidance.	This document does not duplicate other guidance documents, or other pieces of legislation. Links to the *Impact Assessment Act* are provided in the relevant legislation section (section 1.3) in the revised REGDOC. The REGDOC was edited to remove redundancies. Figure 1 was developed to provide clarity on CNSC’s role in the site characterization of DGR facilities, and therefore address numerous comments from industry, civil society, and other stakeholders.

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
224.	1	Nortwatch	In response to a comment by the Saskatchewan Environmental Society, the comments table states that "The selection of a waste disposal site is not covered by the Nuclear Safety and Control Act (NSCA). Information on site selection is provided in IAEA SSG-14, *Geological Disposal Facilities for Radioactive Waste,* Appendix 1, and that the reference to CSA N292.0 *General principles for the management of radioactive waste and irradiated fuel* Review of the revised REGDOC confirmed that the CSA N292.0 is no longer included in the listed references, but is referred to twice in the document. What is the status of CSA N292.0 *General principles for the management of radioactive waste and irradiated fuel* in relationship to REGDOC 1.2.1? Which of the following – if any – set out legal / regulatory requirements: -*CSA N292.0* -*IAEA SSG-14* -*REGDOC 1.2.1*	CSA 292.0,*General Principles for the Management of Radioactive Waste and Irradiated Fuel* is provided in the revised document as additional information that is relevant for a DGR, but not used to inform the elements to be included within a DGR site characterization program (the focus of REGDOC-1.2.1). No requirements are provided in this REGDOC, but guidance on the expected elements that a site characterization program for a DGR facility should have. The requirements relating to site characteristics for a radioactive waste disposal facilities are found in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2, and also within IAEA Specific Safety Requirements SSR-5, *Disposal of Radioactive Waste.* REGDOC-2.11.1, Volume III includes the following requirements relevant to site characterization: ● Site characterization must be included as part of the disposal system description (section 7.3 ● Quality of site characterization: the applicant (or licensee) shall ensure that the safety assessment describes and/or references the approach and criteria used in site selection and demonstrate that the site selected is in accordance with the safety strategy (section 7.4.1.1) ● Site characterization data must be included in the safety assessment (section 8.1.2.1)
225.	1	Nortwatch	In response to a comment by the Saskatchewan Environmental Society, the comments table states that: *"Reference to retrieval has been removed from the*	As pointed out in the comment, IAEA SSG-14, *Geological Disposal Facilities for Radioactive Waste* refers to the legislated requirements that some countries have to maintain retrieval as an option in the post-closure period, while CSA N292.0, *General*

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			document. The cited CSA standard has been moved to "additional information". The project applicant may or may not include retrieval as an option during a phase (e.g. construction, operation, closure). This is consistent with the CSA standard cited. CSA N292.0 General principles for the management of radioactive waste and irradiated fuel makes multiple references to retrieval including in the definition "Repository — a facility, including its associated land, buildings, and equipment, where nuclear substances are emplaced, with no intention after closure of their future retrieval or transfer." CSA N292.0 General principles for the management of radioactive waste and irradiated fuel makes multiple references to retrieval including in the definition "Repository — a facility, including its associated land, buildings, and equipment, where nuclear substances are emplaced, with no intention after closure of their future retrieval or transfer." IAEA SSG-14 Section 1.2 states that "The term 'geological disposal' refers to the disposal of solid radioactive waste in a disposal facility located underground in a stable geological formation so as to provide long term containment of the waste and isolation of the waste from the accessible biosphere. Disposal means there is no intention to retrieve the waste, although such a possibility is not ruled out." (pg 1) Section 1.13 adds that "In some States, post-closure retrievability is a legal requirement and consitutes a boundary condition for the options available, which must always satisfy the safety	*Principles for the Management of Radioactive Waste and Irradiated Fuel* restricts the potential to have retrieval as an option to the pre-closure period. The Government of Canada has not legislated the requirement to maintain retrieval as an option for the post-closure period of disposal facilities. From the perspective of long-term safety, for any/all licensed stages, a DGR facility would need to demonstrate that it met the requirements of a safety case laid out in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2. Should any change be proposed - including adding or removing the option of retrieval - the licensee or applicant would need to demonstrate the safety case could still be met. REGDOC 1.2.1, the focus of this comment, does not contain requirements. It does contain guidance on the expectations of a site characterization program for a DGR facility. Figure 1 and section 3.1 were created in the revision to clarify the role of site characterization, which begins in the pre-licensing period. Figure 1 is also intended to show that site characterization activities are expected to continue during licensed phases.

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			requirements for disposal" (pg3) Where is legal or regulatory guidance / requirements provided to prospective licences with respect to retrievability? For example: -*CSA N292.0* -*IAEA SSG-14* -*REGDOC 1.2.1* -*Other* In what licencing / development stage(s) to those requirements apply? -*Site selection* -*Repository design* -*Repository construction* -*Repository operation* -*Repository closure* -*Post closure* -*other*	
226.	3 / 16	Nortwatch	In response to comments from Northwatch (item 3) CNSC responded "If a proponent wishes to obtain a licence from the CNSC, they will need to demonstrate how they followed guidance (e.g. this document) and meet all applicable regulatory requirements. This document does not detail all of the information that would be required to support and application to licence a DGR." Further, in response item 16, CNSC responds that "This is a guidance document only and does not set out any requirements." Noting that REGDOC 1.2.1 is a "should" document rather than a "shall" document (guidance vs	See responses to comment #225 and 226. There are no regulatory requirements within this document. Guidance is developed with the expectation that a licence applicant can demonstrate how they are following the guidance. While site selection is not a regulated activity in Canada, important information is collected during site selection – including site characterization information (please see response to comment 1 for CNSC regulatory requirements relating to site characterization). As site characteristics would be very important for evaluating the safety of a DGR project – guidance on the expected elements of a site characterization program are provided in this REGDOC. While characterization activities begin in a pre-licensing period, information collected during that time submitted as part of a

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			requirement): -What are the regulatory requirements? -Where are these regulatory requirements set out? -What activities do they apply to, and at what stage in DGR development / licensing stages?	licence application would be formally reviewed by CNSC staff. Figure 1 in the revised document does intend to help address this question, described further in the revised section 3.1.
227.	16	Nortwatch	In response to Northwatch's expression of frustration and the limited availability of CSA "standards", the CNSC responded that "*The notion that CSA standards are not generally available to the public is not accurate. The public can access all CSA Nuclear standards free of charge and can review them as they see fit*."	The Canadian Standards Association (CSA Group) is a not-for-profit independent organization that is accredited by the Standards Council of Canada to be legally allowed to develop standards in Canada. The CSA Group has a fiduciary duty to protect its intellectual property rights. In the interest of balancing the CSA Group's legal obligations with the need for regulatory openness and transparency, the CNSC provides a yearly sum to the CSA Group to provide for free view-access to all its nuclear standards. In addition, to view access stakeholders can also request via a CSA copyright form to use parts of standards as parts of reviews, for example if preparing a submission to the Commission. CNSC staff conducting regulatory analysis and benchmarking work often conduct screen-by-screen analysis of standards and other documents from applicable bodies such as the International Atomic Energy Agency. Online-only documents are becoming increasingly common and the availability of printed documents is becoming increasingly rare. The CNSC has noted the comment and will continue to work with the CSA to improve stakeholders' experience in freely accessing nuclear standards.
228.	21	Nortwatch	In response to a Northwatch comment that the REGDOC should explicitly set out what the pre-licensing requirements, CNSC responded that the revised section 2 explains the need for this type of REGDOC in the pre-licensing stage. This is consistent with international guidance and best practice consulted and listed in reference materials.	Repeatedly, the CNSC response is that REGDOC is for guidance only. -Which is it a REGDOC rather than a guidance document? - where are the standards / criteria by which the site characterization activities undertaken to support an application will be assessed?

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			We did not find that explanation. The CNSC response again stated that "This document provides guidance only". The relationship between site characterization and site selection (that occurs in the pre-licensing period) is illustrated in the new Figure 1 of the revised document. Section 2.1 sets out when this information will be reviewed by the CNSC during the environmental assessment and licence application process.	
229.	26-28	Nortwatch	Northwatch made several comments on the need for transparency and openness; CNSC replied that "As a result of this comment, the text has been revised and moved to section 2. Northwatch has reviewed the revised Section 2 and did not find that it incorporated requirements for openness and transparency, including public access to data, models, model inputs, and interactions between the CNSC and applicants.	In the revised REGDOC-1.2.1, CNSC staff aimed to clarify the need for transparency and openness. In the revised REGDOC, Section 2.2 links to CNSC REGDOC-3.2.1, *Public Information and Disclosure*.
230.	92/98	Nortwatch	CNSC responded (92) to a Northwatch comment on the lack of clarity with respect to shaft sinking and underground characterization with the statement that "The document does not include guidance on shaft sinking. Facilities for verification and characterization, which could include an underground research facility, are described in section 6. Section 5.3 is focused on site characterization activities that begin in a pre-licensing period (outside of CNSC's regulated activities)." CNSC further stated (98) that "Data from other URFs (e.g. generic ones) could be used for this purpose. Site specific URFs are not prescribed by the CNSC"	To clarify, Figure 1 was added to the REGDOC, which is described in a new section (section 3.1). While site characterization will begin from the surface (during the DGR siting process) characterization activities are expected to continue during the DGR facility lifecycle phases that will be licensed by the CNSC. This includes underground characterization. While CNSC does not prescribe the method through which characterization information will be obtained, the guidance in this REGDOC is intended to lay out the expectations of a site

	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
			Underground site characterization, i.e. beyond bore holes and requiring shaft or ramp access to the underground environment, are the larger part of site characterization. -Why is it excluded? -Where is it addressed? To the degree that DGR development is "standard", it is standard practice to develop a URF to conduct site characterization to support predictions made at earlier stages of site investigations (eg. Finland, Sweden, U.S., Canada). -What is the basis for this position being taken by CNSC staff?	characterization program. This is not limited to a particular method and would extend to regulated activities including the examples provided in Figure 1 (e.g., underground research facility activities).

Canada's Nuclear Regulator

Waste Management

Waste Management, Volume I: Management of Radioactive Waste

REGDOC-2.11.1, Volume I

Mayl 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Waste Management, Volume I: Management of Radioactive Waste
Regulatory document REGDOC-2.11.1, Volume I

Cat. No. NNNNN
ISBN NNNNN

Également publié en français sous le titre : Gestion des déchets, tome I : Gestion des déchets radioactifs

Document availability
This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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Publishing history
[Month year] Version x.0

Preface

This regulatory document is part of the CNSC's waste management series of regulatory documents, which also covers decommissioning. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*, sets out requirements and guidance for managing radioactive waste.

An overview of Canada's national framework for radioactive waste management is provided in REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

> The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.
>
> Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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Management of Radioactive Waste

1. Introduction

1.1 Purpose

This document provides requirements and guidance, applicable as part of the licensing basis, for licensees managing radioactive wastes. Specifically it addresses:

- the management of radioactive wastes
- radioactive waste storage and disposal facilities

1.2 Scope

REGDOC-2.11.1, *Waste Management*, *Volume I: Management of Radioactive Waste*, pertains to CNSC licensees that manage radioactive wastes. Sections 4, 5, 6, 7, 8 and 9 of this regulatory document apply to all licensees that manage radioactive wastes. Sections 10 and 11 contain requirements and guidance specific to radioactive waste storage facilities and disposal facilities, respectively.

This document is complemented by the requirements and guidance in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* [1]. Together, this regulatory document and CSA N292.0 provide requirements and guidance for the management of radioactive waste. Furthermore, this regulatory document is complemented by other CNSC regulatory documents.

1.3 Relevant legislation

The following provisions of the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it are relevant to this document:

- subsection 24(5) and section 26 of the NSCA
- paragraphs 12(1)(a) and 17(b), subsection 3(1) and section 4 of the *General Nuclear Safety and Control Regulations*
- paragraphs 3(k), 4(e), 5(f), 5(i), 5(j), 5(k), 6(c), 6(d), 6(h), 6(i), 6(j) and 6(n), and sections 7 and 8 of the *Class I Nuclear Facilities Regulations*
- paragraphs 4(t), 5(i) and 5(k) of the *Class II Nuclear Facilities Regulations*
- paragraphs 3(a), 3(c), 3(d) and 8(b) and section 7 of the *Uranium Mines and Mills Regulations*
- section 1 of the *Nuclear Substances and Radiation Devices Regulations*
- subsections 25(1) to (4) and 26(1) to (5) of the *Packaging and Transport of Nuclear Substances Regulations, 2015*

2. The CNSC's waste management framework

REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* [3], describes the national framework and the philosophy underlying the CNSC's approach to regulating the management of radioactive waste.

In addition to this regulatory document, the CNSC's regulatory framework for waste management includes:

- Draft REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* [4]
- REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* [3]
- REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [5]
- Draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste* [6]
- Draft REGDOC-2.11.2, *Decommissioning* [7]
- Draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* [8]

The following CSA standards complement the CNSC's regulatory framework regarding waste management:

- N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*
- N292.1, *Wet Storage of irradiated Fuel and Other Radioactive Materials*
- N292.2, *Interim Dry Storage of Irradiated Fuel*
- N292.3, *Management of Low- and Intermediate-Level Radioactive Waste*
- N292.5, *Guideline for the Exemption or Clearance From Regulatory Control of Materials That Contain, or Potentially Contain, Nuclear Substances*
- N292.6, *Long-Term Management of Radioactive Waste and Irradiated Fuel*
- N294, *Decommissioning of Facilities Containing Nuclear Substances*

3. Background

Radioactive waste in Canada is defined as any material (liquid, gaseous, or solid) that contains a radioactive nuclear substance, as defined in section 2 of the NSCA, for which no further use is foreseen. In addition to containing nuclear substances, radioactive waste may also contain hazardous substances that are not radioactive, as defined in section 1 of the *General Nuclear Safety and Control Regulations.*

Safety is considered during all steps of radioactive waste management. The process of radioactive waste management, which may involve several licensees, can include the following steps:

- generation and control
- handling, which may comprise:
  - collecting
  - sorting
  - segregating
  - packaging

  - loading
  - transferring
- processing, which may comprise:
  - pre-treatment
  - treatment
  - conditioning
- storage
- transport
- disposal

4. Graded Approach

This document may be applied in a graded manner commensurate with risk. With a graded approach, all requirements shall apply, but to varying degrees depending upon the safety significance and complexity of the work being performed. Consideration for the nature and level of the hazards, complexity of the facility, complexity of the activity, and the characteristics of the waste should be taken into account. Further information on the graded approach can be found in REGDOC-3.5.3, *Regulatory Fundamentals* [9].

5. General Requirements

All licensees who manage radioactive waste shall:

- be responsible for its safe management, taking into consideration the health and safety of persons, the environment and national security
- optimize the steps in radioactive waste management and practices to ensure the protection of the health and safety of people and the environment
- take into account interdependencies among all steps in radioactive waste management, as appropriate; each step shall be evaluated as an individual step in the process and as part of an integrated radioactive waste management system
- produce and/or maintain records for each of the steps in the management of radioactive waste for which they are responsible
- develop, document and implement programs, procedures and instructions to ensure the safety of waste management activities for which they are responsible, commensurate with the scale of the licensed activity and the waste inventory
- use operational experience, lessons learned from other similar facilities or activities, and advances in science and technology in an effort to continuously improve the safety of the waste management facility or activity

6. Waste Management Program

Where a licensee is required by its licence to implement and maintain a waste management program, the program shall control the management of radioactive waste where it is generated, handled, processed, stored, transported or disposed of.

The waste management program shall:

- identify the waste management activities to be undertaken

- clearly state requirements, criteria and objectives to be met, and safety standards to be used
- establish an organizational structure that specifies the roles and responsibilities for positions with respect to the safe management of radioactive waste
- identify the management system elements that ensure the effectiveness of the waste management program
- encompass all waste streams associated with or contaminated by nuclear substances
- consider the waste hierarchy
- require records of the waste inventory under control and maintain those records

The licensee shall implement and maintain associated programs and procedures to support the waste management program (e.g. waste characterization). These programs and procedures should be commensurate with the risk of the waste streams being managed.

7. Radioactive Waste Classification, Waste Characterization and Waste Acceptance Criteria

7.1 Waste classification

In Canada, there are four general classes of radioactive waste used as the basis for a classification system:

- Low-level radioactive waste (LLW) contains material with radionuclide content above established unconditional clearance levels and exemption quantities (set out in the *Nuclear Substances and Radiation Devices Regulations*), but generally has limited amounts of long-lived radionuclides. LLW requires isolation and containment for periods of up to a few hundred years and is suitable for disposal in near surface facilities.
  LLW includes the following sub-classes:
  - Very low-level radioactive waste (VLLW) has a low hazard potential and is above the criteria for unconditional clearance levels and exemption quantities. Long-term waste management facilities for VLLW do not need a high degree of containment or isolation. Concentrations of longer lived radionuclides in VLLW are generally very limited.
  - Very short-lived low-level radioactive waste (VSLLW) is waste that can be stored for a decay period of not more than a few years and subsequently cleared for release. VSLLW includes radioactive waste containing only short half-life radionuclides typically used for research and biomedical purposes. The main criterion for VSLLW is the half-life of the predominant nuclides. In general, the management option of storage for decay for VSLLW should only apply to radionuclides with a half-life of 100 days or less.
  - Intermediate-level radioactive waste (ILW) generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years. ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal. Due to its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near surface repositories.
- High-level radioactive waste (HLW) is used nuclear fuel that has been declared as radioactive waste and/or is waste that generates significant heat via radioactive decay. HLW typically has levels of activity concentration in the range of 10^4 to 10^6 TBq/m^3. HLW is associated with penetrating radiation, and thus shielding is required. HLW also contains significant quantities of long-lived radionuclides necessitating long-term isolation.
- Uranium mine and mill tailings are a specific type of radioactive waste generated during the mining and milling of uranium ore and the production of uranium concentrate. In addition to

tailings, mining activities typically result in the production of large quantities of waste rock as workings are excavated to access the ore body. The wastes contain long-lived radionuclides that do not decrease significantly over extended time periods. Further information can be found in REGDOC-2.11.1, *Waste Management Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [5].

The licensee shall implement a radioactive waste classification system. The classification system shall be based on the four general class of wastes and shall consider the site-specific safety case and supporting safety assessment required for the waste management facility or activity.

Waste should be classified according to the degree of containment and isolation required to ensure safety with consideration given to the hazard potential of different types of waste and the timeframe associated with the hazard.

7.2 Waste characterization

The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. The characterization of radioactive waste shall include the principal radionuclides relevant to safety and assurance that the waste or waste package will meet the acceptance criteria for the appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties, including dominant radionuclide content, of the waste, as applicable. The licensee shall maintain records of the relevant characteristics of the waste based on the characterization performed.

7.3 Waste acceptance criteria

A licensee that receives waste shall develop waste acceptance criteria consistent with, and derived from, the site-specific safety case. The waste acceptance criteria shall specify the chemical, physical, radiological, mechanical, biological and other characteristics of the waste, waste forms, packages and unpackaged waste that will be accepted for handling, processing, storage, transport and/or disposal at the facility or location of the activity.

In situations where acceptance requirements for disposal are not yet available, the licensee should develop waste acceptance criteria with reasonable assumptions about the anticipated disposal option.

8. Steps in the Management of Radioactive Waste

8.1 Generation

The licensee shall consider the waste hierarchy in the management of radioactive waste.

The licensee shall consider measures to control the generation of radioactive waste in terms of both volume and radioactivity content as early as possible prior to the commencement of licensed activities and on an ongoing basis.

The clearance and exemption of waste from regulatory control after having been appropriately characterized, processed and/or stored for a sufficiently long period of time, together with the reuse and recycling of material, can be effective in reducing the amount of radioactive waste that needs further processing or storage. The limits and controls for clearance and exemption from regulatory control are found in the *Nuclear Substances and Radiation Devices Regulations*.

8.2 Handling

For the selected waste handling method(s), the licensee shall take into consideration:

- the characteristics of the waste
- the types of containment systems and packages required for safety
- the minimization of radiological risks in accordance with the ALARA principle

8.3 Processing

The licensee shall take into consideration the characteristics of the waste and the subsequent steps in its management when selecting waste processing methods.

The licensee should reduce the hazard potential of the waste as is practicable at each stage of waste processing. The licensee should consider early processing of waste to convert it to a passively safe form or to otherwise stabilize it.

The licensee should segregate sealed sources from other wastes. The licensee should keep spent or disused sealed sources in a shielded container during handling.

The licensee shall not subject spent or disused sealed sources to compaction, shredding or incineration in order to ensure their integrity. If the integrity of a sealed source has been compromised, the licensee shall no longer treat it as a sealed source.

8.4 Transport

The *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulatio*ns apply to the transport of radioactive waste. While not subject to those regulations, onsite transfers (not on public roads) should meet an equivalent level of safety.

8.5 Storage

The licensee shall store radioactive waste safely, in a manner that provides for the protection of people, the environment and national security, and that is in accordance with regulatory requirements.

The licensee shall conduct storage activities in accordance with its documented procedures. The licensee shall consider the impact of any modification to these activities on the safety of the stored waste.

The licensee shall store the waste in a manner where it can be inspected, monitored, retrieved and preserved in a condition suitable for its subsequent management.

For additional criteria for the storage of radioactive waste, refer to section 10, Radioactive Waste Storage Facility.

8.5.1 Decay storage

The licensee should segregate radioactive waste designated for decay storage from other waste, from the point of generation to its disposition.

8.6 Disposal

The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people, the environment and national security, and that is in accordance with regulatory requirements.

The licensee shall conduct disposal activities in accordance with its documented procedures. The licensee shall consider the impact of any modification to these activities on the safety of the disposed waste.

For additional criteria for the disposal of radioactive waste, refer to section 11, Radioactive Waste Disposal Facility.

9. Waste Packages

Where applicable, the licensee shall use engineered waste packages to contain radioactive waste in accordance with applicable regulations for normal operation and in postulated accident conditions. The licensee shall use engineered waste packages for their intended use in the handling, processing, storage, disposal, and, if applicable, the transport of waste.

The licensee shall ensure that waste packages and unpackaged waste accepted for processing, storage and/or disposal conform to the waste acceptance criteria for the licensed facility or activity.

10. Radioactive Waste Storage Facility

10.1 General requirements

The licensee shall develop, implement and maintain a safety case for the entire lifecycle of the radioactive waste storage facility in accordance with applicable regulations.

10.2 Site preparation

10.2.1 Site characterization

The licensee shall characterize the site of a radioactive waste storage facility at a level of detail sufficient to support an understanding of the current site characteristics and how the site is anticipated to evolve over the duration of the facility's lifecycle.

10.2.2 Facility design

The licensee shall design the radioactive waste storage facility to fulfill the applicable safety functions during normal operation and postulated initiation events (e.g., anticipated operational occurrences, design-basis accidents and design extension conditions), as follows:

- control of sub-criticality
- removal of heat
- radiation shielding
- confinement of radioactive waste
- retrievability

The licensee shall ensure that the design features of the facility are appropriate for the characteristics of the waste to be stored.

The licensee shall design the radioactive waste storage facility to facilitate the inspection, monitoring, testing, and maintenance of:

- the structures, systems and components (SSCs) important to safety
- waste packages stored in the facility

The licensee shall identify and classify SSCs important to safety. Passive SSCs should be prioritized before active SSCs. For active SSCs, consideration should be given to the following: the reliability of the SSCs; the need for redundancy and diversity; and the behaviour of the SSCs in the event of postulated initiating events.

The licensee should ensure that process system controls (e.g., waste handling, equipment and ventilation systems) are independent of protection systems. If this is not feasible, justification should be provided for the use of shared and interrelated systems.

10.3 Construction

The licensee shall construct the radioactive waste storage facility in accordance with the accepted design.

The licensee shall ensure that any changes made to the design during construction are subject to a change-control process.

The licensee shall verify that the SSCs important to safety perform as per design performance criteria. Upon the completion of commissioning, the licensee shall produce a final commissioning report. The report shall provide assurance that all applicable regulatory requirements and performance criteria have been met.

10.4 Operation

The licensee shall establish and document operational limits and conditions derived from safety assessments for the radioactive waste storage facility, in order to maintain and operate the facility in a safe state.

The licensee shall operate the radioactive waste storage facility in accordance with documented procedures. Procedures should be developed for managing and operating a radioactive waste storage facility under normal conditions and during postulated initiating events. The licensee should consider how any modification to operations would impact the safety of the stored waste.

The licensee shall monitor the operational limits and conditions. The operational limits and conditions should be revised for any of the following reasons:

- experience gained by the licensee or other licensees or businesses
- following modifications made to the facility and/or to the type of radioactive waste stored
- as part of the process of periodically reviewing the safety case for the facility
- relevant changes in legislative or regulatory requirements

The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility.

The licensee shall establish an aging management plan to provide for the timely detection and mitigation of aging effects, in order to ensure integrity and functional capacity of the SSCs throughout all stages of the facility's lifecycle.

10.5 Decommissioning

The licensee shall carry out the decommissioning of the radioactive waste storage facility in accordance with Draft REGDOC-2.11.2, *Decommissioning* [7].

11. Radioactive Waste Disposal Facility

11.1 General requirements

The licensee shall develop, implement and maintain a safety case for the entire lifecycle of the radioactive waste disposal facility, and a post-closure safety assessment, in accordance with applicable regulations.

The licensee shall ensure that each of the stages in the lifecycle of a disposal facility is supported, as necessary, by evaluations of the site, design, construction, operation and closure of the facility, and of the performance and safety of the disposal system. Each of these stages shall be supported as necessary by an iterative evaluation of the disposal system.

The licensee shall ensure the safety of the facility by means of multiple safety functions including the use of multiple barriers and controls; for example, the host environment, engineered barriers, and operating the facility within the limits and conditions derived from the safety assessments.

The licensee shall site, design, construct, commission, operate and close the disposal facility:

- in such a way that safety is ensured by passive means to the fullest extent possible
- so as to minimize the need for actions to be taken after closure of the facility

The licensee shall identify SSCs important to safety.

For radioactive waste disposal facilities, draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste* [6], provides requirements and guidance for licensees and applicants.

11.2 Site Preparation

11.2.1 Site characterization

The licensee shall characterize the site at a level of detail sufficient to support an understanding of the current site characteristics and how the site is anticipated to evolve over time for the radioactive waste disposal facility.

Draft REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* [4], provides guidance for deep geological repository applicants.

11.2.2 Facility design

The licensee shall design the radioactive disposal facility and its engineered barriers to:

- contain the waste
- be physically and chemically compatible with the host environment
- provide safety during the pre-closure phase (i.e., construction, operation, decommissioning) during normal operation and postulated initiation events
- provide safety features post-closure that complement those features afforded by the host environment
- facilitate the inspection, monitoring, testing and maintenance of the systems important to safety and the elements of the host environment that are credited in the safety case

The licensee shall base the design of a disposal facility upon:

- expected performance of the facility to protect the health and safety of persons and the environment for time periods that account for the time of maximum effect, or for a time period to be justified by the licensee
- characteristics and inventory of the radioactive waste to be emplaced
- characteristics of the local and regional environment
- the development of waste acceptance criteria for the radioactive waste to be emplaced
- the safety assessment developed for the facility that reflects the chosen waste acceptance criteria

The licensee shall identify and classify SSCs important to safety.

The licensee shall ensure that the design of a disposal facility:

- allows for the containment and isolation of the radioactive waste or irradiated fuel to be emplaced
- uses multiple barriers (defence in depth)
- uses approved engineering practices and principles, and change-control processes
- allows for the safe emplacement of radioactive waste into the facility
- allows for condition assessment inspections of safety-significant SSCs prior to closure
- considers off-gas generated by the radioactive waste over time
- allows for the measurement of water in safety-significant SSCs prior to closure
- allows for maintenance activities of SSCs prior to closure

The licensee shall consider closure in the initial design of the facility. Plans for closure must be updated as the design of the facility is developed.

11.3 Construction

The licensee shall construct the radioactive waste disposal facility in accordance with the accepted design.

The licensee shall ensure that any changes to design during construction or that any unplanned disturbances to the host environment are subject to a change-control process.

The licensee should avoid or limit unintended disturbances to the host environment during construction. The licensee should perform all construction activities to preserve the containment and/or isolation features of the natural barriers of the host environment that were credited in the safety case.

The licensee shall verify that the design meets specifications and shall perform commissioning activities. Commissioning shall demonstrate that the SSCs important to safety perform as expected in support of operations. The licensee shall produce a final commissioning report upon completion of commissioning. The report shall provide assurance that all applicable regulatory requirements and performance criteria have been met.

11.4 Operation

The licensee shall establish and document operational limits and conditions derived from safety assessments in order to maintain and operate the radioactive waste disposal facility in a safe state.

The licensee shall operate the radioactive waste disposal facility in accordance with documented procedures. Procedures should be developed for managing and operating a radioactive waste disposal facility under normal conditions and postulated initiating events. The licensee should consider how any modification to the operation could impact the safety of the emplaced waste.

The licensee shall monitor the operational limits and conditions, which should be revised, as necessary, for any of the following reasons:

- experience gained by the licensee or other licensees or businesses
- after modifications are made to the facility and/or to the type of radioactive waste emplaced
- as part of the process of periodically reviewing the safety case for the facility
- relevant changes in the legislative or regulatory requirements

The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility.

The licensee shall establish an aging management plan to provide for the timely detection and mitigation of the aging effects, in order to ensure integrity and functional capacity of the SSCs appropriate to the facility’s lifecycle.

11.5 Decommissioning

11.5.1 Facility closure

The licensee shall close the radioactive waste disposal facility while maintaining the integrity of those SSCs that perform safety functions and that have been shown to be important to safety in the post-closure phases. The licensee shall ensure that plans for closure, including the transition from active management of the facility, are well defined and practicable so that closure can be carried out safely.

11.5.2 Decommissioning of ancillary facilities

The licensee shall carry out the decommissioning of the support facilities in accordance with draft REGDOC-2.11.2, *Decommissioning* [7].

11.6 Monitoring and surveillance

The licensee shall develop a monitoring and surveillance program for the radioactive waste disposal facility, to be implemented prior to and during construction and operation of a radioactive waste disposal facility. The licensee shall also develop a monitoring and surveillance program for the facility to be carried out and after the facility's closure, if such a program is part of the safety case. The monitoring and surveillance program shall:

- demonstrate compliance with regulatory requirements and with licence conditions
- verify that the disposal facility is performing as expected
- verify that the key assumptions made and models used to assess safety continue to be consistent with actual conditions
- maintain records of the disposal facility, the site and the environment
- ensure the protection and preservation of passive safety features

After closure, the licensee shall remain responsible for any surveillance and remedial actions of the radioactive waste disposal facility unless other arrangements for institutional controls are in place.

11.7 Post-closure period of a radioactive waste disposal facility and institutional controls

The licensee shall prepare plans to address the period following closure of the radioactive waste disposal facility to address institutional controls. These plans shall be consistent with passive safety features that form part of the safety case for the disposal facility.

The CNSC expects the following actions to be taken during the post-closure period:

- implementation of a visual inspection plan for periodic examination of the site to look for signs of deterioration of the facility (e.g., slumping of the ground) or erosion of the surface
- implementation and maintenance of a monitoring and surveillance plan to ensure that the post-closure objectives set out in the safety case continue to be met
- implementation of active controls, where required, to prevent unauthorized access to the site

Note: Active controls include periodic inspections and surveillance, controlled access, limited usage of the disposal site and minor maintenance. Active controls are followed by passive controls, which ensure that knowledge of the disposal site is maintained and that future uses of the site are controlled.

Glossary

For definitions of the terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

The following term is a revision to the current definition for that term found in REGDOC-3.6. The CNSC will be revising the definition that is currently found in REGDOC-3.6.

Radioactive waste
Any material (liquid, gaseous or solid) that contains or is contaminated with radionuclides at activity concentrations greater than clearance levels or exemption quantities as set out in the *Nuclear Substances and Radiation Devices Regulations,* for which no further use is foreseen. In addition to containing or being contaminated with radionuclides, radioactive waste may also contain non-radioactive hazardous substances, as defined in section 1 of the *General Nuclear Safety and Control Regulations.*

References

The CNSC may include references to information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Web page "How to gain free access to all nuclear-related CSA standards".

1. CSA Group. CSA N292.0, *General Principles For The Management Of Radioactive Waste And Irradiated Fuel*. Canada, 2014.

2. Natural Resources Canada. *Radioactive Waste Policy Framework*.

3. CNSC. REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*. Ottawa, 2018.

4. CNSC. Draft REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization*. Ottawa, TBD.

5. CNSC. REGDOC-2.11.1, *Waste Management Volume II: Management of Uranium Mine Waste Rock and Mill Tailings*. Ottawa, 2018.

6. CNSC. Draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*. Ottawa, TBD.

7. CNSC. Draft REGDOC-2.11.2, *Decommissioning*. Ottawa, TBD.

8. CNSC. Draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*. Ottawa, TBD.

9. CNSC. REGDOC-3.5.3, *Regulatory Fundamentals*. Ottawa, 2018.

Additional Information

The CNSC may recommend additional information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Web page "How to gain free access to all nuclear-related CSA standards".

The following documents are not referenced in this regulatory document but contain information that may be useful to the reader:

- CSA Group. CSA N292.1, *Wet Storage of Irradiated Fuel and Other Radioactive Materials*. Mississauga, 2016.
- CSA Group. CSA N292.2, *Interim Dry Storage Of Irradiated Fuel*. Mississauga, 2013.
- CSA Group. CSA N292.3, *Management of Low- and Intermediate-Level Radioactive Waste*. Mississauga, 2008.
- CSA Group. CSA N292.5, *Guideline for the Exemption or Clearance From Regulatory Control of Materials That Contain, or Potentially Contain, Nuclear Substances*. Mississauga, 2011.
- CSA Group. CSA N292.6, *Long-Term Management of Radioactive Waste and Irradiated Fuel*. Mississauga, 2018.
- CSA Group. CSA N294, *Decommissioning of Facilities Containing Nuclear Substances*. Mississauga, 2019.
- International Atomic Energy Agency (IAEA). IAEA General Safety Requirements No. GSR Part 5, *Predisposal Management of Radioactive Waste*. Vienna, 2009.
- IAEA. IAEA Safety Standard No. GSG-1, *Classification of Radioactive Waste*. Vienna, 2009.
- IAEA. IAEA Specific Safety Requirements No. SSR-5, *Disposal of Radioactive Waste*. Vienna, 2011.

CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

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Canada's Nuclear Regulator

Gestion des déchets

Gestion des déchets, tome I : Gestion des déchets radioactifs

REGDOC-2.11.1, tome I

Mai 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Gestion des déchets, tome I : Gestion des déchets radioactifs
Document d'application de la réglementation REGDOC-2.11.1, tome I

N° de cat. NNNNN
ISBN XXXXX

Also published in English as: Waste Management, Volume I: Management of Radioactive Waste

Disponibilité du document
Les personnes intéressées peuvent consulter le document sur le site Web de la CCSN. Pour obtenir un exemplaire du document en français ou en anglais, veuillez communiquer avec :

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Historique de publication
[Mois année]　　　　Version x.0

Préface

Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Gestion des déchets, qui porte également sur le déclassement. La liste complète des séries figure à la fin du présent document et elle peut être consultée sur le site Web de la CCSN.

Le document d'application de réglementation REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*, énonce les exigences et l'orientation de la CCSN relatives à la gestion des déchets radioactifs.

Un aperçu du cadre national canadien pour la gestion des déchets radioactifs est donné dans le document REGDOC-2.11 *Cadre de gestion des déchets radioactifs et du déclassement au Canada*.

Pour de plus amples renseignements sur la mise en œuvre des REGDOC et sur l'approche graduelle, voir le REGDOC-3.5.3, *Principes fondamentaux de réglementation*.

Le terme « doit » est employé pour exprimer une exigence à laquelle le titulaire ou le demandeur de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites de ce document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucune information contenue dans le présent document ne doit être interprétée comme libérant le titulaire de permis de toute autre exigence pertinente. Le titulaire de permis a la responsabilité de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et d'y adhérer.

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Gestion des déchets radioactifs

1. Introduction

1.1 Objet

Ce document présente les exigences et l'orientation, applicables dans le cadre du fondement d'autorisation, pour les titulaires de permis qui gèrent des déchets radioactifs. Il porte plus particulièrement sur les sujets suivants :

- la gestion des déchets radioactifs
- les installations de stockage et d'évacuation des déchets radioactifs.

1.2 Portée

Le document REGDOC-2.11.1, *Gestion des déchets, tome I* : *gestion des déchets radioactifs*, s'adresse aux titulaires de permis de la CCSN qui gèrent des déchets radioactifs. Les sections 4, 5, 6, 7, 8 et 9 du présent document s'appliquent à tous les titulaires de permis qui gèrent des déchets radioactifs. Les sections 10 et 11 renferment des exigences et de l'orientation propres aux installations de stockage et d'évacuation des déchets radioactifs, respectivement.

Le présent document d'application de la réglementation constitue un complément aux exigences et à l'orientation de la norme CSA N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié* [1]. Ensemble, le présent document et la norme CSA N292.0 fournissent les exigences et l'orientation relatives à la gestion des déchets radioactifs. De plus, d'autres documents d'application de la réglementation de la CCSN s'ajoutent en complément au présent document.

1.3 Législation pertinente

Les dispositions de la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et de ses règlements qui s'appliquent au présent document sont les suivantes :

- paragraphe 24(5) et article 26 de la LSRN
- alinéas 12(1)a) et 17b), paragraphe 3(1) et article 4 du *Règlement général sur la sûreté et la réglementation nucléaires*
- alinéas 3k), 4e), 5f), 5i), 5j), 5k), 6c), 6d), 6h), 6i), 6j) et 6n) et articles 7 et 8 du *Règlement sur les installations nucléaires de catégorie I*
- alinéas 4t), 5i) et 5k) du *Règlement sur les installations nucléaires et l'équipement réglementé de catégorie II*
- alinéas 3a), 3c), 3d) et 8b) et article 7 du *Règlement sur les mines et les usines de concentration d'uranium*
- article 1 du *Règlement sur les substances nucléaires et les appareils à rayonnement*
- paragraphes 25(1) à (4) et 26(1) à (5) du *Règlement sur l'emballage et le transport des substances nucléaires (2015)*

2. Cadre de gestion des déchets de la CCSN

Le REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada* [3], décrit le cadre national et la philosophie qui sous-tendent la démarche de la CCSN pour la réglementation de la gestion des déchets radioactifs.

Outre le présent document d'application de la réglementation, le cadre de réglementation de la CCSN en matière de gestion des déchets comprend les documents suivants :

- Version provisoire du document REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* [4]
- Document REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada* [3]
- Document REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium* [5]
- Version provisoire du document REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [6]
- Version provisoire du document REGDOC-2.11.2, *Déclassement* [7]
- Version provisoire du document REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* [8]

Les normes CSA suivantes constituent un complément au cadre de réglementation de la CCSN en matière de gestion des déchets :

- N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié*
- N292.1, *Stockage en piscine du combustible irradié et autres matières radioactives*
- N292.2, *Entreposage à sec provisoire du combustible irradié*
- N292.3, *Gestion des déchets radioactifs de faible et de moyenne activité*
- N292.5, *Ligne directrice sur l'exemption ou la libération du contrôle réglementaire des matières contenant ou susceptibles de contenir des substances nucléaires*
- N292.6, *Gestion à long terme des déchets radioactifs et du combustible irradié*
- N294, *Déclassement des installations contenant des substances nucléaires*

3. Contexte

Au Canada, un déchet radioactif est défini comme toute matière (liquide, gazeuse ou solide) qui contient une substance nucléaire radioactive, au sens que lui donne l'article 2 de la LSRN, et pour laquelle aucune utilisation ultérieure n'est prévue. En plus de contenir des substances nucléaires, les déchets radioactifs peuvent aussi contenir des substances dangereuses non radioactives, telles que définies à l'article 1 du *Règlement général sur la sûreté et la réglementation nucléaires*.

La sûreté est prise en compte dans toutes les étapes de la gestion des déchets radioactifs. Le processus de gestion des déchets radioactifs, qui peut impliquer plusieurs titulaires de permis, peut comprendre les étapes suivantes :

- la production et le contrôle
- la manutention, pouvant comprendre :
  - la collecte
  - le tri

    - la séparation
    - l’emballage
    - le chargement
    - le transfert
- le traitement, pouvant comprendre :
    - le prétraitement
    - le traitement
    - le conditionnement
- le stockage
- le transport
- l’évacuation

4. Approche graduelle

Le présent document peut être utilisé de façon graduelle et proportionnelle aux risques posés. Avec cette méthode, toutes les exigences s’appliquent, mais à des degrés divers selon l’importance pour la sûreté et la complexité des travaux exécutés. La nature et le degré des dangers, la complexité de l’installation, la complexité de l’activité et les caractéristiques des déchets devraient être pris en compte. Pour en savoir plus sur l’approche graduelle, consultez le REGDOC-3.5.3, *Principes fondamentaux de réglementation* [9].

5. Exigences générales

Tous les titulaires de permis qui gèrent des déchets radioactifs doivent :

- assurer la gestion sécuritaire de ces déchets, en tenant compte de la santé et de la sécurité des personnes, de l’environnement et de la sécurité nationale
- optimiser les étapes et les pratiques de gestion des déchets radioactifs pour assurer la protection de la santé et de la sécurité des personnes et de l’environnement
- tenir compte de façon appropriée de l’interdépendance de toutes les étapes de la gestion des déchets radioactifs; chaque étape doit être évaluées en tant qu’étape distincte du processus et dans le cadre d’un système intégré de gestion des déchets radioactifs
- produire et tenir à jour des registres pour chacune des étapes dont ils sont responsables dans la gestion des déchets radioactifs
- élaborer, documenter et mettre en œuvre des programmes, des procédures et des instructions pour assurer la sûreté des activités dont ils sont responsables dans la gestion des déchets, en tenant compte de l’ampleur de l’activité autorisée et de l’inventaire des déchets
- utiliser l’expérience en exploitation, les leçons tirées d’autres installations ou activités semblables ainsi que les progrès réalisés en science et en technologie afin d’améliorer constamment la sûreté de l’activité ou de l’installation de gestion de déchets

6. Programme de gestion des déchets

Lorsque le permis d’un titulaire l’oblige à mettre en œuvre et à tenir à jour un programme de gestion des déchets, ce programme doit contrôler la gestion des déchets radioactifs aux endroits où ceux-ci sont produits, manipulés, traités, stockés, transportés ou éliminés/évacués/stockés de manière définitive.

Le programme de gestion des déchets doit :

- identifier les activités de gestion des déchets à entreprendre
- énoncer clairement les exigences, les critères et les objectifs à atteindre ainsi que les normes de sûreté à utiliser
- établir une structure organisationnelle qui précise les rôles et les responsabilités des divers postes en matière de gestion sécuritaire des déchets radioactifs
- déterminer les éléments du système de gestion qui assurent l'efficacité du programme de gestion des déchets
- englober tous les flux de déchets associés à des substances nucléaires ou contaminées par celles-ci
- tenir compte de la hiérarchie des déchets
- exiger des registres des stocks de déchets sous le contrôle du titulaire de permis et tenir ces registres à jour

Le titulaire de permis doit mettre en œuvre et tenir à jour les programmes et procédures connexes destinés à appuyer le programme de gestion des déchets (p. ex. la caractérisation des déchets). Ces programmes et procédures devraient tenir compte du risque que présentent les flux de déchets gérés.

7. Classification des déchets radioactifs, caractérisation des déchets et critères d'acceptation des déchets

7.1 Classification des déchets

Au Canada, il existe quatre catégories générales de déchets radioactifs qui servent de base à un système de classification :

- Les déchets radioactifs de faible activité (DRFA) contiennent des matières renfermant des radionucléides en quantités supérieures aux niveaux de libération inconditionnelle et aux quantités d'exemption (tels que définis dans le *Règlement sur les substances nucléaires et les appareils à rayonnement),* mais qui sont généralement caractérisés par une quantité limitée de radionucléides à longue durée de vie. Les DRFA requièrent l'isolement et le confinement pour des périodes pouvant atteindre quelques centaines d'années et sont appropriés pour évacuation dans des installations de gestion près de la surface.

  Les DRFA comprennent les sous-catégories suivantes :
  - Les déchets de très faible activité (DTFA) présentent un risque faible, mais renferment des radionucléides en quantités supérieures aux niveaux de libération inconditionnelle ou aux quantités d'exemption. Les installations de gestion à long terme de ces déchets ne requièrent en général pas un confinement ou un isolement poussé. Les concentrations de radionucléides à longue période radioactive sont généralement très limitées.

  - Les déchets radioactifs de faible activité à très courte durée de vie sont des déchets qui peuvent être stockés pour désintégration pour une période ne dépassant pas quelques années et dont la libération est ensuite autorisée. Cette classification englobe les déchets radioactifs ne contenant que des radionucléides de courte durée de vie typiquement utilisés à des fins biomédicales ou de recherche. Le principal critère pour ces déchets est la période radioactive des nucléides prédominants. En règle générale, l'option de stockage pour désintégration des déchets radioactifs de faible activité à très courte durée de vie ne devraient s'appliquer qu'aux radionucléides ayant une période radioactive de 100 jours ou moins.

- Les déchets radioactifs de moyenne activité (DRMA) contiennent généralement des radionucléides à longue période radioactive en concentration telles qu'ils doivent être isolés et confinés pour des durées de plusieurs centaines d'années. Ces déchets ne nécessitent aucune disposition particulière, ou alors des dispositions limitées, pour la dissipation de la chaleur pendant leur stockage et leur évacuation. En raison de leur contenu en radionucléides à longue durée de vie, ces déchets exigent généralement un degré de confinement et d'isolement plus important que celui pouvant être assuré par les dépôts près de la surface.
- Les déchets radioactifs de haute activité (DRHA) désignent le combustible nucléaire irradié qui a été déclaré déchet radioactif ou les déchets produisant beaucoup de chaleur par désintégration radioactive. Ils présentent habituellement des niveaux d'activité volumique de l'ordre de 10^4 à 10^6 TBq/m^3. Ils s'accompagnent de rayonnements pénétrants nécessitant un blindage. Ils contiennent aussi d'importantes quantités de radionucléides à longue durée de vie radioactive, d'où la nécessité d'un isolement à long terme.
- Les résidus de mines et d'usines de concentration d'uranium sont un type particulier de déchet radioactif généré par l'extraction et le traitement du minerai d'uranium et la production de concentré d'uranium. En plus des résidus, les activités minières génèrent typiquement de grandes quantités de stériles lorsque les galeries sont creusées pour permettre l'accès au corps minéralisé. Les déchets renferment des radionucléides à longue durée de vie qui ne décroissent pas de façon significative à long terme. D'autres renseignements sont présentés dans le REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium* [5].

Le titulaire de permis doit mettre en place un système de classification des déchets radioactifs. Ce système de classification doit être fondé sur les quatre catégories générales de déchets et doit tenir compte du dossier de sûreté propre à l'emplacement, y compris l'évaluation de sûreté sous-jacente, requise pour l'installation ou l'activité de gestion des déchets.

Les déchets devraient être classés en fonction du degré de confinement et d'isolement requis pour assurer leur sûreté, en tenant compte du risque potentiel des différents types de déchets et de la durée du danger.

7.2 Caractérisation des déchets

Le titulaire de permis doit procéder à une caractérisation des déchets aux étapes appropriées dans la gestion des déchets radioactifs. La caractérisation des déchets doit comprendre une évaluation des propriétés physiques, mécaniques, chimiques, biologiques, thermiques et/ou radiologiques des déchets, y compris le contenu en radionucléides dominants, s'il y a lieu. En fonction de la caractérisation effectuée, le titulaire de permis doit tenir à jour des registres détaillés des caractéristiques pertinentes des déchets.

7.3 Critères d'acceptation des déchets

Un titulaire de permis qui reçoit des déchets doit définir des critères d'acceptation des déchets qui sont tirés du dossier de sûreté propre à l'emplacement et qui sont conformes. Les critères d'acceptation des déchets doivent préciser les caractéristiques chimiques, physiques, radiologiques, mécaniques, biologiques et autres des déchets, des formes de déchets, des colis de déchets et des déchets non emballés qui seront acceptés pour manutention, traitement, stockage, transport et/ou évacuation à l'installation ou à l'emplacement de l'activité.

Dans les cas où les exigences d'acceptation pour l'évacuation ne sont pas encore disponibles, le titulaire de permis devrait définir des critères d'acceptation des déchets en se fondant sur des hypothèses raisonnables quant à l'option d'évacuation anticipée.

8. Étapes de la gestion des déchets radioactifs

8.1 Production

Le titulaire de permis doit tenir compte de la hiérarchie des déchets dans la gestion des déchets radioactifs.

Le titulaire doit aussi envisager des mesures afin de contrôler tant le volume de déchets radioactifs produits que leur teneur radioactive le plus tôt possible avant le début des activités autorisées et ensuite de façon continue.

La libération et l'exemption des déchets du contrôle réglementaire après avoir été adéquatement caractérisés, traités et/ou stockés pour une période suffisamment longue, ainsi que la réutilisation et le recyclage des matières peuvent être efficaces pour réduire la quantité de déchets radioactifs devant ensuite être traités ou stockés. Les limites et les critères pour la libération et l'exemption du contrôle réglementaire sont présentés dans le *Règlement sur les substances nucléaires et les appareils à rayonnement*.

8.2 Manipulation

Pour les méthodes de manutention des déchets retenues, le titulaire de permis doit tenir compte :

- des caractéristiques des déchets
- des types de systèmes de confinement et des colis requis pour la sûreté
- de la réduction des risques radiologiques, conformément au principe ALARA

8.3 Traitement

En faisant le choix des méthodes de traitement des déchets, le titulaire de permis devra tenir compte des caractéristiques des déchets et des étapes subséquentes de leur gestion.

Le titulaire de permis devrait réduire le risque potentiel des déchets dans la mesure du raisonnable à chaque étape de traitement des déchets. Le titulaire devrait envisager un traitement des déchets tôt dans le processus afin de les convertir en une forme passivement sûre ou à tout le moins de les stabiliser.

Le titulaire de permis devrait séparer les sources scellées des autres déchets. Il devrait conserver les sources scellées épuisées ou retirées du service dans un conteneur blindé pendant la manutention.

Afin de préserver l'intégrité des sources scellées épuisées ou retirées du service, le titulaire du permis ne doit pas soumettre celles-ci à un processus de compactage, de broyage ou d'incinération. Si l'intégrité d'une source scellée a été compromise, le titulaire de permis ne doit plus la traiter comme une source scellée.

8.4 Transport

Le *Règlement sur l'emballage et le transport des substances nucléaires (2015)* et le *Règlement sur le transport des marchandises dangereuses* s'appliquent au transport de déchets radioactifs. Bien qu'ils ne soient pas assujettis à ces règlements, les transferts sur place (non sur les voies publiques) devraient respecter un niveau de sûreté équivalent.

8.5 Stockage

Le titulaire de permis doit stocker les déchets radioactifs de façon sûre de manière à assurer la protection des personnes, de l'environnement et de la sécurité nationale, et ce conformément aux exigences réglementaires.

Le titulaire de permis doit mener les activités de stockage conformément aux procédures documentées. Le titulaire doit tenir compte de l'incidence de toute modification apportée à ces activités sur la sûreté des déchets stockés.

Le titulaire de permis doit stocker les déchets de manière qu'ils puissent être inspectés, surveillés, récupérés et préservés dans un état qui permet leur gestion subséquente.

Des critères supplémentaires pour le stockage des déchets radioactifs sont fournis à la section 10, Installation de stockage des déchets radioactifs.

8.5.1 Stockage pour désintégration

Le titulaire de permis devrait séparer les déchets radioactifs qui doivent être stockés pour désintégration des autres déchets, depuis le point de production jusqu'à leur évacuation définitive.

8.6 Évacuation

Le titulaire de permis doit éliminer les déchets radioactifs de façon sûre de manière à assurer la protection des personnes, de l'environnement, et de maintenir la sécurité nationale, et ce conformément aux exigences réglementaires.

Le titulaire de permis doit réaliser les activités d'évacuation en conformité avec ses procédures documentées. Le titulaire doit tenir compte de l'incidence de toute modification apportée à ces activités sur la sûreté des déchets stockés.

Des critères supplémentaires pour l'évacuation des déchets radioactifs sont fournis à la section 10, Installation d'évacuation des déchets radioactifs.

9. Colis de déchets

Le cas échéant, le titulaire de permis doit utiliser des colis de déchets conçus spécialement pour confiner les déchets radioactifs conformément aux règlements applicables pour les conditions d'exploitation normale et d'accident hypothétique. Le titulaire de permis doit utiliser des colis de déchets conçus spécialement pour la manutention, le traitement, le stockage, l'évacuation et, le cas échéant, le transport des déchets.

Le titulaire de permis doit s'assurer que les colis de déchets et les déchets non emballés acceptés pour traitement, stockage et/ou d'évacuation sont conformes aux critères d'acceptation des déchets établis pour l'installation ou l'activité autorisée.

10. Installation de stockage de déchets radioactifs

10.1 Exigences générales

Le titulaire de permis doit élaborer, mettre en œuvre et tenir à jour un dossier de sûreté pour tout le cycle de vie de l'installation de stockage de déchets radioactifs, conformément aux règlements applicables.

10.2 Préparation de l'emplacement

10.2.1 Caractérisation de l'emplacement

Le titulaire de permis doit caractériser l'emplacement d'une installation de stockage des déchets radioactifs à un niveau de détail suffisant pour étayer la compréhension des caractéristiques actuelles de l'emplacement et son évolution prévue pendant le cycle de vie de l'installation.

10.2.2 Conception de l'installation

Le titulaire de permis doit concevoir l'installation de stockage des déchets radioactifs de façon à ce que soient maintenues les fonctions de sûreté applicables pendant l'exploitation normale et les événements initiateurs hypothétiques (p. ex. incidents de fonctionnement prévus, accidents de dimensionnement et conditions additionnelles de dimensionnement), à savoir :

- le contrôle de la sous-criticité
- la dissipation de la chaleur
- le blindage contre le rayonnement
- le confinement des déchets radioactifs
- les possibilités de récupération

Le titulaire de permis doit s'assurer que les caractéristiques de conception de l'installation conviennent aux caractéristiques des déchets à stocker.

Le titulaire de permis doit concevoir l'installation de stockage de déchets radioactifs de manière à faciliter l'inspection, la surveillance, la mise à l'essai et l'entretien des éléments suivants :

- les structures, systèmes et composants (SSC) importants pour la sûreté
- les colis de déchets stockés dans l'installation

Le titulaire de permis doit répertorier et classer les SSC importants pour la sûreté. L'utilisation de SSC passifs devrait recevoir priorité avant de recourir à des SSC actifs. Pour les SSC actifs, il faudrait tenir compte de la fiabilité des SSC, des besoins de redondance et de diversification et au comportement des SSC en cas d'événements initiateurs hypothétiques.

Le titulaire de permis devrait s'assurer que les contrôles des systèmes de procédé (p. ex. manutention des déchets, équipement et systèmes de ventilation) sont indépendants des systèmes de protection. Si cela n’est pas possible, il faudrait justifier l’utilisation de systèmes partagés ou interreliés.

10.3 Construction

Le titulaire de permis doit construire l’installation de stockage des déchets radioactifs conformément à la conception acceptée.

Le titulaire de permis doit s’assurer que toute modification apportée à la conception pendant la construction est soumise à un processus de contrôle des modifications.

Le titulaire de permis doit vérifier que les SSC importants pour la sûreté fonctionnent conformément aux critères de rendement de leur conception. Au terme de la mise en service, le titulaire doit produire un rapport final de mise en service. Le rapport doit fournir l’assurance que toutes les exigences réglementaires et tous les critères de rendement applicables ont été respectés.

10.4 Exploitation

Le titulaire de permis doit établir et documenter les limites et les conditions d’exploitation découlant des évaluations de sûreté pour l’installation de stockage des déchets radioactifs afin de maintenir et d’exploiter l’installation dans un état sûr.

Le titulaire de permis doit exploiter l’installation de stockage des déchets radioactifs conformément aux procédures documentées. Des procédures devraient être élaborées pour la gestion et l’exploitation d’une installation de stockage des déchets radioactifs dans des conditions normales et lors d’événements initiateurs hypothétiques. Le titulaire de permis devrait tenir compte de l’incidence que toute modification apportée aux activités pourrait avoir sur la sûreté des déchets stockés.

Le titulaire de permis doit surveiller les limites et les conditions d’exploitation. Les limites et conditions d’exploitation devraient être révisées pour l’une ou l’autre des raisons suivantes :

- à la lumière de l’expérience acquise par le titulaire de permis ou d’autres titulaires de permis ou entreprises
- à la suite de modifications apportées à l’installation et/ou au type de déchets radioactifs stockés
- dans le cadre du processus d’examen périodique du dossier de sûreté de l’installation
- dans le cas où des modifications sont apportées aux exigences législatives ou réglementaires

Le titulaire de permis doit entretenir, mettre à l’essai et inspecter l’installation conformément au but de la conception de l’installation.

Le titulaire de permis doit établir un plan de gestion du vieillissement afin de déceler et d’atténuer à temps les effets du vieillissement dans le but de maintenir l’intégrité et l’aptitude fonctionnelle des SSC à toutes les étapes du cycle de vie de l’installation.

10.5 Déclassement

Le titulaire de permis doit procéder au déclassement de l’installation de stockage des déchets radioactifs conformément à la version provisoire du document REGDOC-2.11.2, *Déclassement* [7].

11. Installation d'évacuation de déchets radioactifs

11.1 Exigences générales

Le titulaire de permis doit élaborer, mettre en œuvre et tenir à jour un dossier de sûreté pour tout le cycle de vie de l'installation d'évacuation de déchets radioactifs et une évaluation de la sûreté post-fermeture, conformément aux règlements applicables.

Le titulaire de permis doit s'assurer que chacune des étapes du cycle de vie de l'installation d'évacuation est étayée, au besoin, par des évaluations de l'emplacement, de la conception, de la construction, de l'exploitation et de la fermeture de l'installation, ainsi que de la performance et de la sûreté du système d'évacuation. Chacune de ces étapes doit être étayée au besoin par une évaluation itérative du système d'évacuation.

Le titulaire de permis doit assurer la sûreté de l'installation au moyen de multiples fonctions de sûreté, notamment l'utilisation de multiples barrières et contrôles, par exemple le milieu d'accueil, les barrières artificielles ainsi que l'exploitation de l'installation dans les limites et les conditions établies par les évaluations de sûreté.

Le titulaire de permis doit choisir un emplacement, concevoir, construire, mettre en service, exploiter et fermer l'installation d'évacuation:

- de manière à ce que la sûreté soit assurée par des moyens passifs dans toute la mesure du possible
- de manière à réduire au minimum la nécessité de prendre des mesures après la fermeture de l'installation

Le titulaire de permis doit identifier les SSC importants pour la sûreté.

En ce qui concerne les installations d'évacuation de déchets radioactifs, la version provisoire du document REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [6] fournit des exigences et de l'orientation aux demandeurs et aux titulaires de permis.

11.2 Préparation de l'emplacement

11.2.1 Caractérisation de l'emplacement

Le titulaire de permis doit caractériser l'emplacement à un niveau de détail suffisant pour permettre de comprendre les caractéristiques actuelles de l'emplacement et son évolution prévue pendant le cycle de vie de l'installation d'évacuation de déchets radioactifs.

La version provisoire du document REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* [4], fournit une orientation aux demandeurs de permis un dépôt géologique en profondeur.

11.2.2 Conception de l'installation

Le titulaire de permis doit concevoir l'installation d'évacuation de déchets radioactifs et ses barrières artificielles de manière à :

- contenir les déchets
- être physiquement et chimiquement compatible avec le milieu d'accueil
- assurer la sûreté pendant la phase antérieure à la fermeture (c.-à-d. construction, exploitation, déclassement) dans des conditions d'exploitation normale et lors d'événements initiateurs hypothétiques
- fournir des dispositifs de sûreté après la fermeture qui complètent les caractéristiques offertes par le milieu d'accueil
- faciliter l'inspection, la surveillance, la mise à l'essai et l'entretien des systèmes importants pour la sûreté et des éléments du milieu d'accueil qui sont crédités dans le dossier de sûreté

Le titulaire de permis doit fonder la conception de l'installation d'évacuation sur :

- le rendement prévu de l'installation, afin de préserver la santé et la sécurité des personnes et de l'environnement pendant des périodes qui tiennent compte de la durée de l'effet maximal ou pendant une période devant être justifiée par le titulaire de permis
- l'inventaire et les caractéristiques des déchets radioactifs à stocker
- les caractéristiques de l'environnement local et régional
- l'élaboration de critères d'acceptation des déchets pour les déchets radioactifs à stocker
- l'évaluation de sûreté préparée pour l'installation et reflétant les critères d'acceptation des déchets retenus

Le titulaire de permis doit identifier et classer les SSC importants pour la sûreté.

Le titulaire de permis doit s'assurer que la conception d'une installation d'évacuation :

- permet le confinement et l'isolement des déchets radioactifs ou du combustible irradié à stocker
- comporte de multiples barrières (défense en profondeur)
- utilise des principes et pratiques d'ingénierie ainsi que des processus de contrôle des modifications approuvés
- permet de procéder de façon sûre au stockage sûr de déchets radioactifs dans l'installation
- permet les inspections visant à évaluer l'état des SSC importants pour la sûreté avant la fermeture
- tient compte des effluents gazeux produits par les déchets radioactifs au fil du temps
- permet la mesure de l'eau dans les SSC importants pour la sûreté avant la fermeture
- permet l'entretien des SSC avant la fermeture

Le titulaire de permis doit tenir compte de la fermeture dans la conception initiale de l'installation. Les plans de fermeture doivent être mis à jour à mesure que la conception de l'installation avance.

11.3 Construction

Le titulaire de permis doit construire l'installation d'évacuation de déchets radioactifs en fonction de la conception acceptée.

Le titulaire doit s'assurer que tout changement apporté à la conception pendant la construction ou que toute perturbation imprévue du milieu d'accueil est soumis à un processus de contrôle des modifications.

Le titulaire de permis devrait prévenir ou limiter la perturbation involontaire du milieu d'accueil pendant la construction. Le titulaire devrait exécuter toutes les activités de construction de façon à préserver les caractéristiques de confinement et/ou d'isolement des barrières naturelles du milieu d'accueil qui ont été créditées dans le dossier de sûreté.

Le titulaire de permis doit vérifier que la conception respecte les spécifications et doit réaliser des activités de mise en service. La mise en service doit démontrer que les SSC importants pour la sûreté fonctionnent comme prévu pour soutenir l'exploitation. Le titulaire de permis doit produire un rapport final de mise en service au terme de la mise en service. Le rapport doit fournir l'assurance que toutes les exigences réglementaires et tous les critères de rendement applicables ont été respectés.

11.4 Exploitation

Le titulaire de permis doit établir et documenter les limites et conditions d'exploitation découlant des évaluations de sûreté afin de maintenir et d'exploiter l'installation d'évacuation des déchets radioactifs dans un état sûr.

Le titulaire de permis doit exploiter l'installation d'évacuation ou de stockage définitif des déchets radioactifs conformément à des procédures documentées. Des procédures devraient être élaborées pour la gestion et l'exploitation d'une installation d'évacuation de déchets radioactifs dans les conditions d'exploitation normale et lors d'événements initiateurs hypothétiques. Le titulaire de permis devrait tenir compte de l'incidence de toute modification apportée aux activités sur la sûreté des déchets stockés.

Le titulaire de permis doit surveiller les limites et conditions d'exploitation et devrait les réviser au besoin pour l'une ou l'autre des raisons suivantes :

- à la lumière de l'expérience acquise par le titulaire de permis ou d'autres titulaires de permis ou entreprises
- à la suite de modifications apportées à l'installation et/ou au type de déchets radioactifs stockés
- dans le cadre du processus d'examen périodique du dossier de sûreté de l'installation
- dans les cas où des modifications sont apportées aux exigences législatives ou réglementaires

Le titulaire de permis doit entretenir, mettre à l'essai et inspecter l'installation en conformité avec le but de la conception de l'installation.

Le titulaire de permis doit établir un plan de gestion du vieillissement afin de déceler et d'atténuer à temps les effets du vieillissement de façon à maintenir ainsi l'intégrité et l'aptitude fonctionnelle des SSC appropriés pour le cycle de vie de l'installation.

11.5 Déclassement

11.5.1 Fermeture de l'installation

Le titulaire de permis doit fermer l'installation d'évacuation de déchets radioactifs tout en préservant l'intégrité des SSC qui exercent des fonctions de sûreté et dont l'importance pour la sûreté durant les étapes suivant la fermeture a été. Le titulaire doit veiller à ce que les plans de fermeture, y compris la période de transition qui suit la gestion active de l'installation, soient bien définis et réalisables de manière à ce que la fermeture puisse être effectuée en toute sûreté le moment venu.

11.5.2 Déclassement des installations auxiliaires

Le titulaire de permis doit procéder au déclassement des installations auxiliaires conformément à la version provisoire du document REGDOC-2.11.2, *Déclassement* [7].

11.6 Suivi et surveillance

Le titulaire de permis doit élaborer un programme de suivi et de surveillance pour l'installation d'évacuation de déchets radioactifs et mettre en œuvre ce programme avant et pendant la construction et l'exploitation de l'installation. Le titulaire doit également élaborer un programme de suivi et de surveillance à mettre en œuvre après la fermeture de l'installation, si ce programme fait partie du dossier de sûreté. Ce programme doit :

- démontrer la conformité aux exigences réglementaires et aux conditions de permis
- confirmer que l'installation d'évacuation fonctionne comme prévu
- confirmer que les hypothèses de base et les modèles utilisés pour évaluer la sûreté demeurent conformes aux conditions réelles
- tenir des registres sur l'installation d'évacuation, l'emplacement l'environnement
- assurer la protection et la préservation des dispositifs passifs de sûreté

Après la fermeture, le titulaire de permis doit demeurer responsable de toute surveillance et mesure corrective à l'installation d'évacuation de déchets radioactifs, à moins que d'autres dispositions relatives aux contrôles institutionnels soient en place.

11.7 Période suivant la fermeture d'une installation d'évacuation des déchets radioactifs et contrôles institutionnels

Le titulaire doit dresser des plans en vue de la période suivant la fermeture de l'installation d'évacuation de déchets radioactifs afin de tenir compte des contrôles institutionnels. Ces plans doivent être conformes aux dispositifs passifs de sûreté qui font partie du dossier de sûreté de l'installation.

La CCSN s'attend à ce que les mesures suivantes soient prises pendant la période post-fermeture :

- la mise en œuvre d'un plan d'inspection visuelle pour l' examen périodique de l'emplacement, afin de déceler les signes de détérioration de l'installation (p. ex., un affaissement du sol) ou d'érosion de la surface
- la mise en œuvre et la tenue à jour d'un plan de suivi et de surveillance pour s'assurer que les objectifs post-fermeture définis dans le dossier de sûreté continuent d'être atteints
- la mise en œuvre de contrôles actifs, au besoin, pour empêcher l'accès non autorisé au site.

Remarque : Les contrôles actifs comprennent surveillance et inspections périodiques, le contrôle d'accès, les restrictions quant à l'usage du site d'évacuation et des travaux d'entretien mineurs. Les contrôles actifs sont suivis de contrôles passifs, afin que l'information relative au site d'évacuation soit conservée et que les usages ultérieurs du site soient contrôlés.

Glossaire

Les définitions des termes utilisés dans le présent document figurent dans le REGDOC-3.6, *Glossaire de la CCSN*, qui comprend des termes et des définitions tirés dans la *Loi sur la sûreté et la réglementation nucléaires*, de ses règlements d'application ainsi que des documents d'application de la réglementation et d'autres publications de la CCSN. Le document REGDOC-3.6 est fourni à titre d'information et de référence.

La définition du terme ci-dessous a été révisée par rapport à la définition actuelle du terme qui figure dans le document REGDOC-3.6, laquelle sera révisée par la CCSN.

Déchets radioactifs
Toute matière (sous forme liquide, gazeuse ou solide) qui renferme des radionucléides ou est contaminée par des radionucléides à des concentrations d'activité supérieures aux niveaux de libération ou aux quantités d'exemption définis dans le *Règlement sur les substances nucléaires et les appareils à rayonnement*, et pour laquelle aucune utilisation ultérieure n'est prévue. En plus de contenir des radionucléides ou d'être contaminés par ceux-ci, les déchets radioactifs peuvent également comprendre des substances dangereuses non radioactives, telles que définies à l'article 1 du *Règlement général sur la sûreté et la réglementation nucléaires*.

Références

La CCSN peut inclure des références à des documents sur les pratiques exemplaires et les normes, comme celles publiées par le Groupe CSA. Avec la permission du Groupe CSA, qui en est l'éditeur, toutes les normes de la CSA associées au secteur nucléaire peuvent être consultées gratuitement à partir de la page Web de la CCSN « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au secteur nucléaire ».

1. Groupe CSA. CSA N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié*. Canada, 2014.
2. Ressources naturelles Canada. *Politique-cadre en matière de déchets radioactifs*.
3. CCSN. REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada*. Ottawa, 2018.
4. CCSN. REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* (ébauche). Ottawa, à déterminer.
5. CCSN. REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium*. Ottawa, 2018.
6. CCSN. REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* (ébauche). Ottawa, à déterminer.
7. CCSN. REGDOC-2.11.2, *Déclassement* (ébauche). Ottawa, à déterminer.
8. CCSN. REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* (ébauche). Ottawa, à déterminer.
9. CCSN. REGDOC-3.5.3, *Principes fondamentaux de réglementation*. Ottawa, 2018.

Renseignements supplémentaires

La CCSN pourrait recommander d'autres documents sur les pratiques exemplaires et les normes, comme ceux publiés par le Groupe CSA. Avec la permission du Groupe CSA, qui en est l'éditeur, toutes les normes de la CSA associées au secteur nucléaire peuvent être consultées gratuitement à partir de la page Web de la CCSN « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au secteur nucléaire ».

Les documents suivants ne sont pas mentionnés dans le présent document d'application de la réglementation, mais ils contiennent des renseignements qui pourraient être utiles aux lecteurs.

- Groupe CSA. CSA N292.1, *Stockage en piscine du combustible irradié et autres matières radioactives*. Mississauga, 2016.
- Groupe CSA. CSA N292.2, *Entreposage à sec provisoire du combustible irradié*. Mississauga, 2013.
- Groupe CSA. CSA N292.3, *Gestion des déchets radioactifs de faible et de moyenne activité*. Mississauga, 2008.
- Groupe CSA. CSA N292.5, *Ligne directrice sur l'exemption ou la libération du contrôle réglementaire des matières contenant ou susceptibles de contenir des substances nucléaires*. Mississauga, 2011.
- Groupe CSA. CSA N292.6, *Gestion à long terme des déchets radioactifs et du combustible irradié*. Mississauga, 2018.
- Groupe CSA. CSA N294, *Déclassement des installations contenant des substances nucléaires*. Mississauga, 2019.
- Agence internationale de l'énergie atomique (AIEA). Prescriptions générales de sûreté, GSR Part 5, *Gestion des déchets radioactifs avant stockage définitif*. Vienne, 2009.
- AIEA. Guide de sûreté GSG-1, *Classification of Radioactive Waste*, Vienne, 2009.
- AIEA. Prescriptions de sûreté particulières SSR-5, *Stockage définitif des déchets radioactifs*. Vienne, 2011.

Séries de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la CCSN. En plus de la *Loi sur la sûreté et la réglementation nucléaires* et de ses règlements d'application, il pourrait y avoir des exigences en matière de conformité à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Les documents d'application de la réglementation préparés par la CCSN sont classés en fonction des catégories et des séries suivantes :

1.0 Installations et activités réglementées

Séries 1.1 Installations dotées de réacteurs
1.2 Installations nucléaires de catégorie IB
1.3 Mines et usines de concentration d'uranium
1.4 Installations de catégorie II
1.5 Homologation d'équipement réglementé
1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Séries 2.1 Système de gestion
2.2 Gestion de la performance humaine
2.3 Conduite de l'exploitation
2.4 Analyse de la sûreté
2.5 Conception matérielle
2.6 Aptitude fonctionnelle
2.7 Radioprotection
2.8 Santé et sécurité classiques
2.9 Protection de l'environnement
2.10 Gestion des urgences et protection-incendies
2.11 Gestion des déchets
2.12 Sécurité
2.13 Garanties et non-prolifération
2.14 Emballage et transport

3.0 3.0 Autres domaines de réglementation

Séries 3.1 Exigences relatives à la production de rapports
3.2 Mobilisation du public et des Autochtones
3.3 Garanties financières
3.4 Délibérations de la Commission
3.5 Processus et pratiques de la CCSN
3.6 Glossaire de la CCSN

Remarque: Les séries de documents d'application de la réglementation peuvent être ajustées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste de documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC-2.11.1, *Waste Management, Volume I : Management of Radioactive Waste*

Rapport de consultation: *Gestion des Déchets, Tome I: Gestion des Déchets Radioactifs*

Introduction

REGDOC-2.11.1, Volume I sets requirements and guidance for the management of radioactive wastes and radioactive waste storage and disposal facilities. This regulatory document is part of the CNSC's waste management series of regulatory documents, which also covers decommissioning.

Introduction

Le REGDOC-2.11.1, tome I, établit des exigences et de l'orientation relatives à la gestion des déchets radioactifs ainsi qu'aux installations d'évacuation et de stockage définitif des déchets radioactifs. Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Gestion des déchets, qui porte également sur le déclassement.

Consultation process

CNSC staff have extensively engaged with stakeholders on the waste management and decommissioning framework.

On March 29, 2019, a draft version of REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* was issued for public consultation until June 30, 2019.

During the consultation period, the CNSC received 117 comments from 12 respondents: Bruce Power, Cameco, Canadian Nuclear Association, New Brunswick Power, Canadian Nuclear Laboratories (CNL), Lloyd's Register Consulting, Ministère de la santé et des services sociaux, Northwatch, Nuclear Waste Management Organization (NWMO), Ontario Power Generation (OPG), Dr. Sandy Greer and Dr. Albert Lee.

Consultation submissions were posted for feedback on comments from July 18 to August 1, 2019. The CNSC received 42 comments from 4 respondents: Concerned Citizens of Renfrew

Processus de consultation

Le personnel de la CCSN a mobilisé de manière exhaustive les parties intéressées à l'égard du cadre de gestion des déchets et de déclassement.

Du 29 mars au 30 juin 2019, une ébauche du *REGDOC-2.11.1, Gestion des déchets, tome I : Gestion des déchets radioactifs* a été publiée aux fins de consultation publique.

Pendant cette période de consultation, la CCSN a reçu 117 commentaires provenant de 12 répondants, soit : Bruce Power, Cameco, l'Association nucléaire canadienne, Énergie du Nouveau-Brunswick, les Laboratoires Nucléaires Canadiens (LNC), Lloyd's Register Consulting, le ministère de la Santé et des Services sociaux, Northwatch, la Société de gestion des déchets nucléaires (SGDN), Ontario Power Generation (OPG), Sandy Greer, Ph. D. et Albert Lee, Ph. D.

Les mémoires relatifs à la consultation ont été affichés du 18 juillet au 1er août 2019 aux fins de rétroaction sur les commentaires. La CCSN a reçu 42 commentaires de 4 répondants, soit : les

Country, Ralliement contre la Pollution Radioactive, Northwatch, and Dorothy Goldin Rosenberg.

Civil society organizations (CSOs) and industry requested workshops to discuss REGDOCs from the waste management and decommissioning series, including this one.

CNSC staff held a workshop with industry on February 5, 2020 and a webinar with CSOs on February 26. Due to technical difficulties, a second webinar with members of the public and CSOs was held April 23, 2020. The purpose of the webinars were to explain the changes made to the document following public consultation and to discuss outstanding issues and how comments were dispositioned.

The following organizations participated for the workshop with industry:

- Bruce Power
- BWX Technologies
- Cameco
- CNA
- CNL
- CANDU Owners Group
- Hydro-Québec
- Kinetrics
- New Brunswick Power
- NWMO
- OPG
- Orano

The following commenters participated in the CSO webinar, either in person or through written submissions:

- Algonquin Eco Watch
- Canadian Environmental Law Association
- Concerned Citizens of Renfrew
- Dr. Frank Greening
- Dr. Sandy Greer
- Northwatch

Citoyens concernés du comté et de la région de Renfrew, le Ralliement contre la pollution radioactive, Northwatch et Dorothy Goldin Rosenberg.

Les organisations de la société civile (OSC) et l'industrie ont demandé la tenue d'ateliers afin de discuter des REGDOC relatifs à la gestion des déchets et au déclassement, y compris celui-ci.

Le personnel de la CCSN a organisé un atelier avec l'industrie le 5 février 2020 ainsi qu'un webinaire avec les OSC le 26 février. En raison de difficultés techniques, un deuxième webinaire à l'intention des membres du public et des OSC a eu lieu le 23 avril 2020. Ces webinaires avaient pour but d'expliquer les modifications apportées au document à la suite de consultations publiques et de discuter des problèmes non résolus et de la manière dont les réponses aux commentaires ont été données.

Les organisations suivantes ont participé à l'atelier à l'intention de l'industrie :

- Bruce Power
- BWX Technologies
- Cameco
- l'ANC
- les LNC
- le Groupe des propriétaires de CANDU
- Hydro-Québec
- Kinetrics
- la Société d'énergie du Nouveau-Brunswick
- la SGDN
- OPG
- Orano

Les commentateurs suivants ont participé au webinaire à l'intention des OSC, en personne ou au moyen de mémoires :

- Algonquin Eco Watch
- l'Association canadienne du droit de l'environnement

- Dodie LeGassick
- Michael Stephens
- Regional Municipality of Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

The full responses to stakeholder feedback on individual REGODCs, including comments received during public consultation or in advance of the workshops, can be found in the associated detailed comments table included as part of the Commission Member Document package.

Key comments

The following summarizes some key comments received during the consultation period and provides the CNSC's responses:

Comment 1 :

Licensees and CSOs expressed concern with the lack of clarity of terminology and definitions.

CNSC staff response:

The document was reviewed to ensure that key terms are found in either REGDOC-3.6, *Glossary of CNSC Terminology* or the CSA standards that complement this REGDOC. The definitions were reviewed for alignment with the IAEA safety glossary.

- les Citoyens concernés du comté et de la région de Renfrew
- Frank Greening, Ph. D.
- Sandy Greer, Ph. D.
- Northwatch
- Dodie LeGassick
- Michael Stephens
- la municipalité régionale de Durham
- les Citoyens concernés du comté et de la région de Renfrew
- Gordon Edwards
- la Saskatchewan Environmental Society
- le Ralliement contre la pollution radioactive

Les réponses complètes à la rétroaction des parties intéressées pour chaque REGODC, y compris les commentaires reçus durant les consultations publiques ou avant les ateliers, peuvent être consultées dans le tableau détaillé des commentaires connexe inclus dans la trousse de documents à l'intention des commissaires.

Principaux commentaires

Les principaux commentaires reçus lors de la période de consultation sont résumés ci-après, accompagnés des réponses de la CCSN.

Commentaire 1

Les titulaires de permis et les OSC ont exprimé des préoccupations quant au manque de clarté de la terminologie et des définitions.

Réponse du personnel de la CCSN

On a révisé le document afin de veiller à ce que les principaux termes se trouvent soit dans le REGDOC-3.6, *Glossaire de la CCSN*, soit dans les normes de la CSA qui complètent ce REGDOC. La correspondance des définitions au glossaire de l'AIEA sur la sûreté a été vérifiée.

Comment 2 :

Licensees and CSOs expressed concern with the clarity of the scope and applicability of the REGDOC.

CNSC staff response:

The scope was changed to: "REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*, pertains to CNSC licensees that manage radioactive wastes. Sections 4, 5, 6, 7, 8 and 9 of this regulatory document apply to all licensees that manage radioactive wastes. Sections 10 and 11 contain requirements and guidance specific to radioactive waste storage facilities and disposal facilities, respectively."

Comment 3:

CSOs expressed concerns on the lack of clarity and details regarding waste characterization, making it harder for detailed records of radioactive waste to be made available to the public.

CNSC staff response:

The section of the document was changed to include further expectations on the characteristics that should be included as part of waste characterization such as the identification of the principal radionuclides relevant to safety.

Characterization information is available to the CNSC for review during inspections. The CNSC does not require characterization records made available to the public due to

Commentaire 2

Les titulaires de permis et les OSC ont exprimé des préoccupations quant à la clarté de la portée et de l'applicabilité du REGDOC.

Réponse du personnel de la CCSN

La portée a été modifiée ainsi : « Le REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* s'applique aux titulaires de permis de la CCSN qui gèrent des déchets radioactifs. Les sections 4, 5, 6, 7, 8 et 9 du présent document s'appliquent à tous les titulaires de permis qui gèrent des déchets radioactifs. Les sections 10 et 11 renferment des exigences et de l'orientation propres aux installations de stockage de déchets radioactifs et aux installations d'évacuation et de stockage définitif des déchets radioactifs, respectivement. »

Commentaire 3

Les OSC ont exprimé des préoccupations quant au manque de clarté et de renseignements à l'égard de la caractérisation des déchets, ce qui rend plus difficile de mettre à la disposition du public des registres détaillés des déchets radioactifs.

Réponse du personnel de la CCSN

Cette section du document a été modifiée afin d'y inclure davantage d'attentes quant aux caractéristiques qui devraient être incluses dans la caractérisation des déchets, comme l'identification des principaux radionucléides pertinents pour la sûreté.

L'information sur la caractérisation est mise à la disposition de la CCSN aux fins d'examen durant les inspections. La CCSN n'exige pas potential security concerns.

que les registres de caractérisation soient rendus publics en raison des préoccupations potentielles en matière de sécurité.

Comment 4:

Licensees had concerns regarding the applicability of a graded approach to waste management.

CNSC staff response:

A section on the graded approach was added to provide clarity. The section explains that the licensee may apply the document in a graded manner commensurate with risk. It also clarifies that all requirements in the documents are applicable, but to varying degrees depending upon the safety significance and complexity of the work being performed. A graded approach is not a relaxation of requirements. All regulatory requirements must be met. A graded approach allows for tailoring of activities, commensurate with the hazard, such that safety is achieved.

Commentaire 4

Les titulaires de permis ont formulé des préoccupations sur l'applicabilité d'une méthode graduelle de la gestion des déchets.

Réponse du personnel de la CCSN

Une section sur la méthode graduelle a été ajoutée aux fins de clarification. Elle explique que le titulaire de permis peut appliquer le document de manière graduelle, proportionnellement au risque. Elle permet également de clarifier que toutes les exigences énoncées dans le document sont applicables, mais à divers degrés, selon l'importance pour la sûreté et la complexité du travail exécuté. L'utilisation d'une méthode graduelle ne constitue pas un assouplissement des exigences. Toutes les exigences réglementaires doivent être respectées. Une méthode graduelle permet d'adapter les activités proportionnellement au risque, de sorte d'assurer la sûreté.

Comment 5:

Licensees and CSOs had concerning regarding the clarity of the radioactive waste classifications.

CNSC staff response:

The document was reviewed and modified to ensure that the classification system in the REGDOC aligned with CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* and IAEA GSG-1, *Classification of Radioactive Waste*.

A reference to GSG-1, *Classification of*

Commentaire 5

Les titulaires de permis et les OSC ont exprimé des préoccupations quant à la clarté de la classification des déchets radioactifs.

Réponse du personnel de la CCSN

Le document a été examiné et modifié de sorte d'assurer que le système de classification du REGDOC soit harmonisé à la norme CSA N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié* et au GSG-1, *Classification of Radioactive Waste* de l'AIEA.

Radioactive Waste was included in the REGDOC.

The section on waste classification was expanded to include some information on suitable methods of waste disposal.

Une référence au GSG-1, *Classification of Radioactive Waste* a été incluse dans le REGDOC.

La section sur la classification a été étayée pour y inclure de l'information sur les méthodes appropriées d'évacuation ou de stockage définitif des déchets.

Concluding remarks

This project has undergone extensive stakeholder consultations. CNSC staff have listened to concerns and the document has been modified, as appropriate.

Mot de la fin

Ce projet a fait l'objet de vastes consultations auprès des parties intéressées. Le personnel de la CCSN a entendu les préoccupations et a modifié le document, au besoin.

REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*
REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

NOTE: Draft REGDOC-2.11.1, Volume I has gone through an iterative consultation process with stakeholders involving three distinct phases and three separate draft versions of the document being created. Therefore changes noted in Tables A, B and C reflect document modifications that were used for further stakeholder comments in Table D. As a result, only the changes noted in the final table (Table D) are reflected in the final draft version of the document submitted to the Commission for approval.

Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

Comments received:
- Table A: Comment on the Request for Information document: No comments received
- Table B: public consultation period (March 29 to June 30, 2019): 117 comments from 12 reviewers
- Table C: feedback on comments period (July 18 to August 1, 2019): 42 comments from 4 reviewers
- Table D: workshop with industry and civil society organizations on February 5, 2020 and April 23, 2020: 61 comments received

Commentaires reçus :
- Tableau A : sur le document Demande d'information : Aucun commentaire reçu
- Tableau B : période de consultation publique (29 mars au 30 juin 2019) : 117 commentaires reçus de douze (12) examinateurs
- Tableau C : période des observations (18 juillet au 1er août 2019) : 42 commentaires reçus de quatre (4) examinateurs
- Tableau D : atelier avec l'industrie et avec des organisations de société civile du 5 février 2020 et du 23 avril 2020 : 61 commentaires reçus

Table A: Comments on the "Request for Information" / Tableau A : Sur le document Demande d'information

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
	No comments received.		

Table B: Comments received on the draft document / Tableau B: période de consultation publique

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	Lloyd's Register Consulting	General	REGDOC-2.11.1, Volume I, will help in filling a current gap, as it contains a wide range of relevant requirements pertaining specifically to disposal facilities.	Comment noted.
2.	Lloyd's	General	The draft REGDOC-2.11.1, Volume I, refers to two different types of facilities:	As a result of this comment, the document was revised for clarity and

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Register Consulting		1.Waste Management Storage Facility; and 2.Waste Management Disposal Facility That terminology contains a confusing redundancy, as Storage and Disposal, respectively, are a subset of Management. This both according to how those three terms are used in the CSA N292 suite of standards, as well, among CNSC's own wording (see examples below). Within the CSA N292 standards, terms like "disposal facility" and "long-term storage facility" are used. For alignment, therefore, and to remove the potentially confusing redundancy in the two facility types referred to in REGDOC-2.11.1, Volume I, CSA N292 recommends that those two terms be changed to 1) Waste Storage Facility; and 2) Waste Disposal Facility, respectively. This has the further advantage of being shorter, without the term losing any meaning. **Examples from REGDOC-3.6, *Glossary of CNSC Terminology*:** **long-term management of nuclear waste** — The long-term management of radioactive nuclear waste by means of storage or disposal, including handling, treatment, conditioning or transport for the purpose of storage or disposal. Also called long-term waste management. **management** — In relation to nuclear fuel waste, long-term management by means of storage or disposal, including handling, treatment, conditioning or transport for the purpose of storage or disposal. (Source: *Nuclear Fuel Waste Act*) **Examples from CSA N292.0-19, *General principles for the management of radioactive waste and irradiated fuel*:** **Long-term management** — a coherent set of activities required to ensure controlled containment and isolation of radioactive material while in long-term storage or in a disposal facility prior to closure. This would include all systematic processes to coordinate, direct, and control operations. **Waste management facility** — a facility, including its associated land, buildings, and equipment, whose primary purpose is for the management of radioactive waste.	precision: the use of the terms "long-term management", "long-term storage" and "disposal facility" was reviewed throughout the document. Sections 10 and 11 are now titled 'Radioactive Waste Storage Facility' and 'Radioactive Waste Disposal Facility'.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			Note: *Management can include processing, packaging, storage, or the activities associated with the operation of a repository until its closure.*	
3.	Northwatch	General	As summarized in the notice, "*REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste is for CNSC-licensed facilities and activities that are required to have a waste management program. The purpose of this document is to provide requirements and guidance:* • *on radioactive waste management applicable to different types of CNSC licensees* • *related to CSA Group standards applicable to radioactive waste management* • *supplemental to specific topics in radioactive waste management standards"* As noted in the preface on the first page of the draft REGDOC-2.11.1 Waste Management Volume 1, "*An overview of Canada's national framework for radioactive waste management is provided in REGDOC-2.11, Framework for Radioactive Waste Management and Decommissioning in Canada*." This "Framework" document was published in December 2018 with no consultation and no opportunity for public or other agency comment prior to it being published as a final document: *REGDOC-2.11*, Framework for Radioactive Waste Management and Decommissioning in Canada, *provides an overview of the governance and regulatory framework for radioactive waste management and decommissioning in Canada. This overview provides the basis for the other documents in the CNSC's waste management series of regulatory documents. This regulatory document was not issued for public consultation, nor was it presented to the Commission, since it combines existing information from the CNSC's website and does not contain any requirements or guidance.* As set out in the CNSC's listing of regulatory documents, there is a suite of interrelated documents under the category "2.11 Waste management" summarized in the REGDOC listing as **"***The internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. Also covers the planning for decommissioning*." Setting aside that it is poorly written and difficult to understand, it seems to suggest that this suite of documents is limited to "internal" program facilities, whereas the scope of the suite of documents confirms that the content is much broader, including extending to off-site from the facilities	No changes were made to the document as a result of this comment. REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* provides information on the framework for radioactive waste management and decommissioning in Canada. As noted in the comment, it describes the philosophy underlying the CNSC's approach to regulating the management of radioactive waste and the decommissioning of facilities, and explains the principles taken into account in CNSC regulatory decisions. The regulatory document does not include regulatory requirements or guidance There was no public consultation for REGDOC-2.11 because it combined existing information from P-290, *Managing Radioactive Waste*, and in the 6th Canadian National Report for *the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (2017). REGDOC-2.11.1, Volume I requires licensees to develop comprehensive programs in a manner that protects health, safety, security and the environment, and that conforms with Canada's domestic and international obligations on the peaceful use of nuclear energy. Licensees are directly responsible for managing all aspects of its regulated activities and that must be reflected in the programs developed in specific areas (generating, handling, processing, storing, transporting or disposing of). The CNSC's role is to ensure that the licensees' programs are comprehensive. To that end, the CNSC assesses programs based on completeness (coverage and adequacy), comprehensiveness (depth), and the validity of the rationale and technical justification provided in submissions describing the programs. The CNSC then conducts compliance and verification activities to ensure that the programs are strictly adhered to and that that regulated parties have safety and security provisions in place that ensure compliance with regulatory

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			where the waste was generated, and the design and development of “storage” and “disposal” (sic) facilities.	requirements. Taken together, the suite of Waste management REGDOCs encompass a comprehensive set of requirements throughout the lifecycle of a nuclear facility or for the duration of a licensed activity. CNSC welcomes feedback on any regulatory document at any time. Comments received after a document has been published will be considered for the next update.

REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*
REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

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<table>
<tr><th>Title</th><th>Supercedes</th><th>PDF</th><th>Status</th></tr>
<tr><td>REGDOC-2.11. Framework for Radioactive Waste Management and Decommissioning in Canada</td><td>Not Stated</td><td>PDF, 13 pages, 177 KB</td><td>Published December 2018</td></tr>
<tr><td>REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste</td><td>Not Stated</td><td>PDF, 21 pages, 285 KB</td><td>Currently under development</td></tr>
<tr><td>REGDOC-2.11.1, Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings</td><td>RD/GD-370, Management of Uranium Mine Waste Rock and Mill Tailings | PDF

P-290, Managing Radioactive Waste | PDF</td><td>PDF, 16 pages, 276 KB</td><td>Published November 2018</td></tr>
<tr><td>REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2</td><td>REGDOC-2.11.1, Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management | (PDF)
G-320, Assessing the Long term Safety of Radioactive Waste Management | PDF
P-290, Managing Radioactive Waste | PDF</td><td>PDF, 39 pages, 418 KB</td><td>Currently under development</td></tr>
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<tr><td>REGDOC-2.11.2, Decommissioning Planning</td><td>G-219, Decommissioning Planning for Licensed Activities | PDF</td><td>Not yet developed</td><td>Not yet developed</td></tr>
</table>

CNSC Consultation Approach
Northwatch strongly disagrees with the decisions by CNSC staff to prepare, finalize and publish REGDOC-2.11. Framework for Radioactive Waste Management and Decommissioning in Canada without any public input and without presenting it to the Commission. If this document is of any value in providing a framework for Canada’s approach and regulatory regime with respect to radioactive waste management and the decommissioning of nuclear facilities, then there is value in engaging both the public and the Commission in its development.

In addition and more specifically:
• Our review of REGDOC-2.11. Framework for Radioactive Waste Management and Decommissioning in Canada identified ample cause for this document being the subject of public and other agency review and comment; for example, as a document that self-describes as being the “basis” for a suite of regulatory documents, some of which will be the subject of a public comment period, the document itself should be subject to public comment
• The “framework” includes statements which are presented as fact but are subjective and interpretive
• At minimum, public review might have reduced the number of typographic errors found in the “final” document
</td><td></td></tr>
<tr><td>4.</td><td>Dr. Sandy Greer</td><td>General</td><td>The intention of my citizen response is to encourage CNSC to demand much more transparency from the Canadian nuclear industry, in regard to the risks and dangers of radionuclides rather than minimize such dangers in communications with the wider public. The CNSC itself must provide the guidance for transparency in its regulations, as well as demonstrate it in all other communications.

My comments, therefore, will address specific passages chronologically throughout the draft document for REGDOC-2.11.1, where requests for clarity about radionuclides could be inserted by CNSC. The closing comment will critique lack of transparency about risks and dangers to human health and the environment in the new (?) definition in the Glossary for ‘radioactive waste,’ and suggest a fuller definition.</td><td>No changes were made to the document as a result of this comment.

The draft definition for radioactive waste is in alignment with IAEA safety glossary definition of radioactive waste.</td></tr>
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	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
5.	Dr. Sandy Greer	General	In this preamble, I also want to take the opportunity to declare my disappointment with the CNSC, as per its lack of support to add "radionuclides" to 'Chemicals of Mutual Concern.' The CNSC elaborated on the reasons for its rejection, at the request of the federal Ministry of Environment and Climate Change Canada (ECCC), in the September 2017 publication ***Assessment of the relevance of the inclusion of radionuclides as a chemical of mutual concern under Annex 3 of the Canada-United States Great Lakes Water Quality Agreement***. CNSC justifies its rejection of the CMC category for radionuclides by arguing: *"Radionuclides are currently among the most heavily regulated substances in the world. Canada has an independent national nuclear regulatory body (i.e., the CNSC), the mandate of which is to ensure Canada's nuclear industry is protective of the environment and the health and safety of persons. …* *"The [CNSC] report concludes that radionuclides are not recommended as a candidate CMC for further evaluation under Annex 3. However, it identifies opportunities to improve the public availability of, and access to, release and monitoring data associated with the nuclear fuel cycle in Canada, and the need to improve coordination and collaboration among various stakeholders on science priorities, research, surveillance and monitoring activities in the Great Lakes basin ecosystem"* [Executive Summary, p.ii, 2017]. Important to emphasize – and why radionuclides ought to be added as officially recognized CMCs – is evident in examining *why* radionuclides *are* "among the most heavily regulated substances in the world." The fact is, radionuclides are among the most lethal substances in the world, particularly in their range of forms created from anthropogenic activities and, by the way, the CNSC definition for "radioactive wastes" needs to acknowledge the reality of potential risks and dangers. Interestingly, later in the aforementioned CNSC assessment, **Table 13: Comparison of risk- management activities associated with a CMC classification to the current status of such activities within Canada for radionuclides** provides a list of what currently is in place as well as opportunities for improvement.	No changes were made to the document as a result of this comment. Adding radionuclides to 'Chemicals of Mutual Concern' is beyond the scope of this document. The CNSC is currently working on improving the accessibility and consistency of the public reporting on radionuclides, including making raw data available.
6.	Dr. Sandy Greer	General	To its credit CNSC identifies two areas for its own improvement under the following two respective sub-headings for risk-management:	No changes were made to the document as a result of this comment.

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			1) Exchange information on monitoring, surveillance, research, technologies and measures for managing CMCs. **Opportunity for improvement:** The CNSC considers this to be an area that could benefit from additional improvements, and initiatives are currently under development to achieve this goal. There is a need to improve public access to data regarding releases of radionuclides and the results of environmental monitoring collected and reported by various government agencies. 2)Coordinate and collaborate with various stakeholders on science priorities, research, surveillance and monitoring activities in the Great Lakes basin ecosystem. **Opportunity for improvement:** This will continue to be an area marked for continuous improvement, especially with respect to coordination of whole lake research and surveillance activities due to the logistical difficulties and costs associated with such activities. The CNSC, indeed, in its role "to ensure Canada's nuclear industry is protective of the environment and the health and safety of persons" [Executive summary, p. iii, 2017], has the ongoing responsibility to make improvements – and most particularly improvement to public access to data. The reason why the Chemicals of Mutual Concern identification ought to be supported, rather than rejected, resides in the purpose of this binational initiative by the International Joint Commission in its GWLQA **Annex 3**. I quote from **C. Science**: *"The Parties, in cooperation and consultation with State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal Governments, watershed management agencies, other local public agencies, and the Public, shall coordinate on science priorities, research, surveillance and monitoring activities, as appropriate, including:* ***5.*** *coordinating research, monitoring, and surveillance activities as a means* ***to provide early warning for chemicals that could become chemicals of mutual concern*** [my bold]	The opportunities for improvement are beyond the scope of this document.
7.	Dr. Sandy	General	To sum up, CNSC does need to do better to make its own studies much easier to access;	No changes were made to the document as a result of this comment.

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	Greer		but doing so is not enough. The CNSC, if it were to support adding radionuclides to CMCs would thereby demonstrate that it is more receptive to improving the documentation of baselines, etc. by including a range of research techniques, such as field studies and laboratory studies – carried out by a wider number of sources beyond the CNSC, and broaden methodologies – because computer models are sorely limited. The fact of computer model limitations is something which I have written about in previous submissions, both to the International Joint Commission on the Great Lakes and also to the Canadian Environmental Assessment Agency. Instead of repeating a long quote citing computer scientists from Fritjof Capra's book ***THE WEB OF LIFE: A New Scientific Understanding of Living Systems***, go to print page 9 (PDF 10) in my 2016 submission to the IJC. My above-cited document also challenges the confidence which the CNSC invests in its aforementioned assessment in its section **5.1 International science and radiation safety framework**, on print page 45 (PDF 51). While it is true that "There currently exists an extremely robust science and regulatory network both internationally and nationally for radionuclides," my own extensive and continuing international science research reveals that the understanding about potential impacts upon the environment is only in its early years. Furthermore, not everyone is in agreement with the ICRP, the latter whom itself recognizes that more and better research is an ongoing mission. Among the international organizations not identified in the CNSC assessment paper is the International Union of Radioecology, which engages in continuing research. Another excellent source that illustrates continuing research is the ***Journal of Environmental Radioactivity*** from which I cited the work of F. Brechnignac: *"The symposium gathered an academically diverse group of 30 scientists to consider the still debated ecological impact of radiation on populations and ecosystems…* *"Scientific research conducted in a variety of laboratory and field settings has improved our knowledge of the effects of ionizing radiation on the environment. However,* ***the results***	See response to comment #5, concerning Chemicals of Mutual Concern.

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			***from such studies sometimes appear contradictory and there is disagreement about the implications of risk assessment**… .”* [my bold] [2016, p. 22, Brechignac, F. et al]. My final criticism about the CNSC’s rejection to support radionuclides as CMCs in its assessment is based on what I see as what appears to be an unsatisfactory mapping of the `cumulative effects.’ I refer to the following statement in its aforementioned assessment on print page 36 (PDF 42): *“Canada is not identified as being among the top-10 phosphate producing regions, and the CNSC is not aware of any significant phosphate rock and fertilizer and production on the Canadian side of the Great Lakes basin.”* *But, I recall during one of the two public hearings, on Ontario Power Generation’s (OPG) proposed deep geological repository for low-and-intermediate level radioactive waste, that the OPG could not answer a question in the affirmative, from the Joint Review Panel, whether it had included “agricultural run-off” in its studies about cumulative effects.* *All of the above, and remembering the repeated failure of the OPG to have compiled evidence satisfactory to the Joint Review Panel – at both public hearings, and also afterwards as related to requests from ECCC and the Saugeen Ojibway Nation (SON) – is why I argue strongly in this citizen response that the CNSC must demand more transparency, which includes much more rigorous data collecting, from all players in the nuclear industry who seek licences to bury radioactive waste.*	
8.	Canadian Nuclear Association	General	CNA found that the wording in a few sections needed to be clearer and more precise. (see detailed comments). Waste Management is an area of great interest to the general public and the wording needs to be clear. As licensees our members appreciate the need for technical precision, but context is important for members of the general public many of whom do not have a high level of technical expertise.	As a result of this comment, the document was revised for clarity and precision.
9.	Canadian Nuclear Association	General	In several sections, references were made to regulatory documents that have not yet been published and key terms were either not defined or their definitions not included or aligned with those in REGDOC-3.6, Glossary of CNSC Terminology. Regulatory documents should not reference unpublished documents.	As a result of this comment, the document was reviewed to ensure that key terms are found in either REGDOC-3.6, *Glossary of CNSC Terminology* or the CSA standards that compliment this REGDOC. The glossary sections of draft REGDOCs contain terms that are either not yet in REGDOC-3.6 or terms that are to be revised. Should a REGDOC be approved by the Commission, the new or revised terms

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				would be added into REGDOC-3.6 in its next update. REGDOC-2.11.1, Volume I was used to consult on the revised "radioactive waste" definition. Only REGDOCs that are already published or will be published at the same time as REGDOC-2.11.1, Volume I will be referenced in the published version.
10.	Canadian Nuclear Association	General	CNA believes it is important for the CNSC clearly differentiate between a "waste generator" and a "waste owner" by amending the opening paragraph in Section 2 to read, "Under Canada's Radioactive Waste Policy Framework, waste owners are required to ensure the safe and secure management of radioactive waste and to make arrangements for its long-term management. This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose."	As a result of this comment, the document was revised for clarity and precision: section 2 was changed to align with NRCan's *Radioactive Waste Policy Framework.*
11.	Canadian Nuclear Association	General	The regulatory document needs to clearly distinguish between facility types and/or the requirements that apply to them throughout their lifecycle.	As a result of this comment, the document was revised for clarity and precision: • the scope was changed to: "REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* pertains to CNSC licensees that manage radioactive wastes. Sections 4, 5, 6, 7, 8 and 9 of this regulatory document apply to all licensees that manage radioactive wastes. Sections 10 and 11 contain requirements and guidance specific to radioactive waste storage facilities and disposal facilities, respectively." • Headings in sections 10 and 11 were changed to align with lifecycle stages of a waste storage facility and waste disposal facility, respectively. • a new section was included on the graded approach.
12.	Nuclear Waste Management Organization	General	NWMO's main concerned is: that the document should be clear on the different lifecycle phases when requirements apply to a repository. The repository and its components have unique timeframes that should be considered to ensure that requirements do not inadvertently create safety issues.	See response to comment #11.

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13.	Bruce Power	General	Following a collaborative review of the draft document with our industry peers, we have compiled a series of detailed observations and requests for clarification in Attachment A for the CNSC's consideration. In general, licensees found the language in some sections of the draft to be either unclear or imprecise. In some areas, references were made to regulatory documents that have not yet been published and key terms were either not defined or their definitions not included or aligned with those in *REGDOC-3.6, Glossary of CNSC Terminology*. More specifically, Bruce Power encourages the CNSC to clearly differentiate between a "waste generator" and a "waste owner" by amending the opening paragraph in Section 2 to read, "Under Canada's Radioactive Waste Policy Framework, waste owners are required to ensure the safe and secure management of radioactive waste and to make arrangements for its long-term management. *This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose*." This would clarify that radioactive waste management may be the responsibility of more than one licensee and that robust agreements are in place to ensure it is managed safely and securely. We believe clear, accessible language equates to improved compliance and public understanding of the scientific rigor that forms industry's waste management programs.	As a result of this comment, the document was revised for clarity and precision: the document was changed to align with NRCan's *Radioactive Waste Policy Framework*. Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version. See response to comment #9 concerning definitions.
14.	Canadian Nuclear Laboratories	General	The major concerns identified could result in further misalignment between public understanding of requirements and the understanding by both the CNSC and CNL with respect to the management of radioactive waste. Please give due consideration as to how the draft regulatory document might be revised to avoid this potential concern with respect to the understanding of requirements.	As a result of this comment, the document was revised for clarity and precision.
15.	Cameco	General	Our review of the REGDOC identifies instances in which the language used could create confusion and misunderstandings for the public. In general, the REGDOC would be clearer if the graded or risk-based approach is referred to when requirements vary with the types of wastes and types of facilities or activities (e.g. storage facilities and disposal facilities). Although the Preface refers to the graded approach and REGDOC-3.5.3, we di not believe that this is sufficient for a REGDOC that may have an elevated public interest.	As a result of this comment, the document was revised for clarity and precision: a new section was added on the graded approach.
16.	Cameco	General	Related to the above comment, the REGDOC does not clearly identify when more than one licensee may manage particular radioactive wastes at different times (i.e. waste generators may not remain waste owners) and does not make it clear that requirements vary with the type of wastes and activities.	As a result of this comment, the document was revised for clarity and precision: the wording on waste owners was changed to align with NRCan's *Radioactive Waste Policy Framework*.

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				A new section was added on the graded approach.
17.	Cameco	General	The REGDOC also refers to draft or unpublished REGDOCs. Cameco understands that the development of related REGDOCs may be concurrent. However, in our view, this practice does not permit adequate review by licensees of draft REGDOCs. It is our view that until a REGDOC has been finalized, it should not be referres to in another draft REGDOC.	No changes were made to the document as a result of this comment. Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version.
18.	OPG	General	The language in some sections of the draft REGDOC is either unclear or imprecise. Clear, accessible language leads to improved compliance by licensees.	As a result of this comment, the document was revised for clarity and precision.
19.	OPG	General	The draft REGDOC does not clearly distinguish between facility types or the requirements that apply to them at various times in their lifecycle, which can to unclear expectations for licensees and challenge compliance.	See response to comment #11.
20.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	General	**Issue (Major)** Licensees found the language in some sections of the draft REGDOC to be either unclear or imprecise, which made it challenging at times to offer a thorough, contextual review. In some sections, reviewers found references to regulatory documents that have not yet been published and alignment to related documents such as IAEA standards to be unclear. In addition, several key terms were either not defined or their definitions not included or aligned with those in *REGDOC-3.6, Glossary of CNSC Terminology*. **Suggested change** Given the public interest in the subject, industry encourages the CNSC to ensure the language used to describe requirements and guidance in future drafts is clear to all interested readers. As those responsible for the safe management of radioactive waste, licensees appreciate the scientific basis that supports the CNSC's requirements in this REGDOC. However, industry also appreciates the need for this technical information to be presented in a way that is accessible to people of all levels of technical expertise. Please see specific examples in the table below for areas that could be amended for clarity. **Impact on industry** A lack of clarity can inadvertently lead to misunderstanding of requirements and the reasons for them. Clear, accessible language equates to improved compliance and public understanding of the scientific rigor that forms industry's waste management programs.	As a result of this comment, the document was revised for clarity and precision: the wording was changed to align with NRCan's *Radioactive Waste Policy Framework*. See response to comment #9 concerning definitions. Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version.
21.	Northwatch	General	The language and terminology used in several instances is overly vague, subjective, or	As a result of this comment, the document was revised for clarity and

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			open to interpretation, such as "undue burden"	precision: the terminology such as "undue burden" was removed.
22.	Northwatch	General	The REGDOC should clearly set out the any temporal or other criteria which distinguish a facility as a "disposal" facility versus a "storage" or "management" facility.	No changes were made to the document as a result of this comment. The definitions for disposal, storage and radioactive waste management are found in CSA N292.0
23.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	General	**Issue (Major)** The draft REGDOC does not clearly distinguish between facility types or the requirements that apply to them at various times in their lifecycle. For context, a disposal facility generally has the following lifecycle phases: siting; construction; operation; pre-closure monitoring; closure; decommissioning of ancillary facilities; post-closure. However, for some deep geologic repositories (DGR), SSCs will be "closed" during the operational phase (e.g., used fuel containers and placement panels) and not accessible prior to closure of the DGR and during the post-closure phase. Applicability of requirements for these timeframes need to clear and should not inadvertently create other safety issues. **Suggested change** The REGDOC should be more specific about the timeframe when requirements apply. For example, there are many references to "prior to closure" that should be clarified and there are requirements that should not apply to the post-closure phase. Please see specific examples in the table below for items that could be amended for clarity **Impact on industry** Unclear expectations could challenge compliance verification. This could also inadvertently result in: additional requirements being applied to low-risk facilities with no commensurate impact on safety; confusion for members of the public as to expected requirements for facilities.	See response to comment #11.
24.	Northwatch	1.1, 1.2 and 2.1	The document confuses the role, function and authority of CSA Group standards with CNSC REGDOCs and CNSC's role, function and authority in sections 1.1 and 1.2and 2.1.	As a result of this comment, the document was revised for clarity and precision: the terminology in sections 1.1, 1.2 and 2.1 was modified.
25.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear	1.1	**Issue (Major)** As per comment 20, the purpose of the document is unclear as currently written and could generate confusion regarding which requirements or guidance applies to various facility types, such as storage and disposal facilities. Licensees believe the purpose should clearly tell readers which type (low, intermediate, or	As a result of this comment, the document was revised for clarity and precision: a new section was added on the graded approach. Generally, the document does duplicate information that is found in CSA N292.0. A statement was added to the scope clarifying that is document expands upon N292.0. Definitions for storage and disposal

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	laboratories, NB Power, OPG		high-level) radioactive waste to which the guidance applies. It should also recognize there are varying opinions and conventions on what constitutes storage versus disposal. (*REGDOC-3.6, Glossary of CNSC Terminology* does not provide full definitions. **Suggested change** Amend to read, "The purpose of this document is to provide requirements and guidance: • on radioactive waste management applicable to different types of CNSC licensees • related to CSA Group standards applicable to radioactive waste management • supplemental to specific topics in radioactive waste management standards. Requirements and guidance will vary depending on the level of radioactive waste being managed and the facility type, such as storage and disposal facilities, using a graded approach commensurate with their relative risks." For additional clarity, definitions of storage and disposal facilities should be added to *REGDOC-3.6, Glossary of CNSC Terminology* and referenced in this REGDOC. **Impact on industry** An unclear purpose could lead to incorrect assumptions regarding requirements for facility type – storage vs disposal. For context, the time period for storage facilities is measured in decades as opposed to centuries for disposal facilities.	are found in CSA N292.0. The time period for storage facilities is provided for in CSA N292.0.
26.	Cameco	1.1	At the end of the bulleted list, insert "Requirements and guidance will vary the type of radioactive waste being managed and the type of facility using a graded approach commensurate with their relative risks."	As a result of this comment, the document was revised for clarity and precision: a new section was added on the graded approach.
27.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	1.2	**Issue** As per comment #20, the Scope is not entirely clear to all readers. For instance, it does not align with Section 24 of the NSCA, which says activities are licensed, not facilities. Nor does it define the term "waste management" or highlight what the "end goal" is with respect to waste management facilities. This could lead licensees to define different "end goals" and, in turn, drive the solutions to address waste management. **Suggested change** Amend the 1st sentence to read, "The requirements and guidance in this document pertain to CNSC-licensed activities ~~facilities~~…" Define the terms "waste management" and "end goal" to ensure requirements are clear for licensees and CNSC inspectors.	As a result of this comment, the document was revised for clarity and precision: • the scope was changed to: "REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* pertains to CNSC licensees that manage radioactive wastes. Sections 4, 5, 6, 7, 8 and 9 of this regulatory document apply to all licensees that manage radioactive wastes. Sections 10 and 11 contain requirements and guidance specific to radioactive waste storage facilities and disposal facilities, respectively." • the term 'end-goal' was removed from the document.

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				Radioactive waste management, storage and disposal are defined in CSA N292.0. These definitions are in alignment with the IAEA safety glossary.
28.	Dr. Albert Lee	1.3	The list of relevant legislation does not include paragraph 1 of the Nuclear Substances and Radiation Devices Regulations, which provides the definitions for conditional clearance levels and exemption quantities. Section 6.1 in REGDOC-2.11.1 refers to the clearance levels and exemption quantities set out in the Nuclear Substances and Radiation Devices Regulations. **Proposed change** Add paragraph 1 of the Nuclear Substances and Radiation Devices Regulations to the list of relevant legislation.	As a result of this comment, the document was revised for clarity and precision: the reference to section 1 of the *Nuclear Substances and Radiation Devices Regulations* was added to section 1.3.
29.	Dr. Albert Lee	1.3	The list of relevant legislation does not include the *Packaging and Transport of Nuclear Substances Regulations, 2015. However, Section 7.4 in REGDOC-2.11.1 states "*The licensee shall transport radioactive waste in accordance with the *Packaging and Transport of Nuclear Substances Regulations, 2015."* **Proposed change** Add the *Packaging and Transport of Nuclear Substances Regulations, 2015* to the list of relevant legislation.	As a result of this comment, the document was revised for clarity and precision: the reference to *Packaging and Transport of Nuclear Substances Regulations, 2015* was added to section 1.3.
30.	Northwatch	1.3	In titling a section "relevant legislation" but identifying only CNSC's own regulations this section is misleading and incomplete.	Section 1.3 lists the relevant sections of the NSCA and its regulations. The list is not meant to be a comprehensive list of all the legislations that apply to the licensing activities. As stated in the preface: "Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions." The *Nuclear Fuel Waste Act* was added to section 1.3.
31.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear	1.3	**Issue** As per comment #20, the list of relevant legislation is incomplete. **Suggested change** Add references to the *Nuclear Substances and Radiation Devices Regulations* and the *Nuclear Fuel Waste Act.*	As a result of this comment, the document was revised for clarity and precision: the suggested references were added.

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	laboratories, NB Power, OPG			
32.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	2	**Issue (Major)** As per comment #23, the REGDOC should differentiate between a 'waste generator' and a 'waste owner.' **Suggested change** Amend the 1st paragraph to read, "Under Canada's Radioactive Waste Policy Framework [4], waste owners are required to ensure the safe and secure management of radioactive waste and to make arrangements for its long-term management. This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose …" **Impact on industry** The management of radioactive waste may be the responsibility of more than one licensee. Reinforcing this in the REGDOC would help clarify the roles and responsibilities for waste generators and waste owners.	As a result of this comment, the document was revised for clarity and precision: the terminology used in section 2 was changed to align with NRCan's *Radioactive Waste Policy Framework*.
33.	Cameco	2	This section does not differentiate between a waste generators and waste owners. We recommend adding "This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose …" after the first sentence in the first paragraph.	As a result of this comment, the document was revised for clarity and precision: the terminology used in section 2 was align with NRCan's *Radioactive Waste Policy Framework*.
34.	Dr. Albert Lee	2.1	The list of CNSC documents in Section 2.1 that are relvevant to waste management is incomplete. • Draft REGDOC-2.4.4, Safety Analysis for Class 1B Facilities is included in Sections 9.1 and 10.5, and • Draft REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization is included in Section 10.2 **Proposed change** Add REGDOC-2.4.4 and REGDOC-1.2.1 to the list in Section 2.1.	As a result of this comment, the document was revised for clarity and precision: the reference to REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* was added to section 2. Only REGDOCs specific to waste management and decommissioning are included in this list, therefore references to REGDOC-2.4.4, *Safety Analysis for Class 1B Facilities* were removed.
35.	Bruce Power, Canadian Nuclear Association,	2.1	**Issue** As per comment #20, the CSA standard for decommissioning is missing from the list of complementary documents. **Suggested change**	As a result of this comment, the document was revised for clarity and precision: a reference to *N294, Decommissioning of facilities Containing Nuclear Substances* was added.

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	Canadian Nuclear laboratories, NB Power, OPG		Include *N294, Decommissioning of facilities Containing Nuclear Substances.*	
36.	Cameco	3	Section 3: The definition of "radioactive waste" should reproduce the definition in REGDOC-3.6 in order to clarify that only the waste owner may declare when material is waste.	No changes were made to the document as a result of this comment. REGDOC-2.11.1, Volume I was used to consult on the revised "radioactive waste" definition. The revised definition is aligned with the IAEA definition as well as CSA N292.0. Once this document is approved, the revised definition of radioactive waste will be incorporated into REGDOC-3.6, *Glossary of CNSC Terminology*.
37.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	3	**Issue (Major)** As per comment #20, the definition of radioactive waste does not align with that in *REGDOC 3.6*, which says "the owner declares to be waste" vs "no further use if foreseen." This introduces a question as to who must foresee "no further use" of the waste. As per Comment #23, it is not clear that the steps listed for the management of radioactive waste may be the responsibility of more than one licensee and may involve transfers/hand offs between licensees. Also, the fact that not all radioactive substances will become radioactive waste is not identified in the background. Some substances may simply decay away to the point the waste is no longer radioactive waste. **Suggested change** Amend the 1st paragraph to align with the definition of radioactive waste in *REGDOC-3.6* Amend the 2nd paragraph to read, "~~All nuclear substances associated with licensed activities will eventually become radioactive waste. Therefore, t~~ The safe management of ~~that~~ waste is considered during all steps of its management and may involve several licensees. The steps involved in the management of radioactive waste can include:" **Impact on industry** Unclear expectations could challenge compliance verification. Generation, control and handling are typically in-facility activities. Processing may be in-facility or it may be contracted to an external party. Storage, transport and disposal may be	As a result of this comment, the document was revised for clarity and precision: • the 2nd paragraph of section 3 was changed as suggested. • The text in section 2 was changed to align with NRCan's *Radioactive Waste Policy Framework*, including the responsibility of the waste owner. The definition of "radioactive waste" has not been changed as a result of this comment. The definition used for REGDOC-2.11.1, Volume I is aligned with the IAEA definition as well as CSA N292.0. Once this document is approved, the definition of radioactive waste will be incorporated into REGDOC-3.6, *Glossary of CNSC Terminology*. Decay storage is described in the following sections: Waste Classification; and Storage.

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			managed by the licensee who generated the waste, but may also be managed by a contracted party. As currently written, the background section potentially limits the ability for waste to decay to safe levels and be treated as non-radioactive waste.	
38.	Dr. Albert Lee	4-10.8	Requirements should be indicated before the start of the paragraphs containing requirements, and guidance should be indicated before the paragraphs containing guidance in each section and subsection.	No changes were made to the document as a result of this comment. The document was organized by topic rather than requirements and guidance.
39.	Northwatch	4	In stipulating that licensees "track the waste inventory under their control" but not setting out requirements for tracking of radioactive wastes as it moves through various control regimes the REGDOC is creating a regulatory regime that lacks rigour and where radioactive waste materials cannot assume to be tracked or traced; this contrasts sharply with the notion that those who generate the waste are responsible for the waste.	No changes were made to the document as a result of this comment. Draft REGDOC-2.11.1, Volume I states that licensees shall track the waste inventory under their control. Further requirements and guidance on waste tracking including the requirement that records shall track the characteristics of radioactive waste through all pertinent steps from initial generation to long-term management and track the waste inventory under the control of the waste management site can be found in the CSA N292.0.
40.	Northwatch	4	In stipulating that licensees "provide the CNSC with information about the ownership of radioactive waste in their possession" regimes the REGDOC is creating a regulatory regime that lacks rigour and where radioactive waste materials cannot assume to be tracked or traced; this contrasts sharply with the notion that those who generate the waste are responsible for the waste.	No changes were made to the document as a result of this comment. Draft REGDOC-2.11.1, Volume I states that licensees shall track the waste inventory under their control. Further requirements and guidance on waste tracking can be found in the CSA N292.0, including the requirement that records shall track the characteristics of radioactive waste through all pertinent steps from initial generation to long-term management and track the waste inventory under the control of the waste management site.
41.	Dr. Sandy Greer	4	As per the rationale detailed in my PREAMBLE, the following are specific passages where the explicit identifications of radionuclides could be requested by the CNSC, in REGDOC-2.11.1: Under 4. General Requirements, as per licensees managing radioactive waste, regarding "track the waste inventory under their control," please specify that the range of radionuclides be identified and disclosed for public information.	Public information disclosure is outside the scope of this REGDOC. Further information can be found in REGDOC-3.2.1, *Public Information and Disclosure*. Public reporting of exact inventories is not possible due to potential security concerns.
42.	Bruce Power, Canadian	4	**Issue (Major)** The section on General Requirements is unclear in many areas.	As a result of this comment, the document was revised for clarity and precision:

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	Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG		Bullet #1 requires all licensees to find long-term management solutions that "avoid imposing an undue burden on future generations." While licensees understand the intent of this phrase, it is a policy statement inappropriately embedded in a REGDOC. This requirement is not part of the federal policy on radioactive waste management. *Bullet #3* needs to be related to specific waste types so licensee and the CNSC can demonstrate to the public that waste is being safely managed in a manner commensurate with the potential hazard of the waste. Bullet #4 is unclear as to what aspects are interdependencies to be taken in account for. Nor is it clear if "evaluation" refers to CNSC inspections or internal self-assessments by licensees. Bullet #5 should not place the emphasis on the documentation. The licensee does not "implement the documentation" – they implement and document the program, procedures, etc. This statement should also point to guidance on what is considered acceptable as per the graded approach. Bullet #6: When is contaminated material held in storage no longer "useful" and is designated as waste? Bullet #7: The use of OPEX, lessons learned and advances in science and technology should be commensurate with the risk associated with waste. If the risk is very low, it should not be a requirement to use "advances in science and technology" for continuous improvement. Bullet#8: Reporting requirements are not well defined/ specified. Mandatory and periodic versus discretionary and only upon request? **Suggested change** Amend the bullets for clarity in the following ways: Bullet #1: "manage radioactive waste ~~so as to avoid imposing an undue burden on future generations,~~ by finding safe, practicable and environmentally acceptable solutions for the	• Bullet #1: Bullet was deleted as it already appears in CSA N292.0. Further principles for waste management are found in REGDOC 2.11. • Bullet #4: To better align with CSA N292.0 the text was changed to the following "take into account interdependencies among all steps in radioactive waste management. Each step shall be evaluated by the licensee as an individual step in the process and as part of an integrated radioactive waste management system" • Bullet #5: Bullet revised as suggested. • Bullet #7: This applies to all types of waste. A new section on the graded approach was added to the REGDOC. • Bullet #8: This requirement was deleted. The following suggested changed have not been made: • Bullet #3: This applies to all waste types. • Bullet #6: The definition of radioactive waste is found in the glossary of this REGDOC.

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			long-term” Bullet #3: Clarify the specific waste types this bullet relates to. Bullet #4: Clarify what aspects of interdependencies need to documented and who is expected to “evaluate” and by what means. Amend to say licensees should consider all known steps, but the integration waste management systems should detail how interdependencies will be addressed. Bullet #5: Amend to read, “develop, document and implement programs, procedures and instructions to ensure the safety of all waste management activities for which they are responsible commensurate with the scale of the licensed ~~facility or~~ activity and the inventory.” Bullet #6: Clearly state when contaminated material is designated as waste. Apply the definition of “waste.” Bullet #7: Amend to align with the 5th bullet and read: “use operational experience, lessons learned from other similar facilities or activities, and advances in science and technology in an effort to continuously improve the safety of the waste management facility or activity commensurate with the scale of the licensed activity and the inventory.” Bullet #8: Amend to clearly state the requirement to provide information is upon request/audit. **Impact on industry** Generally, a lack of clarity may inadvertently lead public expectations for low-level waste to be the same as that for high-level waste. Specifically, for the 1st bullet, licensees do not have the authority to define “undue burden” on future generations. That responsibility rests with government. Regarding the 5th bullet, industry has had challenges in the past with applying graded approaches, which causes uncertainty in the licensing process when the regulator does not	

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			accommodate this approach for low-risk activities. Regarding the 7th bullet, the time and resources required to identify truly relevant OPEX, lessons learned and advances in science and technology for licensees who generate low-level radioactive waste, and are not Waste Management Facilities, is not always commensurate with the impact on nuclear safety. A graded approach would improve this requirement.	
43.	Cameco	4	Bullet 1: The words "so as to avoid imposing an undue burden on future generations" should be deleted because licensees cannot manage wastes against a subjective, undefined standard. Bullet 5: Documentation is not implemented; this bullet should be amended to read "develop and implement programs, procedures and instructions to ensure..." Bullet 7: This is an example where the graded approach should be expressly included by adding "commensurate with the scale of the licensed activity and the inventory" at the end of the bullet	See response to comment #42.
44.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	4 and 5	**Issue (Major)** For clarity, the General Requirements in Section 4 and requirements in Section 5 on the Waste Management Program should include the option/ability of a licensed waste generator to contractually (commercially) engage the services of other licensed parties to transport, process, store and dispose of radioactive waste. The contractual arrangement might, in some instances, involve the transfer of care & custody, or of title, to certain waste; i.e. a change waste ownership & going forward responsibility. **Suggested change** Amend the 1st sentence in Section 4 to read, "All licensees who manage radioactive waste they generate or assume ownership for shall:" Amend the 1st paragraph of Section 5 to read, "The licensee shall develop and implement a waste management program to control the management of radioactive waste where it is generated, handled, processed, stored, transported or disposed of. Licensees may contractually engage another licensed party to carry out some or all of these activities." **Impact on industry** The management of radioactive waste may be the responsibility of more than one licensee.	No changes were made to the document as a result of this comment. Section 2 of the document covers the responsibilities of the management of radioactive waste in accordance with NRCan's *Radioactive Waste Policy Framework*. The proposed change to section 4 was not included, as the link between generation and ownership is implied for waste management. Management of contractors is covered under the Management System safety and control area (SCA).

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			Reinforcing this in the REGDOC helps clarify the roles and responsibilities for waste generators and waste owners.	
45.	Dr. Albert Lee	5	“In addition, the licensee shall develop and implement associated programs and procedures specific to waste management as part of the waste management program. The associated programs and procedures should be commensurate with the hazard of the waste streams being managed. For more information on managing programs consult REGDOC-2.1.1, Management System [6], and CSA N286, Management system requirements for nuclear facilities [7].” Separate the requirement from the guidance. **Proposed change** Change to: **Requirements** “In addition, the licensee shall develop and implement associated programs and procedures specific to waste management as part of the waste management program.” **Guidance** “The associated programs and procedures should be commensurate with the hazard of the waste streams being managed. For more information on managing programs consult REGDOC-2.1.1, Management System [6], and CSA N286, Management system requirements for nuclear facilities [7].”	No changes were made to the document as a result of this comment. The document was organized by topic rather than requirements and guidance.
46.	Cameco	5	Section 5: The first three bullets duplicate licence requirements and should be deleted. The words “managing programs in the last sentence should be replaced with “management systems”.	As a result of this comment, the document was revised for clarity and precision: the last sentence on managing programs was deleted and a reference to REGDOC-2.1.2, *Management System* has been added to section 1.2. To ensure the waste management program meets CNSC expectations, the first three bullets remain for completeness, therefore no change was made.

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47.	Dr. Sandy Greer	5	Under 5. Waste Management Program, similarly, the licensee ought to declare full disclosure of the radionuclides in the radioactive waste hierarchy that it manages. The CNSC can request, regarding "consider the waste hierarchy," that the request for full disclosure be added here.	As a result of this comment, the document was revised for clarity and precision: the following bullet was added to requirements for a waste management program: •"maintain records of the waste inventory under their control" See response to comment #41.
48.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	5	**Issues** Facilities that require a waste management program comply with *CSA N286-12* as part of their licence. As such, this REGDOC should only capture management system requirements that are incremental to the requirements in *N286-12* to minimize duplication and inconsistencies with general management system requirements. It should also be clear that *N286* does not provide information on how to manage programs, but how to establish an integrated management system. **Suggested change** Remove the first 3-bullets as they are already addressed in licensee's LCHs for Management Systems. Amend the final sentence in the section to read, "For more information on ~~managing programs~~ management systems, consult REGDOC-2.1.1, Management System [6], and CSA N286, Management system requirements for nuclear facilities [7]."	As a result of this comment, the document was revised for clarity and precision: the last sentence on managing programs was deleted. To ensure the waste management program meets CNSC expectations, the first three bullets remain for completeness, therefore no change was made.
49.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	5	**Issue** As per comment #20, clarity is sought for several of the bullet points in this section. Bullet #5: clarify what is meant by "address all waste streams." Not all waste streams need to be addressed, but they should be identified so an informed decision can be made to implement actions when required. Bullet #6 requires the licensee to consider the waste 'hierarchy' but this is the first time it is mentioned and the term is not defined. Later, Section 7.1 lists four items in the 'hierarchy' (prevent generation, reduce volume and radioactivity content, reuse and recycle, dispose).	As a result of this comment, the document was revised for clarity and precision: the changes were made as suggested. The definition for 'waste hierarchy' will be added to REGDOC-3.6, *Glossary of CNSC Terminology*.

REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*
REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
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			Suggested change Bullet #5 :Amend to read, "manage ~~address~~ all waste streams associated with or potentially contaminated by nuclear substances" Bullet#6: The requirements regarding the waste management hierarchy need to be clarified either in the text or in the glossary. If the hierarchy in 7.1 is to be addressed in section 5, it should be clearly stated.	
50.	Northwatch	6	The descriptions provided in Section 6 are overly vague and lack definition; what is required is a consistent method and system of categorizing, classifying and characterizing radioactive wastes; the REGDOC fails to provide that direction in sufficient detail or with sufficient explanation and description.	No changes were made to the document as a result of this comment. The waste classification outlined aligns with international guidance for waste classification. IAEA safety standard GSG-1 explains that the quantitative boundaries between the classes for different facilities may differ in accordance with scenarios, geological, and technical parameters and other parameters that are relevant to the site specific safety assessment. Furthermore, this waste classification scheme aligns with CSA N292.0.
51.	Northwatch	6	The descriptions of the various waste classes includes in each very brief description a statement about "disposal facilities", all of them near or sub-surface at various depths, with the depths varied by waste class; this is an unsupported and unsupportable position that has been inserted in what should have been a description of a group of wastes according to its characteristics. NOTE: No near or subsurface radioactive waste "disposal" facility has been fully designed or licensed in Canada. Is it the CNSC staff's intent to pre-empt scientific, public and regulatory processes by these unsupported assertions that all radioactive waste "disposal" facilities will be geological repositories?	As a result of this comment, the text on types of disposal facilities was removed. It is a CNSC expectation that the type of facility be based on the project-specific safety case.
52.	Northwatch	6	The draft REGDOC does include a requirement that licensees characterize radioactive wastes and maintain detailed records of the characterization performed, but fails to include requirements that these detail records by reported regularly to the CNSC and made available to the public	No changes were made to the document as a result of this comment. This information is typically reported to the CNSC in licensing basis documents and reports, such as the Annual Compliance Reports (in accordance with REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants* and REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*). In addition, this information is available to the CNSC for review during inspections. The CNSC does not require characterization

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				records be made available to the public due to potential security concerns.
53.	Dr. Sandy Greer	6	Under 6. Radioactive Waste Classification, Waste Characterization and Waste Acceptance Criteria, subsection 6.2 Waste Characterization reads: *The licensee shall perform waste characterization at the various steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste material, as applicable. The licensee must justify to CNSC the aspects that do not apply. The licensee shall maintain detailed records of the characterization performed.* Unless "waste characterization" implicitly is referring to radionuclide identification, I again ask the CNSC to request the naming of radionuclides as essentially imbedded in the characterization. Furthermore, this information must be easily accessible and rendered in clear language understandable to the wider public. If `waste characterization' includes the naming of radionuclides, then that information is helpful in regard to all phases of the handling of radioactive waste as delineated in 7. Steps in the Management of Radioactive Waste, and sections in this regulation document up to, and including, 10. Waste Management Disposal Facility. Important to declare here is the reality, as time progresses and as science incrementally improves, the more that information is transparent and known not just within the nuclear industry yet, imperatively, more readily accessible to the wider public of stakeholders, the more quickly and more effectively actions can be carried out, in order to minimize harm, as per whatever unknown incidents happen in future.	As a result of this comment, the document was revised for clarity and precision: the paragraph was changed to: "The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The licensee shall maintain detailed records of the relevant characteristics of the waste based on the characterization performed." Characterization information is typically reported to the CNSC in licensing basis documents and reports, such as the Annual Compliance Reports (in accordance with REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants* and REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*). Characterization information is available to the CNSC for review during inspections. The CNSC does not require characterization records be made available to the public due to potential security concerns. The IAEA safety standard GSR-5 states that characterization serves to provide information relevant to process control and assurance that the waste or waste package will meet the acceptance criteria for processing, storage, transport and disposal of the waste. The relevant characteristics of the waste have to be recorded to facilitate its further management. Waste characterization purposes are provided in CSA N292.0.
54.	Dr. Albert Lee	6.1	"LLW includes the following sub-classes: • Very-low-level radioactive waste (VLLW) has a low hazard potential and is above the criteria for clearance and exemption levels …" It should state "… the criteria for clearance levels and exemption quantities …" **Proposed change** "LLW includes the following sub-classes: Very-low-level radioactive waste (VLLW) has a low hazard potential and is above the	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.

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			criteria for clearance levels and exemption quanities …"	
55.	Dr. Albert Lee	6.1	"Waste should be classified according … n REGDOC-2.11.1, Waste Management Volume II: Management of Uranium Mine Waste Rock and Mill Tailings [8]." The text after the first paragraph in Section 6.1 is stated as guidance. **Proposed change** Change to: **Requirements** "The licensee shall implement a radioactive waste classification system. The classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity." **Guidance** "Waste should be classified according … n REGDOC-2.11.1, *Waste Management Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [8]."	No changes were made to the document as a result of this comment. The document was organized by topic rather than requirements and guidance.
56.	Cameco	6.1	Subsection 6.1: The second last statement in the last bullet is incorrect: Near-surface facilities are not the only practical option for long-term management of the mine and mill tailing wastes and such a statement is misleading. This sentence should be deleted.	As a result of this comment, the text on types of disposal facilities was removed. It is a CNSC expectation that the type of facility be based on the project-specific safety case.
57.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	6.1	**Issue (Major)** As per comment #20, the section on waste classification is not clear or consistent. For example: • Historically, not all waste management facilities have required safety assessments. Is this phrase being used generically? • The 4th bullet is a potentially misleading or biasing statement. There are current plans to place ILW in aboveground mounds. • Does the 5th bullet consider acid rock drainage and the need for subaqueous disposal? Subaqueous disposal has been employed at Elliott Lake. Also, has there been no backfilling of underground uranium mines in Canada? • The current wording does not provide sufficient guidance as to the range of factors that	As a result of this comment, the document was revised for clarity and precision:: • Bullets #2-3-6: the sentences on disposal options were removed. • Bullet #6: The text on types of disposal facilities was removed. It is CNSC expectation that the type of facility be based on the project-specific safety case. The following suggested changed have not been made:

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			should be considered when determining containment and isolation requirements, which may lead to inappropriate requirements. • The section does not make it clear who classifies the waste. Canada already has four main waste classifications, but the REGDOC indicates licensees should classify the waste. • In some cases potential "disposal" solutions are presented. In others, they are not. • There is no reference for source of radioactive waste classes and a lack of clarity on the definition of ILW. **Suggested change** Amend the 2nd sentence of the 1st paragraph to read, "Where appropriate, ~~T~~the classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity. Amend 4th bullet to read, "Due to its long-lived radionuclides, ILW ~~generally~~ may require a higher level of containment and isolation than can be provided in near surface repositories. " Amend the 5th bullet to read, "~~In general, L~~Long-term management in near-surface facilities adjacent to mines and mills is ~~the only~~ one of the more practical options for these wastes, given the large volumes of waste generated in mining and milling operations. Industry suggests this section should list factors like waste form (solid, liquid, gas etc.) that should be considered when determining the degree of containment and isolation. It should also clarify who classifies waste and add to the definition of ILW e.g. >2mSv/hr near contact. **Impact on industry** A lack of clarity can inadvertently lead to misunderstanding of requirements and the reasons for them by licensees, the regulator and the public. For this section, it may result in licensee's developing unique classifications and unintended confusion when discussing waste. If potential management and disposal approaches are to be cited, this document should do so for all types of waste. Currently, it only provides this information for some of the waste types.	• Bullet #1: This aligns with CSA N292.0. • Bullet #4: The waste classification outlined provides the basis for a classification scheme and aligns with international guidance for waste classification. IAEA safety standard GSG-1 explains that the quantitative boundaries between the classes for different facilities may differ in accordance with scenarios, geological, and technical parameters and other parameters that are relevant to the site specific safety assessment. • Bullet #5: The text was changed to: "The licensee shall implement a radioactive waste classification system. The classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity." • Bullet #7: The definition of ILW in draft REGDOC-2.11.1, Volume I aligns with both the IAEA and CSA, therefore no change was made.

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58.	Ministère de la santé et des services sociaux	6.1	Les grandes classifications de déchets radioactifs suivantes sont présentées: • déchets radioactifs de faible, activité très courte durée de vie, • déchets radioactifs de moyenne activité, • déchets radioactifs de forte activité, • les résidus de mines et d'usines de concentration d'uranium. Ces classes sont largement basées sur la classification des déchets radioactifs de l'AIEA (2009). Cependant, certaines clarifications s'imposent. En effet, les déchets radioactifs de moyenne activité comprennent des déchets de faibles activités à longue période non couverts dans les catégories de faible activité. Ceci est la conséquence d'une pratique historique datant de 1994 à l'époque où l'on séparait les déchets de faible et moyenne activités en deux catégories : courte et longue périodes (AIEA 2009b). À des fins de classification, on considère généralement que les déchets à courte période ont une durée de vie inférieure à 31 ans (basée sur le 137Cs). Cela devrait être clarifié, en particulier la demi-vie. La catégorie « déchets de faible activité à courte période » (<31 ans) pouvant être traités dans une installation de surface pourrait être créée afin de couvrir tous les cas d'espèce et serait en cohérence avec les définitions de l'AIEA (2009) De plus, nous ne voyons pas de raison particulière de créer une catégorie pour résidus de mines et d'usines de concentration d'uranium, alors qu'il existe une catégorie pour les matières radioactives naturelles. Ces deux types de déchets se gérant de la même façon, nous ne voyons pas la pertinence de créer deux catégories distinctes.	Aucun changement n'a été apporté au document. Les classifications de déchets radioactifs présentées dans le document sont : • déchets radioactifs de faible activité, • déchets radioactifs de moyenne activité, • déchets radioactifs de forte activité, • les résidus de mines et d'usines de concentration d'uranium. Les déchets radioactifs de faible activité à très courte durée de vie sont une sous-catégorie des déchets radioactifs de faible activité. La définition des catégories proposée dans le document est alignée avec les définitions courantes de l'AIEA telles que présentées dans le document GSG-1, *Classification of Radioactive Waste* (en anglais seulement). Dans le cadre du contexte réglementaire canadien non-prescriptif, il relève du demandeur de s'assurer que l'évaluation de sûreté spécifique à l'installation proposée pour la gestion des déchets supporte et justifie l'inventaire des déchets proposé. Cette attente est aussi conforme à l'orientation de l'AIEA qui se trouve au paragraphe 2.29 du document GSG-1. Les résidus de mines et d'usines de concentration d'uranium ne sont pas une nouvelle classification de déchets radioactifs. En fait, cette classification existe dans la norme CSA N292.0 depuis 2008. Au Canada, Les résidus de mines et d'usines de concentration d'uranium sont assujettis à la Loi sur la sûreté et la réglementation nucléaires depuis son entrée en vigueur en 2000, les matières radioactives naturelles ne le sont pas.
59.	Ministère de la santé et des services	6.1	De même, nous considérons qu'il serait pertinent de clarifier la valeur minimale des déchets d'activité intermédiaire. En effet, « quelques dizaines… de mètres » peut être interprété comme plus de 20 m. Cependant, la lecture de la littérature et des normes laisse	Aucun changement n'a été apporté au document. Dans le cadre du contexte réglementaire canadien non-prescriptif, il

REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*
REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
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	sociaux		penser que cette valeur minimale est de l'ordre de 30 m (AIEA 2007, 2009, 2009 b). Le document NW-T-1.20 *Disposal approaches for long lived low and intermediate level radioactive waste* (2009 b) est plus explicite en parlant de 30 à 50 m, en se basant sur la profondeur des fondations d'un grand édifice (NEA 1987, Yamoto 2007). Nous notons que cette profondeur est du même ordre de grandeur que la profondeur des puits artésiens et, par conséquent, de la nappe phréatique. Il semble donc que cette valeur pourrait de servir de base logique à la limite de profondeur minimale pour les installations de gestion des déchets de niveau intermédiaires.	relève du demandeur de s'assurer que l'évaluation de sûreté spécifique à l'installation proposée pour la gestion des déchets supporte et justifie l'inventaire des déchets proposé.
60.	Cameco	6.2	Subsection 6.2: This first sentence could be interpreted to mean that waste characterization occurs at every step in waste management. The last sentence should be combined and revised to read "The licensee shall perform and record waste characterization at the appropriate step(s) for the management of the specific radioactive waste by considering, as applicable, the physical, mechanical, chemical, biological, thermal and/or radiological properties."	As a result of this comment, the document was revised for clarity and precision: the first sentence was changed to: "The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste." Further details on when waste characterization shall and should be performed can be found in CSA N292.0.
61.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	6.2	**Issue (Major)** As per comment #20, there is an opportunity to clarify the language and intent of the 1st paragraph. **Suggested change** Amend the 1st paragraph to read, "The licensee shall perform waste characterization at the ~~various~~ appropriate step(s) for ~~in~~ the management of ~~radioactive waste~~ the specific radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste material, as applicable. ~~The licensee must justify to the CNSC the aspects that do not apply.~~ The licensee shall maintain ~~detailed~~ records of the characterization performed." **Impact on industry** As written, the first requirement has no clear purpose. Clarity is needed as to why the characterization is performed and at what stage(s) the characterization should be performed. As written, this may result in characterization being undertaken when not required and/or characterization not being performed when required. In the 3rd sentence, by default, aspects that do not apply will be ruled out during the various steps of the characterizations and recorded in detail. As written, licensees are being asked to prove a negative, which is not clear direction. This passage also raises a series of unintended questions: At what stage(s) of the full life cycle waste management process is	As a result of this comment, the document was revised for clarity and precision: the first sentence was changed to: "The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The licensee shall maintain detailed records of the relevant characteristics of the waste based on the characterization performed." Further details on when waste characterization shall and should be performed can be found in CSA N292.0. The third sentence was removed. The last sentence was changed to: "The licensee shall maintain detailed records of the relevant characteristics of characterization performed."

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			documented waste characterization applicable? If it is primarily for long term storage and disposal, the requirement is imposed upon a generator by the service provider of waste storage and disposal services. What exactly are the requirements for satisfactory characterization of waste? Are the requirements universal and standardized across the industry, or are they variable by generator / service provider.	
62.	Northwatch	6.2	The draft REGDOC does include a requirement that licensees characterize radioactive wastes and maintain detailed records of the characterization performed, but fails to include requirements that these detail records by reported regularly to the CNSC and made available to the public.	As a result of this comment, the document was revised for clarity and precision: the last sentence was changed to: "The licensee shall maintain detailed records of the relevant details of characterization performed." Characterization information is typically reported to the CNSC in licensing basis documents and reports, such as the Annual Compliance Reports (in accordance with REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants* and REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*). Characterization information is available to the CNSC for review during inspections. The CNSC does not require characterization records be made available to the public due to potential security concerns.
63.	Dr. Albert Lee		"In situations where acceptance requirements for disposal are not yet available, the licensee should develop waste acceptance criteria with reasonable assumptions about the anticipated disposal option." The above cited paragraph is not stated as a requirement, but a requirement statement is needed. In order to ensure that reasonable consideration has been given to disposal of the wastes, waste acceptance criteria that have a technical basis are required. **Proposed change** "In situations where acceptance requirements for disposal are not yet available, the licensee shall develop waste acceptance criteria with reasonable assumptions about the anticipated disposal option."	No changes were made to the document as a result of this comment. This clause is in current alignment with IAEA safety standards.
64.	Bruce Power, Canadian Nuclear Association, Canadian	6.3	**Issue** This entire section on WAC is only applicable to Waste Storage Facilities, or Waste Disposal Facilities. As per Section 1.2 (Scope), the entirety of Section 6 is applicable to all licensees that have a waste management program. **Suggested change**	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "Licensees who receive waste shall develop waste acceptance criteria consistent with and derived from the safety case and safety assessment."

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	Nuclear laboratories, NB Power, OPG		Move Section 6.3 to new subsections in Sections 9 and 10.	
65.	Northwatch	6.3	The brief section on Waste acceptance criteria does not – but should – include requirements for quality control / quality assurance programs, for tracking and inventory of waste packages from time of generation / receipt onwards, and does not – but should – incorporate requirements for characterization and inventory management noted above.	As a result of this comment, the document was revised for clarity and precision: a requirement was added to section 6.0 Waste Management Program : "maintain records of the waste inventory under their control" The information requested for quality assurance and quality control programs is covered in CSA standards including N286-12 and N292.0. Both of these standards are now referenced in this REGDOC. This REGDOC is complemented by CSA N292.0, including requirements pertaining to characterization and waste packages.
66.	Northwatch	6.3	Problematically, the draft REGDOC states that "In situations where acceptance requirements for disposal are not yet available, the licensee should develop waste acceptance criteria with reasonable assumptions about the anticipated disposal option"; the REGDOC should clarify that no facility should receive wastes from another site, location or facility if it is without the means to contain and manage that waste in isolation from the environment into perpetuity; this management system must be approved and operational, rather than simply theoretical and /or intended.	No changes were made to the document as a result of this comment. Waste is currently safely stored at waste management facilities across the Country which have appropriate waste acceptance criteria for interim storage until such a time that a permanent radioactive waste disposal option is available. This REGDOC is complemented by CSA N292.0. In accordance with CSA N292.0, the waste receiver shall be responsible for establishing WAC for waste management facilities under its responsibilities.
67.	Cameco	6.3	Subsection 6.3: One licensee may transfer wastes to another licensee. This first sentence should be amended to read "For waste it generates or for which it assumes ownership, the licensee shall develop..." This is the only subsection of Section 6 that does not apply to all licensees. We recommend that it be moved to the sections 9 and 10 specific to storage facilities and disposal facilities, respectively.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "Licensees who receive waste shall develop waste acceptance criteria, consistent with and derived from the safety case and safety assessment."
68.	Northwatch	7	The REGDOC fails to establish criteria for the transfer off-site of radioactive wastes (comparative to requirements in other jurisdictions that radioactive wastes be managed as close to their point of generation as possible).	No changes were made to the document as a result of this comment. Section 8.4 on transport states that transportation has to be in accordance with the *Packaging and Transport of Nuclear Substance Regulations, 2015*. These regulations ensure the safety of nuclear substance transportation. There was no need from a safety perspective to add anymore requirements, on top of those in the *Packaging and*

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				Transport of Nuclear Substance Regulations, 2015 to this REGDOC to ensure that radioactive waste is transported in a safe manner.
69.	Dr. Albert Lee	7.1	"The clearance of some materials from regulatory control after they have been appropriately processed and/or stored for a sufficiently long period of time, together with reuse and recycling of material, can be effective in reducing the amount of radioactive waste that needs further processing or storage. The limits and controls for clearance from regulatory control are found in the Nuclear Substances and Radiation Devices Regulations." The above cited paragraph is informative and should be shown as guidance. Paragraph 5 in the Nuclear Substances and Radiation Devices Regulations refers to exempted activities. It would be better to use the term "exemption" rather than "clearance" in the above cited paragraph. Also, it would be better to change "limits and controls for clearance" to "criteria for exemption". **Proposed change** **Guidance** **"**The exemption of some materials from regulatory control after they have been appropriately processed and/or stored for a sufficiently long period of time, together with reuse and recycling of material, can be effective in reducing the amount of radioactive waste that needs further processing or storage. The criteria for exemption from regulatory control are found in the Nuclear Substances and Radiation Devices Regulations.**"**	As a result of this comment, the document was revised for clarity and precision: the paragraph was amended to include both clearance and exemption.
70.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	7.1	**Issue** As per comment #20, the 2nd paragraph does not clearly state that what is listed is in order of preference and inappropriately links "reduce volume and radioactivity content." The word "some" is not needed" in the 3rd paragraph. It precludes the potential for all waste to be cleared in this manner. **Suggested change** Clarify the order of preference and amend the 2nd paragraph to read, "The licensee should ~~shall~~ consider where practicable the waste hierarchy in the management of radioactive	As a result of this comment, the document was revised for clarity and precision: the text was changed to: "The clearance and exemption of waste from regulatory control after having been appropriately characterized, processed and/or stored for a sufficiently long period of time, together with the reuse and recycling of material, can be effective in reducing the amount of radioactive waste that needs further processing or storage. The limits and controls for clearance and exemption from regulatory control are found in the *Nuclear Substances and Radiation Devices Regulations*."

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			waste, including prevent generation, reduce volume, ~~and~~ radioactivity content …” Delete the word “some” in the 3rd paragraph.	The wording for the waste hierarchy is consistent with CSA N292.0, therefore no change was made. The definition for ‘waste hierarchy’ will be added to REGDOC-3.6, *Glossary of CNSC Terminology*.
71.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	7.3	**Issue (Major)** As per Comment #20, the requirement is unclear in the first paragraph. What demands? **Suggested change** Delete or clarify. Unclear how to demonstrate compliance	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: “The licensee shall take into consideration the characteristics of the waste and the subsequent steps in its management when selecting waste processing methods”
72.	Cameco	7.3	Subsection 7.3: The first sentence should be revised to “Subject to prescribed waste acceptance criteria the licensee shall take into consideration”	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: “The licensee shall take into consideration the characteristics of the waste and the subsequent steps in its management when selecting waste processing methods.”
73.	Canadian Nuclear Association	7.4	**Issue (Major)** This section on transport is not complete. **Suggested change** Add a provision for the on-site transfer (transport) of waste between licensed facilities where the movement does not take the package off the licensee’s property or into the public domain. **Impact on industry** For ease of compliance, licensees believe the REGDOC should clearly state the requirements for on-site transfer/transport of waste and define/differentiate the terminology for: transport; transfer/movement; shipment	As a result of this comment, the document was revised for clarity and precision: the following sentence was added: “Onsite transfers (not on public roads) should meet an equivalent level of safety to these regulations.”
74.	Bruce Power, Canadian Nuclear Association,	7.5	**Issue** As per comment #20, clarity is needed for this section. Can decay storage take place at final disposal, with a view of limiting the number of times waste is handled? Is segregation a requirement or recommendation what is the expectation?	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: “The licensee should segregate sealed sources from other wastes because of the different regulatory requirements that apply. The

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	Canadian Nuclear laboratories, NB Power, OPG		**Suggested change** Clarify. Decay may not be until "final disposal." Licensees suggest using "disposition."	licensee should keep spent or disused sealed sources in a shielded container during handling."
75.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	7.5	**Issue** As per comment #23, the section on storage needs to be clarified. The requirement to differentiate 'staging' versus 'storing' should be broadened. As an example, for Routine LLW and ILW, a licensee can hold or stage the waste pending out-of-facility shipment. **Suggested change** Amend to read, "The licensee shall store, or make arrangements for the storage of, radioactive waste …"	No changes were made to the document as a result of this comment. The requirements found in section 8.5 are for short and long-term storage. This would also include waste that is transiently stored.
76.	Cameco	7.6	Subsection 7.6: Uncertainty would be avoided by replacing the first sentence with "...in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements at the time of the licence application."	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with applicable regulatory requirements."
77.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	7.6	**Issue** The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements. **Suggested change** Amend to read, "The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements at the time of the licence application."	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall dispose of radioactive waste safely in a manner that provides for the protection of people and the environment, and in accordance with applicable regulatory requirements."
78.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories,	7.6	**Issue** As per comment #23, the section on disposal needs to be clarified. **Suggested change** Amend to read, "The licensee shall dispose of, or make arrangements for the disposal of, radioactive waste …."	No changes were made to the document as a result of this comment. This section is only applicable to licensees who dispose of radioactive wastes.

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	NB Power, OPG			
79.	Cameco	8	Section 8: Licensees may purchase packaging. This first sentence should be revised to "The licensee shall use engineered waste packages as required to contain radioactive waste..."	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.
80.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	8	**Issue (Major)** Industry has concerns with the opening sentence in the section on Waste Packages. Not all containers will be for storage *and* disposal as this seems to imply. **Suggested change** Amend the 1st sentence to read, "The licensee shall use engineered waste packages as required to contain radioactive waste in accordance with applicable regulations, both during normal operation and in accident conditions of its intended use. **Impact on industry** Not all licensees engineer their own packages; and/or not all packages are required to be engineered.	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.
81.	Dr. Albert Lee	9.1	"The licensee shall develop, implement, and maintain a safety case and supporting safety assessment for the entire lifecycle of a waste management storage facility. Draft REGDOC-2.4.4, Safety Analysis for Class 1B Facilities [10], provides requirements and guidance on the safety analysis for a waste management storage facility. For long-term waste management storage facilities, Draft REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management [11], provides requirements and guidance for licensees and applicants in developing the safety case and supporting safety assessment for the long-term management of radioactive waste." I suggest adding "in accordance with applicable regulations" to the end of the first sentence. Draft REGDOC-2.4.4 and draft REGDOC-2.11.1, Waste Management Volume III need to be issued either before or at the same time as this REGDOC. The requirement should be separated from the guidance.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall develop, implement and maintain a safety case for the entire lifecycle of the radioactive waste storage facility in accordance with applicable regulations." Only REGDOCs that are already published will be referenced in the published version of REGDOC-2.11.1, Volume I, therefore references to REGDOC-2.4.4, *Safety Analysis for Class 1B Facilities* were removed.

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			Proposed change Change to: **Requirement** "The licensee shall develop, implement, and maintain a safety case and supporting safety assessment for the entire lifecycle of a waste management storage facility in accordance with applicable regulations." **Guidance** "REGDOC-2.4.4, Safety Analysis for Class 1B Facilities [10], provides requirements and guidance on the safety analysis for a waste management storage facility. For long-term waste management storage facilities, REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management [11], provides requirements and guidance for licensees and applicants in developing the safety case and supporting safety assessment for the long-term management of radioactive waste."	
82.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.1	**Issue** Saying safety case and safety assessment is not required. By maintaining an up to date safety case, the safety assessment would have to be up to date. In addition, more than just a safety assessment would go into a safety case. There would be multiple supporting documents that would have to be kept up to date. **Suggested change** Delete "and supporting safety assessment"	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.
83.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.1, 10.1, 10.2, 10.5	**Issue** Draft REGDOCs are mentioned in these sections. As a matter of principle, draft REGDOCs should only reference other REGDOCs that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and informed comments cannot be provided. **Suggested change** Cite only currently published versions of REGDOCs.	Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version.
84.	Northwatch	9.2	The presentation in the document of requirements for "site characterization for a waste management storage facility" could be taken to infer that site characterization is required	As a result of this comment, the document was revised for clarity and precision: the title for section 10 was changed to 'Radioactive Waste

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			only in the case of waste management facilities, rather than it be a requirement of all nuclear facilities; the next draft should clarify this.	Storage Facility' and subsection 10.2 was changed to 'Site Preparation'.
85.	Dr. Albert Lee	9.3	**Major** "The licensee should ensure that process system controls (e.g., waste handling, equipment and ventilation systems) are independent of protection systems. If this is not feasible, detailed justification should be provided for the use of shared and interrelated systems." It is unclear why the above cited paragraph is written as guidance rather than as a requirement. **Proposed change** "The licensee shall ensure that process system controls (e.g., waste handling, equipment and ventilation systems) are independent of protection systems to the extent practical. If this is not feasible, detailed justification shall be provided for the use of shared and interrelated systems." **Impact on industry** Independence of process system controls from protection systems is highly desirable to avoid single failures that compromises multiple levels of defence in depth.	No changes were made to the document as a result of this comment. This clause is based on guidance found in the IAEA safety standards.
86.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.3	**Issue (Major)** As per comment #23, this section applies to facility states that may not be applicable to all waste management storage facilities. The requirements should apply to only new facilities. **Suggested change** Amend to read, "The licensee shall design the new storage facilities to fulfill ~~the fundamental~~ applicable safety functions for the states defined for the facility ~~during normal operation, anticipated operational occurrences, design basis accidents and design extension conditions~~, as follows **Impact on industry** The execution of additional work for operating states beyond those of the analysis is required in the licenses basis.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall design the radioactive waste storage facility to fulfill the applicable safety functions during normal operation and postulated initiation events (e.g., anticipated operational occurrences, design basis accidents and design extension conditions), as follows: […]"
87.	Cameco	9.3	Subsection 9.3: Not all facility states apply to all waste storage facilities. The first sentence should be revised to"...shall design the new storage facilities to fulfill applicable safety functions for the states defined for the facility..." and the bullets should be deleted.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall design the radioactive waste storage facility to fulfill the applicable safety functions during normal operation and postulated initiation events (e.g., anticipated operational occurrences,

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				design basis accidents and design extension conditions), as follows:”
88.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.4	**Issue (Major)** This should be focused on SSC “important to safety.” Other equipment is an operational issue only and should not be a nuclear safety concern. **Suggested change** Specify “SSC important to safety” **Impact on industry** Prevents increased commissioning requirements on systems that are not safety related.	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.
89.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.4	**Issue (Major)** As per comment #20, clarity is sought on the 3rd paragraph. Commissioning requirements may be met through other means other than testing. What are “conditions of authorization” and where are they? **Suggested change** Amend to read, “The licensee shall verify that the equipment or SSCs important to safety perform as per design performance criteria. Upon the completion of commissioning, the licensee shall produce a final commissioning report. The report shall provide assurance that all licence conditions have been satisfied.” ~~document: the as-built status of the facility; the testing conducted with evidence to support the successful completion of the testing; and, any modifications made to the facility or to procedures during construction. The report shall provide assurance that all the conditions of authorization have been satisfied.~~ **Impact on industry** The phrase “conditions of authorization” is not defined and will make it difficult for licensees to comply and CNSC inspectors to audit against.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: “The licensee shall verify that the SSCs important to safety perform as per design performance criteria. Upon the completion of commissioning, the licensee shall produce a final commissioning report. The report shall provide assurance that all applicable regulatory requirements and performance criteria have been met.”
90.	Cameco	9.4	Subsection 9.4: The last paragraph should be replaced with “The licensee shall verify that the equipment or SSCs important to safety perform as per design performance criteria. The report shall provide assurance that all licence conditions have been satisfied.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: “The licensee shall verify that the SSCs important to safety perform as per design performance criteria. Upon the completion of commissioning, the licensee shall produce a final commissioning report. The report shall provide assurance that all applicable regulatory requirements and performance criteria have been met.”
91.	Dr. Albert Lee	9.5	**Major** “The licensee should maintain, test and inspect the facility at a frequency that ensures that	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to:

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			the reliability of the equipment remains high and that the effectiveness of the systems remain in accordance with the design intent for the facility." It is unclear why the above cited paragraph is written as guidance rather than as a requirement. **Suggested change** "The licensee shall maintain, test and inspect the facility at a frequency that ensures that the reliability of the equipment remains high and that the effectiveness of the systems remain in accordance with the design intent for the facility." **Impact on industry** The reliability of the equipment and the effectiveness of the systems must ensure that the safety case remains valid.	"The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility."
92.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	9.5	**Issue** As per comment #20, licensees have concerns with the clarity of the final paragraph on page 8. **Suggested change** Amend to read, "The licensee should maintain, test and inspect in accordance with the design intent." ~~the facility at a frequency that ensures that the reliability of the equipment remains high and that the effectiveness of the systems remain in accordance with the design intent for the facility.~~	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility."
93.	Cameco	9.5	Subsection 9.5: The last paragraph on page 8 should be replaced with "The licensee should maintain, test and inspect in accordance with the design intent."	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility."
94.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories,	10	**Issue** A graded approach could be applied to the waste facility in consideration of such things as the waste type to be managed and hazards or consequences. **Suggested change** Suggest adding wording to clearly enable a graded approach to be applied based on waste type.	As a result of this comment, the document was revised for clarity and precision: a new section was included on the graded approach.

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	NB Power, OPG			
95.	Dr. Albert Lee		“The licensee should ensure that the step by step approach to the development of a disposal facility allows opportunities for independent technical review, regulatory review, decision making and public involvement at all stages.” “For long-term waste management disposal facilities, Draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management* [11], provides requirements and guidance for licensees and applicants in developing the safety case and supporting safety assessment for the long-term management of radioactive waste.” The above cited paragraphs are stated as guidance. Draft REGDOC-2.11.1, Waste Management Volume III needs to be issued either before or at the same time as this REGDOC. **Proposed change** Change to: **Guidance** “The licensee should ensure that the step by step approach to the development of a disposal facility allows opportunities for independent technical review, regulatory review, decision making and public involvement at all stages.” “For long-term waste management disposal facilities, REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management* [11], provides requirements and guidance for licensees and applicants in developing the safety case and supporting safety assessment for the long-term management of radioactive waste.”	No changes were made to the document as a result of this comment. The document is organized by topics rather than requirements and guidance. REGDOCs will only be cited if they are already published or will be published at the same time as REGDOC-2.11.1, Volume I.
96.	Ministère de la santé et des services sociaux	10.1	Nous notons qu’il devrait y avoir une exigence réglementaire de traçabilité des déchets de la source initiale à sa disposition dans l’inventaire final. En effet, selon notre expérience, le régime de gestion actuel ne permet pas de suivre la trace d’un déchet de son propriétaire initial au site de stockage dans bien des cas.	Aucun changement n’a été apporté au document. Le document REGDOC-2.11.1, tome I ne répète pas les exigences spécifiées dans la norme CSA N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié* mais donne

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			Dans le même ordre d'idée, il est essentiel de s'assurer que la documentation technique survive à la phase institutionnelle de l'installation (AIEA 2012). Il serait prudent qu'elles soient aussi transmises aux archives nationales de pays étrangers ayant une expertise dans la conservation de documents, ainsi qu'à l'AIEA (AIEA 2017) et que le site devrait être marqué de façon à rester visible et lisible pendant plusieurs siècles (Trauth et al 1993 ; IAEA 2017) afin de maintenir un avertissement aux visiteurs en l'absence de tout contrôle institutionnel.	plutôt des précisions sur ces exigences. Selon la section 4.7 *Gestions des registres* de la norme CSA N292.0, chaque titulaire de permis qui gère des déchets est tenu de maintenir un inventaire détaillé des déchets en sa possession. Entre outre, les protocoles de gestion des registres doivent être utilisés pour enregistrer les informations sur les déchets suivantes : a) les origines; b) l'historique; et c) les caractéristiques En ce qui concerne les installations de gestion à long terme et d'évacuation des déchets, le projet de REGDOC-2.11.1, *Gestion des déchets, tome III : Évaluation de la sûreté à long terme de la gestion des déchets radioactifs*, fournit aux demandeurs et aux titulaires de permis des exigences et de l'orientation pour l'élaboration du dossier de sûreté et de l'évaluation de la sûreté connexe aux fins de la gestion à long terme des déchets radioactifs.
97.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.1	**Issue** This section could be clarified in a number of small ways. • As per comment #23, the licensee shall develop, implement, and maintain a safety case and supporting safety assessment for the entire lifecycle of a waste management disposal facility. This should include Post Closure assessments. • Second paragraph – why the options for design and not the design itself? • Safe facility operation is not a function. • As per comment #20, what is meant by "classify SSC"? • The 4th paragraph is a duplication of existing licensing processes and other regulatory documents **Suggested change** Amend to: • Make it clear this also includes Post Closure Safety assessments • Change from "options for design" to "design" • Change function to "barriers" • Make requirement more specific: SSC important to safety and "normal" SSC. • Delete the 4th paragraph.	As a result of this comment, the document was revised for clarity and precision: • Bullet #1: the sentence was changed to: "The licensee shall develop, implement and maintain a safety case for the entire lifecycle of the radioactive waste disposal facility, and a post-closure safety assessment, in accordance with applicable regulations." • Bullet #2: The text was changed to: "The licensee shall ensure that each of the stages in the lifecycle of a disposal facility is supported, as necessary, by evaluations of the site, design, construction, operation and closure, and of the performance and safety of the disposal system." • Bullet #3: The text was changed to: "The licensee shall ensure the safety of the facility by means of multiple safety functions including the use of multiple barriers and controls such as the host environment, the engineered barriers, and safe facility operation and closure."

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				• Bullet #4: The text was changed to: "The licensee shall identify SSCs important to safety." • Bullet #5: the fourth paragraph was deleted.
98.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.1 and 9.1	**Issue** As per comment #23, it is unclear if there is a difference between Long Term Storage and a Disposal Facility. Confusingly, both sections reference draft *REGDOC-2.11.1 Waste Management Volume III Safety Case for Long Term Radioactive Waste Management*. **Suggested change** Licensees suggest the requirements for Long Term Waste Management be only specified in one place. Or, additional guidance could be added to make it clear what the differences in requirements for the two different facilities	As a result of this comment, the document was revised for clarity and precision: the use of the terms "long-term management", "long-term storage" and "disposal facility" was reviewed throughout the document. Long-term storage and disposal are defined in CSA N292.6-18.
99.	Dr. Albert Lee		"The CNSC's guidance for licence applicants on technical aspects that may be considered during the site characterization stage of the siting process for a deep geological repository (DGR) for radioactive waste is found in draft REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization [12]." The above cited paragraphs are stated as guidance. Draft REGDOC-1.2.1 needs to be issued either before or at the same time as this REGDOC. **Proposed change** Change to: **Guidance** "The CNSC's guidance for licence applicants on technical aspects that may be considered during the site characterization stage of the siting process for a deep geological repository (DGR) for radioactive waste is found in REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization [12]."	No changes were made to the document as a result of this comment. The document is organized by topics rather than requirements and guidance. REGDOCs will only be cited if they are already published or will be published at the same time as REGDOC-2.11.1, Volume I.
100.	Dr. Sandy Greer	10.2	As an aside to mapping radionuclides, regarding 10.2 Site characterization for a waste management disposal facility, as of this date which is the evening of June 30, 2019, the	No changes were made to the document as a result of this comment.

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			updated regulation document appears not to have yet been presented to the Commission nor published. Regarding REGDOC-1.2.1, I severely criticized the nuclear industry feedback which advocated for more leniency in regulations, a position in contrast to my own feedback's advocacy for more rigour. I only can assume that the revised REGDOC-1.2.1 will be available when forthcoming licence applicants read it. I will be interested what the final revised version requires of licence applicants.	
101.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.2	**Issue** As currently written, this section inappropriately suggests that only DGRs are an acceptable method of waste disposal. Licensees would like to see statements here referring to other methods of waste disposal, especially as earlier sections mention near surface and intermediate depth disposal. This should also describe anticipated levels of detail required for various types of waste and disposal methods. **Suggested change** For clarity and to avoid confusion, licensees suggest removing the second paragraph. For additional clarity, industry believes the phrase "long-term waste management" should be used instead of "disposal" where appropriate throughout the document.	As a result of this comment, the document was revised for clarity and precision: the use of the terms "long-term management", "long-term storage" and "disposal facility" was reviewed throughout the document. The second paragraph is intended to point DGR applicants to the appropriate REGDOC for site characterization, not to suggest that a DGR is the only appropriate disposal facility option.
102.	Dr. Sandy Greer	10.3	Returning to the need to map radionuclides, full disclosure of their identification ought to be known prior to, under subsection **10.3 Design of a waste management disposal facility**, when this draft of REGDOC-2.11.1 reads: *The licensee shall base the design of a disposal facility upon:* … ***characteristics and inventory of the radioactive material to be emplaced***…	No changes were made to the document as a result of this comment. This REGDOC requires that the licensee perform waste characterization at the appropriate step(s) in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The licensee shall maintain detailed records of the relevant characteristics of characterization performed. This document is complemented by CSA N292.0 that states characterization be performed at the point of generation but may be conducted at any time during all steps of radioactive waste management.
103.	Bruce Power, Canadian Nuclear Association,	10.3	**Issue** As per comment #20, licensees believe this section and its bullets are unclear and its requirements are vague. For instance, paragraphs 6 and 7 do not seem to be properly sequenced.	As a result of this comment, the document was revised for clarity and precision: • Bullet #1: paragraphs 6 and 7 were moved to the beginning of the

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	Canadian Nuclear laboratories, NB Power, OPG		As per comment #23, licensees also believe the bullets can be revised to better relate to different phases of a facility's lifecycle. For the second list of bullets, some SSCs will be "closed" prior to DGR closure (as per comment #23). In some cases, amounts of water could be bounded by other evidence and calculated as opposed to measured. Also, the second list of bullets is a mixture of high-level requirements and specific design requirements, which can lead to confusion. The scope of the final paragraph needs to be more clearly defined to ensure engineering requirements and monitoring programs are appropriate and commensurate with potentials risks. **Suggested change** Enhance clarity in future drafts by: 1. Moving paragraph 6 & 7 to the beginning of this section 2. Explicitly stating the bullets relate to different phases of the facility's lifecycle and this is an iterative process that takes place during the design. 3. Amending Bullet #1 of the first bullet list to read, "to be emplaced in accordance with the expected performance of the facility." 4. Amending Bullet #1 of the second list to read, "allows for the measurement or calculations of water in safety-significant SSCs prior to closure of the specific SSC" 5. Updating the second list of bullets to only include high-level requirements. Examples of specific requirements for systems important to safety can be cited, but the actual requirements related to the hazards (i.e. the type of waste, low level, intermediate, fuel etc.) must be clear. 6. Ensuring the bullets refer to radioactive waste, not radioactive material 7.Amend the final paragraph to read, "The licensee shall design the disposal facility to facilitate the inspection, monitoring, testing, and maintenance of the systems important to safety ~~facility~~ and the elements of the host environment that are credited in the safety case~~., as applicable. The licensee must justify to the CNSC the aspects that do not apply~~.	section as recommended. • Bullet #2: the second paragraph of 'General Requirements for a radioactive waste disposal facility' was revised to state: "The licensee shall ensure that each of the stages in the lifecycle of a disposal facility is supported, as necessary, by evaluations of the site, design, construction, operation and closure, and of the performance and safety of the disposal system. Each of these stages shall be supported as necessary by iterative evaluation of the disposal system." To address the comment. • Bullet #6: where appropriate, radioactive material was replaced with radioactive waste throughout the REGDOC. • Bullet #7: the sentence was removed. The following suggested changes have not been made: • Bullets #3 to5: the changes would result in inconsistencies between this REGDOC and CSA N292.6, the changes
104.	Dr. Albert Lee		"The licensee should avoid or limit disturbances to the host environment during	No changes were made to the document as a result of this comment.

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			construction. The licensee should perform all construction activities so that containment and isolation features of the host environment are preserved. The licensee shall ensure that any changes to design during construction or disturbances to the host environment are subject to change control." The above cited paragraph contains a requirement in the last sentence and guidance in the first two sentences. These should be separated into two paragraphs under requirements and guidance. **Proposed change** Change to: Requirements "The licensee shall ensure that any changes to design during construction or disturbances to the host environment are subject to change control." **Guidance** "The licensee should avoid or limit disturbances to the host environment during construction. The licensee should perform all construction activities so that containment and isolation features of the host environment are preserved."	The document is organized by topics rather than requirements and guidance.
105.	Dr. Sandy Greer	10.4	Again, as an aside to mapping radionuclides, subsection **10.4 Construction and commissioning of a waste management disposal facility** begins: *The licensee shall construct the disposal facility in accordance with its design. The licensee shall have sufficient evidence that the closure design will function as intended before construction activities commence.* My question is, how is the acquisition of "sufficient evidence" humanly possible when the deep geological repositories (DGRs) being proposed in Canada are a conceptual design only. (The controversy about whether other repositories exist elsewhere is too complicated for this paper, although I have engaged in this debate elsewhere.) To be fair, I do recognize that the federal government has mandated that a series of steps be carried out by the Nuclear Waste Management Organization, which has been given the	As a result of this comment, the document was revised as follows: • in section 11.2.2, Facility Design: "The licensee shall consider closure in the initial design of the facility. Plans for closure must be updated as the design of the facility is developed." • in section 11.3, Construction were revised as follows: "The licensee shall construct the radioactive waste disposal facility in accordance with the accepted design. The licensee shall ensure that any changes to design during construction or that any unplanned disturbances to the host environment are subject to a change-control process."

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			mandate to find a willing host community to bury high level radioactive waste. Therefore, it is incumbent upon the CNSC and also NWMO to pursue an interdisciplinary journey of scientific and technological studies to make this happen. Nevertheless, among concerned citizens who have done our own in depth research, I believe we have legitimate concerns to raise about yet unproven DGRs to bury some of the most lethal substances created in anthropogenic activities on the planet.	
106.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.4	**Issue** As per comment #20, the 1st paragraph is unclear and should focus on SSC's important to safety, not equipment of an operational nature and not a nuclear safety concern. The 1st sentence is self-evident and not needed. The 2nd paragraph is not practical. If site preparation is undertaken, the local environment will be impacted. The impact of construction needs to be considered and any geological features credited by the facility design must be shown not to be adversely impacted during construction. **Suggested change** For clarity: 1. Specify "SSC important to safety" 2. Amend the 1st paragraph to read, "~~The licensee shall construct the disposal facility in accordance with its design~~. The licensee shall have sufficient evidence that the closure design will function as intended before construction activities commence 3. Amend the 2nd sentence of the 2nd paragraph to read, "The licensee should perform all construction activities so that containment and isolation features of the host environment as credited in the safety case are preserved." 4. The licensee shall verify that the equipment meets design specifications ~~requirements~~ and perform commissioning ~~validation~~ activities to demonstrate that the equipment and SSCs perform as expected in support of operations."	As a result of this comment, the document was revised for clarity and precision: the changes were made as suggested in bullets 1, 3 and 4. However, the change suggested in bullet 2 has not been made. Although the text may seem self-evident, the requirement remains to establish the commitment to use the approved design.
107.	Dr. Albert Lee	10.5	"Further information on operational aspects during the pre-closure period is provided in draft REGDOC-2.4.4, Safety Analysis for Class IB Nuclear Facilities [10]." The above cited paragraph is guidance. Draft REGDOC-2.4.4 needs to be issued either before or at the same time as this REGDOC.	No changes were made as a result of this comment. The document is organized by topics rather than requirements and guidance. REGDOCs will only be cited if they are already published or will be published at the same time as REGDOC-2.11.1, Volume I, therefore references to REGDOC-2.4.4, *Safety Analysis for Class 1B Facilities*

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			Proposed change Change to: **Guidance** "Further information on operational aspects during the pre-closure period is provided in REGDOC-2.4.4, Safety Analysis for Class IB Nuclear Facilities [10]."	were removed.
108.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.6	**Issue** The title is misleading. Disposal facilities are not normally decommissioned. Ancillary and support structures needed during operations are the elements that are decommissioned. The second paragraph can be clarified. **Suggested change** Change the title to 'Closure and Decommissioning of a waste management disposal facility' Amend the 1st sentence of the 2nd paragraph to read, "The licensee shall close the disposal facility in a way that maintains the integrity of those SSCs that perform safety functions that have been shown to be important to safety in the ~~after~~ post-closure phases.	As a result of this comment, the document was revised for clarity and precision: this section was subdivided between facility closure and decommissioning of ancillary facilities. The other sentences were revised as suggested.
109.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.7	**Issue** As per comment #20, this section could be edited slightly to enhance clarity. **Suggested change** Amend the final bullet to read, "maintain records of the information on the disposal facility, the site and the environment ~~its surroundings~~ Amend the final sentence to read, "After closure and until removal from CNSC licensing ~~revocation of the licence~~, the licensee shall remain responsible for surveillance of the disposal system and for any remedial action that might be required.	As a result of this comment, the document was revised for clarity and precision: the change was made to the first bullet as suggested. The final sentence was changed to: "After closure, the licensee shall remain responsible for any surveillance and remedial actions of the radioactive waste disposal facility unless other arrangements for institutional controls are in place."
110.	Ministère de la santé et des services sociaux	10.8	Bien qu'une période de contrôle institutionnel de quelques siècles soit compatible avec des pratiques en cours ailleurs dans le monde et dans la fourchette des limites plausibles (IAEA 2007), nous considérons qu'une période excédant un siècle présente un risque inacceptable. En effet, la demi-vie moyenne des empires est de l'ordre 220 ans (Arbesman 2011), soit l'équivalent d'un taux de défaillance de 27 % par siècle. Même en l'absence d'effondrement total de l'état, une période prolongée d'inaction des institutions gouvernementales est des plus probables, surtout en l'absence de risque imminent apparent.	Aucun changement n'a été apporté au document. Dans le cadre du contexte réglementaire canadien non-prescriptif, il relève du demandeur de s'assurer que l'évaluation de sûreté spécifique à l'installation proposée pour la gestion des déchets supporte et justifie l'inventaire des déchets proposé.

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			Pour cette même raison, il est essentiel que le site puisse cesser ses opérations de façon sécuritaire à n'importe quel moment de la phase opérationnelle avec un minimum d'interventions supplémentaires.	En ce qui concerne les installations de gestion à long terme et d'évacuation des déchets, le projet de REGDOC-2.11.1, *Gestion des déchets, tome III : Évaluation de la sûreté à long terme de la gestion des déchets radioactifs*, fournit aux demandeurs et aux titulaires de permis des exigences et de l'orientation pour l'élaboration du dossier de sûreté et de l'évaluation de la sûreté connexe aux fins de la gestion à long terme des déchets radioactifs. Le demandeur ou le titulaire de permis doit prévoir, dans la conception de l'installation, des caractéristiques de sûreté passives afin de réduire la dépendance aux systèmes actifs durant l'exploitation et après la fermeture, le cas échéant. Dans les installations de gestion à long terme des déchets radioactifs, la sûreté devrait être assurée par des moyens passifs. Le demandeur ou le titulaire de permis doit définir le rôle que jouent les contrôles institutionnels dans la sûreté du système de gestion des déchets et expliquer comment ce rôle est pris en compte dans le dossier de sûreté et l'évaluation de la sûreté connexe. S'il a l'intention d'assurer la sûreté à long terme au moyen de contrôles institutionnels, le demandeur ou le titulaire de permis pour ce type d'installation doit l'indiquer et le justifier dans le dossier de sûreté. Les contrôles institutionnels devraient rester en place aussi longtemps que possible afin d'assurer le maintien et la vérification de la sûreté à long terme. Il est aussi important de souligner que la CCSN exige que les titulaires de permis maintiennent des garanties financières pour le déclassement des installations nucléaires qui doivent couvrir la surveillance et l'entretien à long terme du site et toute période de contrôle institutionnel.
111.	Dr. Albert Lee	10.8	"The CNSC expects the following actions to be taken during the institutional control period: • implementation of a visual inspection plan for periodic examination of the site to look for signs of deterioration of the facility (e.g., slumping of the ground) or erosion of the surface	No changes were made to the document as a result of this comment. The document is organized by topics rather than requirements and guidance.

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			• operation and maintenance of a monitoring system to provide early warning of the release of radionuclides before they leave the site boundary • implementation of active controls to prevent unrestricted access to the site Note that active controls include periodic inspections and surveillance, controlled access, limited usage and minor maintenance. Active controls may be followed eventually by passive controls, which will ensure that knowledge of the disposal site is maintained and that future uses of the site are controlled." The above cited paragraphs are stated as guidance. **Proposed change** Change to: **Guidance** "The CNSC expects the following actions to be taken during the institutional control period: • implementation of a visual inspection plan for periodic examination of the site to look for signs of deterioration of the facility (e.g., slumping of the ground) or erosion of the surface • operation and maintenance of a monitoring system to provide early warning of the release of radionuclides before they leave the site boundary • implementation of active controls to prevent unrestricted access to the site Note that active controls include periodic inspections and surveillance, controlled access, limited usage and minor maintenance. Active controls may be followed eventually by passive controls, which will ensure that knowledge of the disposal site is maintained and that future uses of the site are controlled."	
112.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	10.8	**Issue** • The last paragraph states "active controls *may be* followed *eventually* by passive controls," making the implementation of passive controls sound optional. However, Section 10.1 says, "The licensee *shall* site, design, construct, commission, operate and close the disposal facility in such a way that safety is *ensured by passive means* to the fullest extent possible" These two statements seem at odds with one another. • The phrase "institutional control period" is used for the first time in section 10.8, but its requirement is unclear. The phrase should also be in 10.6 and 10.7.	As a result of this comment, the document was revised for clarity and precision: • Bullet #1: the sentence was changed to: "Active controls are followed by passive controls that ensure knowledge of the disposal site is maintained and that future uses of the site are controlled." • Bullet #5: the sentence was changed to: "Note that active controls include periodic inspections and surveillance, controlled access, limited usage and minor maintenance."

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			•The 2nd bullet's expectations for actions to be taken during the institutional control period should be clarified. Surface and groundwater pathways are site-specific and the "site boundary" is open to interpretation and unknown until a specific site and the final repository are assessed. •In the 3rd bullet, the use of active controls is contrary to the Province of Saskatchewan's IC program that is based on an expectation that passive controls will be used wherever possible to reduce future maintenance requirements of a site in the program. The goal of many decommissioning plans is to allow future land users to have "unrestricted access to the site". •Regarding the note in the final sentence - controlling future land use permitting is *not* controlled access. **Suggested change** Amend to clarify which statement is accurate in the last paragraph what requirements apply to the "institutional control period." Amend the 2nd bullet to read, "operation and maintenance of a monitoring system to provide early warning of the release of radionuclides will be prepared and accepted in support of the decommission licence ~~before they leave the site boundary~~" Amend the 3rd bullet to read, "Replace this statement with "Implementation of active controls, where required, to prevent unauthorized access to the site." Remove the note on active controls.	• Bullet #3: the sentence was changed to: "The licensee shall develop a monitoring and surveillance program for the radioactive waste disposal facility, prior to and during construction and operation of a radioactive waste disposal facility, and after its closure, if part of the safety case." • Bullet # 4: the sentence was amended to add "where required" as suggested. The following suggested changes have not been made: • Bullet # 2: This list represents the CNSC's expectations, not requirements as CNSC may not be the regulatory authority for the institutional control period.
113.	Cameco	10.8	Subsection 10.8: In the second bullet, it is unclear whether "early warning" refers to passive controls, such as environmental monitoring or active controls such as on-line sensors. In Cameco's view, a post-closure monitoring and maintenance plan is acceptable to ensure ongoing performance of the decommissioning objectives as part of an institutional control program while the maintenance of an automated early warning control system that requires "operation and maintenance" is an unreasonable expectation post-closure. A site requiring this type of rigorous ongoing monitoring should not be considered for institutional control. We recommend replacing this bullet with "development of a post closure monitoring and maintenance plan to ensure that the decommissioning objectives	As a result of this comment, the document was revised for clarity and precision: the bullet was changed to: "implementation and maintenance of a monitoring and surveillance plan to ensure that the post-closure objectives set out in the safety case continue to be met"

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			continue to be met”.	
114.	Cameco	10.8	The reference in the third bullet to the CNSC expectation that “active controls” will be used during institutional control monitoring is inconsistent with the Province of Saskatchewan’s expectation in its institutional control program that passive controls will be used whenever possible to reduce maintenance requirements for a site. In addition, the goal of many, decommissioning plans is to allow unrestricted access to future land users. We recommend replacing this bullet with “implementation of active controls, where required, to prevent unauthorized access to the site”. If the above recommendation is accepted, then the Note should be deleted because it would be unnecessary and it also confuses controlling land use with controlling access to a site.	As a result of this comment, the document was revised for clarity and precision: the change was made as suggested.
115.	Bruce Power, Canadian Nuclear Association, Canadian Nuclear laboratories, NB Power, OPG	Glossary	**Issue** As per comment #20, there are other terms that are not defined in *REGDOC-3.6* that would be useful for this glossary. **Suggested change** Define: SSCs - Systems Important to Safety	No changes were made to the document as a result of this comment. The term “SSCs important to safety” is defined in REGDOC-3.6, *Glossary of CNSC Terminology*.
116.	Dr. Sandy Greer	Glossary	I question how “new” the CNSC definition for “radioactive waste” actually is, as shown in the **Glossary** of the draft for REGDOC-2.11.1, which reads in part: *…The following are new terms that are being defined in this draft for public consultation. Following public consultation, the final versions of the terms and definitions will be submitted for inclusion in the next version of REGDOC-3.6.* However, only one definition appears in draft REGDOC-2.11.1 **Glossary**, as follows: **Radioactive waste** *Any material (liquid, gaseous, or solid) that contains a radioactive nuclear substance, as defined in section 2 of the NSCA, for which no further use is foreseen. In addition to containing nuclear substances, radioactive waste may also contain non-radioactive hazardous substances, as defined in section 1 of the General Nuclear Safety and Control Regulations.* Thank you for inviting public consultation, regarding which my two criticisms are, first of all, it is not currently accurate to include the phrase “**for which no further use is**	As a result of this comment, the document was revised for clarity and precision: the definition of radioactive waste was changed to align with the IAEA definition. The glossary sections of draft REGDOCs contain terms that are either not yet in REGDOC-3.6 or terms that are to be revised. Should a REGDOC be approved by the Commission, the new or revised terms would be added into REGDOC-3.6 in its next update. REGDOC-2.11.1, Volume I was used to consult on the revised “radioactive waste” definition.

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			foreseen." The phrase "**for which no further use is foreseen**," in fact, is an integral part of the definition given by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and cited on a web page of the European Nuclear Safety Regulators Group, but no less inaccurate today. Controversial or not, international debate has been active in recent years (probably longer) in regard to the wisdom behind constructing and eventually closing off deep geological repositories, with no possibility of access to reuse radioactive waste. One current web page of ***Science*Daily** at the top shows this definition: "Radioactive waste is waste type containing radioactive chemical elements that does not have a practical purpose," in contrast to further down, under section \`Related Stories,' has a list of several articles that can be clicked and opened, about various contemporary explorations and experiments to reuse nuclear waste. A further specific example of reuse of radioactive waste is cited on a web page of the Nuclear Energy Institute (NEI), the policy organization of the nuclear technologies industry based in Washington, D.C., and reads in part: *"Some countries like France reprocess and recycle nuclear fuel, extracting elements still capable of generating energy for use in new fuel. The United States currently does not, but some advanced reactor designs…in development would be able to run on used fuel.* Meanwhile, the phrase "**for which no use is foreseen**" appeared as far back as 1982 in *RADIOACTIVE WASTE MANAGEMENT GLOSSARY*, presented in Vienna as a Technical Document Issued by the International Atomic Energy Agency (IAEA), here: *"radioactive waste: Any material that contains or is contaminated with radionuclides at concentrations of radioactivity levels greater than the \`exempt quantities' established by the competent authorities and for which no use is foreseen."*	
117.	Dr. Sandy Greer	Glossary	My final comment is to ask you to be more fully accurate regarding your current definition for \`radioactive waste.' Identify specifically either that the radionuclides are hazardous (as you refer to non-radioactive substances) or, alternatively, that the waste is "contaminated	As a result of this comment, the document was revised for clarity and precision: the definition was changed as suggested.

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			with radionuclides," to be transparent about the risks and dangers.	

Table C: Feedback on comments / Tableau C : Période des observations

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<tr><th></th><th>Organization / Organisation</th><th>Section</th><th>Comment / Commentaire</th><th>CNSC Response / Réponse la CCSN</th></tr>
<tr><td>1</td><td>Ralliement contre la pollution radioactive</td><td>6.1</td><td>Nous constatons d’abord que les principaux joueurs de l’industrie nucléaire canadienne ont réuni leurs commentaires sur ce REGDOC dans un même document qui leur est commun.
Pour notre part, nous nous contenterons de réagir à deux des nombreuses propositions formulées d’une même voix par Les Laboratoires nucléaires canadiens, par l’Association nucléaire canadienne, par la Société de gestion des déchets nucléaires, par Ontario Power Generation, parc Bruce Power et par Énergie NB Power. Nos deux réactions concernent la section 6.1 du REGDOC, consacrée à la classification des déchets.

1) Le confinement des déchets radioactifs de moyenne activité
Voici le premier commentaire auquel nous voulons réagir, en page 11 du document soumis entre autres par les Laboratoires nucléaires canadiens (notre surligné en jaune):
<table>
<tr><th>#</th><th>Section</th><th>Industry Issue</th><th>Suggested Change (if applicable)</th><th>Major Comment/ Clarification</th><th>Impact on Industry, if major comment</th></tr>
<tr><td>13.</td><td>6.1</td><td>As per comment #1, the section on waste classification is not clear or consistent. For example:
• Historically, not all waste management facilities have required safety assessments. Is this phrase being used generically?
• The 4th bullet is a potentially misleading or biasing statement. There are current plans to place ILW in aboveground mounds.
• Does the 5th bullet consider acid rock drainage and the need for subaqueous disposal? Subaqueous disposal has been employed at Elliott Lake. Also, has there been no backfilling of underground uranium mines in Canada?
• The current wording does not provide sufficient guidance as to the range of factors that should be considered when determining containment and isolation requirements, which may lead to inappropriate requirements.
• The section does not make it clear who classifies the waste. Canada already has four main waste classifications, but the REGDOC indicates licensees should classify the waste.</td><td>Amend the 2nd sentence of the 1st paragraph to read, “Where appropriate, ~~T~~the classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity.

Amend 4th bullet to read, “Due to its long-lived radionuclides, ILW ~~generally~~ may require a higher level of containment and isolation than can be provided in near surface repositories. “

Amend the 5th bullet to read, “~~in general,~~ Long-term management in near-surface facilities adjacent to mines and mills is ~~the only~~ one of the more practical options for these wastes, given the large volumes of waste generated in mining and milling operations.

Industry suggests this section should list factors like waste form (solid, liquid, gas etc.) that should be considered when determining the degree of containment and isolation.

It should also clarify who classifies waste and add to the definition of ILW eg >2mSv/hr near contact.</td><td>MAJOR</td><td>A lack of clarity can inadvertently lead to misunderstanding of requirements and the reasons for them by licensees, the regulator and the public.

For this section, it may result in licensee’s developing unique classifications and unintended confusion when discussing waste. If potential management and disposal approaches are to be cited, this document should do so for all types of waste. Currently, it only provides this information for some of the waste types.</td></tr>
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Les six organismes majeurs de l’industrie nucléaire canadienne déjà identifiés refusent que le REGDOC dise à nouveau qu’en raison de leur contenu en radionucléides à longue période, les déchets de moyenne activité exigent généralement un degré de confinement et d’isolement plus important que ce que peuvent assurer les dépôts près de la surface. Cette proposition est à leurs yeux « potentiellement trompeuse et biaisée » puisqu’il existerait déjà des projets pour empiler de tels déchets</td><td>Le texte a été révisé tel que suggéré en jaune, puisqu’il n’altère pas de façon significative l’intention du texte. En effet, le texte révisé « ces déchets peuvent exiger un degré de confinement et d’isolement plus important » ne diffère que légèrement du texte original « ces déchets exigent généralement un degré de confinement et d’isolement plus important ».

Dans le cadre du contexte réglementaire canadien non-prescriptif, il relève du demandeur de s’assurer que l’évaluation de sûreté spécifique à l’installation proposée pour la gestion des déchets supporte et justifie l’inventaire des déchets proposé.</td></tr>
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			d'activité moyenne sous forme de monticules à la surface du sol. Ils proposent donc d'assouplir le texte du REGDOC en écrivant simplement que ces déchets **peuvent exiger** un tel degré supérieur de confinement et d'isolement. **Notre Ralliement s'oppose vivement à une telle dilution injustifiée et injustifiable des exigences réglementaires**. Il est inconcevable qu'on veuille affaiblir des règles qui protègent la santé et la sécurité des citoyens simplement pour éviter de bousculer les projets ou les espoirs de l'industrie nucléaire. Non seulement les porte-paroles de l'industrie n'apportent aucun exemple de ces projets où l'on prévoirait empiler des monticules de déchets de moyenne activité à la surface du sol mais ils ne fournissent aucun autre motif à l'appui de leur demande. Les Laboratoires nucléaires canadiens ont brièvement « flirté » avec l'idée de placer des déchets de moyenne activité dans leur future installation de déchets près de la surface à Chalk River. C'est même cette perspective qui a déclenché notre opposition militante et la création du Ralliement contre la pollution radioactive ! Par contre, les Laboratoires nucléaires canadiens ont publiquement abandonné l'idée dès octobre 2017 et ils répètent maintenant sur toutes les tribunes que leur monticule de Chalk River contiendra uniquement des déchets radioactifs de faible activité. La société nous l'a encore confirmé par écrit ces dernières semaines. Les seuls autres monticules de déchets radioactifs établis à la surface du sol sont ceux de Port Hope et de Port Granby, tous deux en cours de remplissage. Toutefois, ces deux structures sont surtout destinées à des résidus de mines et d'usines de concentration d'uranium ou de radium, des déchets qui se classent dans une autre catégorie de déchets radioactifs, au 4ème point noir de la section 6.1. Il est d'ailleurs de commune renommée que ces deux monticules sont simplement un « moindre mal », puisqu'on ne trouvait aucune autre solution pour mettre fin à la contamination généralisée des deux municipalités. Nous ne savons pas si on tolère déjà des déchets de moyenne activité dans les monticules de Port Hope et Port Granby mais, le cas échéant, ce pis-aller ne doit surtout pas devenir la norme partout ailleurs ! En somme, notre Ralliement demande que cette portion du REGDOC ne soit pas modifiée. Les déchets de moyenne activité doivent continuer à bénéficier d'un degré de confinement et d'isolement plus important que celui des dépôts près de la surface.	
2	Ralliement contre la pollution radioactive	6.1	**2) Le seuil de débit de dose de 2 millisieverts par heure, au contact** À titre de deuxième réaction aux commentaires formulés jusqu'à maintenant, notre Ralliement veut appuyer la demande unanime de l'industrie nucléaire pour maintenir la référence à un débit de dose maximal de 2 millisieverts par heure, au contact, comme seuil-frontière entre les déchets de faible	Aucun changement n'a été apporté au document. La définition des déchets radioactifs de moyenne activité demeure inchangée pour que le cadre réglementaire canadien demeure fidèle à

activité et les déchets de moyenne activité. Cette demande apparaît de manière sibylline, sans aucun argument, à la même page du mémoire de l’industrie que nous avons déjà reproduite plus haut :

#	Section	Industry Issue	Suggested Change *(if applicable)*	Major Comment/ Clarification	Impact on Industry, *if major comment*
13.	**6.1**	As per comment #1, the section on waste classification is not clear or consistent. For example: • Historically, not all waste management facilities have required safety assessments. Is this phrase being used generically? • The 4th bullet is a potentially misleading or biasing statement. There are current plans to place ILW in aboveground mounds. • Does the 5th bullet consider acid rock drainage and the need for subaqueous disposal? Subaqueous disposal has been employed at Elliott Lake. Also, has there been no backfilling of underground uranium mines in Canada? • The current wording does not provide sufficient guidance as to the range of factors that should be considered when determining containment and isolation requirements, which may lead to inappropriate requirements. • The section does not make it clear who classifies the waste. Canada already has four main waste classifications, but the REGDOC indicates licensees should classify the waste.	Amend the 2nd sentence of the 1st paragraph to read, “Where appropriate, ~~T~~the classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity. Amend 4th bullet to read, “Due to its long-lived radionuclides, ILW ~~generally~~ may require a higher level of containment and isolation than can be provided in near surface repositories. “ Amend the 5th bullet to read, “~~In general, L~~Long-term management in near-surface facilities adjacent to mines and mills is ~~the only~~ one of the more practical options for these wastes, given the large volumes of waste generated in mining and milling operations. Industry suggests this section should list factors like waste form (solid, liquid, gas etc.) that should be considered when determining the degree of containment and isolation. It should also clarify who classifies waste and add to the definition of ILW eg >2mSv/hr near contact.	**MAJOR**	A lack of clarity can inadvertently lead to misunderstanding of requirements and the reasons for them by licensees, the regulator and the public. For this section, it may result in licensee’s developing unique classifications and unintended confusion when discussing waste. If potential management and disposal approaches are to be cited, this document should do so for all types of waste. Currently, it only provides this information for some of the waste types.

Ce seuil du débit de dose est déjà présent dans la définition des déchets de moyenne activité au sein de l’annexe A.6.1 du document N292. 0-14 du Groupe CSA. Ce document a valeur de norme au Canada. Il dit que ce seuil du débit de dose peut être utilisé pour distinguer les déchets radioactifs de faible activité et les déchets radioactifs de moyenne activité. Nous n’avions pas remarqué que le projet de REGDOC retire ce repère de la définition des déchets radioactifs, sans quoi notre Ralliement s’y serait objecté plus tôt. Nous faisons ici cause commune avec l’industrie nucléaire.

Il y a d’ailleurs une grande logique à cette position consensuelle puisque ce débit de dose de 2 millisieverts par heure au contact d’un déchet radioactif est aussi le seuil au-delà duquel les travailleurs n’ont plus le droit de manipuler un déchet radioactif à main nue; ils doivent alors se protéger contre les rayonnements avec des blindages ou encore utiliser de l’équipement de télémanipulation.

Il serait trompeur de prétendre publiquement qu’un déchet nucléaire n’a qu’une « faible activité » quand il est trop dangereux pour qu’on puisse le manipuler sans blindage ou sans équipement commandé à distance. Aucun déchet dont le débit de dose excède les 2 millisieverts par heure ne peut être dit de « faible activité ». C’est une considération dont la CCSN devrait être

la définition qui se trouve dans la norme CSA N292.0 et à l’orientation de l’AEIA.

			particulièrement consciente puisque la loi lui fait obligation d'informer objectivement la population du Canada sur tous les aspects de l'énergie nucléaire. Certains produits radioactifs peuvent aussi tomber dans la catégorie des déchets de moyenne activité même si leur débit de dose n'atteint pas ce seuil de 2 millisieverts quand ils contiennent par exemple une grande quantité d'éléments radioactifs à longue période de désintégration. La norme N292.0-14 du groupe CSA précise clairement que les déchets dits « de faible activité » ne doivent généralement présenter que « des niveaux limités d'activité à longue période ». Cette exigence est d'ailleurs si vague qu'il faudrait préciser quel est ce « niveau limité », en pourcentage, en becquerels ou en sieverts.	
3	Dorothy Goldin Rosenberg	General	I fully support and endorse the Northwatch submission on this Waste Management of Radioactive Waste matter. Please accept my endorsement of that submission and please confirm receipt of this message of support.	Comment noted. The dispositions to Northwatch's submission can be found in table B.
4	Northwatch	General	We have reviewed the comments provided by other stakeholders, and find nothing in those submissions that caused us to alter our assessment of the REGDOC-2.11.1 Volume I or to amend our comments as submitted on June 30th. Moving forward, we request that the Canadian Nuclear Safety Commission undertake the following as next steps in the development of the suite of documents that comprise REGDOC-2.11.1, Waste Management: • Complete the first comment period on REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2 • Complete a dispositioning of comments received on each of the draft REGDOCs in REGDOC-2.11.1 and make those public • Prepare a second draft on each of the draft REGDOCs in REGDOC-2.11.1 and make those public • Convene a workshop with balanced participation on REGDOC-2.11.1, Waste Management (Framework and Volumes I to III) • Invite feedback on second draft of the Framework and each of the REGDOCs in REGDOC-2.11.1, Waste Management second draft REGDOCs • Provide participant funding to support public participation with technical support • Complete a dispositioning of comments received on the second draft of each of the framework and the draft REGDOCs in REGDOC-2.11.1 and make those public • Consider next steps (final draft, final version, additional consultation) This is an extremely important suite of regulatory documents, and their development merits the	Comment noted. All consultations related to the development of the REGDOC were done publically. The REGDOC which was sent out for public consultation was the result of extensive public consultations dating back to 2016. The CNSC published *DIS-16-03, Radioactive Waste Management and Decommissioning* for a 120-day public comment period on May 13, 2016. Comments were received from 18 organizations and individuals, and were posted on the CNSC website for feedback between October 13 and November 2, 2016. That consultation lead to a wide variety of comments being submitted. Comments were received from civil society groups, environmental non-government organizations (including Northwatch), members of the general public, government organizations and industry. Public comments identified areas of improvement such as classification of radioactive waste, waste program requirements and provide clarity by defining key terms. All comments were duly considered in the creation of REGDOC-2.11.1, Volume I. All comments submitted related to the 2.11.1 REGDOCs were dispositioned and sent to all stakeholders who submitted comments during the public consultation phase (including feedback on

			CNSC taking a thoughtful and measured approach which includes public and Indigenous participation and is undertaken in an iterative and responsive fashion.	comments). Public consultations resulted in changes to the REGDOCs as identified in this disposition table. The revised draft documents will be submitted in April to the Commission at a public meeting. The draft documents are included in this stakeholder package. In response to requests from industry and civil society stakeholders, the CNSC arranged to hold two separate workshops concerning the REGDOC-2.11 series of documents in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April and discuss how stakeholder comments were taken into consideration. Draft REGDOCs and the associated detailed comments tables will be sent to all stakeholders and invitees in advance of the workshops. The CNSC's Participant Funding Program (PFP) provides reasonable funding support to eligible recipients to more meaningfully participate in and bring value-added information to the Commission. The PFP is flexible and is offered for a range of different regulatory activities and processes. Typically all publicly available funding opportunities are announced on the CNSC's PFP webpage. However, should any member of the public and Indigenous communities be interested in applying for funding for other CNSC related activities such as for the review of REGDOCs and proposed regulations, the CNSC encourages interested parties to contact the PFP Administrator: cnsc.pfp.ccsn@canada.ca with a proposal for consideration. Funding for these activities will be considered on a case by case basis. For information on the CNSC's PFP, see: http://www.nuclearsafety.gc.ca/eng/the-commission/participant-funding-program/opportunities/index.cfm
5	Northwatch	General	As noted above, we have reviewed the submissions on Draft REGDOC 2.11.1 Volume I. For the most part, our feedback reflects on the joint submission by the nuclear licensees. Our feedback includes the following: **Feedback**	Comment noted. See response to comment #4 in table C concerning the dispositioning of comments and the approval of the waste series of regulatory documents.

			Northwatch agrees with the industry comment that the draft REGDOC lacks clarity, is imprecise in its language, and this could result in misunderstandings or misinterpretation. However, we strongly disagree with the industry comment that "Clear, accessible language equates to improved compliance and public understanding of the scientific rigor that forms industry's waste management programs." Clear language might contribute to compliance or increased public understanding, but it does not "equate" with either compliance or public understanding; in addition, improved public understanding cannot be assumed to conclude that there it is scientific rigour that forms the industry's waste management plan. **Recommendation** The development of this suite of REGDOCs must be done in an iterative and methodical fashion. A next draft of Volume I should be released for a second round of comment, either preceded or accompanied by a dispositionning by CNSC staff of comments received. The next draft should show marked improvement in structure and terminology to address the deficits of the first draft. Subsequent states of the review should be integrated with further review of the Framework and Volumes I, II and III.	
6	Northwatch	1.1	**Feedback** The industry's commentary lacks clarity and consistency of language, and uses not only terminology which is unclear, but acronyms which are never explained. For example, the acronym for Systems, Structures and Components (SCCs) is used repeatedly, but only as the acronym. This section of their commentary is heavily laden with the industry's internal assumptions, which they fail to set out and certainly fail to justify. For example, they appear to assume that "disposal facilities" are deep geological repositories, but do not state that clearly; they leave the reader to accept their assumption implicitly. Some of the industry comments are unintelligible, such as "for some deep geologic repositories (DGR), SSCs will be "closed" during the operational phase (e.g., used fuel containers and placement panels) and not accessible prior to closure of the DGR and during the postclosure phase" . The meaning is entirely lost, perhaps because it is so assumption laden or perhaps because they provide no explanation of the SCCs they are referring to, or perhaps it was a group write and everyone got a few words in. Their next statement, that "applicability of requirements for these timeframes [pre and post closure] need to clear and should not inadvertently create other safety issues" is equally opaque **Recommendation** The REGDOC should avoid the current lack of clarity displayed in both the draft document and the industry commentary. In particular, the REGDOC should be clear about the management system(s) the requirement or guidance applies to, the time frame for application and	As a result of this comment, the document was revised for clarity and precision.

			compliance, and the rationale for those selections. The REGDOC must absolutely avoid taking up the industry's proposal that requirements be such that additional margins of safety are not built into the design for systems or facilities the industry (or regulator) estimates to be "low-risk".	
7	Northwatch	1.2	**Feedback** It's not clear from the industry comments whether they think it would be a good thing or a bad thing to "drive the solutions to address waste management". However, we do agree that it would not be appropriate for the licensees to be setting the "end goal" for waste management , whether that be for decommissioning or for waste isolation. We strongly disagree that it should be "activities" that are licensed and not "facilities". In the case of waste management, it is both; the facility design is intrinsically linked to performance, but so are the "activities" of the waste management program, including aspects such as quality control, monitoring, and human performance. **Recommendation** The REGDOC must include clear definitions and terminology, and the method by which performance standards for each waste management system (and system component) will be established and for which time frame, and the means by which those performance standards and their achievement by the waste management system is to be evaluated / verified.	See response to comment #27 in table B. As a result of this comment, the document was revised for clarity and precision.
8	Northwatch	1.3	**Feedback** We agree that the list of relevant legislation is incomplete. **Recommendation** Add the *Packaging and Transport of Nuclear Substances Regulations, 2015*	As a result of this comment, the document was revised for clarity and precision: the reference to *Packaging and Transport of Nuclear Substances Regulations, 2015* was added to section 1.3.
9	Northwatch	2	**Feedback** The industry is asserting that the REGDOC should differentiate between a waste generator and a waste owner, while at the same time misrepresenting the Radioactive Waste Policy Framework as saying that "This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose…". The Framework clearly does not say that. In contrast, it in no way references any transfers of ownership of radioactive waste from one licensee to another, for commercial or other purposes. Rather, in the very brief three-bullet "Framework" makes two references to "the waste producers and owners" as if a single entity, stating "The waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the funding, organization, management and operation of disposal and other facilities required for their wastes." **Recommendation** The REGDOC must be consistent with the 1996 Radioactive Waste Policy Framework, which clearly	As a result of this comment, the document was revised for clarity and precision: the text in section 2.0 was changed to align with the *Radioactive Waste Policy Framework*.

			sets out that "The waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the funding, organization, management and operation of disposal and other facilities required for their wastes" and clearly does not entertain the notion of commercial transactions which would sever the relationship between the waste producers and owners and the wastes that they have generated.	
10	[Northwatch]()	2.1	**Feedback** Industry is proposing that the CSA standard be added to the list of complementary documents. While we would not argue against it being referenced, the industry-set standard is not a substitute for regulation, or even for Regulatory Documents, and the relationship must be clearly stated. **Recommendation** Address industry's confusion about the relationship between the CSA standards and the regulatory documents by moving requirements into actual regulations under the Nuclear Safety Control Act. In addition, clearly establish that legislation, regulation, and regulatory documents are paramount to industry association documents, including CSA standards.	No changes have been made to the document as a result of this comment. The comment that CSA standards are "paramount to industry association documents" is not correct. Recognized experts develop nuclear standards through a transparent consensus process that provides opportunities for meaningful public involvement. Committees are comprised of members representing varied viewpoints including the CNSC, government, industry, academia, and general interest groups. This system prevents any single group from dominating the final product. Before a standard can become part of the licensing basis for a facility it has to be approved by the Commission through its hearing process. The public can appear before the Commission and express any concerns they may have with the content of a standard. Standards are referenced if the Commission views a standard as essential to promoting safety. the Commission can assign additional conditions it deems necessary to reduce risks to a reasonable level The CNSC maintains an efficient and streamlined regulatory framework by making appropriate use of standards created by independent, third-party standard-setting organizations such as the CSA Group, the American Society of Mechanical Engineers, the International Commission on Radiological Protection and the Institute of Electrical and Electronics Engineers. Together with regulatory documents, standards provide additional clarity to licensees and applicants by explaining how to meet the requirements set out in the *Nuclear Safety Control Act* and the regulations made under it. CSA standards are complement regulatory documents that are developed by CNSC staff. The public can have free view-access to all published CSA Group nuclear related standards following the

				instructions listed on this webpage.
11	Northwatch	3	**Feedback** The industry appears to suggesting that REGDOC-3.6 overrides the Nuclear Safety Control Act; this is in error. The industry is also pursuing their theme of nuclear waste being a commodity that is "handed off" among corporate entities as commercial transactions. This is inconsistent with the Radioactive Waste Policy Framework, and while we appreciate that the industry group may be becoming increasingly dominated by non-Canadian corporations and nuclear executives whose professional experience has largely been outside of Canada, they would do well to accept that the Canadian systems are different than those in the U.S., where we understand that the generation and management of radioactive wastes is largely a private sector for-profit enterprise. Perhaps it is just poor communication, but the industry commentary really does make some exceptional statements; for example: "As currently written, the background section potentially limits the ability for the waste to decay to safe levels ..." **Recommendation** The REGDOC and any future regulations should be consistent with the Canadian policy of waste producers and owners being responsible for the wastes they have generated. The CNSC should not engage with industry in developing an American style system of radioactive waste wheeling and dealing (as Northwatch and others have expressed in the past, the tracking of waste transfers needs to become more rigourous and more transparent).	As a result of this comment, the document was revised for clarity and precision: the text in section 2.0 was changed to align with the *Radioactive Waste Policy Framework.* If industry were to suggest that REGDOC-3.6, *Glossary of CNSC Terminology* overrides the NSCA, it would be an error.
12	Northwatch	4	**Feedback** We find the industry arguments against inclusion of the requirement to "avoid imposing undue burden on future generations" unconvincing and even disingenuous. On the one hand they are arguing against a statement they characterize as "policy" and on the other they are arguing that it not be included because it is not included in the three bullets that constituted the Radioactive Waste Policy Framework. Meanwhile, this is a phrase that is pervasive throughout international discussions of radioactive waste management, and appears in the documents produced by the nuclear industry in Canada. Our own discomfort with the phrase is the permissiveness of avoiding "undue" burdens, as if to say that a certain undefined level of burden is the rightful due of future generations. **Recommendation** Rather than imposing even a "due" burden on future generations, the regulatory regime – delivered through regulation or a REGDOC – require the highest standard of care and maximize isolation of radioactive wastes from the environment. For example, it must include clear	As a result of this comment, the document was revised for clarity and precision: the terminology such as "undue burden" was removed. This REGDOC includes requirements and guidance for waste management facilities. CNSCs expectations for the safety case of radioactive waste management facilities are provided in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2.* Furthermore, REGDOC-2.11 provides principles the CNSC considers when making regulatory decisions about the management of radioactive waste.

			method by which performance standards for each waste management system (and system component) will be established and for which time frame, and the means by which those performance standards and their achievement by the waste management system is to be evaluated / verified. The performance standard must be one of full isolation of radioactive wastes from the environment, with the system evolution designed to allow improvements over time and replacements over time. This will require retrievability of the wastes, and ability to conduct detailed monitoring to verify performance and detect failures or degradation in the system.	
13	Northwatch	4	**Feedback** The industry comments present the notion that the purpose is “to Demonstrate to the public that waste is being safely managed in a manner commensurate with the potential hazard of the waste”. We would argue that the purpose is less “demonstration to the public” than it is the isolation of radioactive wastes from the environment. Further, we are troubled by industry’s repeated assertion that improved performance is not to be pursued in conditions the industry deems to be “low risk”. **Recommendation** The resulting systems and approaches to the management of radioactive wastes must incorporate continuous improvements, seeking to move from “low risk” to “very low risk” and so on’ if the risk is low, bring it lower. A “graded approach” that results in a less-than optimum management condition is not acceptable.	Comment noted. The safety significance of continuous improvement is important and is captured as a unique specific area under the Management System SCA. With a graded approach, all requirements shall apply but to varying degrees depending upon the safety significance and complexity. This statement is now included in the document in Section 4.0.
14	Northwatch	5	**Feedback** The industry is again arguing that the REGDOC be limited by what is the CSA standard N286-12. This is inappropriate. **Recommendation** In an appendix, set out the relationship between any requirements in this REGDOC and other regulations, REGDOCs and/or other information pieces such as CSA standards.	No changes were made to the document as a result of this comment. See response to comment #30 in table B concerning non-CNSC requirements. See response to comment #10 in table C on the use of CSA standards. In the interest of regulatory clarity, CNSC regulatory documents do not repeat requirements contained elsewhere, such as CSA standards, if those requirements are sufficient to ensure the health and safety of Canadians and the environment are protected. As a result, the CNSC also ensures that CSA and REGDOC requirements and guidance are aligned.
15	Northwatch	6	**Feedback** In their comments, the industry argues against the draft REGDOC statement that “Due to its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near surface repositories”, stating that “The 4th bullet is a potentially misleading or biasing statement. There are current plans to place ILW in aboveground mounds.” This is a significant statement. WHERE	As a result of this comment, the text on types of disposal facilities was removed. It is CNSC expectation that the type of facility be based on the project-specific safety case.

			are there plans to place ILW in above ground mounds? Where? In Canada? Perhaps in Chalk River, in the so-called "Near Surface Disposal Facility" as proposed by Canadian Nuclear Laboratories to contain only LLW, then amended to include ILW, the amended to be only LLW. Is it now to include intermediate level waste? We would further note that "plans" to include ILW in a surface mound is not in itself a refuting of the statement that "ILW generally requires a higher level of containment and isolation than can be provided in near surface repositories". In addition, internationally a reference to "near surface" facilities generally are references to near sub surface facilities, not "mounds" which are on-surface. Industry notes that "The current wording does not provide sufficient guidance as to the range of factors that should be considered when determining containment and isolation requirements, which may lead to inappropriate requirements." The larger issue (larger than inappropriate requirements) is inadequate containment. **Recommendation** The REGDOC should avoid relying on terms such as "geological repositories" or "near surface facilities" as they are inconsistently applied and do not in and of themselves convey any information about the level of isolation or containment that would be provided, as these are design and site specific.	
16	Northwatch	6.2	**Feedback** In response to the industry question "At what stage(s) of the full life cycle waste management process is documented waste characterization applicable?" we would propose that a full characterization be undertaken at the time of generation or shortly thereafter, and prior to each change in management condition, i.e. at discharge to the irradiated fuel bay, from the irradicated fuel bay to dry cask, from dry cask to hardened on-site storage, etc. unless these are very short intervals of time. **Recommendation** We agree with industry that there should be a consistent approach taken to waste characterization, but have a somewhat different remedy than that suggested by industry. The REGDOC requirement should be edited to read "Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste material.", removing the "as applicable" qualifier, which – as industry pointed out – could lead to inconsistencies. In addition, in this or a companion document specific methodologies should be set out for determining material and methods for shielding and containment of various wastes.	As a result of this comment, the document was revised for clarity and precision: the characterization section was changed to: "The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The licensee shall maintain detailed records of the relevant characteristics of the waste based on the characterization performed." Further details on when waste characterization shall and should be performed and waste containment can be found in CSA N292.0.
17	Northwatch	7.5	**Feedback** Industry's comment is that "the section on storage needs to be clarified. The requirement to differentiate 'staging' versus 'storing' should be broadened. As an example, for Routine LLW and ILW, a licensee can hold or stage the waste pending out-of-facility shipment" but their meaning is not clear. The section on storage (7.5) makes no reference to "staging", so the requirement they are proposed be broadened is	See response to comment #75 in table B.

			unknown. We could surmise that this is part of their overall theme of trade and traffic in radioactive wastes, and that the "staging" is referring to storage prior to off-site transfer, but that would be purely speculation on our part. The only context in which we are familiar with the term "staging" in relation to radioactive waste is in the case of large radiological release as part of the emergency response, but we are not speculating that is the context the industry is wishing to draw attention to in this document. **Recommendation** The current wording in the draft REGDOC "The licensee shall store radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements" is more consistent with the Radioactive Waste Policy Framework than changed wording proposed by industry to "The licensee shall store, or make arrangements for the storage of, radioactive waste".	
18	Northwatch	7.6	**Feedback** The industry is proposing an amendment to Section 7.6 to read, "The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements at the time of the licence application", seemingly attempting to freeze legal requirements in time and avoid having to meet emerging regulatory requirements. This is particularly problematic given past experience of the industry's applying for licenses years prior to project commencement. This is even more the case when the reference is simply to "license" which could include a license to prepare the site prior to the facility design even being completed or the waste fully characterized (as is the case with OPG's proposed deep geological repository for low and intermediate level radioactive wastes). **Recommendation** Reject the industry's proposed amendment.	See response to comment #77 in table B.
19	Northwatch	9.1, 10.1, 10.2, 10.5	**Feedback** While industry characterizing it as a "As a matter of principle" that draft REGDOCs "should only reference other REGDOCs that are currently published and not out for review" we consider it to be a matter of practical importance. **Recommendation** As noted above, the development of this suite of REGDOCs must be done in an iterative and methodical fashion. A next draft of Volume I should be released for a second round of comment, either preceded or accompanied by a dispositionning by CNSC staff of comments received. The next draft should show marked improvement in structure and terminology to address the deficits of the first draft. Subsequent states of the review should be integrated with further review of the Framework and Volumes I, II and III.	Comment noted. Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version. See response to comment #4 in table C regarding dispositioning of comments and the path forward for the waste series of documents.
20	Northwatch	10.2	**Feedback**	As a result of this comment, the text on types of disposal facilities

			We agree with the industry observation that "As currently written, this section inappropriately suggests that only DGRs are an acceptable method of waste disposal." We disagree that inserting "near surface" and/or "intermediate depth disposal" would be a remedy. We also agree that "the phrase "long-term waste management" should be used instead of "disposal" where appropriate throughout the document" and would suggest that it would be appropriate in every instance. **Recommendation** The REGDOC should focus on containment and isolation of radioactive wastes, and the necessary precursors to that, including waste characterization, design and execution of containment, monitoring and measuring performance, and response and replacement based on performance assessment. The generic concepts of "geological repositories" or "disposal" do not contribute to assessing or achieving the actual requirements of long term management / isolation of radioactive wastes.	was removed. It is CNSC expectation that the type of facility be based on the project-specific safety case. See response to comment #101 in table B.
21	Northwatch	10.3	**Feedback** The industry comments on specific bullets to not appear to co-relate to the bullets in the text of the draft REGDOC. **Recommendation** As was the case in Northwatch's comments on Section 10 of the Draft REGDOC, our review of the industry submissions on this section will be incorporated into our comments on REGDOC-2.11.1, Waste Management, Volume III: Assessing the Long-term Safety of Radioactive Waste Management.	Comment noted.
22	Concerned Citizens of Renfrew County	General	CCRCA notes that it is not the role of the Canadian Nuclear Safety Commission (CNSC) to create. The *Radioactive Waste Policy Framework* states that "federal government has the responsibility to develop policy." The CNSC's role is to implement policy, and to regulate the nuclear industry so as to protect workers, the public and the environment. With regard to radioactive waste, this should include assessment of future impacts of radioactive waste on the health and safety of persons and the environment, so as to avoid imposing an undue burden on future generations. CCRCA feels that it is important to provide detailed feedback on the nuclear industry comments, because most of them would weaken the REGDOC. As a civil society group concerned about health, the environment and future generations, we ask the CNSC to resist their incorporation in the REGDOC.	See response to comment #4 in table C. The full CNSC responses to nuclear industry comments is provided in the suite of disposition tables for the waste REGDOCs series.
23	Concerned Citizens of Renfrew County	1.1	The nuclear industry suggests adding "Requirements and guidance will vary depending on the level of radioactive waste being managed and the facility type, such as storage and disposal facilities, using a graded approach commensurate with their relative risks." Requirements and guidance should not "vary" for different facilities and waste types. While recognizing that waste storage and disposal are different activities, there should be an overarching requirement to contain and isolate nuclear wastes, so as to protect human health and the environment from the effects of ionizing radiation and other toxic hazards. Our group recommends that a statement to this effect be included in section 1.1. Further, we do not support inclusion of a reference to "graded	See response to comment #25 in table B. A new section was included on the graded approach. See response to comment #10 in table C on the use of CSA standards. The principles outlined in REGDOC 2.11 apply to all facilities and all activities related to waste management.

			approach" in the purpose statement, noting that REGDOC-3.5.3, *Regulatory Fundamentals*, uses this phrase in the context of enforcement action, rather than in a more general sense. We are concerned that the second bullet in Section 1.1 delegates the development of standards to the nuclear industry via the CSA Group. Standards should not be developed by industry, but should be developed and approved by the nuclear regulator, as in other OECD countries.	
24	Concerned Citizens of Renfrew County	1.2	The nuclear industry suggests amending the first sentence to read "The requirements and guidance in this document pertain to CNSC-licensed facilities and activities that are required to have a waste management program." The nuclear industry justifies this by stating that "Section 24 of the NSCA, says activities are licensed, not facilities." In our view this is a misreading of the *Nuclear Safety and Control Act*. CNSC does license facilities. Waste management requirements must apply to facilities as well as activities. The current wording should be retained.	See response to comment #27 in table B.
25	Concerned Citizens of Renfrew County	2	The first paragraph of Section 2 begins "Under Canada's Radioactive Waste Policy Framework [4], waste owners are required to ensure the safe and secure management of radioactive waste and to make arrangements for its long-term management." The nuclear industry suggests adding another sentence to differentiate between a 'waste generator' and a 'waste owner.' The *Radioactive Waste Policy Framework* does not create distinct responsibilities for waste generators and waste owners, and does not provide for transfer of waste "ownership" responsibilities. The *Framework* says that both producers and owners are responsible for "management and operation of disposal and other facilities required for their wastes." More fundamentally, CNSC does not set policy for the management of radioactive waste. Policy setting is the responsibility of the Government of Canada. The CNSC implements policy. The heading and first paragraph of this section should accurately reflect the federal government's role, and not attempt to recast or duplicate it.	As a result of this comment, the document was revised for clarity and precision: the text in section 2.0 was changed to align with the *Radioactive Waste Policy Framework*.
26	Concerned Citizens of Renfrew County	3	In the second paragraph of section 3, the nuclear industry suggests deleting the entire first sentence ("All nuclear substances associated with licensed activities will eventually become radioactive waste."), noting that "some substances may simply decay away to the point the waste is no longer radioactive waste." Deleting the word "radioactive" from the sentence to read "All nuclear substances associated with licensed activities will eventually become ~~radioactive~~ waste" would address this, while retaining an important point.	As a result of this comment, the document was revised for clarity and precision: the paragraph was changed to: "The safe management of radioactive waste is considered during all steps of its management and may involve several licensees."
27	Concerned Citizens of Renfrew County	4	The nuclear industry proposes to delete the phrase "avoid imposing an undue burden on future generations." The nuclear industry says that this requirement "is not part of the federal policy on radioactive waste management." However, not imposing an undue burden on future generations is broader federal policy, enshrined in the government's sustainable development strategy. It defines sustainable development as not "compromising the ability of future generations to meet their own needs." This requirement is central to responsible management of radioactive waste. It is troubling that	As a result of this comment, the document was revised for clarity and precision: the terminology such as "undue burden" was removed. The bullet in section 4 on documentation was changed to: • develop, document and implement programs, procedures and instructions to ensure the safety of waste management activities for which they are responsible, commensurate with the scale of the

			the nuclear industry, including the Nuclear Waste Management Organization, seeks to be exempted from this requirement. The nuclear industry wishes to change the phrase "develop and implement the documentation (programs, procedures, instructions, etc.) required to ensure the safety of all waste management activities" so as to "not place the emphasis on the documentation." Documentation is clearly of critical importance in long-term radioactive waste management. The nuclear industry's rationale for its proposed change is unconvincing and it should be rejected.	licensed activity and the inventory
28	Concerned Citizens of Renfrew County	5	The nuclear industry suggests deleting three bullets that it claims are covered by CSA Group standards referenced in Licence Conditions Handbooks. Specifically, it wants to delete language requiring that a "waste management program shall identify the waste management activities undertaken… [and] clearly state requirements, criteria and objectives to be met, and safety standards to be used." Omitting this information from a waste management program would create a lack of transparency and would disadvantage the public.	As a result of this comment, the document was revised for clarity and precision: the waste management program requirements were changed to: • identify the waste management activities to be undertaken • clearly state requirements, criteria and objectives to be met, and safety standards to be used • establish an organizational structure that specifies the roles and responsibilities for all positions with respect to the safe management of radioactive waste • identify the management system elements that ensure the effectiveness of the waste management program • encompass all waste streams associated with or potentially contaminated by nuclear substances • consider the waste hierarchy • require records of the waste inventory under control and maintain those records
29	Concerned Citizens of Renfrew County	6.1	The nuclear industry proposes to weaken the following requirement by adding "Where appropriate": "The licensee shall implement a radioactive waste classification system. [Where appropriate,] The classification system shall be based on the specific safety case and safety assessment required for the waste management facility or activity." Waste classification has been the source of much confusion and controversy with regard to recent proposed disposal facilities for the federal government's radioactive wastes. Classifying radioactive waste and managing different classes of radioactive waste are matters of great public interest. These matters should be addressed by federal radioactive waste policies. The Government of Canada should flesh out policies that can be reflected in regulations under the *Nuclear Safety and Control Act* and in REGDOCs prepared by the CNSC. For the regulator to attempt to develop policies for these matters independent of the Government of Canada is inappropriate. This creates an appearance that key aspects	As a result of this comment, the document was revised for clarity and precision: the requirements on classification was changed to: "The licensee shall implement a radioactive waste classification system. The classification system shall be based on the four general class of wastes and consider the site specific safety case and supporting safety assessment required for the waste management facility or activity." The waste classification outlined aligns with international guidance for waste classification. IAEA safety standard GSG-1 explains that the quantitative boundaries between the classes for different facilities

			of policy (such as waste classification) are being delegated to licensees, which would be highly inappropriate. Radioactive waste classification must not be facility-specific. A radioactive waste classification system should be developed that is applicable to all waste management facilities and activities. Section 6.1 has already been weakened by use of the word "generally" in five places. We suggest that all these occurrences of "generally" be removed. But the nuclear industry proposes to further weaken the language, e.g., with the following change in the fourth bullet related to intermediate-level waste (ILW): "Due to its long-lived radionuclides, ILW generally may requires a higher level of containment and isolation than can be provided in near surface repositories." The nuclear industry's rationale for this suggestion is that "There are current plans to place ILW in aboveground mounds." This would appear to refer to CNL's "Near Surface Disposal Facility" (NSDF) proposal. This reference to plans to place intermediate-level waste in aboveground mounds (such as the NSDF) illustrates the confusion and controversy generated by radioactive waste classification. On October 27, 2017, CNL announced the decision to include only low-level radioactive waste in the NSDF. The Canadian Environmental Assessment Registry for the NSDF project includes a public notice to this effect. On the other hand, we agree with the nuclear industry that worker handling considerations (a 2 mSv/hr contact dose limit) could be included in the definition of ILW (in addition to a reference to long-lived radionuclides). We also suggest including the following information from the ILW definition in the *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2018 Edition*: • Intermediate level waste may contain long lived radionuclides, in particular, alpha emitting radionuclides that will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. • Waste in this class may therefore require disposal at greater (intermediate) depths, of the order of tens of metres to a few hundred metres or more. The issues of waste classification and definitions of waste types require further work and clarification before this REGDOC can be finalized. The Government of Canada, which has the responsibility to develop policy under the *Radioactive Waste Policy Framework*, should provide guidance on this matter.	may differ in accordance with scenarios, geological, and technical parameters and other parameters that are relevant to the site specific safety assessment. The text on types of disposal facilities was removed. It is CNSC expectation that the type of facility be based on the project-specific safety case. Remaining text was not changed to ensure alignment with CSA N292.0-19.
30	Concerned Citizens of Renfrew County	6.2	The nuclear industry suggests amending the statement that "The licensee shall perform waste characterization at the various steps in the management of radioactive waste" by changing "various" to "appropriate". Further, after the statement "Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste material, as applicable," the nuclear industry suggests deleting the sentence "The licensee must justify to the CNSC the aspects that do not apply."	As a result of this comment, the document was revised for clarity and precision: the characterization section was changed to: "The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The

			If a licensee feels there are aspects of waste characterization that "do not apply", it should justify this to the CNSC. Radioactive waste characterization and retention of records are of vital importance owing to hazards associated with the various steps in waste management. For example, transport of radioactive waste is a key management step. Inadequate waste characterization prior to transport can create both short-term transport accident risks and long-term risks associated with subsequent storage and disposal. The nuclear industry provides no justification for its suggestion to delete "detailed" from the sentence "The licensee shall maintain detailed records of the characterization performed." Indeed, CNSC should prioritize the development of requirements for detailing waste characterization records.	licensee shall maintain detailed records of the relevant characteristics of the waste based on the characterization performed." Further details on when waste characterization shall and should be performed and waste containment can be found in CSA N292.0-19.
31	Concerned Citizens of Renfrew County	6.3	The nuclear industry suggests that Section 6.3 be deleted and its contents moved to sections 9 (on waste storage) and 10 (on waste disposal), arguing that waste acceptance criteria are "only applicable to Waste Storage Facilities, or Waste Disposal Facilities." This suggestion should be rejected. Waste acceptance criteria are applicable to other steps in waste management, notably processing and transport. This section states that "The licensee shall develop waste acceptance criteria, consistent with and derived from the safety case and safety assessment." It follows that a safety case and safety assessment for waste management activities should be finalized prior to the development of waste acceptance criteria. Further, the safety case and safety assessment should be made available for independent review and should be approved by the regulator. Waste acceptance criteria should be developed as a subsequent step. These should also be made available for review and approved by the regulator. This sequence of steps should be clarified in the REGDOC.	See response to comment #64 in table B.
32	Concerned Citizens of Renfrew County	7.1	The first sentence in the second paragraph ("The licensee shall, as far as practicable, minimize the generation of radioactive waste") is already weakened by the inclusion of the phrase "as far as practicable". The phrase "as far as practicable" is unnecessary and should be removed. The nuclear industry suggests weakening the following sentence as well ("The licensee shall consider the waste hierarchy in the management of radioactive waste…") by changing "shall" to "should" and by inserting "where practicable". The nuclear industry's suggestions to weaken this section should be rejected. We further suggest that the term "waste hierarchy" be clarified. Presumably this means that a licensee should consider the specific characteristics of different waste classes (i.e., low-, intermediate- and high-level) in making management decisions. This is clearly good practice. The nuclear industry fails to provide a clear justification for resisting this.	See responses to comments #70 and #71 in table B. The definition for 'waste hierarchy' will be added to REGDOC-3.6, *Glossary of CNSC Terminology*.
33	Concerned Citizens of Renfrew County	7.4	The content of this section is limited to a single sentence that reads "The licensee shall transport radioactive waste in accordance with the *Packaging and Transport of Nuclear Substances Regulations, 2015*." These *Regulations* lack any content specific to transport of radioactive waste. Radioactive waste can include a complex mixture of radionuclides with highly variable properties, and its transport is a controversial and potentially dangerous activity. This section should state that Part 2 of the *Transportation of Dangerous Goods Regulations* applies to transport of radioactive waste, including section 2.2, Responsibility for Classification. This section says	No changes were made to the document as a result of this comment. The document references the *Packaging and Transport of Nuclear Substances Regulations, 2015*, which include the appropriate references to the *Transportation of Dangerous Goods Regulations*.

			"Before allowing a carrier to take possession of dangerous goods for transport, the consignor must determine the classification of the dangerous goods in accordance with this Part." Section 2.2 says that for radioactive materials the consignor must use the "classification determined in accordance with the "*Packaging and Transport of Nuclear Substances Regulations*"." However, the *Packaging and Transport of Nuclear Substances Regulations* have no provisions specific to packaging, transport or classification of radioactive waste *per se*. This creates uncertainty as to how radioactive wastes should be classified for transport. Improper classification of radioactive waste shipments could cause serious problems in the event of a transport accident. If shipments contain quantities of alpha and beta emitters, these may not trigger radiation alarms but would nonetheless create health risks to emergency responders inhaling radioactive dust or gases released in a fire. Absence of policy or regulations specific to radioactive waste transport is a serious matter that requires urgent attention from the Government of Canada. The issue of radioactive waste transport will require further work before this REGDOC can be finalized.	
34	Concerned Citizens of Renfrew County	7.6	This section states that "The licensee shall dispose of radioactive waste safely, in a manner that provides for the protection of people and the environment, and in accordance with regulatory requirements." However, given that there are no radioactive waste regulations under the NSCA, and limited federal policy specific to radioactive waste disposal, the issue of radioactive waste disposal needs further work before this REGDOC is finalized.	No changes were made to the document as a result of this comment. Sections 5 to 9, as well as section 11 of this document provide requirements and guidance for waste disposal. In addition, the CNSC is currently developing the following regulatory documents: REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* and REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2*. These documents will include further requirements and guidance for radioactive waste disposal.
35	Concerned Citizens of Renfrew County	8	This section states that "The licensee shall engineer waste packages so that the radioactive waste is contained in accordance with applicable regulations…" As noted above, there are no regulations at present specific to packaging of radioactive waste to ensure containment. Further elaboration of the topic of waste packaging for waste transport, storage and disposal is needed. Requirements regarding the application of the *Packaging and Transport of Nuclear Substances Regulations* to radioactive waste should be included in the REGDOC.	No changes were made to the document as a result of this comment. Packaging for containment is covered in the *Packaging and Transport of Nuclear Substances Regulations, 2015*. This regulatory document is complimented by CSA N292.0-19 that contains further requirements on waste packaging.
36	Concerned Citizens of Renfrew County	9.3	This section states that "The licensee shall design the storage facility to fulfill the fundamental applicable safety functions during normal operation, anticipated operational occurrences, design basis accidents and design extension conditions…" The nuclear industry suggests modifying this sentence so that it does not apply to existing facilities (by adding the word "new" before "storage facility") and by deleting language after "safety function" (including references to "design basis accidents" and "design extension conditions"). These suggestions would greatly weaken this section and should be rejected. Design of radioactive waste storage facilities, including for high-level waste irradiated fuel, is a major public concern.	See response to comment #86 in table B. Further requirements and guidance on the development of safety assessment including scenarios are included in REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2*.

			Accidents in these facilities have could have widespread and serious public health impacts. Further elaboration of the topic of accidents in both radioactive waste storage and disposal facilities is needed.	
37	Concerned Citizens of Renfrew County	9.5	With regard to maintaining, testing and inspecting a waste management storage facility, the nuclear industry suggests deleting the following: "at a frequency that ensures that the reliability of the equipment remains high and that the effectiveness of the systems remain in accordance with the design intent for the facility." This proposed deletion is not justified, and this language should be retained.	As a result of this comment, the document was revised for clarity and precision: the sentence was changed to: "The licensee shall maintain, test and inspect the facility in accordance with the design intent for the facility."
38	Concerned Citizens of Renfrew County	10	The nuclear industry suggests "adding wording to clearly enable a graded approach to be applied based on waste type." We do not support a reference to "graded approach". REGDOC-3.5.3, *Regulatory Fundamentals*, uses this phrase in the context of enforcement action, rather than in a more general sense.	As a result of this comment, the document was revised for clarity and precision: a new section was added on the graded approach. This section stipulates that with the application of a graded approach all requirements shall apply but to varying degrees depending upon the safety significance and complexity.
39	Concerned Citizens of Renfrew County	10.2	The nuclear industry does not provide a clear rationale for its suggestion to remove the second paragraph in this section related to deep geological repositories. This suggestion should be rejected. We also recommend that this section be generalized to address siting of geological repositories for management of low- and intermediate-level waste, given that the term "deep" may not apply to them. More generally, this section should address siting of all types of disposal facilities, including near surface disposal facilities.	No changes were made to the document as a result of this comment. The second paragraph of Section 10.2 is intended to point DGR applicants to REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* for site characterization, not to suggest that a DGR is the only appropriate disposal facility option. This paragraph was not removed from the document.
40	Concerned Citizens of Renfrew County	10.3	While this section states that "The licensee shall design the disposal facility to facilitate the inspection, monitoring, testing, and maintenance of the facility and the host environment, as applicable," it does not address waste retrieval in the event that monitoring indicates a loss of containment. Given the problems experienced with waste disposal facilities in other countries, this topic should be addressed. This comment also applies to section 10.7, "Monitoring and surveillance of a waste management disposal facility."	Comment noted. The legal requirement for retrievability of radioactive waste is beyond the means of this REGDOC.
41	Concerned Citizens of Renfrew County	10.7	In this section the nuclear industry suggests changing the wording "revocation of the licence" to "removal from CNSC licensing". We suggest including a reference to "application for a licence to abandon" for consistency with section 26 of the *Nuclear Safety and Control Act*.	See response to comment #109 in table B.
42	Concerned Citizens of Renfrew County	10.8	The nuclear industry does not provide an adequate justification for its suggestion to remove the note on "active controls". This suggestion should be rejected.	See response to comment #112 in Table B.

Table D: workshop with industry and civil society organizations / Tableau D: Atelier avec l'industrie et avec des organisations de société civile

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	General	Industry appreciates the CNSC's efforts to revise the previous draft and clarify the application of the REGDOC to licensees who manage, store and/or dispose of radioactive waste. The revisions better define the types of radioactive waste to which the REGDOC applies. However, there remain several items which licensees believe require additional revisions or clarifications before this draft is presented to the Commission for approval and publication. Of particular concern, while the Waste Management REGDOCs (2.11.1 Volumes I, III) and Decommissioning document (REGDOC-2.11.2) are clearly interdependent, the sequence of their public review and eventual publication appear to be independent, or phased. This lack of synchronization posed a significant challenge for reviewers who were asked to comment on documents knowing other interdependent REGDOCs were still in draft form. Draft guidance is subject to change, which makes the path to compliance unclear. Given this, industry encourages CNSC staff to consider the suggested amendments in the table below and to present a complete package of interdependent REGDOCs to the Commission at the same time. That way, licensees can be assured only issued versions will be referenced in published REGDOCs.	The following drafts regulatory documents will all be presented to the Commission together as one package: • REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* • REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* • REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2 • REGDOC-2.11.2, *Decommissioning* • REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* Only published documents will be referenced in the published versions of the five REGDOCs. If approved by the Commission, the five REGDOCs will be published at the same time.
2.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB	1.2	The Scope should clearly describe the relationship between the REGDOC, which defines requirements, and CSA standards which offer guidance and best practices to help licensees' meet those requirements. **Suggested change:** Amend and simplify the 2nd paragraph to read, "This document is complemented by other CNSC regulatory documents and the requirements and guidance in CSA N292.0, General Principles for the Management of Radioactive Waste and Irradiated Fuel [1], which offers guidance and best practices to meet the requirements in this REGDOC." Together, this regulatory document and CSA N292.0 provide requirements and guidance for the management of radioactive	The text was revised to : "This document is complemented by the requirements and guidance in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* [1]. Together, this regulatory document and CSA N292.0 provide requirements and guidance for the management of radioactive waste. Furthermore, this regulatory document is complemented by other CNSC regulatory documents."

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Power, NWMO, OPG, Orano		waste. Furthermore, this regulatory document is complemented by other CNSC regulatory documents.	
3.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	2	**MAJOR** Licensees appreciate the CNSC's effort to align Section 2 with NRCan's Radioactive Waste Policy Framework, but believe additional edits are needed to ensure readers have a complete, contextual understanding of the framework. The current wording omits key elements of the policy and implies that waste producers operate a waste storage and/or disposal facility. Also, industry believes a brief clarifier would ensure readers truly understand the obligations of waste producers and owners. **Suggested change:** Amend Section 2 to read, "Under Canada's Radioactive Waste Policy Framework [2], waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the funding, organization, management and operation of disposal and other facilities required for their wastes. The policy recognizes that arrangements may be different for nuclear fuel waste, low-level radioactive waste and uranium mine and mill tailings. REGDOC-2.11, Framework for Radioactive Waste Management and Decommissioning in Canada [3], describes the national framework and the philosophy underlying the CNSC's approach to regulating the management of radioactive waste. This includes waste generated by another licensee and transferred under a commercial agreement to a waste owner to process, store and dispose." **Impact on industry:** Without these clarifiers, the document could require small waste producers to meet the same requirements as larger producers with established waste programs. Also, as issues related to waste management draw increased political and public scrutiny, it's imperative that all readers of this REGDOC understand the relationship between waste producers and owners and their commercial agreements. Plain language helps reduce misunderstandings, which is important for companies that	REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* outlines the radioactive waste policy in Canada. As a result of this comment, the section was revised as follows: Section 2 "The CNSC's waste management framework" REGDOC-2.11, Framework for Radioactive Waste Management and Decommissioning in Canada [3], describes the national framework and the philosophy underlying the CNSC's approach to regulating the management of radioactive waste. In addition to this regulatory document, the CNSC's regulatory framework for waste management includes…"

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			contract other companies for waste management.	
4.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	2.1	**MAJOR** As per the initial comment, bullets 1, 4, 5 and 6 cite draft documents. It is confusing to suggest that licensees comply with REGDOCs that are still in draft form and potentially subject to change. As an example, since REGDOC-2.11.1, Waste Management, Volume III is still in draft form, industry's previous comments regarding which types of radioactive waste management facilities require safety analyses remains unclear. **Suggested change:** References to draft REGDOCs should be removed. REGDOCs should only be cross-referenced in interdependent documents after they have been presented to the Commission and approved for publication. **Impact on industry:** Draft guidance is subject to change. The path to (e.g., timing of) compliance is therefore unclear.	See response to comment #1 in Table D.
5.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	5	**MAJOR** Similarly, industry has concerns with: • The 3rd bullet, which reads, "take into account interdependencies among all steps in radioactive waste management; each step shall be evaluated as an individual step in the process and as part of an integrated radioactive waste management system" • The clarity of the 4th bullet. **Suggested change:** As currently written, the 3rd bullet would require a fully-integrated waste management system in which the waste is generated, managed and disposed of by the same licensee. Also, for clarity, the 4th bullet should read, "produce and~~/or~~ maintain records for each of the steps in the management of radioactive waste for which they are responsible" **Impact on industry:**	The wording of the third bullet aligns with CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, other than the "should" was changed to "shall". To address the concern, the word "appropriately" has been added to the third bullet to align with IAEA GSR-5, *Predisposal Management of Radioactive Waste* to read: "take into account interdependencies among all steps in radioactive waste management, as appropriate; each step shall be evaluated as an individual step in the process and as part of an integrated radioactive waste management system." No change made for the fourth bullet. Not all licensees will have to both produce AND maintain records.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			Unless amended, it will be difficult for smaller waste producers to demonstrate how they are accounting for waste interdependencies.	
6.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	6	**MAJOR** Again, licensees feel it's important that readers fully understand that commercial agreements can be used to ensure a waste management program is implemented and maintained. **Suggested change:** Amend the 1st bullet on page 3 to read, "- identify the ~~waste~~ management activities to be undertaken by waste producers and owners " **Impact on industry:** As issues related to waste management draw increased political and public scrutiny, it's imperative that all readers of this REGDOC understand the relationship between waste producers and owners and their commercial agreements. Plain language helps reduce misunderstandings.	No change made to remove the word "waste", as that would change the meaning of the sentence. No change made to add "by waste producers and owners" as it is up to the licensee to determine what activities are carried out by the producer versus the owner. The waste program document shall list the activities to be conducted; the licensee may then add additional information on the roles and responsibilities to conduct those activities.
7.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	6	The REGDOC should clearly differentiate between ongoing management and handling of waste storage versus disposal. For example, in section 6: 1) The use of the word "all" in the 3rd bullet is a potential trap for future audits and inspections. The focus should be on key roles related to the process, not defining all roles within an organization. 2) The use of the word "potentially" in the 5th bullet is too open-ended to be implemented reasonably. It may create variations in interpretation and application among licensees. Monitoring programs are well-established and documented and "potentially contaminated" waste is addressed elsewhere. **Suggested change:** Amend the 3rd bullet to read: 1) "establish an organizational structure that specifies the roles and responsibilities for ~~all~~ positions with respect to the safe management of radioactive waste" Amend the 5th bullet to read,	1) Change made to remove the word "all". CNSC staff agree that the addition of the word "all" was superfluous, as the positions for which roles and responsibilities shall be documented is qualified at the end of the clause. 2) Change made to remove the word "potentially". CNSC staff agree that the addition of the word "potentially" was open-ended.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			2) "encompass all waste streams associated with or ~~potentially~~ contaminated by nuclear substances	
8.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.1	**MAJOR** Licensees continue to have concerns with this section. The waste classifications as listed are similar, but not identical, to the waste classifications used by at least one licensee (OPG) in that they appear to be independent of dose rate provided they are above exemption limits. The classification is defined by the life of the radionuclides contained in the material. In addition: 1) The 2nd sub-bullet (VSLLW) appears to contradict itself. Why is a nominal 100 day half-life provided? 2) The last sentence of the 2nd main bullet is commentary and inconsistent with the contents of the section, which aim to describe/characterize the categories. The sentence should be removed. **Suggested change:** The CNSC is urged to: 1) Remove the last sentence in the 2nd sub-bullet related to VSLLW, or change the listed half-life to align with the broader category of "decay within several years." This is consistent with the CNSC Glossary and IAEA definitions. 2) Amend the 2nd main bullet to read, "Intermediate-level radioactive waste (ILW) generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years. ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal. ~~Due to its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near surface repositories~~." **Impact on industry:** As the REGDOC nears the end of its development stage, most readers should have very few questions about the intended meaning or purpose of passages. This is	To align with CSA and IAEA, dose rates are no longer used to define the classes of radioactive waste. Licensees can however use dose rates in their own programs that will be reviewed and approved by the CNSC. 1)The sentence has been revised to align with the IAEA. The sentence now reads: "In general, the management option of storage for decay for VSLLW should only apply to radionuclides with a half-life of 100 days or less." 2)The wording aligns with IAEA GSG-1, no change made.

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			particularly true of readers/practitioners with expertise in waste management. If phrases or classifications are not immediately clear, the CNSC is urged to delete or rephrase them to avoid confusion and compliance issues. Otherwise, additional analysis may be required to determine if this REGDOC will require re-classification of any waste streams by some licensees. Also: 1) Setting 100 days as a nominal half-life in the 2nd sub-bullet excludes the possibility of broadening the application of this category based on research, innovations and future waste treatment options. 2) Including the commentary in the 2nd main bullet limits the potential for evaluating long-term disposal options based on their merit and safety analysis.	
9.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.3	**MAJOR** The document needs to clearly distinguish between safety analysis used for waste management and a safety case that is only applicable to disposal facilities. **Suggested change:** Amend the 1st paragraph to read, "A licensee that receives waste shall develop waste acceptance criteria consistent with, and derived from, the site-specific safety analysis ~~case~~." **Impact on industry:** Failure to distinguish between safety case and safety analysis could result in misunderstanding in expectations by licence holders and members of the public.	No change made, the use of safety case in this clause is appropriate. See the definitions of safety case and safety assessment in draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2 and REGDOC-3.6, *Glossary of CNSC terminology*; which is aligned with CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* and GSR Part 5, *Predisposal Management of Radioactive Waste*.
10.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU	8.3	**MAJOR** Licensees continue to have concerns with the following items in this section: 1) The 3rd paragraph has inappropriately gone from guidance to a requirement that now says, "The licensee shall segregate sealed sources from other wastes…" This was properly a "should" statement in the previous version. Now, it is inconsistent with REGDOC 2.12.3, Security of Nuclear Substances.	1)The wording of the clause was amended to "should" instead of "shall" to align with the IAEA. The 1st sentence in the 3rd paragraph was additionally modified to remove "because of the different regulatory requirements that apply." The clause now reads: "The licensee should segregate sealed sources from other wastes. The licensee

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	Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano		2) Additional clarity is required for the 2nd sentence of the 2nd paragraph. 3) The 1st sentence of the 4th paragraph prevents waste that meets waste-acceptance criteria from being placed in that facility. **Suggested change:** The CNSC is urged to: 1) Amend the 3rd paragraph to read, "The licensee should ~~shall~~ segregate sealed sources …The licensee should keep spent or disused sealed sources in a shielded container during handling." Licensees are subject to REGDOC 2.12.3, which discusses the handling and storage of sealed sources, but does not specifically mention the need to segregate sealed sources from other wastes 2) Amend the 2nd paragraph to read, "The licensee should consider early processing of waste to convert it to a passively safe form or to otherwise stabilize it while being in compliance with any WAC disposal requirements." 3) Amend the 1st sentence of the 4th paragraph to read, "The licensee shall not subject spent or disused sealed sources ~~for storage~~ to compaction, shredding or incineration in order to ensure their integrity." **Impact on industry:** As currently written, this draft: 1) Introduces a new requirement for the storage and handling of sealed sources with no clear rationale. 2) Does not recognize that by converting waste to a passively safe form or stabilizing it, it must be done in a manner that allows it to meet the WAC for subsequent disposal. 3) Prevents waste that meets waste-acceptance criteria from being placed in that facility	should keep spent or disused sealed sources in a shielded container during handling." 2)No change made. There may be situations where processing is in line with WAC for the storage facility, and additional processing will need to take place prior to disposal to be in line with WAC disposal criteria. See sections 7.3 and 9 for requirements and guidance regarding waste acceptance criteria. 3)No change made. This clause is applicable for both storage and disposal
11.	Bruce Power, BWXT, Cameco, CNA, CNL,	8.4	**MAJOR** If CNSC inspectors interpret the phrase "… onsite transfers (not on public roads) should meet an equivalent level of safety" as a defacto requirement, some licensees may unnecessarily alter the way they currently – and safely -- transport low and intermediate waste onsite. This could cascade into additional time and costs for	No change made. The clause remains as: "While not subject to those regulations, onsite transfers (not on public roads) should meet an equivalent level of safety."

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	CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano		licensees with commercial transport agreements. **Suggested change:** Amend the 2nd sentence to read, "While not subject to those regulations, onsite transfers (not on public roads) should meet an appropriate ~~equivalent~~ level of safety." **Impact on industry:** If taken as a defacto requirement – not guidance - this will increase the time it takes to transport waste and the cost associated with the preparation and packaging of the waste.	
12.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	8.5 and 8.6	**MAJOR** It is difficult to differentiate between "storage" versus "disposal" requirements. **Suggested change:** Recommend the clarification for long-term aspects are referenced with RD-2.11.1, Vol III. **Impact on industry:** The requirements are blurred between "storage" and "disposal."	The requirements in sections 8.5 (storage) and 8.6 (disposal) were reviewed and were aligned where appropriate. For alignment, the second requirement of section 8.5 is now also a requirement under section 8.
13.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners	8.5.1	**MAJOR** This section introduces a time limit on decay storage that requires additional clarity. **Suggested change:** Remove or modify the time limit. Otherwise, clarify the intent of this section. **Impact on industry:**	Section 8.5.1 was amended as requested and now only contains one clause as follows: "The licensee should segregate radioactive waste designated for decay storage from other waste, from the point of generation to its disposition."

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	Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano		There is no stated purpose for the proposed time limit on decay storage other than the reference in 7.1 for VSLLW and so applicability is limited. Is this intended to preclude the possibility of storing LLW until clearance or exemption limits have been reached? Can this be modified to allow release or clearance of any material that can be shown to meet those limits?	
14.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	11.2.2	Additional clarity is sought regarding the following bullets beneath the 4th paragraph: 1) In the 7th bullet, it is unclear how measurement of water in an SSC will contribute to safety. 2) The 8th bullet does not recognize that maintenance requirements for disposal facility SSCs will change over the licensing stages and into disposal for this type of facility. **Suggested change:** For clarity, the CNSC is urged to: 1) Remove the 7th bullet as this appears to be a specific requirement for one type of facility. Otherwise, modify it to read, "considers the presence of water in safety-significant SSCs prior to closure" 2) Amend the 8th bullet to read, "allows for maintenance activities of SSCs appropriate to the facility's lifecycle stage"	1)No change made to remain in alignment with N292.6, · *Long-Term Management of Radioactive Waste and Irradiated Fuel*. 2)The 8th bullet was amended to add additional context and to align with CSA N292.6 and now reads: "allows for maintenance activities of SSCs prior to closure".
15.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec,	11.3	Additional clarity is sought regarding the following: 1) The 1st sentence on page 11 should be amended slightly to align with wording in IAEA SSR5. 2) The 2nd sentence of the 4th paragraph should remove the term 'equipment' to be consistent with the 3rd paragraph in section 10.3. **Suggested change:** For clarity, the CNSC is urged to amend: 1) The 1st sentence on page 11 to read, "The licensee should avoid or limit unintended disturbances to the host environment during construction."	1)The clause was amended as recommended to provide additional clarity. 2)The clause was amended as recommended to provide additional clarity and terminology alignment within the document.

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	Kinetrics, NB Power, NWMO, OPG, Orano		2) The 2nd sentence of the 4th paragraph to read, “Commissioning shall demonstrate that the ~~equipment and~~ SSCs important to safety perform as expected in support of operations.”	
16.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	11.4, 4th par.	Additional clarity is sought regarding the following: 1) The 4th paragraph should be updated to be consistent with the comment in section 10.4. 2) The 5th paragraph should be updated due to changes in requirements over the lifecycle of the facility. **Suggested change:** For clarity, the CNSC is urged to amend: 1) The 4th paragraph to read, “The licensee shall maintain, test and inspect the facility ~~at a frequency that ensures that the reliability of equipment remains high and that the effectiveness of systems remains~~ in accordance with the design intent for the facility.” 2) The 5th paragraph to read, “The licensee shall establish an aging management plan to provide for the timely detection and mitigation of the aging effects, in order to ensure integrity and functional capacity of the SSCs appropriate to ~~throughout all stages of~~ the facility’s lifecycle stage.	1)The clause was amended as recommended to provide alignment between sections 10.4 and 11.4. 2)The clause was amended as recommended to provide additional clarity.
17.	Dr. Frank Greening		**Section *7.2 Waste Characterization*** *The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties of the waste, as applicable. The licensee shall maintain detailed records of the relevant characteristics of the waste based on the characterization performed.* As someone who has worked for over 30-years as a radioanalytical chemist, I can say with certainty: <u>*this license requirement is totally impractical*</u>. Now, it <u>*is*</u> possible to carry out radiochemical analyses of selected CANDU feeder pipes, pressure tubes or end-fittings, and determine radionuclide concentrations that	REGDOC-2.11.1, Volume I requires that licensees implement and maintain associated programs and procedures to support the waste management program (e.g., waste characterization). Characterization serves to provide information relevant to the step in waste management or the stage in the facility lifecycle. At various stages of a facility or step in waste management, characterization that is more elaborate may be required and requested by the CNSC. In addition to the requirements stipulated in this REGDOC,

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			are applicable to many similar components, but a lot of CANDU waste is stored in plastic bags full of assorted "garbage" such as mop heads, rags, protective clothing, smears, plastic gloves, etc, etc. I would like to ask the CNSC how it proposes one should determine tritium, carbon-14, Cl-36, Ni-63, Sr-90, Tc-99, I-129, Pu-239, etc, in such waste. A simple "gamma-scan" won't help because the radioactive species noted above are not gamma-active, and there are no instruments available that can non-destructively measure pure alpha or pure beta-active species *dispersed inside* large plastic bags. To do a proper job, one has to carry out a complete combustion of an entire garbage bag, collect the off-gases, and analyze these gases as well as the remaining ash for their radionuclide content. It is true that this can be done for a few bags of waste – at great expense, (e.g. ~ $1000 per bag) – but there are literally thousands of these bags *and they are all potentially quite different in chemical and radiochemical composition*. And besides, destructive analysis of radioactive waste defeats the purpose of its disposal. This has been a long-standing problem for CNL, OPG and Bruce Power, who have had to resort to highly uncertain "guesstimates" – frequently based on so-called *scaling factors* – to determine a waste facility's radioactive inventory. But it should be noted that the *calculation* of an activity does not constitute *waste characterization* as I would read the intended meaning of item 7.2 above. However, using scaling factors to estimate radionuclide inventories is unacceptable for other reasons. Thus, consider the data presented in Tables 1 & 2, below, which are based on *direct measurements* of smears collected on a variety of surfaces inside the vault of Bruce Unit 1 in 2008. **Table 1: Radionuclide Activities Measured on Surfaces in the Bruce Unit 1 Vault** <image001.png> **Table 2: Activity Ratios for Selected Radionuclides Listed in Table 1** <image002.png> The data in Table 2 show that many "difficult-to-measure" radionuclides such as tritium, C-14, Tc-99, Pu-239 and Am-241 exhibit highly variable activity ratios with respect to other easily analyzed, (i.e. gamma-active), species such as Co-60,	additional requirements and guidance on waste characterization are provided in CSA 292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, which complements this REGDOC. CSA N292.0 outlines characterization methodologies, such as radioactivity measurements, radiochemical analysis and scaling factors that, as applicable, CNSC staff verify as part of licence application reviews and compliance inspections. As outlined in CSA N292.0, re-characterization shall be performed for existing radioactive material(s) in storage, in transition to storage or disposal, and in support of decommissioning, if existing information and records are insufficient (e.g., as specified in the Waste Acceptance Criteria-WAC of the receiving facility). REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2 states that uncertainties that remain in the safety case and that have implications on safety should be addressed through uncertainty and sensitivity analyses. Licensees or applicants are required to describe the treatment of uncertainty in the safety case and supporting assessment. For example, the uncertainty in the case of OPG DGR was handled by scenarios where the expected inventory is multiplied by orders of magnitude. The CNSC expects that the waste characterization provide confidence that the waste inventory, which acts as the source term in the safety case, is bounding the actual waste that will be emplaced. As a result of this comment, the requirement on waste characterization was revised to:

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			and Cs-137. As a consequence, the scaling factor methodology of waste inventory determination for these radionuclides is subject to very large uncertainties and does not fulfill the requirements of Section 7.2 of REGDOC-2.11.1. – namely *to assess, (not assume!), the radiological properties of the waste*. To illustrate just how unreliable the scaling factor approach to waste characterization is, consider the radionuclide inventory data published by OPG for its Deep Geological Repository in Report No. 00216-REP-03902-00003: *Reference Low-and Intermediate-Level Waste Inventory for the DGR*, issued December 2010. This OPG report provides tables of different types of radioactive waste packages and their radionuclide inventories determined either by direct measurement, typically by gamma spectrometry, or by the use of scaling factors. Table 3, below, provides examples of these waste packages and the proportion that were subject to direct analysis – the balance being characterized using scaling factors. It can be seen that in most cases over 95 % of the package activities were determined indirectly using scaling factors. However, OPG candidly admits that "*the validity of this approach is uncertain, … and has not been confirmed*". **Table 3: Proportion of Waste Packages Analyzed Prior to Disposal in OPG's DGR** Type of Waste / Number of Packages / Number Analyzed / Percent Analyz Bottom Ash (New) / 632 / 3 / 0.5 Baghouse Ash (New) / 172 / 3 / 1.7 Compact Waste / 1,383 / 7 / 0.5	"The licensee shall perform waste characterization at appropriate steps in the management of radioactive waste. The characterization of radioactive waste shall include the principal radionuclides relevant to safety and assurance that the waste or waste package will meet the acceptance criteria for the appropriate steps in the management of radioactive waste. Waste characterization shall include assessing the physical, mechanical, chemical, biological, thermal and/or radiological properties, including dominant radionuclide content, of the waste, as applicable. The licensee shall maintain records of the relevant characteristics of the waste based on the characterization performed." In REGDOC-2.11.1, Volume III, the safety case disposal system description requirements has been revised to explicitly include the waste acceptance criteria of the waste disposal system. As outlined in CSA N292.0, the WAC must consider the radionuclide content and radiological properties. REGDOC-2.11.1, Volume III requires that the limits, controls and conditions derived from the safety assessment for the waste include the waste acceptance criteria for individual packages as well as for the entire facility, and the acceptable waste inventory and/or the allowable concentration levels of radionuclides in the waste.

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Box Compacted	6,135	25	0.4	
Non-Processible	22,591	85	0.4	
Non-Processible Drummed	7,840	100	1.3	
LL/ALW Resin	2,165	11	0.5	
ALW Sludge	1,709	4	0.2	
Moderator IX Resin	430	28	6.5	

But this brings us to another very important requirement of radioactive waste characterization – that of establishing *waste acceptance criteria* – an issue that is addressed in Section 7.3 of REGDOC-2.11.1. where we read:

7.3 Waste Acceptance Criteria

A licensee that receives waste shall develop waste acceptance criteria consistent with, and derived from, the site-specific safety case. The waste acceptance criteria shall specify the chemical, physical, radiological, mechanical, biological and other characteristics of the waste, waste forms, packages and unpackaged waste that will be accepted for handling, processing, storage, transport and/or disposal at the facility or location of the activity.

Clearly, the radiochemical content of a waste package should constitute the basis of its acceptance, (or rejection!), by an interim waste storage or permanent waste disposal facility. Certainly, the US approach to radioactive waste acceptance, as laid out in its regulatory document 10 CFR Part 61, is to set specific limits on the

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			concentration of selected radionuclides in a waste container. However, OPG notes in its Deep Geological Repository Report: *Reference Low-and Intermediate-Level Waste Inventory for the DGR*: *There is some uncertainty associated with gamma activity measurements of both boxed and drummed non-processible (NP) wastes. While gamma dose measurements are available for all packages, there are only a limited number of gamma spectroscopy measurements.* This reveals the unfortunate fact that the only "characterization" of many waste packages stored at OPG's WWMF – waste that is ultimately destined for permanent disposal in a DGR – is a single gamma dose rate measurement. Such a measurement provides *no information* on the radionuclide content of the package and therefore is of no use in deciding if a waste package meets waste acceptance criteria with regard to the presence of pure alpha or beta emitters. Before concluding this discussion, it is important to also note that CNSC Regulatory Guide G–320 entitled "*Assessing the Long-Term Safety of Radioactive Waste Management*", issued December 2006, identifies a number of requirements of a waste depository safety assessment, including: (i) Measured values of radionuclide inventories should be used, whenever possible, in safety assessments. (ii) Conservative calculations should be used to provide a margin of safety so that radioactive inventory predictions never underestimate the actual inventories or potential risks of a waste repository. (iii) All software and equations used in an assessment should conform to accepted quality assurance (QA) standards. This means the calibration, verification and validation of software should be carried out using procedures and protocols that may be reproduced by a third party. (iv) Validation and verification of software used to describe radioactive waste should ensure that the mathematical equations in the computer models simulate, with reasonable accuracy, the processes and conditions they are supposed to represent. (v) All adjustable parameters used in the mathematical equations of a model should be set to minimize the differences between the calculated and *measured*	

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			responses of a system. Because these items are *mandated* by the CNSC, they *must* be addressed in license applications for the construction and operation of radioactive waste repositories. However, a review of such documents leads to the following conclusions with regard to past "characterizations" reported for CANDU waste components such as pressure tubes: (i) In many instances, reported radionuclide inventories are *calculated* values. Furthermore, even when measures activities are available, calculated values of the inventories are used. (ii) Many radionuclide inventories reported by OPG have been significantly *underestimated* when compared to actual (measured) inventories. (iii) The calibration, verification and validation of software are *not* carried out in accordance with procedures and protocols that could be reproduced by a third party. (iv) Most calculated activities have *not* been checked for consistency with measured data. (v) When calculated activities have been checked, they generally prove to be significantly *lower* than measured data. Based on these five points alone, past Environmental Impact Statements for CANDU waste disposal facilities have been in non-compliance with the requirements of CNSC Regulatory Guide G–320. **Conclusions and Recommendations:** In this submission, Volume I of the CNSC's REGDOC-2.11.1 entitled *Management of Radioactive Waste*, has been reviewed and *two* items have been identified as requiring significant revision: (i) Section 7.2 on *Waste Characterization* and (ii) Section 7.3 on *Waste Acceptance Criteria*. Both items (i) and (ii) use the terminology "*radiological properties/characteristics of the waste*", but fail to provide a definition of this phrase which can unfortunately mean different things to different people. For example, to a health physicist it would probably mean the *type and intensity* of radiation – alpha, beta, gamma or neutron – emanating from a sample. On the other hand, to a radiochemist it would imply a sample's radionuclide content. Then there is the complication that a	

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			package may be subject to out-gassing with continuous release of tritium or $^{14}CO_2$, as has been observed with many packages at OPG's WWMF. The bottom line here is that the requirement of a waste disposal facility operator to "*characterize the radiological properties of its waste*" is too vague and allows the operator license to simply measure the gamma radiation intensity coming off each waste package and thereby consider it to have been "characterized". Under such an ill-defined protocol we are left with a totally inadequate waste acceptance criterion; namely, that a package only has to measure a radiation field of less than *x* mSv/hr to be "acceptable". This is simply not good enough since it provides no information on, or protection from pure alpha and/or beta activities in the package. It is therefore recommended that REGDOC-2.11.1 should be re-written to include a definition of what "waste characterization" means and also to include a license condition that a radioactive waste facility operator should submit a detailed waste acceptance criteria statement for approval by the CNSC before a license to operate that facility is issued.	
18.	Concerned Citizens of Renfrew County and Area		Q #1. Article 11(iv) of the IAEA's *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (to which Canada is a Party) requires that Canada have "due regard to internationally endorsed criteria and standards." The IAEA recently issued a report based on a peer review of Canada's nuclear safety framework in which peer reviewers experienced "difficulties to find exact wording when searching where and by what provision individual requirements of the IAEA Safety Standards are addressed." Has the CNSC made a systematic analysis of how the IAEA's requirements for safe radioactive waste storage in GSR Part 5, and requirements for safe disposal of radioactive waste in SSR-5, are addressed in the REGDOC? Can the CNSC share this analysis? If not, could the CNSC please explain how IAEA requirements were addressed in developing this REGDOC?	As part of the development of REGDOC-2.11.1 Volume I, CNSC staff conducted a thorough analysis of a number of IAEA standards, including: • GSR-5, *Predisposal Management of Radioactive Waste* • GSG-1, *Classification of Radioactive Waste* • SSG-40, *Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors* • SSG-41, *Predisposal Management from Nuclear Fuel Cycle Facilities* • WSG-6.1, *Storage of Radioactive Waste* • SSR-5, *Disposal of Radioactive Waste* • SSG-15, *Storage of Spent Fuel* • SSG-29, *Near Surface Disposal Facilities for Radioactive Waste* • SSG-31, *Monitoring and Surveillance of Radioactive Waste Disposal Facilities* • SSG-14, *Geological Disposal Facilities for Radioactive*

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				Waste CNSC staff assessed the requirements and guidance and mapped applicable clauses to the regulatory framework. The CNSC leveraged other regulatory documents and standards, such as CSA standard to maintain an efficient streamlined regulatory framework. As such, this REGDOC is complemented by other REGDOCs and CSA standards. Through the REGDOC analysis, it was determined that there were no gaps in the framework, however there were areas for improvement and clarity. These are included in this draft series of REGDOCs.
19.	Concerned Citizens of Renfrew County and Area		Q #2. Section 1.1 ("Purpose") of the March 2019 version stated that "The purpose of this document is to provide requirements and guidance… related to CSA Group standards applicable to radioactive waste management." This statement was removed from the February 2020 post-consultation version. Why was this statement removed? Who asked for it to be removed? For clarity and precision, does the CNSC consider CSA Nuclear Standards to be the definitive means by which it regulates the radioactive waste management activities of its licensees?	Based on comments received from public consultation, CNSC staff reviewed and revised the purpose and scope of the document. Following the incorporation of changes resulting from the public consultation, an editorial review was conducted to improve readability and clarity. Each of the three initial bullets from the public consultation version of the document are still covered in other sections of the current version of the document. CSA standards are part of the licensing basis for a licensee when they are referenced in a Licence or Licence Conditions Handbook. Once a CSA standard is included in the licence or LCH for a particular licensee, all applicable requirements in that CSA standard are enforceable by CNSC staff, similar to CNSC regulatory documents.
20.	Concerned Citizens of Renfrew County and		Q #3. In section 1.2, "Scope", why was the statement that licensees are "subject to the requirements" of the REGDOC removed? How does this affect how CNSC will apply the REGDOC?	Based on comments received from public consultation, CNSC staff reviewed and revised the purpose and scope of the document.

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	Area			That particular statement was removed for clarity and precision. A licensee is in fact not subject to the requirements of this REGDOC unless the document is referenced in their Licence or Licence Conditions Handbook.
21.	Concerned Citizens of Renfrew County and Area		Q #4. In section 1.2 on "Scope", the March 2019 version stated that "this regulatory document is complemented by other CNSC regulatory documents, such as REGDOC-3.2.1, *Public Information and Disclosure* [2], and REGDOC-3.2.2, *Aboriginal Engagement* [3]." Why was this statement deleted (and references to these two "complementary" REGDOCs removed from the References section)?	Based on comments received from public consultation, CNSC staff reviewed and revised the purpose and scope of the document. The particular statement was revised to: "Furthermore, this regulatory document is complemented by other CNSC regulatory documents." This REGDOC is complemented by all other applicable CNSC regulatory documents. To avoid potential confusion, examples were removed as the examples may not apply to all licensees.
22.	Concerned Citizens of Renfrew County and Area		Q #5. Section 1.3 ("Relevant Legislation") lists provisions of the *Nuclear Safety and Control Act* and the regulations made under it that "are relevant to" this document. The March 2019 REGDOC referenced all of section 26 of the *Nuclear Safety and Control Act*. The post-consultation version narrows the scope to sections 26(e) and (f) of the *Act*. Who asked for this change? How was it decided that other sections of section 26 of the *Nuclear Safety and Control Act* are not relevant to the REGDOC?	The application of the requirement for a licence under section 26 of the NSCA is not limited by this REGDOC. Based on comments received from public consultation, the current version of the document has been revised to include paragraph 24(5) and section 26 of the NSCA.
23.	Concerned Citizens of Renfrew County and Area		Q #6. Several other changes were made to section 1.3 on "Relevant Legislation". Did the CNSC carry out a systematic analysis to determine what legislation and regulations are relevant to the REGDOC? Can the CNSC share this analysis? Given that the REGDOC contains references to high-level waste and nuclear fuel, how was it determined that the *Nuclear Fuel Waste Act* is not relevant to the REGDOC?	Based on comments received from public consultation, CNSC staff reviewed and revised this section of the document. The reference to the *Nuclear Fuel Waste Act* was removed as the list of applicable pieces of legislation referenced was incomplete. All CNSC licensees are required to comply with all applicable acts and regulations, and those pieces of legislation take precedence over the CNSC's regulatory documents. In addition, no other legislation outside the NSCA and its regulations were referenced.

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				Reference to the *Nuclear Substances and Radiation Devices Regulations* was included for completeness.
24.	Concerned Citizens of Renfrew County and Area		Q #7. The title of section 2 ("The CNSC's Policy and Guiding Principles for the Management of Radioactive Waste") has not been changed from the March 2019 version. A reviewer suggested this title should be changed, noting that "It is not the role of the Canadian Nuclear Safety Commission (CNSC) to create policy. The *Radioactive Waste Policy Framework* states that "federal government has the responsibility to develop policy."" What is the CNSC's role in developing and implementing radioactive waste policy? Does the CNSC's "Policy for the Management of Radioactive Waste" fully reflect federal policy? If not, how does the CNSC's policy different from federal policy?	Natural Resources Canada is responsible for creating policy regarding the management of radioactive waste. The CNSC is responsible for creating a regulatory framework on the basis of policy, and enforcing that framework. REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* outlines the radioactive waste policy in Canada. As a result of this comment, the section was revised as follows: **Section 2 "The CNSC's waste management framework"** REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* [3], describes the national framework and the philosophy underlying the CNSC's approach to regulating the management of radioactive waste. In addition to this regulatory document, the CNSC's regulatory framework for waste management includes […]" REGDOC-2.11 supersedes the CNSC regulatory document P-290, *Managing Radioactive Waste*. REGDOC-2.11 provides the principles the CNSC considers when making regulatory decisions about the management of radioactive waste.
25.	Concerned Citizens of Renfrew County and Area		Q #8. Section 2 of the March 2019 version stated that "Under Canada's *Radioactive Waste Policy Framework*… waste owners are required to ensure the safe and secure management of radioactive waste and to make arrangements for its long-term management." This language was replaced by language stating that "Under Canada's *Radioactive Waste Policy Framework*... waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the	Natural Resources Canada is the government agency responsible for radioactive waste management policy. Policy making is not within the CNSC's mandate. REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* outlines the radioactive waste

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			funding, organization, management and operation of disposal and other facilities required for their wastes." Canada's *Radioactive Waste Policy Framework* also states that the federal government will "…ensure that radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner"; and will ensure that waste producers and owners "meet their funding and operational responsibilities in accordance with approved waste disposal plans." Are these provisions of Canada's *Radioactive Waste Policy Framework* also part of the CNSC's policy? Why does the REGDOC not describe the content of and approval process for waste disposal plans? Why does the REGDOC not explain how the CNSC will ensure that waste disposal plans are environmentally sound?	policy in Canada. As a result of this comment, the section was revised as follows: **Section 2 "The CNSC's waste management framework"** REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* [3], describes the national framework and the philosophy underlying the CNSC's approach to regulating the management of radioactive waste. In addition to this regulatory document, the CNSC's regulatory framework for waste management includes…" This document is not a licence application guide, rather it is meant to provide requirements and guidance for all licensees managing radioactive wastes. Specifically it addresses: ● the management of radioactive wastes ● radioactive waste storage and disposal facilities This REGDOC contains requirements for both: disposal as a waste management activity; and those applicable for a radioactive waste disposal facility. This REGDOC includes the requirement to conduct the safety case and safety assessment. It is complemented by other REGDOCs that provide details on the additional information required to be submitted in support of an application. REGDOC-2.11.1, *Waste Management*, *Volume III: Safety Case for Disposal of Radioactive Waste* provides CNSC's expectation for the safety case of a disposal facility. All applicants are required as part of a licence application for a disposal facility to submit a safety case and supporting safety

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				assessment that demonstrate the protection of people and the environment.
26.	Concerned Citizens of Renfrew County and Area		Q #9. Section 2.1 ("The CNSC's waste management framework") says CSA nuclear standards "complement the CNSC's regulatory framework regarding waste management." The CSA Group says its "standards are integrated into the national regulatory framework, referenced in regulatory documents, licenses and compliance handbooks for nuclear facilities across Canada." CNSC staff members play a very active role on the CSA waste management committees, serving as chairs or vice-chairs, with nearly all other members representing the nuclear industry. The IAEA requires that regulatory bodies such as the CNSC remain independent from the nuclear industry. How does the CNSC ensure that the process for creating nuclear standards remains independent from the nuclear industry? Which has primacy, a CNSC REGDOC or a CSA standard?	CNSC staff develop regulatory documents independent from the nuclear industry. Industry is provided the same opportunity to comment on the regulatory documents as other stakeholders during the public consultation phase of developing a regulatory document. CNSC staff consider and disposition all comments received. CSA standards are consensus documents developed by government, industry, and other subject matter experts with input from interested members of the public and Indigenous peoples through its public consultation process. The CNSC contributes to the CSA standards and provides CNSC regulatory requirements and expectations, as well as technical expertise. The CNSC maintains an efficient and streamlined regulatory framework by making appropriate use of industry standards and may impose additional requirements if it determines that these are needed. As many other CNSC REGDOCS, the suite of waste management and decommissioning REGDOCs are complemented by the CSA standards. Together the waste REGDOCs and CSA standards provide a complete framework for waste management.
27.	Concerned Citizens of Renfrew County and Area		Q #10. IAEA GSR Part 5 requires that "characterization and classification" be considered as the second step in management of radioactive waste, immediately after waste generation, noting that "relevant characteristics of the waste have to be recorded to facilitate its further management" (such as processing, storage, transport and disposal). However, section 3 ("Background") of the REGDOC omits waste characterization and classification as a "step" in radioactive waste	The REGDOC includes waste classification and waste characterization as activities. These activities may be conducted at multiple steps in the management of radioactive waste. This REGDOC does contain requirements and guidance for both waste classification and waste characterization. For example,

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			management. This is important in the context of the REGDOC's "General Requirements" in section 5, because three requirements pertain to the "steps" in radioactive waste management ("optimize the steps," "take into account interdependencies among all steps," "produce and/or maintain records for each of the steps.") Was the omission of characterization and classification as a "step" deliberate? Why is characterization and classification of radioactive waste not considered to be a "step" in radioactive waste management?	section 7.2 states that waste characterization shall be performed at the appropriate steps in the management of radioactive waste. In addition, CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* provides that waste characterization should be performed at the point of waste generation, but may be conducted at any time during all steps of radioactive waste management.
28.	Concerned Citizens of Renfrew County and Area		Q #11. A new section 4 ("The Graded Approach") has been added to the REGDOC, with the following new language: "With a graded approach, all requirements shall apply, but to varying degrees depending upon the safety significance and complexity of the work being performed." The IAEA, in *Use of a Graded Approach in the Application of the Management System Requirements for Facilities and Activities* (IAEA-TECDOC-1740) uses "graded approach" in the specific context of how to manage different classes of waste (e.g., for long-lived and higher-activity wastes, "a greater degree of control will need to be applied to an increasing number of factors such as site selection, inventory control, cooling, containment and secure storage"). An industry comment was that "the REGDOC would be clearer if the graded or risk-based approach is referred to when requirements vary with the types of wastes and types of facilities or activities (e.g. storage facilities and disposal facilities)." Why has a section on "The Graded Approach" been added to the REGDOC that lacks information on different waste types and facility types?	A section on the graded approach was added to this REGDOC to address comments received from industry during the public consultation phase. All of the requirements in sections 4, 5, 6, 7, 8, and 9 of this REGDOC apply regardless of the type of waste. It is the level of detail required to satisfy the requirement that varies depending on safety significance and complexity. This regulatory document contains specific requirements for radioactive waste storage (section 9) and disposal (section 10) facilities, and so applying the graded approach to a facility type is included.
29.	Concerned Citizens of Renfrew County and Area		Q #12. In section 5 ("General Requirements"), the March 2019 version required licensees to manage their radioactive waste in a manner that would not impose a permanent burden on future generations. A nuclear industry comment on this section was that language was "overly vague, subjective, or open to interpretation, such as 'undue burden'." The CNSC responded "As a result of this comment, the document was revised for clarity and precision: the terminology such as "undue burden" was removed." However, CSA Standard N292.0 (*General Principles for the Management of Radioactive Waste and Irradiated Fuel*) contains the exact wording that was removed from the REGDOC. Furthermore, in the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of*	During the public consultation stage, both CSOs and industry raised concerns on the use of the terminology "undue burden". This language was removed from this document to avoid duplication as the principle is covered in REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*: "The measures needed to prevent unreasonable risk to present and future generations from the hazards of radioactive waste are developed, funded and implemented as soon as reasonably practicable."

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			Radioactive Waste Management, Article 11 ("General Safety Requirements") requires that "Each Contracting Party shall take the appropriate steps to… avoid imposing undue burdens on future generations." Why is language found in a CSA standard insufficiently clear and precise to include the REGDOC? Will CNSC require licensees to manage radioactive waste so as not to impose an undue burden on future generations? Should Canada comply with the requirements of the *Joint Convention* in this matter?	Also, the requirement and language is currently found in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* which complements this REGDOC.
30.	Concerned Citizens of Renfrew County and Area		Q #13. In section 5, the requirement that "All licensees that manage radioactive waste shall… track the waste inventory under their control" has been removed. The detailed comments table for the REGDOC has no comments requesting the removal of this requirement. Why was it removed? Does this mean that waste owners will no longer be required to keep records of wastes transferred off site, or to keep records of the destination(s) of the transferred wastes? Without this requirement, how will Canada meet its obligation under Article 32 of the *Joint Convention* to submit national reports that include "(iv) an inventory of radioactive waste that is subject to this Convention that (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities; (b) has been disposed of; or (c) has resulted from past practices?"	The requirement was not removed, it was moved to a more appropriate section. The requirement can now be found in Section 6, Waste Management Program: "The waste management program shall: …require records of the waste inventory under control and maintain those records."
31.	Concerned Citizens of Renfrew County and Area		Q #14. In section 5, the requirement that "All licensees that manage radioactive waste shall… provide the CNSC with information about the ownership of radioactive waste in their possession" has been removed. The detailed comments table for the REGDOC contains no comments requesting its removal. What is the rationale for removing this requirement? Without this information, how will the CSNC hold waste owners responsible, "in accordance with the principle of "polluter pays", for the funding, organization, management and operation of disposal and other facilities required for their wastes?" How will the CNSC address risks that waste may be lost or deliberately abandoned?	Information about the waste in a licensee's possession must be maintained by the licensee. Upon request, the CNSC expects licensees to provide information about the ownership of waste in their possession. Section 5 states: "All licensees who manage radioactive waste shall: [...] produce and/or maintain records for each of the steps in the management of radioactive waste for which they are responsible." Further, clause 4.7.3 of CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* states: "While following operational processes and procedures, records management protocols shall be used for logging information on

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				the following aspects of the waste: a) the origins; b) the history; and c) the characteristics." As well, clause 4.7.6 of CSA N292.0 states: "Records related to the waste's origin, history, and characteristics shall be provided to subsequent organizations when waste is transferred." Additionally, all licensees are required to maintain financial guarantees to ensure that all decommissioning activities, including disposal of all radioactive waste, can be safely completed should the licensee not be able to do so.
32.	Concerned Citizens of Renfrew County and Area		Q #15. In section 6 ("Waste Management Program"), the phrase "Where a licensee is required by its licence to implement and maintain a waste management program…" has been added to the section's preamble. However, the REGDOC provides no indication as to which CNSC licensees are required to implement waste management programs and which are not. Why was this language added? How does the CNSC decide whether or not a licensee is required to implement and maintain a waste management program? Why is this not explained in the REGDOC?	The requirement to implement and maintain a waste management program is a licence condition, which if required, will be a part of a licence. The inclusion of the licence condition for a waste management program is based on the licensed activities and commensurate with risk. The preamble to this section of the regulatory document was added because if a licence does not include the requirement for a waste management program, then this section would not be applicable to that particular licensee.
33.	Concerned Citizens of Renfrew County and Area		Q #16. The term "waste hierarchy" – which appears in both sections 6 and 8 - is not defined. This was noted in comments on the REGDOC. The CNSC responded that "The definition for 'waste hierarchy' will be added to REGDOC-3.6, *Glossary of CNSC Terminology*."). However, this term is not currently found in the CNSC Glossary (or in the IAEA Glossary). Furthermore, although the April 2019 version of the REGDOC did provide a rather vague description of "waste hierarchy" in the section on "Waste Generation" -- "prevent generation, reduce volume and radioactivity content, reuse and recycling of materials and components, and disposal" – it was removed. Why is the term "waste hierarchy" included in the	A definition for "waste hierarchy" will be added to the glossary of REGDOC 3.6, *Glossary of CNSC Terminology.*

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			REGDOC? Why was the limited language clarifying the meaning of this term removed?	
34.	Concerned Citizens of Renfrew County and Area		Q #17. Several reviewers commented (#50, #57 and #58 in Table B; #29 in Table C) on the lack of clarity and precision in section 7.1 ("Waste Classification"). Apart from rearranging of paragraphs, this section remains unchanged. In response to these comments the CNSC stated that "IAEA safety standard GSG-1 explains that the quantitative boundaries between the classes for different facilities may differ in accordance with scenarios, geological, and technical parameters and other parameters that are relevant to the site specific safety assessment." However, this IAEA standard, not referenced in the REGDOC, contains additional important information on the relationship of different waste classes to different types of waste facilities. Rather than adopting the IAEA standard classification (or indeed any standard waste classification), the REGDOC requires licensees to implement their own system. Furthermore, Industry comment #101 in Table B noted that whereas the section on waste classification contained some information on methods of waste disposal, the section on waste disposal facilities only referenced one facility type, deep geological repositories. This comment said "Licensees would like to see statements here referring to other methods of waste disposal, especially as earlier sections mention near surface and intermediate depth disposal." However, the CNSC's response to the previous industry comment #57 in Table B was "…the document was revised for clarity and precision... the sentences on disposal options were removed… text on types of disposal facilities was removed." Why does the REGDOC require licensees to implement a classification system without indicating what system they should implement? Why does the REGDOC quote selectively from IAEA standard GSG-1 without referencing that standard? Why was information on the relationship between different disposal options and types of disposal facilities and waste classification removed from the REGDOC? Who decided to remove this information? How does removal of this information add "clarity and precision"?	The classification system provided in REGDOC-2.11.1, Volume I was developed using the classification system from IAEA GSG-1, *Classification of Radioactive Waste* as the basis in combination with the information found in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel.* CSA N292.0 includes additional requirements and guidance contains a list of parameters that must be used in classifying the waste. This REGDOC requires that licensees implement a radioactive waste classification system, and that the system be based on the four general classes of wastes as defined. CNSC staff are taking this opportunity to ensure that the waste class definitions align with the IAEA safety standard, for example, where appropriate disposal paths are suggested. Licensees may incorporate additional information into their classification system such as quantitative boundaries between the classes that takes into account the site-specific safety case and supporting safety assessment. As a result of this comment, the following has been included in low-level waste classification description: "LLW requires isolation and containment for periods of up to a few hundred years <u>and is suitable for disposal in near surface facilities</u>" In addition, a reference to GSG-1, *Classification of Radioactive Waste* has been included in the REGDOC.

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35.	Concerned Citizens of Renfrew County and Area		Q #18. In section 8 ("Steps in the Management of Radioactive Waste"), the first "step" discussed is "Generation" (section 8.1). The pre-consultation version of the REGDOC contained the following clear and simple statement: "The licensee shall, as far as practicable, minimize the generation of radioactive waste." This statement was removed. The CNSC explains that this was done in response to a nuclear industry comment, although the nuclear industry did not specifically request deletion of this statement (detailed comment table, Table B, #70). Furthermore, with the elimination of the description of "waste hierarchy" from this section (see Q #16), the remaining language gives the impression that waste minimization need only be considered <u>after</u> waste has been generated, whereas waste minimization is an important consideration in all stages of a facility, including design, operation and decommissioning. Why was the requirement for waste minimization removed from the REGDOC?	This clause was not removed, but rather expanded on. The second clause in subsection 8.1, Generation states the following: "The licensee shall consider measures to control the generation of radioactive waste in terms of both volume and radioactivity content as early as possible prior to the commencement of licensed activities and on an ongoing basis."
36.	Concerned Citizens of Renfrew County and Area		Q #19. In the pre-consultation REGDOC the section on "Transport" stated "The licensee shall transport radioactive waste in accordance with the *Packaging and Transport of Nuclear Substances Regulations, 2015*." Section 8.4 of the post-consultation REGDOC changes this to "The *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulatio*ns apply to the transport of radioactive waste. As a result of this change, which is not referenced in the detailed comments table, application of the transport regulations for nuclear substances and dangerous goods is no longer expressed as a requirement for licensees. Why was the requirement to transport radioactive waste in accordance with regulations removed from the REGDOC? Who requested this change?	The *Packaging and Transport of Nuclear Substances Regulations* and the *Transportation of Dangerous Goods Regulations* apply whether there is a requirement in this REGDOC or not. Inclusion of the requirements may give the impression that this regulatory document was the reason that the regulations applied. The text was removed to avoid potential confusion.
37.	Concerned Citizens of Renfrew County and Area		Q #20. A new section 8.5.1 ("Decay storage") includes language not found in the previous version: "This waste may be stored for decay over a limited period of time of up to a few years." This language, which was not requested during the comment period, lacks clarity and precision. With regard to waste destined for decay storage, IAEA Safety Guide No. WS-G-6.1, *Storage of Radioactive Waste*, says "The activity concentration of the waste should be carefully determined… Representative measurements should be carried out on samples taken and analysed prior to the removal of each batch from control. In taking samples, workers should	The following was added to the very short lived low-level radioactive waste section "In general, the management option of storage for decay for VSLLW section should only apply to radionuclides with a half-life of 100 days or less." Additional guidance on decay storage is found in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel.*

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			be protected against both radiological and nonradiological hazards." This Safety Guide adds that "Practical experience shows that storage for decay is suitable for waste contaminated by radionuclides with a half-life of less than about 100 d." Why was unclear and imprecise language on decay storage added to the REGDOC? Who requested this?	
38.	Concerned Citizens of Renfrew County and Area		Q #21. Section 9 ("Waste Packages") now states "Where applicable, the licensee shall use engineered waste packages to contain radioactive waste in accordance with applicable regulations…" The words "Where applicable" did not appear in the April 2019 version. They create a lack of clarity and precision. Why was this language added? Who requested it? Are there cases where the CNSC does not require licensees to use packages in accordance with applicable regulations?	Change was made as a result of a comment received during consultation that not all licensees engineer their own packages; and/or not all packages are required to be engineered. That reviewer also noted that not all containers will be for storage *and* disposal as it seemed to imply. The requirements is aligned with IAEA GSR Part 5, *Predisposal Management of Radioactive Waste*.
39.	Concerned Citizens of Renfrew County and Area		Q #22. In section 10 ("Radioactive Waste Storage Facility") and in section 11 ("Radioactive Waste Disposal Facility"), a new heading "(Site preparation") has been added to encompass the activities of "Site characterization" and "Facility design". The common sense meaning of "site preparation" involves preparation of a site prior to construction of a facility (e.g., clearing vegetation, grading, building access roads, providing storm water drainage). The definition of "site preparation" in the CNSC Glossary ("The act of establishing basic infrastructure to support the future construction and operation of a nuclear facility") has a similar meaning. Why was the heading "site preparation" added to the REGDOC? What is meant by this term? Who requested its addition?	Changes were made as a result of comments received that clarity should be added around requirements that apply to facilities at various times in their lifecycle. As a result headings in the storage and disposal facility specific sections were added to align with lifecycle stages.
40.	Concerned Citizens of Renfrew County and Area		Q #23 Section 11 ("Radioactive Waste Disposal Facility") lacks information on the siting of waste disposal facilities (i.e., finding an appropriate location). IAEA Specific Safety Guide SSG-29, *Near Surface Disposal Facilities for Radioactive* Waste states that "Siting is a fundamentally important activity in the disposal of radioactive waste." SSG-29 recognizes four stages in the siting process: (1) A conceptual and planning stage; (2) An area survey stage, leading to the selection of one or more sites for more detailed consideration; (3) A site investigation stage of detailed site specific studies and site characterization; and (4) A site confirmation stage. Similar details are contained in IAEA Specific Safety Guide SSG-14, *Geological Disposal Facilities for Radioactive Waste*. The companion draft	This REGDOC is complemented by the following REGDOCs and CSA standards that include requirements and guidance on site selection: -REGDOC 1.2.1, *Guidance on Deep Geological Repository Site Characterization* -CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* -CSA N292.6, *Long-Term Management of Radioactive Waste and Irradiated Fuel*

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			REGDOC-2.11.1, Volume 3 (*Safety Case for the Disposal of Radioactive Waste*) also lacks information on siting. Why is there no consideration of waste disposal facility siting in REGDOC-2.11.1, Volume 1 or REGDOC-2.11.1, Volume 3?	In addition, CSA N292.7, *Disposal of radioactive waste and irradiated Fuel* (proposed title) is currently underdevelopment. CNSC have verified that these requirements for site characterization and design are inline with IAEA safety standard SSR-5, *Disposal of Radioactive Waste*.
41.	Concerned Citizens of Renfrew County and Area		Q #24. Section 11.1 (General Requirements") under "Radioactive Waste Disposal Facility" says "The licensee shall site, design, construct, commission, operate and close the disposal facility i) in such a way that safety is ensured by passive means to the fullest extent possible, ii) so as to minimize the need for actions to be taken after closure of the facility. Requirement #22 of SSR-5, *Disposal of Radioactive Waste* states that "The long term safety of a disposal facility for radioactive waste has not to be dependent on active institutional control." The IAEA requirement is definitive. The CNSC REGDOC language is equivocal ("fullest extent possible" and "minimize the need.") A disposal facility requiring long-term institutional control would place an undue burden on future generations in the form of ongoing costs, environmental risks, and health risks. These risks would increase if licensees were allowed to place wastes in sub-standard disposal facilities requiring ongoing controls that were not designed to contain and isolate wastes if institutional control were to cease. The companion draft REGDOC-2.11.1, Volume 3 (*Safety Case for the Disposal of Radioactive Waste*) also does not state clearly that safety of a disposal facility should not be dependent on institutional control. It says "Reliance on such longer-term institutional control (beyond a few hundred years) should be justified." Would the CNSC licence a disposal facility requiring long term institutional controls? Is it appropriate to allow radioactive waste to be disposed of in a facility that does not conform to international safety requirements? How would the CSNC ask a licensee to "justify" such a facility?	The language in the safety standard does not consider institutional control as a safety feature with respect to mines and mills. REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailing* explains that for uranium mine and mill waste, the large volume of the waste and the longevity of some of the radionuclides might necessitate longer periods of institutional control as a means of providing safety. REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2 includes additional requirements and guidance on institutional controls. It states that the "presence of institutional controls should not be used to justify a reduction in the level of design of the containment and isolation system." REGDOC-2.11.1, Volume III also states that long term safety should not be dependent on institutional control and that institutional control should be used to confirm the disposal system is performing as designed and should be limited to only a few hundred years. The CNSC expects licensees to submit their institutional control plans for disposal facilities to the CNSC for review prior to licensing.

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42.	Michael Stephens		Can we also discuss REGDOC 3.6, the Glossary of CNSC Terminology? In particular, I think that the definition of "storage" is inadequate and really must be improved to something closer to the IAEA definition. One of my long-standing pet peeves in radioactive waste management is inadvertent (or deliberate?) confusion between "disposal" and "storage": The CNSC Glossary (REGDOC 3.6) contains the definitions: · **disposal *(évacuation* or *élimination)*** The placement of radioactive waste without the intention of retrieval · **storage *(stockage)*** With respect to nuclear substances and radiation devices, possession for storage only. (Note that intended retrieval is not mentioned, and storage is defined in terms of itself, which should not be done in a definition!). In contrast, The 2003 IAEA Radioactive Waste Management Glossary contains the following definitions (with my added underlining): · **disposa**l. Emplacement of waste in an appropriate facility without the intention of retrieval. Some countries use the term disposal to include discharges of effluents to the environment. · **storage**. The holding of spent fuel or of radioactive waste in a facility that provides for its containment, with the intention of retrieval [3]. Storage is by definition an interim measure, and the term interim storage would therefore be appropriate only to refer to short term temporary storage when contrasting this with the longer term fate of the waste. Storage as defined above should not be described as interim storage. *(Reference [3] is the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, IAEA, Vienna (1997).)* I think the IAEA definition of storage is clear as regards intended retrieval. The CNSC glossary definition isn't clear. Worse, I see widespread confusion between the terms "long-term waste management" and "disposal". For example: · Is "long-term waste management" just another term for "long-term" (i.e., greater than ~50 years?) storage, from which waste is planned to be retrieved – and not disposal? Are the new Port Hope and Port Granby "long-term waste management" facilities considered/licenced to be storage or disposal?	Given time constraints, the REGDOC 3.6, *Glossary of CNSC Terminology* will not be part of the workshop but CNSC staff will consider your comments as part of the next revision of the Glossary. This will be done after the suite of five REGDOCs is published in order to incorporate the changes in definitions that were included in those documents. Please note that we are always seeking greater alignment with IAEA definitions but the scope of workshop does not include comments on the glossary or other CNSC REGDOCs as well.

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			See https://www.phai.ca/en/home/port-hope-project/new-long-term-waste-management-facility.aspx I have heard people who should know disagree on the point. If these facilities are qualified/licensed only as storage, what is the plan to eventually retrieve the waste for disposal elsewhere or qualify the current facilities for disposal? Then there is the subtle question of whether or not a closed waste disposal repository is still a "waste management" facility? I always thought it was, even though there may be no further need or plans for active human involvement. I spent a decade of my career at AECL on teams doing safety cases for disposal, so I am sensitive to these issues. I currently live upstream and downstream from two CNL disposal projects.	
43.	Ralliement contre la pollution radioactive		We are extremely frustrated with the cavalier manner in which the staff of the Canadian Nuclear Safety Commission (CNSC) responded to our worries with one or two short sentences during this last phase of public consultation. Their answer falsely suggests that we are wrongly concerned since this redefinition of the classes would only formalize the status quo. On the contrary, this regulatory process obviously aims to surreptitiously increase the level of radioactivity and the risk of radioactive waste admissible in a surface nuclear landfill. These new provisions already apply to the first above-ground dump that the Government of Canada is trying to set up in Chalk River. They thus muddy any public debate, even before being formally adopted. This is an obvious violation of the CNSC's legal obligation to provide the population with objective and credible information on nuclear energy and on its regulations, under section 9 (b) of the Canada's Nuclear Safety and Control Act. This harsh judgment is based on an analysis of the CNSC's consultation procedure and its little known international context.	The CNSC's public consultation process on its draft regulatory documents is targeted towards industry, CSOs and members of the public and Indigenous communities that would be impacted by the implementation of the regulatory document. CNSC staff read and take into careful consideration each comment that is submitted on its draft regulatory documents. Each comment is dispositioned in writing and made publicly available to further ensure that the process of developing regulatory documents remains transparent. The classification system provided in REGDOC-2.11.1, Volume I was developed using the classification system from IAEA GSG-1, *Classification of Radioactive Waste* as the basis in combination with the information found in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel.*
44.	Ralliement contre la pollution radioactive		The Ralliement contre la pollution radioactive (RCPR) is among only three citizen organizations that have participated in this debate so far. It alone brings together mainly French-speaking citizens. Here is why our involvement in this debate was so late, at the end of the last consultation: • First, there did not appear to be any significant issues. The CNSC has itself	Discussion paper DIS-16-03, *Radioactive Waste Management and Decommissioning* was used to solicit early public feedback from stakeholders to improve the regulatory framework for waste management and decommissioning. The paper presented several proposed changes such as defining waste categories, increasing

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			downplayed the importance of its initiative. In 2016, its consultation document DIS- 16-03 Radioactive Waste Management and Decommissioning was talking about simply "modernizing the vocabulary" and about "formally adopt the four main waste categories as defined in CSA N292.0-14, which are in turn, based on the International Atomic Energy Agency's GSG-1 Classification of Radioactive Waste." They said they wanted to formalize the traditional distinction between low and intermediate level radioactive waste in Canada, by ensuring that the classes of radioactive waste remain based on their intrinsic radioactive characteristics: Low-level waste does not give off any heat and "it is not particularly dangerous to handle," explained the CNSC: At worst, a person might receive a dose rate of 2 milliSieverts per hour (2 mSv/h) if he/she touches this waste without protective packaging or shielding. On the contrary, intermediate-level waste is radioactive enough to spontaneously release up to 2 000 watts of heat per cubic meter and its radiation is too dangerous for it to be handled without shielding. At that date, at the end of 2017, we had many other fish to fry. The Canadian Nuclear Laboratories had just announced that they would avoid placing any intermediate-level waste in their future radioactive dumping ground in Chalk River, leaving only "low-level waste". For its part, the CNSC had just published a summary of all the comments made by government experts (its own and those of other federal or provincial departments). It was also about to do the same with all the public comments that seemed worthy of note. Although no one has ever made it clear, these two summaries listed the countless issues that are still the subject of intense secret negotiations between the CNSC and Canadian Nuclear Laboratories.	clarity of requirements for waste management programs and new regulatory on the waste hierarchy. The proposed categories in the discussion paper were based on CSA N292.0-14, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* and GSG-1,*Classification of Radioactive Waste,* which was revised in 2019. In December 2017, the CNSC published a What We Heard Report that provided a summary of stakeholder comments in themes. Also published on the CNSC website are all the comments received and feedback on comments. On March 29, 2019, a draft version of REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste was issued for public consultation until June 30th. The consultation submissions were then posted for feedback on comments from July 18 to August 1, 2019. On February 19, 2020, the revised REGDOCs and comment disposition tables were sent to CSOs who had provided comments on the REGDOCs. The specifics of the CNL projects are outside the scope of this REGDOC.
45.	Ralliement contre la pollution radioactive		Brutal awakening on July 29, 2019, when an activist told us that Canadian Nuclear Laboratories explicitly admitted, in their comments on REGDOC 2.11.1, that they still intend to put intermediate level waste in their aboveground dump. They even seem to ask the CNSC to change its regulations in order to allow anybody to pile up such radioactive waste in a near-surface landfill. Naturally, we immediately checked the consultation documents about the REGDOC 2.11.1 project. LNC effectively write: "There are current plans to place ILW in aboveground mounds". This document has even been endorsed by the entire Canadian nuclear industry,	The classification system provided in REGDOC-2.11.1, Volume I was developed using the classification system from IAEA GSG-1, *Classification of Radioactive Waste* as the basis in combination with the information found in CSA N292.0-19, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*. GSG-1 no longer provides that a contact dose rate of 2 mSv/h be

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			which has asked with one voice to be allowed to dispose of their ILW (intermediate level waste) in a near-surface landfill. Secondly, we re-examined the REGDOC2.11.1 itself. It quickly became apparent to us that the redefinition of the radioactive waste classes appears to be a maneuver to allow the disposal of much more radioactive waste in nuclear near-surface landfills, without alarming the public too much. In order to do this, the CNSC writes inconsistent definitions for intermediate and low-level waste. It eliminates any precise border between the two classes. Most importantly, it eliminates any requirement that low-level waste will be harmless enough for it to be safely handled. Second surprise: the nuclear industry agrees with CNSC's objective but disagrees with the method: Yes, it wants to place more hazardous waste in future nuclear near-surface landfills. But no, the nuclear industry refuses to distort the definitions. There is also no question of eliminating the traditional limit between low and intermediate level waste; it wants to keep the contact dose rate threshold of 2 mSv/hr. Since we had barely two days left to react, we joined the industry to demand that they keep the 2 mSv threshold. On the other hand, we have denounced the idea of adding "intermediate level" nuclear waste in a simple near-surface landfill, especially if this waste were to remain dangerous many centuries after the dump had disintegrated, according the new draft REGDOC definition.	used to distinguish between low and intermediate level waste, which is now based primarily on long term safety considerations. However, contact doses remain an element that has to be considered in the handling and transportation of nuclear waste, and for operational radiation protection purposes at waste management and disposal facilities, but is not necessarily a determining factor for the ultimate disposition of the waste and the long term safety of a disposal facility. As a result of this comment, the following phase which had been previously been omitted has been included in low-level waste classification description: "LLW requires isolation and containment for periods of up to a few hundred years <u>and is suitable for disposal in near surface facilities</u>" In addition, a reference to GSG-1 has been included in the REGDOC.
46.	Ralliement contre la pollution radioactive		Our effort was totally wasted! The CNSC simply made its definitions even more vague, rejecting collective requests both from the nuclear industry and from the three groups of citizens who are still asking for more precise standards. The CNSC therefore discards the results of its own "public consultation"! the CNSC even hosted a half-day webinar to "explain" its decisions on February 26. This webinar held in English was aborted due to technical difficulties and was due to be repeated on March 26. This is why we were asked to submit this document before March 24. CNSC staff also suggested that we should read carefully all the responses already provided to stakeholders. What have we been told, by the way? • About the type of radioactive waste that can (or cannot) be placed in a near surface landfill, we are told that it is up to the dump promoter to prove that his installation can safely contain all the waste he wants to put in: (our translation)	See response to 29 in Table D. The CNSC takes a non-prescriptive approach to the classification of waste and the appropriateness of the waste disposition method that corresponds to each type. An applicant for a disposal facility must demonstrate in the safety case that the system, including the engineered and natural barriers, will contain the waste until the radioactive inventory is reduced to levels comparable to either background and/or natural analogues such as uranium deposits. If this level can be achieved in periods of a few hundred years, shallow management can be considered. However, it must be demonstrated in a safety case,

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			«Within the framework of the non-prescriptive Canadian regulatory context, it is the responsibility of the applicant to ensure that the safety assessment specific to the proposed facility for waste management supports and justifies the proposed waste inventory." Word for word, the same answer also provided to the Quebec Ministry of Health and Social Services! • On the vague definition of low and intermediate activity waste and on the elimination of the 2mSv/hour threshold for the waste contact dose rate, they simply dodge the issue: (our translation) "The definition of intermediate activity radioactive waste remains unchanged so that the Canadian regulatory framework remains faithful to the definition found in the CSA N292.0 standard and to the IAEA orientation. "	that includes for both normal evolution and human intrusion scenarios, that the natural and engineered barriers are stable and fulfill their confinement function for hundreds of years, and that the impact on human health and confinement is below acceptance criteria. If the danger posed by waste continues for more than hundreds of years, which may preclude the presence of ILW in the waste inventory as it requires isolation and containment for longer timeframes, in-depth management would be appropriate. As a result of this comment, the following phrase which had been previously omitted, has been included in low-level waste classification description: LLW requires isolation and containment for periods of up to a few hundred years "<u>and is suitable for disposal in near surface facilities</u>" In addition, a reference to GSG-1 has been included in the REGDOC.
47.	Ralliement contre la pollution radioactive		However, the draft regulation is actually NOT in CONFORMITY with the traditional definition of CSA N292.0 that the CNSC had outlined in its 2016 document! To better understand the issues, we therefore turned to the IAEA document GSG-1 Classification of Radioactive Waste since the CNSC often refers to it in its responses to other stakeholders. And there, we went from one surprise to another! • First, this GSG-1 document is only available in Russian, Spanish and English. Although the CNSC has claimed to have consulted with Canadian citizens since 2016 on how Canada should apply this guide, no one has ever seen fit to make it available in French. We asked for a french version in vain, both from the IAEA office in Toronto and from the CNSC staff in Ottawa. • Contrary to what the CNSC still claims, <u>the recommendations in the GSG 1 document are completely incompatible with the Canadian standard CSA N292.0</u> that our nuclear industry wants to keep. The CSA N292 standard was rather	See response to comment #46 in Table D.

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			inspired by a previous version of the GSG-1 document, published in 1994. This old document was completely redone on a different footing in 2009. And the draft Canadian regulation is now in line with this "new" incompatible text. (~~Here is our translation of~~) Here are two crucial paragraphs from the new GSG-1 document. They shed light on the radical turn of 2009 as well as the hidden issue of REGDOC 2.11.1: "Low level waste (LLW) 2.21. In previous classification schemes, low level waste was defined to mean radioactive waste that does not require shielding during normal handling and transport. Radioactive waste that requires shielding but needs little or no provision for heat dissipation was classified as intermediate level waste. A contact dose rate of 2 mSv/h was generally used to distinguish between the two classes of waste. Contact radiation dose rate is not used to distinguish waste classes in the present, revised classification scheme, which is based primarily on long term safety. However, it remains an issue that has to be considered in handling and transporting the waste, and for operational radiation protection purposes at waste management and disposal facilities but is not necessarily a determining factor for the long-term safety of a disposal facility. 2.22. In the classification scheme set out in this Safety Guide, low level waste is waste that is suitable for near surface disposal. This is a disposal option suitable for waste that contains such an amount of radioactive material that robust containment and isolation for limited periods of time up to a few hundred years are required. This class covers a very wide range of radioactive waste. It ranges from radioactive waste with an activity content level just above that for VLLW, that is, not requiring shielding or particularly robust containment and isolation, to radioactive waste with a level of activity concentration such that shielding and more robust containment and isolation are necessary for periods up to several hundred years." • Note the beginning of paragraph 2.22: In this new classification of the IAEA, " low level waste is waste that is suitable for near surface disposal". This lies at the heart of the 2009 changes. They no longer define low-level waste according to its intrinsic properties, as the CNSC claimed to do in its 2016 consultation document,	

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			but rather according to the characteristics of the near-surface landfill that should receive it. It is no longer because a low-level waste is harmless that it can be discarded in a near-surface landfill; it's the opposite: As soon as the CNSC accepts that a waste may be discarded in a near-surface landfill, it becomes ipso facto "low activity waste", whatever its hazard level! This explains why Canadian Nuclear Laboratories are planning to place deadly cobalt60 radioactive sources of in their near-surface landfill at Chalk River, while repeating to Canadians that they will only place "low level waste" in accordance with the guidelines for the IAEA! As for the CNSC, they never protest! Rather, they dismiss our own protests with their usual langue de bois: (our translation) "The definition of intermediate level radioactive waste remains unchanged so that the Canadian regulatory framework remains faithful to the definition found in the CSA N292.0 standard and to IAEA orientation," they write.	
48.	Ralliement contre la pollution radioactive		The text of the draft REGDOC 2.11.1 on radioactive waste management closely aligns with the formulations proposed in this IAEA document GSG-1, despite the protests from the nuclear industry and those from the rare citizen groups who spoke out on the issue. Meanwhile, the CNSC President reiterates everywhere the need to "harmonize" Canadian regulations with international standards and boasts of working hand in hand with the US NRC.	The CNSC maintains an efficient and streamline regulatory framework by making appropriate use of international and national standards. The CNSC has harmonized these REGDOCs with the IAEA safety standards which are consensus standards at an international level.
49.	Ralliement contre la pollution radioactive		On the one hand, the CNSC has rejected many proposals under the guise of respecting the status quo and remaining faithful to the CSA-N292 standard which, it says, will still be in force. On the other hand, article 1.2 of the first volume specifies nevertheless that the REGDOC will henceforth take precedence; the CSA standard will only be a complement. "This document is complemented by the requirements and guidance in CSA N292.0, General Principles for the Management of Radioactive Waste and Irradiated Fuel", says the English version. (To add to the confusion, the French version of REGDOC erroneously states the exact opposite: « Le présent document constitue un complément aux exigences et à l'orientation de la norme CSA N292.0 », says the French text. It also contains several other inaccuracies. Even its numbering is offset from that of the English	The CNSC maintains an efficient and streamline regulatory framework by making appropriate use of industry standards. The waste suite of REGDOCs are complemented by the CSA standards. Together the waste REGDOCs and CSA standards provide a complete framework for waste management. The text was revised to : "This document is complemented by the requirements and guidance in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* [1]. Together, this REGDOC and CSA N292.0 provide requirements and guidance for the management of radioactive waste.

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			text!)	Furthermore, this regulatory document is complemented by other CNSC regulatory documents.” The text in the French version has not yet undergone final editing and will be corrected accordingly.
50.	Ralliement contre la pollution radioactive		In popular parlance and in their traditional definition in Canada, low-level waste is almost harmless waste that can be safely touched. This traditional meaning has been completely obliterated in the new definition. No way of being able to touch it. No attempt to quantify its radiotoxicity for a human being (in milliSieverts/hour). Even more serious, the CSSN regulations purport to define the level of "activity" of radioactive waste, **when this is not the case**. (The activity of an element designates its number of radioactive disintegrations per second, measured in becquerels.) However, the new definition of low activity or intermediate activity waste eliminates any reference to their radioactive activity! The only remaining criterion is the duration of this waste, according to article 7.1 of the draft regulation: “Low-Level radioactive waste (LLW) (…) generally has limited amounts of long-lived activity. LLW requires isolation and containment for periods of up to a few hundred years. " There is a problem: the longer or shorter "period" of a radioactive material does not define its level of radioactivity or danger; it just defines its lifespan. If the period is long, it will disappear slowly and its activity will generally be weak, with a small number of disintegrations per second. This definition of a low-level waste therefore becomes quite **contradictory**: It requires to LIMIT long-lived radionuclides (the most persistent), that is to say those which would have LOW activity and which decay slowly! This is how we end up with a Chalk River landfill dominated 98% by the radioactivity of cobalt-60 alone, an radionuclide whose period is very short. Moreover, even if the definition requires a limited quantity of persistent elements, it at the same time underlines the importance of confining them for ... a few hundred years! And in the very same definition, they manage to use the word "period" many times, with two different meanings. Sometimes it means “a radioactive half-life”; sometimes it just means a time lenght. How can the CNSC and Canada's best nuclear professionals **confuse** concepts and	As a result of this comment, “long-lived activity” has been revised to “long-lived radionuclides” in the low-level waste classification description. It now reads as follows: “Low-level radioactive waste (LLW) contains material with radionuclide content above established unconditional clearance levels and exemption quantities (set out in the *Nuclear Substances and Radiation Devices Regulations*), but generally has limited amounts of long-lived radionuclides.”

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			definitions so much? Why does the CNSC derail any intelligent public debate in this way, when the law entrusts it with the mission of providing the public with objective scientific information on nuclear energy?	
51.	Ralliement contre la pollution radioactive		The only likely explanation is that the new definition of low-level waste does not really relate to what it claims to define, but rather to the type of radioactive waste that can be placed in a nearsurface landfill, like in Chalk River. The CNSC applies the far-fetched definition we quoted earlier from the IAEA's GSG-1 document: "low level waste is waste that is suitable for near surface disposal." Here we must remember that the main weakness of a near surface site is its short useful life. It is vulnerable to weathering, erosion and plant, animal or human intrusions (to recycle precious metals for example), etc. Waste should therefore never be placed a landfill if it remains dangerous for much longer than the useful life of the dump itself. And for the waste to disappear quickly, its radionuclides must have a short period (i.e. a short half-life). In the same way, they no longer define "Intermediate-Level Waste" according to the intensity of their activity or their radiotoxicity but rather according to their much longer persistence, which compels us to confine them will force them to be confined for "periods greater than several hundred years". Here again, they confuse concepts and public debate.	See response to comment #46 in Table D. The specifics of the CNL projects are outside the scope of this REGDOC.
52.	Ralliement contre la pollution radioactive		The redefinition of low and intermediate level waste therefore eliminates all the old distinctions. Since they don't want to impose new constraints on themselves, they also eliminate any specific limit on acceptable "low-level waste" in a surface landfill such as at Chalk River. Admire the precision of the vocabulary! "Low-Level waste (...) generally (but not always) has limited amount (what quantity, exactly? 1%? 4%? 15%?) of long-lived radionuclides (how long? The period of a radionuclide is often said to be 'long' when it lasts more than 30 years, but the regulations avoid specifying it). LLW requires isolation and containment for periods of up to a few hundred years (how many centuries? 2? 10?)". The same is unclear for intermediate-level waste which must be confined for "periods greater than several hundred years". (how much more than how many centuries, exactly?) And if LLW goes up to "a few" hundred years and ILW start at "several" hundred years, what happen between a few and several	See response to comment #46 in Table D.

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			centuries? All answers are good! No wonder the CNSC must now organize webinars to clarify things for the nuclear industry! What else will it take to be sure the general public understands clearly?	
53.	Ralliement contre la pollution radioactive		The Ralliement contre la pollution radioactive submits that Canada should adopt the same classification system as France for radioactive waste. Not only has this classification stood the test of time, but it has the immense advantage of being clear, complete and nuanced. Above all, it always distinguishes the definition of a class of radioactive waste and the description of the type of long-term storage they require. This system provides for four classes according to the level of activity (high, intermediate, low and very low) and for three other classes according to the period length (long-lived, short or very short). These classes do also intersect to define up to twelve distinct classes of waste (high activity with short life, for example). Such a system allows for clear and nuanced public discussion, with well-defined concepts, and there is no reason why Canada could not learn from it. More fundamentally, we submit that no one has the slightest advantage in making the waste definitions so blurry and confusing like CNSC is trying to do in Canada, insofar as the real criteria for acceptance of waste will henceforth depend only on the “safety case” specific to each installation, as explained in the third volume of this REGDOC. This is what the CNSC itself pointed out to us when our Ralliement contre la pollution radioactive objected to the possibility of discarding ILW in a near-surface landfill: "(our translation) In the non-prescriptive Canadian regulatory context, it is the responsibility of the applicant to ensure that the safety assessment specific to the proposed waste management facility supports and justifies the proposed waste inventory. " The RCPR recognizes that this "safety case" concept could possibly provide an interesting flexibility to decide which kind of waste would be acceptable in each particular waste facility, without being constrained by a priori technical solutions. The most important thing is to never compromise security and our next chapter will examine how this essential objective could be confidently ensured.	See response to comment #48 in Table D.
54.	Ralliement		The RCPR requests that the new REGDOCs on radioactive waste, on their	See response to comment #44 in Table D.

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	contre la pollution radioactive		management and on decommissioning, be thoroughly reworked before their adoption by the CNSC.	
55.	Ralliement contre la pollution radioactive		The RCPR requests that the CNSC broaden the consultation of Canadian citizens in both official languages by first explaining clearly : a. the problems that its draft regulations would solve; b. the potential conflicts between IAEA rules and Canadian practices, including CSA standards; c. the pros and cons of the major strategies under study; d. the consequences sought through each of its new regulatory provisions.	REGDOC 2.11.1, Volume I was developed as part of CNSC's commitment to modernizing its waste management and decommissioning regulatory framework based on evolving international best practices and lessons learned. The purpose of the document is to provides requirements and guidance for licensees managing radioactive wastes. As part of the development of REGDOC-2.11.1 Volume I, CNSC staff conducted a thorough analysis of a number of IAEA standards, including: GSR-5, *Predisposal Management of Radioactive Waste; and* GSG-1, *Classification of Radioactive Waste.* Through the analysis that precedes the development of a REGDOC, it was determined that there were no gaps in the framework, however there were areas for improvement and clarity. These are included in this draft series of REGDOCs. The CNSC leveraged other regulatory documents and standards, such as CSA standard to maintain an efficient streamline regulatory framework. As such this REGDOC, is complemented by other REGDOCs and CSA standards. As all regulatory documents, REGDOC 2.11.1 volume I is intended to form part of the licensing basis for all CNSC licensees to who it applies. This REGDOC will be incorporated into their licence condition handbooks. The implementation plans and timelines would be established through discussions and

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				consultations between CNSC staff and licensees and according to the CNSC's management system process for the implementation of REGDOCs and included in the individual LCHs.
56.	Ralliement contre la pollution radioactive		The RCPR requests that the regulations be inspired by France's classification system to provide short definitions for each radioactive waste class, based on their own physical characteristics, so as to clarify the public debate and, particularly: a. Expand the number and variety of these classes; i. according to the level of radiation activity (number of radionuclide disintegrations in Bq, their absorption in the human body or their dose factor in milliSieverts and their heat generation); ii. according to their persistence (period, required protection length, etc.); b. That the subclasses be organized logically within each waste class; c. That the boundary values between classes and between subclasses be defined as precisely as possible.	See responses to comments #45, 46, 48 and 50 in Table D. As part of the development of the REGDOC, CNSC staff did undertake a benchmarking of waste classification systems existing in other jurisdictions, including the classification used in France. Following this benchmarking, the CNSC opted to harmonize the waste classification system with the IAEA safety standards, which are consensus standards at an international level.
57.	Ralliement contre la pollution radioactive		The RCPR recommends that the identification of the types of containment (geological or surface storage for example) required for various waste classes should not be included in the definition of each waste class; these specifications should rather appear in separate articles for each type of radionuclide.	See response to comment #45 and 46 in Table D. The REGDOC and CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* currently outline that because of its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near-surface repositories.
58.	Mike Wilton, Algonquin-eco-watch		Several years ago, I participated in discussions regarding the storage of low-medium radiation waste at Bruce Nuclear. To the best of my knowledge, that problem is as yet unresolved. Now (all of a sudden), we seem to be approaching finality regarding the possible storage of high radiation waste, also in south western Ontario. To the best of my knowledge, there has as yet been no "guaranteeable" storage facility completed anywhere in the world. With research such as the attached coming to light at regular intervals, it seems to me that we are a long way from nearing a knowledge level that can justify proceeding with construction of an "acceptable" storage facility. "Is it time for a moratorium on Nuclear Power?"	The acceptability of storage and/or disposal facilities for the management of radioactive waste is outside the scope of this REGDOC. The CNSC does not promote or prescribe waste disposition paths. Any proposed waste management storage or disposal facilities and activities will be assessed by the CNSC to ensure the protection of the health and safety of the public and the environment. For a waste management facility, the regulations require

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			I am suggesting this as a topic at the CNSC webinar, to be held on February 26th, which I look forward to attending.	applicants to submit comprehensive information on their programs (e.g , safety analysis, fitness for service, etc) the design and components of the proposed facility, the manner in which the facility is expected to operate, facility operating manuals and procedures, and any potential impacts on the site or surrounding environment. Applicants are required to identify the manner by which the facility may fail to operate correctly, predict the potential consequences of such a failure and establish specific engineering measures to mitigate the consequences to acceptable levels. CNSC staff review all submissions to determine if the proposed waste management safety and control measures described in the application and the documents that support the application are adequate and meet the applicable requirements.
59.	Mike Wilton, Algonquin-eco-watch		**Current model for storing nuclear waste is incomplete** **Study finds the materials -- glass, ceramics and stainless steel -- interact to accelerate corrosion** *Date:* January 27, 2020 *Source:* Ohio State University *Summary:* The materials the United States and other countries plan to use to store high level nuclear waste will likely degrade faster than anyone previously knew, because of the way those materials interact, new research shows. The findings show that corrosion of nuclear waste storage materials accelerates because of changes in the chemistry the nuclear waste solution, and because of the way the materials interact with one another. The materials the United States and other countries plan to use to store high-level nuclear waste will likely degrade faster than anyone previously knew because of the way those materials interact, new research shows. The findings, published today in the journal *Nature Materials*, show that corrosion	See response to comment #58 in Table D. Draft REGDOC-2.11.1, Volume I and CSA standards N292.0, *General principles for the management of radioactive waste and irradiated fuel*, N292.2, *Interim dry storage of irradiated fuel* and N292.3, *Management of low and intermediate level radioactive waste* together provide detailed requirements regarding the design of waste containment systems, including requirements regarding material selection and material compatibility.

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			of nuclear waste storage materials accelerates because of changes in the chemistry of the nuclear waste solution, and because of the way the materials interact with one another. "This indicates that the current models may not be sufficient to keep this waste safely stored," said Xiaolei Guo, lead author of the study and deputy director of Ohio State's Center for Performance and Design of Nuclear Waste Forms and Containers, part of the university's College of Engineering. "And it shows that we need to develop a new model for storing nuclear waste." The team's research focused on storage materials for high-level nuclear waste -- primarily defense waste, the legacy of past nuclear arms production. The waste is highly radioactive. While some types of the waste have half-lives of about 30 years, others -- for example, plutonium -- have a half-life that can be tens of thousands of years. The half-life of a radioactive element is the time needed for half of the material to decay. The United States currently has no disposal site for that waste; according to the U.S. General Accountability Office, it is typically stored near the plants where it is produced. A permanent site has been proposed for Yucca Mountain in Nevada, though plans have stalled. Countries around the world have debated the best way to deal with nuclear waste; only one, Finland, has started construction on a long-term repository for high-level nuclear waste. But the long-term plan for high-level defense waste disposal and storage around the globe is largely the same. It involves mixing the nuclear waste with other materials to form glass or ceramics, and then encasing those pieces of glass or ceramics -- now radioactive -- inside metallic canisters. The canisters then would be buried deep underground in a repository to isolate it. In this study, the researchers found that when exposed to an aqueous environment, glass and ceramics interact with stainless steel to accelerate corrosion, especially of the glass and ceramic materials holding nuclear waste. The study qualitatively measured the difference between accelerated corrosion and natural corrosion of the storage materials. Guo called it "severe." "In the real-life scenario, the glass or ceramic waste forms would be in close contact with stainless steel canisters. Under specific conditions, the corrosion of	

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			stainless steel will go crazy," he said. "It creates a super-aggressive environment that can corrode surrounding materials." To analyze corrosion, the research team pressed glass or ceramic "waste forms" -- the shapes into which nuclear waste is encapsulated -- against stainless steel and immersed them in solutions for up to 30 days, under conditions that simulate those under Yucca Mountain, the proposed nuclear waste repository. Those experiments showed that when glass and stainless steel were pressed against one another, stainless steel corrosion was "severe" and "localized," according to the study. The researchers also noted cracks and enhanced corrosion on the parts of the glass that had been in contact with stainless steel. Part of the problem lies in the Periodic Table. Stainless steel is made primarily of iron mixed with other elements, including nickel and chromium. Iron has a chemical affinity for silicon, which is a key element of glass. The experiments also showed that when ceramics -- another potential holder for nuclear waste -- were pressed against stainless steel under conditions that mimicked those beneath Yucca Mountain, both the ceramics and stainless steel corroded in a "severe localized" way.	
60.	Ralliement contre la pollution radioactive		The REGDOCS require licensees to implement a classification system without indicating what system they should implement. Don’t you think the licensees could do that easily when the definitions of the nuclear waste categories are so vague? This is not realistic and it will create even more confusion. Could you consider the following practical suggestion? It would be useful to have in the REGDOC a list of all the radionuclides and their individual class as very low level, low level, intermediate level, high level activity radionuclide and to include their period and their number of mSV/h on contact. Also the threshold of 2mSV/h for intermediate level waste is a must for the public. It is clear and easily understandable. Even if the wastes are a mix of radionuclides I contribute to lift the confusion. A lack of clarity leads to misunderstanding of requirements and their reasons by licensees, the regulator and the public.	See response to comment #17, 45 and 46 in Table D.
61.	Ralliement contre la		The condition that *all licensees who manage radioactive waste shall… track the waste inventory* under their control. has been removed in the REGDOC. How will	The requirement was not removed, it was just moved to a more appropriate section. The requirement can now be found in

REGDOC-2.11.1, *Waste management, Volume I: Management of Radioactive Waste*
REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	pollution radioactive		waste owners ensure the safe and secure management of radioactive waste and make arrangements for its long-term management (Under Canada's Radioactive Waste Policy *Framework)* if they do not track the inventory? No tracking, no inventory, no responsibility? We have discovered in the past that the CNL did not have a complete inventory of the nuclear waste transiting in and out at Chalk River because it was presumed to be the only responsibility of the licensees who transport the wastes. It has taken 6 months to obtain this list because CNL did not have it. How do you insure that radioactive wastes are not lost if you do not track them thoroughly? There is not reference in the REGDOC, to the IAEA standard that contains important information on the relationship of different waste classes to different types of waste facilities. If the CNSC cannot define clearly the waste classes and the types of disposal for each of them, how do you think that the licensees could do that?	Section 6, Waste Management Program: "The waste management program shall: …require records of the waste inventory under control and maintain those records." As a result of this comment, a reference to GSG-1 has been included in the REGDOC.

Canada's Nuclear Regulator

Waste Management

Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste

REGDOC-2.11.1, Waste Management, Volume III, Version 2

May 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2
Regulatory document REGDOC-2.11.1, Volume III, Version 2

Cat. No. XXXXX
ISBN XXXXX

Également publié en français sous le titre : Gestion des déchets, tome III : Dossier de sûreté pour le stockage définitif des déchets radioactifs, version 2

Document availability

This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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YouTube: youtube.com/cnscccsn
Twitter: @CNSC_CCSN
LinkedIn: linkedin.com/company/cnsc-ccsn

Publishing history

May 2018	Assessing the Long-Term Safety of Radioactive Waste Management, Version 1

Preface

This regulatory document is part of the CNSC's waste management series of regulatory documents, which also covers decommissioning. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2 provides requirements and guidance to CNSC licensees and applicants for developing a safety case and supporting safety assessment for activities pertaining to a disposal facility, location or site.

This is the second version of this document and supersedes REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management*, Version 1, published in May 2018.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

> The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.
>
> Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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Safety Case for the Disposal of Radioactive Waste

1. Introduction

1.1 Purpose

The purpose of this document is to provide requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment activities pertaining to the disposal of all classes of radioactive waste.

1.2 Scope

This regulatory document addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal facilities, which includes locations or sites, for all classes of radioactive waste. This document also applies to long-term radioactive waste management facilities, locations or sites where there is no intention to retrieve the waste. **Note**: In this regulatory document, the term 'disposal facilities' also refers to disposal locations or sites, which are not classified as 'nuclear facilities' under the NSCA.

The post-closure safety case considers information from the pre-closure phase (site preparation, construction, operation, decommissioning) insofar as this information impacts post-closure safety.

For disposal facilities that operated, or that were decommissioned or closed before 2020, this document is to be considered as guidance.

This regulatory document is complemented by other CNSC regulatory documents, such as REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures* [1]**.**

1.3 Relevant Legislation

The requirements and guidance in this regulatory document should also be adopted for the disposal of uranium mine and mill waste, as applicable. The licensee must provide a justification to the CNSC with respect to requirements that do not apply. Additional requirements and guidance for waste management at uranium mines and mills are provided in REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [2].Relevant legislation

The following provisions of the *Nuclear Safety and Control Act* (NSCA) and its associated regulations are relevant to this document:

- section 26 of the NSCA
- paragraphs 4(d) and 12(1)(c) of the *General Nuclear Safety and Control Regulations*
- paragraphs 3(k), 4(e), 5(f), (i), (j), (k), 6(c), (h), (i), (j), 7(f), (k) and 8(a) of the *Class I Nuclear Facilities Regulations*
- paragraph 4(t), 5(i) and 5(k) of the *Class II Nuclear Facilities and Prescribed Equipment Regulations*
- section 1 of the *Nuclear Substances and Radiation Devices Regulations*
- subparagraph 3(a)(viii), 3(c)(iii), 3(d)(i), 7(d) and 8(b) of the *Uranium Mines and Mills Regulations*

2. The CNSC's Waste Management Framework

In addition to this regulatory document, the CNSC's regulatory framework for waste management includes:

- REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*
- REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*
- REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings*
- REGDOC-2.11.2, *Decommissioning*

The following CSA standards complement the CNSC's regulatory framework:

- CSA N286, *Management System Requirements for Nuclear Facilities*
- CSA N288.4, *Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills*
- CSA N288.5, *Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills*
- CSA N288.6, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills*
- CSA N288.7, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*
- CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*
- CSA N292.1, *Wet Storage of Irradiated Fuel and Other Radioactive Materials*
- CSA N292.2, *Interim Dry Storage of Irradiated Fuel*
- CSA N292.3, *Management of Low- and Intermediate-Level Radioactive Waste*
- CSA N292.5, *Guideline for the Exemption or Clearance From Regulatory Control of Materials That Contain, or Potentially Contain, Nuclear Substances*
- CSA N292.6, *Long-Term Management of Radioactive Waste and Irradiated Fuel*
- CSA N294, *Decommissioning of Facilities Containing Nuclear Substances*

3. Graded Approach

This regulatory document may be applied in a graded manner commensurate with risk. With a graded approach, all requirements apply, but to varying degrees depending upon the safety significance and complexity of the work being performed. The level of analysis, the depth of documentation and the scope of actions necessary to comply with regulatory requirements are commensurate with the nature and level of the hazards and complexity of the facility or activities, and with the characteristics of the waste.

Further information on the graded approach can be found in REGDOC-3.5.3, *Regulatory Fundamentals* [3].

4. Definition of Safety Case and Safety Assessment

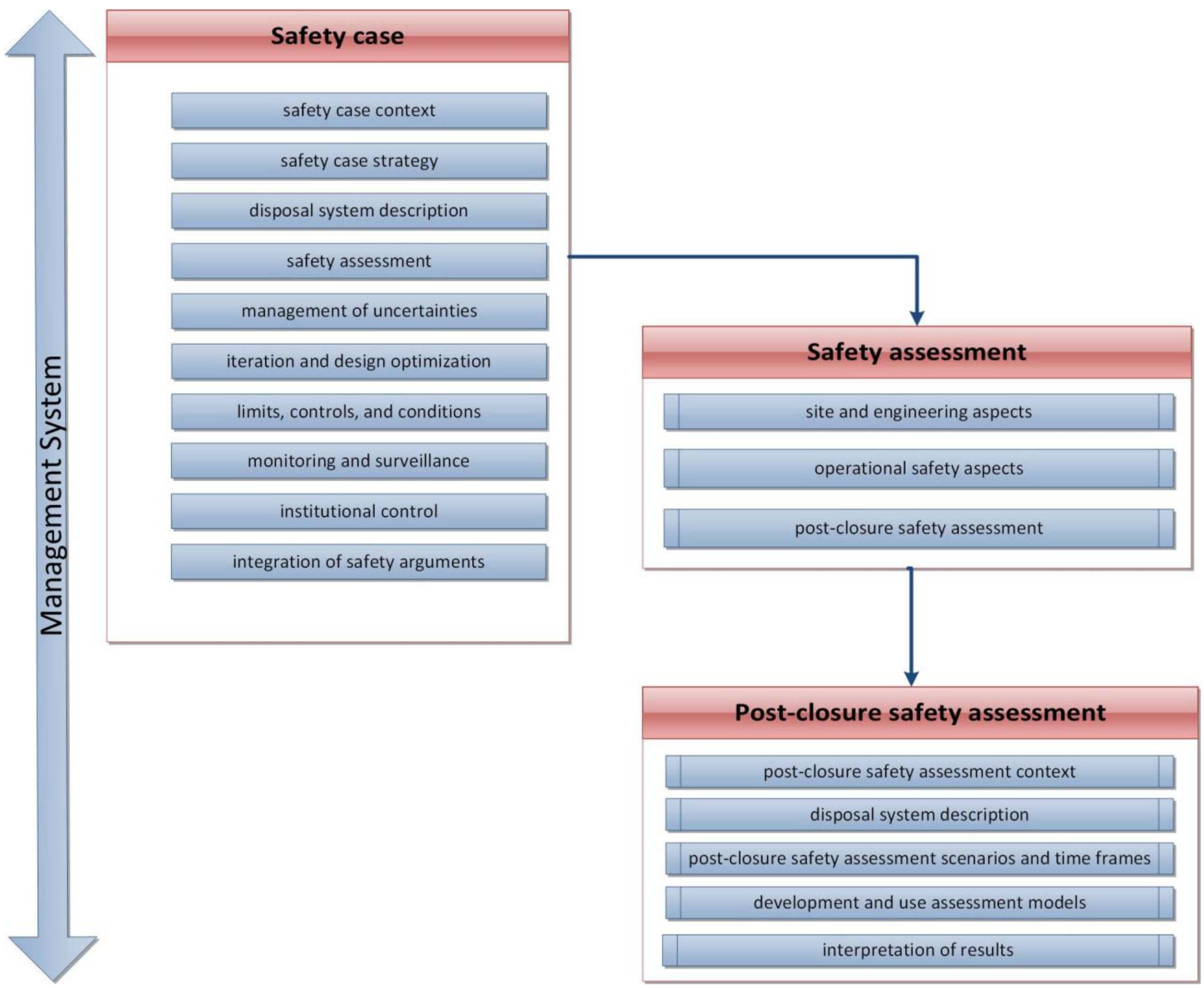
A safety case is defined as an integrated collection of arguments and evidence to demonstrate the safety of a facility and the meeting of all applicable regulatory requirements. A safety case normally includes a safety assessment, but could also typically include information (such as supporting evidence and reasoning) on the robustness and reliability of the safety assessment and the assumptions made therein.

For a disposal facility, the safety case may support the decision to proceed to a specific stage of development. In such instances, the safety case should acknowledge the existence of any remaining uncertainties and should provide guidance for work to manage these uncertainties in future development stages.

A safety assessment is defined as an assessment of all aspects relevant to safety of a nuclear facility. It is a systematic process that includes quantitative analyses and the interpretation of the results of those analyses. The safety assessment follows an iterative approach that carries on throughout the design process and over the lifecycle of the facility or the activity, to ensure that all the relevant safety requirements are met. Safety assessment is often used interchangeable with safety analysis.

Figure 1 provides an outline of the components of a safety case and safety assessment.

Figure 1. Components of a safety case and safety assessment



5. Role and Development of the Safety Case

5.1 Role of the safety case

The safety case relates to all hazards and is the main tool used to document and demonstrate that a facility will adequately protect people and the environment during its entire lifecycle (site preparation, construction, operation and decommissioning) and in the post-closure period. For a post-closure safety assessment, the emphasis is on the performance of the disposal facility and the assessment of its impact after closure. The safety case is a structured framework for documenting and presenting all of the safety-related information for a disposal facility in a consolidated manner.

The safety case supports the regulatory process, including decision making, and is a means of communicating and consulting with interested parties at different points throughout the facility's lifecycle.

The safety case can be used to:

- verify a concept
- support the selection of a site
- perform design optimization
- establish limits, controls and conditions
- design the monitoring program
- guide operation, decommissioning and closure
- prioritize research and development programs

5.2 Development of the safety case

A post-closure safety case is required for a disposal facility throughout its entire lifecycle – at the start of each major licensing stage, from site preparation through to decommissioning (which includes closure and decommissioning of ancillary facilities) – and post-closure period until release from regulatory control. The post-closure safety case evolves throughout the lifecycle of the disposal facility using an iterative approach.

In the pre-licensing phase, assumptions may need to be made regarding concept development and site selection. These activities do not require licensing from the CNSC; however, due to their very long time spans, typically several decades, early engagement with the CNSC during the pre-licensing period is encouraged. As concept development and site selection proceed, empirical site-specific data is necessary and details of the proposed design, construction, operation, decommissioning, closure and post-closure, as appropriate, need to be developed. This will allow specific issues to be addressed in more detail in the safety case.

The safety case is updated progressively throughout the lifecycle of the disposal facility by the systematic collection, analysis, and interpretation of the necessary scientific and technical data. The scope and level of technical detail will depend on stage of development of the disposal facility. Data used in the safety case can be obtained from a variety of sources, including site specific sampling, regional field investigations, scientific literature and analogous examples. Updates to the safety case consider comments from technical and regulatory reviews, increased knowledge, and operational experience, as well as results from monitoring programs and research activities. The lifecycle approach to the development of the safety case enables ongoing engagement with the public and Indigenous groups and the incorporation of stakeholder feedback.

At closure of the disposal facility, the safety case will contain information that future generations may require (e.g., institutional control plans, long-term monitoring plan).

6. General Requirements for the Safety Case

In support of a licence application for activities pertaining to a disposal facility, the licensee or applicant shall submit a safety case to the CNSC for acceptance. The safety case must:

- demonstrate that all safety requirements will be met
- be detailed and comprehensive so as to provide the necessary technical input for informing the decisions required
- include clearly written documentation, including arguments justifying the approaches in the safety case, based on information that is traceable and credible
- assess the safety of the facility using a graded approach
- describe all relevant safety aspects of the site, and design, construction, operation, decommissioning, closure and post-closure (including institutional control), as applicable, of the facility or site in the safety case
- be periodically reviewed and updated at all licensing stages and whenever there are significant changes to the disposal facility
- include the implementation of management system principles; additional requirements and guidance for management systems is provided in REGDOC-2.1.1, *Management System* [4]

7. Components of the Safety Case

The safety case shall include the following components, as illustrated in figure 1:

- safety case context
- safety case strategy
- disposal system description
- safety assessment
- management of uncertainties
- iteration and design optimization
- limits, controls and conditions
- monitoring and surveillance
- safety features during the period of institutional control
- integration of safety arguments

Note: there are many possible ways of structuring and documenting the safety case.

7.1 Safety case context

The licensee or applicant shall ensure that the safety case:

- defines its scope and purpose
- states the requirements to be met to demonstrate safety

Boundaries and interfaces with facilities and activities in close proximity, both within and outside the site, should be considered in the safety case.

The scope of the safety case should provide a clear description of the relevant stage in the facility's lifecycle; how the safety case has changed from previous revisions; and, how it will support future revisions.

Safety requirements are those that ensure that the proposed licensed activities do not incur unreasonable risk, to the environment and to the health and safety of persons. Requirements typically include acceptance criteria (see section 8.1.1.1) for selected safety indicators (such as dose, risk, radionuclide concentration), in addition to principles of containment, isolation, defence in depth, and robustness. Safety requirements should be developed in consultation with the CNSC and other stakeholders.

7.2 Safety case strategy

The licensee or applicant shall develop and adopt a safety case strategy that describes the integrated approach that will be taken to meet the safety requirements. The strategy should be established early in the development of the safety case.

The strategy shall identify and describe a number of key elements to provide confidence in safety, such as:

- containment and isolation of the waste
- multiple safety functions, defence in depth, and passive safety features
- robustness
- demonstrability and feasibility
- the interdependencies of the various steps in waste management
- other elements that contribute to and provide confidence in safety

The safety case strategy should identify the time frames associated with the key elements of the strategy.

Containment and isolation

Containment and isolation shall demonstrate by presenting evidence that the overall barrier system retains its safety functions during the safety case time frame. For each barrier, the safety functions, the expected performance, and design life shall be provided. Degradation of these safety functions under normal evolution or disruptive events shall be taken into account. It must be demonstrated that, despite this degradation, containment and isolation and all other safety requirements including acceptance criteria (such as dose, risk, or contaminant concentration) will be met.

Multiple safety functions and defence in depth

The principle of defence in depth shall be applied so that the performance of the disposal facility, described in section 7.3, does not unduly rely on a single barrier. The principle of defence in depth is usually applied in disposal facilities by the provision of a system of multiple barriers with multiple safety functions that contribute to the containment and isolation of the waste.

The safety functions of the individual barrier, as well as the time frames over which the barrier is expected to perform should be identified and justified. Each safety function should be independent of the others, to the extent possible, in order to ensure that they are complementary and that barriers are unlikely to fail through a single failure mode. The number and extent of the barriers necessary should be commensurate with the hazards of the waste to be disposed of.

Safety functions shall be provided by passive means, to the extent possible. Active controls, such as monitoring, can contribute to the confidence in passive barriers and safety functions although shall not be solely relied on to ensure defence in depth. The multiple barrier system should provide resistance, primarily by passive means, to radionuclide migration.

Robustness

The overall disposal system as well as each individual barrier shall be shown to be robust. The overall disposal system is robust if it can be demonstrated that none of the safety requirements would be jeopardized if one or more barriers or safety functions were to fail. Barrier robustness is demonstrated with evidence that the barrier would fulfill its safety functions under the effects of the expected natural processes or anthropogenic disturbances.

The effect of long time frames on robustness should be considered. For disposal facilities with long time frames, there is an increased likelihood that natural processes or disturbances could affect the performance of individual barriers or the overall disposal facility.

Time frames

The licensee or applicant shall define the time frame, which is the period covered by the safety assessment. Time frames establish boundary conditions for the longevity and performance of barriers to isolate and contain the waste.

The licensee or applicant shall justify the time frame associated with the required performance of the overall disposal facility and of its individual components, as part of the safety strategy. This justification shall be commensurate with the class of waste to be stored or emplaced and with the time frame associated with hazards imposed by the waste.

The time frame shall consider the following, at a minimum:

- time of the peak radiological impact predicted by the safety assessment
- normal (expected) evolution of the disposal system, in consideration of the decay of the radiological substances associated with the waste and of the stability of the host medium or site
- type and severity of events considered in the safety assessment

The licensee or applicant should also consider the following to provide additional evidence to support the determination of the time frame:

- use of appropriate natural analogs (e.g., geological, hydrogeological and geochemical characteristics similar to those of the site)
- site-specific natural background levels of radiological and non-radiological contaminants

It may be necessary to define several different time frames within one safety case in order to deal with different scenarios and to demonstrate containment. For example, additional time frames, in addition to the reference time frame used in the normal evolution scenario, may be used to illustrate the robustness of the disposal facility for time periods beyond when the maximum impact is predicted to occur. The licensee or applicant should define additional time frames to illustrate the performance of particular barriers in response to disruptive events (e.g., earthquakes, glaciation, climate change) that are predicted to occur in the future. The design of the disposal facility should be based on disruptive events that are consistent with the time frame of the normal evolution scenario. In some other situations (e.g., for the deep geological disposal of high-level or intermediate-level waste), impact predictions using very long time frames up to tens of millions of years could illustrate the containment capabilities of the barriers, despite significant environmental or geological perturbations. The evolution of the disposal facility shall be considered when deriving the time frame, and the normal evolution scenario used in the safety assessment would be defined accordingly.

7.3 Disposal system description

The licensee or applicant shall describe the disposal system in the safety case. The disposal system is defined as the integrated collection of properties of the site for a disposal facility; design of the disposal system; physical structures and items; procedures for control; and characteristics of the waste and other elements that contribute in different ways and over different time frames to the fulfilment of safety functions for disposal. The description should also include both quantitative and qualitative information. As applicable, the following shall be included:

- specific understanding of features, events and processes (FEPs) associated with the site and the disposal facility
- waste information (e.g., quantities and properties of the waste and the radionuclide inventory)
- waste acceptance criteria at the disposal facility
- description of the biosphere including human and non-human biota and the surface environment
- site characteristics including, as applicable, the deep and near-surface geological units at the site, including:
  - the description of surface and subsurface characteristics (e.g. geology, hydrogeology, hydrology, geochemistry, tectonics, seismicity, geomorphology, climate, ecology)
  - current and foreseeable land use
  - the identification and description of expected natural evolution and disruptive events
- the design and assumptions upon which the design is based
- description of the structure, systems and components (SSCs) of the disposal system, which includes the engineered and natural barriers, their safety functions, interfaces, associated uncertainties and performance as a function of time[1]
- radiological, thermal, hydraulic, mechanical, chemical and biological processes that may affect the disposal system and its components as well as the possible interaction among those components

The licensee or applicant shall demonstrate that nuclear criticality safety has been considered as applicable. Nuclear criticality safety analysis for the post-closure phase shall utilize waste acceptance criteria and technical practices that are provided in REGDOC-2.4.3, *Nuclear Criticality Safety* [5].

[1] For disposal, the performance should take into consideration the degradation of the barriers during the time frame associated with the disposal facility.

Following a graded approach to safety, the level of rigour and completeness in the description of the system and its components should be commensurate with the hazards imposed by the waste, and with the development and licensing stage of the facility. For example, in the concept development stage, generic data might be sufficient, but it is expected that an increasing level of site-specific data would be available at later stages such as site selection, construction and operation. The safety case should be updated by taking into account improved knowledge of the behaviour of the disposal system obtained through a systematic research and development program.

The licensee or applicant shall identify the safety functions of both the overall disposal system and the individual SSCs and assess the safety performance in terms of their ability to fulfill the safety functions. The safety case and its supporting safety assessment should explain and justify the safety functions of the overall disposal system and of each individual barrier.

Guidance on the site characterization of a deep geological repository is found in REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* [6].

7.4 Safety assessment

The licensee or applicant shall perform a safety assessment that addresses impacts to people and the environment that may arise from normal evolution of the site and from potential disruptive events identified in an FEPs analysis. The FEPs analysis may consider the Nuclear Energy Agency's International FEP List.

7.4.1 Components of the safety assessment

The safety assessment shall include the following components, as applicable:

- site and engineering aspects
- operational safety aspects
- post-closure safety assessment

7.4.1.1 Site and engineering aspects

The licensee or applicant shall use data obtained from the disposal system description as inputs to the safety assessment, and provide boundary conditions for the quantitative assessment models (discussed in section 8.1.1.2).

The licensee or applicant should use the results of the safety assessment to provide confidence in the adequacy of the site and engineering design.

Passive safety

The licensee or applicant shall take passive safety means into account in the design of the facility to minimize the dependence of safety on active means.

Multiple safety functions

The licensee or applicant shall assess defence in depth in the context of the site and engineering aspects. This entails a demonstration that multiple safety functions are provided at the facility.

Scientific and engineering principles

The licensee or applicant should make use of established construction techniques and materials, and should give due consideration to feedback from experience gained. If the licensee or applicant uses other techniques and materials, these should be justified.

Quality of site characterization

The licensee or applicant shall ensure that the safety assessment describes and/or references the approach and criteria used in site selection and demonstrate that the site selected is in accordance with the safety strategy and any criteria that have been established.

For disposal facilities, site characterization activities will take place over many years and should be carried out under a formal site characterization plan that includes quality assurance / quality control protocols to verify the data.

7.4.1.2 Operational safety aspects

While operational safety aspects are outside the scope of this document, the licensee shall ensure that the impacts of pre-closure activities on post-closure safety are assessed and minimized.

7.4.1.3 Post-closure safety assessment

The licensee or applicant shall perform a post-closure safety assessment. The post-closure safety assessment forms the core of the safety assessment for a disposal facility. It involves an analysis of the expected normal evolution of the disposal system, possible disruptive events, and the potential radiological and non-radiological impacts on people and the environment, as well as the interpretation of results. Scenarios are used to describe possible evolutions of the disposal system and its environment as well as the impacts.

The impacts are determined quantitatively by means of mathematical models. This includes an analysis of the potential migration of radioactive and hazardous substances from the disposal facility, their movement in the environment and resulting impacts. Requirements and guidance on how to perform a post-closure safety assessment can be found in section 8 of this document.

7.5 Management of uncertainties

The licensee or applicant shall characterize uncertainties in the safety case with respect to their source, nature and degree using quantitative methods as well as professional judgment.

The licensee or applicant shall ensure that the safety case demonstrates how uncertainties are managed; for example by:

- modifying the safety strategy to reduce the uncertainties
- showing that the uncertainties do not have implications on safety
- using conservative assumptions to bound the uncertainties and showing that there remains a sufficient margin for safety requirements to be met

The licensee or applicant should reduce uncertainties throughout the different stages of the development of the safety case. The licensee or applicant should identify the remaining uncertainties within the safety case and how the safety case is still supported despite these uncertainties.

Uncertainties that remain in the safety case and that have implications on safety should be addressed through uncertainty and sensitivity analyses. In addition, the development of monitoring and research and development programs could be used to further reduce the uncertainties.

7.6 Iteration and design optimization

The licensee or applicant should ensure that the disposal system design and its components are optimized using a well-defined and iterative process. As the project proceeds and additional information is gained, initial results should be refined and should replace the generic or default data, reducing the reliance on assumptions.

The licensee or applicant should demonstrate within the safety case how the selected design and its components have been optimized. The design process should include a comparison between the design options considered, an assessment of their advantages and disadvantages, and a justification for the preferred option. Optimization may be demonstrated through a comparison of previous design iterations to the final design.

7.7 Limits, controls and conditions

The licensee or applicant shall establish limits, controls and conditions using the safety case. These shall be applied to all activities that have an influence on the post-closure safety of the facility and to the waste that will be disposed of at the facility.

The limits, controls and conditions derived from the safety assessment for the waste shall include the waste acceptance criteria for individual packages as well as for the entire facility, and the acceptable waste inventory and/or the allowable concentration levels of radionuclides in the waste.

The licensee or applicant shall use the established limits, controls and conditions as an input to the development of operational programs and procedures in consideration for the post-closure phase. For example, the safety case and established limits, controls and conditions should be used to inform the development of the monitoring and surveillance program for the site and of the surrounding area appropriate to the specific facility.

7.8 Monitoring and surveillance

REGDOC 2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [7], provides requirements for the monitoring and surveillance of waste management facilities.

7.9 Institutional controls

The licensee or applicant shall identify the role that institutional controls play in disposal facility safety, and how that role is taken into account in the safety case and its supporting safety assessment. The presence of institutional controls should not be used to justify a reduction in the level of design of the containment and isolation system.

While long-term safety of the disposal facility should not be dependent on institutional controls, these should be used to the extent practicable to confirm that the disposal system is performing as designed.

Uncertainties associated with future human activities and the evolution and stability of societies, licensees or applicants should limit reliance on institutional control as a safety feature to a few hundred years. For uranium mine and mill waste, the large volume of the waste and the longevity of some of the radionuclides might necessitate longer periods of institutional control as a means of providing safety. Reliance on such longer-term institutional control (beyond a few hundred years) should be justified in the safety case through an optimization process taking into account technical and socio-economic factors.

REGDOC 2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [7], provides guidance on institutional control.

7.10 Integration of safety arguments

The licensee or applicant should ensure that the safety case provides a synthesis of available evidence, arguments and analyses. This synthesis should be provided in a well-structured, transparent and traceable manner.

The licensee or applicant should:

- provide evidence that all safety requirements have been met
-
- provide complementary safety indicators, such as radionuclide concentrations and fluxes through individual barriers
- provide additional safety arguments, for example from the study of paleohydrogeological information on the site, and the study of natural analogs to the overall disposal system, and /or its individual components
- address how hazardous substances contained in the radioactive waste could affect the environment

In addition, the licensee or applicant should:

- describe the treatment of uncertainty in the safety case and supporting assessment
- provide evidence on the quality and reliability of the science and design work that form the basis of the safety case
- provide evidence of the quality and reliability of the safety assessment with respect to the derivation of scenarios; the adequacy of methods, models, computer codes and databases; and quality of the calculations
- provide findings that contradict the arguments made in the safety case
- acknowledge any limitations of currently available evidence, arguments and analyses
- document any third-party peer review of the safety case, showing how the outcomes of the peer review have been taken into consideration
- provide management system requirements on the performance of safety assessment calculations to provide assurance of their quality

Following the integration of safety arguments, the licensee or applicant should provide justification for the continuation of the project.

7.10.1 Comparison with acceptance criteria

The licensee or applicant shall compare the selected assessment end points for the assessment to acceptance criteria (such as dose and contamination concentrations). It should be noted that meeting the acceptance criteria is not sufficient for making a safety case acceptable, since other safety requirements (e.g., isolation, containment) also have to be met. In addition, it should be demonstrated that the proposed disposal system has been optimized.

7.10.2 Complementary safety indicators

In addition to comparing safety assessment end points with the acceptance criteria, the licensee or applicant should use complementary safety indicators (i.e., the calculation of values other than the end points of the assessment) to provide additional confidence in the conclusions of the safety case. Assessments that use complementary safety indicators as additional arguments for safety should present justification for their use.

Complementary indicators from the safety assessment can also be used to inform the monitoring program. In many instances, however, those indicators cannot be directly or practically monitored (e.g., container corrosion rates), but must be inferred by a set of sub-indicators that are easily measured or quantified. For example, corrosion rates depend on temperature and the geochemical composition of the groundwater, and the former parameters can be included in a monitoring program.

7.10.3 Additional arguments (multiple lines of reasoning)

The licensee or applicant should use multiple lines of reasoning to provide confidence in the safety case; for example, from natural or anthropogenic analogs or from paleohydrogeological information.

Natural analogs can be used to demonstrate that components of a disposal system remain effective over extended temporal and spatial scales considered in post-closure safety assessment models, which cannot be replicated in laboratory studies. Natural analogs can provide data for verifying and validating both detailed process and simplified assessment models, and for developing generic models that describe the site in the absence of site-specific characterization data. Anthropogenic analogs, if relevant, may also be used in addition to natural analogs. Site-specific paleohydrogeological information can build confidence in the site's geological stability and containment capability. Natural analogs and paleohydrogeological information can provide complementary assessments of long-term safety, and be included in the safety case to provide confidence in the conclusions drawn from the safety assessment.

8. Post-Closure Safety Assessment

The licensee or applicant shall ensure that the post-closure safety assessment for a disposal system includes a systematic quantitative analysis of the evolution of the disposal system and its environment, possible disruptive events, and the potential resulting radiological and non-radiological impacts on people and the environment. The interpretation of the quantitative results should be clear.

The licensee or applicant shall develop and use scenarios to describe possible evolutions of the facility and its environment as well as the potential impact of the identified FEPs on safety.

The licensee or applicant should apply models to each given scenario to assess:

- evolution of the waste form and associated contaminant activity/concentrations over time
- contaminant release rates
- evolution of the engineered barriers

- evolution of the natural barriers
- contaminant transport through the engineered barriers, the geosphere and the biosphere
- receptor exposure
- potential effects resulting from the exposure

The licensee or applicant shall ensure that the post-closure safety assessment demonstrates their understanding of the disposal system through a well-structured, transparent and traceable methodology.

The post-closure safety assessment documentation should provide a clear and complete record of the decisions made and the assumptions adopted in developing the model of the disposal system. The parameters and variables used to run the model and to arrive at a given set of results should be reported and justified. This input data should be obtained from site-specific studies and research results.

The assumptions and data of the post-closure safety assessment shall be supported by an assessment of the current and future conditions of the disposal system.

Due to the uncertainty of assumptions made about future events, the reliability of quantitative estimates diminishes with increasing time scale. The demonstration of safety will therefore rely less on quantitative estimates and more on qualitative arguments as the time scale increases. The licensee or applicant should not consider long-term quantitative estimates as guaranteed impacts, but rather as safety indicators. To build confidence, the post-closure safety assessment should be performed using an approach that combines multiple lines of reasoning (additional arguments) and safety indicators within the context of the safety case.

8.1 Components of the post-closure safety assessment

The licensee or applicant should use a structured approach to perform the post-closure safety assessment of a disposal system that includes the following components:

- post-closure safety assessment context
- disposal facility description
- post-closure safety assessment scenarios and time frames
- development and use of safety assessment models
- interpretation of results

8.1.1 Post-closure safety assessment context

The licensee or applicant shall ensure that the safety assessment context:

- defines the scope and purpose
- states the assessment criteria used in the assessment
- outlines the approach adopted to demonstrate safety
- states the end points for the assessment (i.e. the modelling output that needs to be compared to the acceptance criteria; see section 8.1.1.1)

8.1.1.1 Acceptance criteria used in the assessment

The licensee or applicant shall ensure that the safety assessment context contains the criteria by which the safety assessment results will be deemed acceptable. These criteria shall be based on regulatory requirements and/or derived from other scientifically justifiable benchmarks or safety indicators that indicate system performance. The licensee should establish explicit criteria for the level of safety to be achieved.

Radiological protection of persons

The post-closure safety assessment of a disposal facility shall provide reasonable assurance that the regulatory radiological dose limit for public exposure (currently 1 mSv/year) will not be exceeded for the normal evolution scenario. To account for the possibility of exposure to multiple sources, and their potential cumulative effects, and to help ensure that doses resulting from the disposal system are as low as reasonably achievable (ALARA), a dose constraint should be established as a fraction of the regulatory dose limit. The dose constraint is not a limit, but rather a design tool in the optimization process. For example, for optimization, the International Commission on Radiological Protection (ICRP) [8] recommends a dose constraint of 0.3mSv/year.

The dose constraint should not be used to account for uncertainties in safety assessment model predictions. The achievement of a design constraint does not, in itself, demonstrate that a design satisfies the optimization principle. A dose should be reduced below a constraint if this can be done at a justifiable cost, taking into consideration social and economic factors. The form of the radiological design target should be consistent with the approach and strategy chosen for the post-closure safety assessment.

The IAEA's SSR-5, *Disposal of Radioactive Waste* [9], proposes the following criteria, according to ICRP recommendations:

(a) The dose limit for members of the public for doses from all planned exposure situations is an effective dose of 1 mSv in a year. This and its risk equivalent are considered criteria that are not to be exceeded in the future.

(b) To comply with this dose limit, a disposal facility (considered as a single source) is so designed that the calculated dose or risk to the representative person who might be exposed in the future as a result of possible natural processes affecting the disposal facility, does not exceed a dose constraint of 0.3 mSv in a year or a risk constraint of the order of 10^{-5} per year.

(c) In relation to the effects of inadvertent human intrusion after closure, if such intrusion is expected to lead to an annual dose of less than 1 mSv to those living around the site, then efforts to reduce the probability of intrusion or to limit its consequences are not warranted.

(d) If human intrusion were expected to lead to a possible annual dose of more than 20 mSv to those living around the site, then alternative options for waste disposal are to be considered; for example, disposal of the waste below the surface, or separation of the radionuclide content giving rise to the higher dose.

(e) If annual doses in the range of 1 to 20 mSv are indicated, then reasonable efforts are warranted, at the facility development stage, to reduce the probability of intrusion or to limit its consequences by means of optimization of the facility's design.

(f) Similar considerations apply where the relevant thresholds for deterministic effects in organs may be exceeded.

Protection of persons from hazardous substances

Benchmark values for protection from hazardous substances can be found in federal and provincial environmental objectives and guidelines. Where available, the *Canadian Environmental Quality Guidelines* [10], established by the Canadian Council of Ministers of the Environment (CCME) for protection of human health, should be used for benchmark or toxicological reference values. Where the CCME's human health guidelines are not available, human health-based federal or provincial guidelines should be used. If none are available, benchmarks can be derived from the toxicity literature or other regulatory agencies, or from CCME protocols for the derivation of criteria.

Radiological protection of the environment

For the protection of non-human biota from radiation exposure, the primary concern is the total radiation dose to the organisms resulting in deterministic effects. Radiation dose benchmarks for a quantitative effects analysis should follow the guidance of the United Nations Scientific Committee on the Effects of Atomic Radiation [11]. For species identified to be in need of special protection (e.g., those named on the Government of Canada's List of Wildlife Species at Risk), a more conservative screening dose rate criterion [8] should be considered. Other benchmark values for mean radiation doses to non-human biota have been derived for various types of organisms [12, 13, 14, 15, 16, 17].

Development of criteria for ensuring radiological protection of the environment should follow the protocols established for hazardous substances, as discussed below.

Protection of the environment from hazardous substances

Non-radiological acceptance criteria for protection of the environment can include concentration or flux of hazardous substances. The *Canadian Environmental Quality Guidelines* [10] for water, sediment and soil are appropriate benchmarks for conservative safety analyses. Provincial guidelines can be used, where appropriate, for substances for which federal guidelines have not been established.

Alternatively, benchmarks for hazardous substances can be derived from toxicity literature, or other regulatory agencies (e.g., the U.S. Environmental Protection Agency). The CCME provides protocols for the derivation of air, soil and water quality criteria. The protocols for developing criteria for the protection of the environment include determining critical toxicity values – such as an effects concentration for a 10% or 20% response, lowest observable adverse effects level, or no observable adverse effects level – from studies of chronic exposure to the most sensitive species. The assessment of risks of hazardous substances to non-human biota is done at the population level, but for species identified to be in need of special protection (e.g., those identified under the *Species at Risk Act*), the assessment should focus on protection at an individual level.

8.1.1.2 Approach adopted to demonstrate safety

A licensee or applicant should use risk-informed approaches to estimate the release and dispersal of contaminants and resulting concentrations in water, sediment, soil and air based on waste characteristics, release mechanisms and rates, and contaminant transport rates. This may be a combination of modelling supported by monitoring data.

A licensee or applicant should assess post-closure safety using a number of quantitative approaches, including, without being limited to:

- a scoping assessment to illustrate the factors that are important to post-closure safety and a bounding assessment to show the limits of potential impact
- calculations that give a realistic best estimate of the performance of the disposal facility or system, or conservative calculations that intentionally over-estimate potential impact
- deterministic or probabilistic calculations, appropriate for the purpose of the safety assessment, to reflect data uncertainty

The licensee or applicant may use any combination of these or other appropriate assessment strategies in a complementary manner to increase confidence in the demonstration of the safety of the facility.

The licensee or applicant should discuss and justify the choice of approach in the documentation demonstrating post-closure safety. It is expected that the purpose of the safety assessment will also justify the assessment model used (section 8.1.5) and the level of confidence that is needed in the results.

Scoping and bounding assessment

The licensee or applicant may use a scoping assessment to provide a general understanding of the overall disposal facility, and to help identify the aspects of the system that are critical to safety.

The licensee or applicant may use a bounding assessment to provide limiting estimates of disposal facility performance. Such assessment may be performed with simple mathematical models, or detailed models that use limiting parameter values.

Realistic best estimates vs. conservative overestimations assessment

The licensee or applicant may use a realistic best-estimate assessment to provide the most likely behavior of the disposal facility. The licensee or applicant should use real site and as-built facility data, site-specific scenarios and accurate models of the processes being simulated in the realistic estimate.

The licensee or applicant may use conservative assessments to intentionally overestimate future consequences to provide an additional margin of safety for situations where the assessment results cannot be considered accurate estimates, but indicators of safety. A conservative approach should be used when developing computer codes and models. Assumptions and simplifications of processes should not result in underestimation of the potential risks or impacts. It may not be necessary for every assumption to be conservative; however, the net effect of all assumptions should be a conservative representation of long-term impact and risk.

Conservative values of boundary and initial conditions of an assessment model, as well as input data, can be used to overestimate future consequences. Because models do not necessarily have a linear response to input data, conservative input values are not necessarily upper or lower limits of the data. It is the value of the computed result that determines whether the model structure and input data have given a conservative overestimation.

If the assessment results are to be used for compliance with a numerical measure or standard of performance, it may be appropriate to undertake a conservative approach based on relatively simple models. Such an approach will be feasible if there is a large margin of safety. Caution is necessary because if misused, results from overly conservative or worst case representations of the facility or activity may lead to poor decision making based on assessment results that bear little resemblance to the actual disposal system.

Deterministic and probabilistic approach

The licensee or applicant may use a deterministic model to illustrate the impact of specific individual uncertainties or alternative model assumptions. The deterministic model uses single-valued input data to calculate a single-valued result that will be compared to an acceptance criterion. To account for data variability, individual deterministic calculations must be done using different values of input parameters.

This is the approach used for performing sensitivity analyses (determining the response of model predictions to variations in input data) and importance analyses (calculating the range of predicted values that corresponds to the range of input values).

The licensee or applicant may use probabilistic models which typically perform repeated deterministic calculations based on input values sampled from parameter distributions, with the set of results expressed as a frequency distribution of calculated consequences. Frequency multiplied by consequence is interpreted as the overall potential risk of harm from the disposal. Probabilistic models can explicitly account for uncertainty arising from variability in the data used in safety assessment predictions. Such models may also be structured to take account of different scenarios or uncertainty within scenarios.

The potential risk calculated by a probabilistic model cannot be compared directly to an acceptance criterion unless that criterion is also expressed as a risk. The results of a probabilistic model should be presented and discussed. When risk is calculated as the magnitude of the consequence and the likelihood of its occurrence, the model will reflect the probability that a scenario with those particular input data values will actually occur.

8.1.1.3 Assessment end points

The licensee or applicant shall demonstrate that the selected assessment end points are consistent with the purpose of the assessment and with relevant regulatory requirements, such as requirements related to radiological dose.

Other safety indicators, complementary safety indicators, such as those that reflect containment barrier effectiveness or impacts on non-human species, can also be presented to illustrate the long-term performance of a disposal system. Some examples of complementary safety indicators include:

- container corrosion rates
- waste degradation rates
- groundwater age and travel time
- fluxes of contaminants from a disposal facility
- impacts of the system on site-specific flora and fauna
- concentrations of contaminants in specific environmental media (for example, concentration of radium in groundwater)
- changes in toxicity of the waste

The licensee or applicant should derive and justify the acceptance criteria by which these complementary safety indicators are to be judged from the relationship between the complementary safety indicator and the more direct assessment end-points. For example, if the environmental concentration of a hazardous substance is directly related to groundwater velocity near a disposal facility, then groundwater velocity could be used as a criterion to demonstrate post-closure safety to complement a more complete safety assessment that uses impact on the environment, such as environmental concentration, as end points.

Identification of human and environmental receptors

The licensee or applicant shall develop scenarios to include the identification of human and environmental receptors that may be exposed to radioactive and hazardous substances. The exposures of persons and the various receptor organisms can occur by different pathways and will be judged by different acceptance criteria even when all receptors are present in the same environment at the same time.

Human and environmental receptors should be identified based on the guidance of CSA N288.1, *Guidelines for Calculating Derived Release Limits for Radioactive Material in Airborne and Liquid Effluents for Normal Operations* [18], and CSA N288.6, *Environmental Risk Assessment for Class I Facilities and Uranium Mines and Mills* [19].

IAEA-TECDOC-1077, *Critical Groups and Biospheres in the Context of Radioactive Waste Disposal* [20], provides guidance for assessing exposures to critical groups throughout the time frame of the normal evolution scenario. For long time frames, the proponent may elect to use a reference biosphere for the critical group. Additional guidance on the use of reference biospheres can be found in the 2003 IAEA's BIOMASS-6, *Reference Biospheres for Solid Radioactive Waste Disposal* [21].

8.1.2 Disposal system description

The licensee shall include the disposal system description, a component of the overall safety case, which should be reiterated to show that the features are relevant to the safety assessment. The disposal system description should present both the characteristics of the site and the design of the SSCs important to safety, as well as a description of the waste to be managed.

As licensing progresses through the facility's lifecycle, as-built information and operational data are acquired. Both of these sources of information will enhance the understanding of the site characteristics. It is expected that safety assessments that are made later in the facility's lifecycle will be based on updated and refined models and data. There should be less reliance on default, generic or assumed information, resulting in more reliable model results.

8.1.2.1 Site characterization

The licensee or applicant shall include site characterization data in the safety assessment.

The licensee or applicant should ensure that the site characteristics are sufficiently defined to support an accurate description of the current site conditions and a credible projection of their future evolution.

Guidance on the site characterization of a deep geological repository is found in draft REGDOC-1.2.1, *Guidance on Deep Geological Repository Site Characterization* [6].

8.1.3 Post-closure safety assessment scenarios and time frames

The licensee shall develop and use scenarios to describe possible evolutions of the disposal system and its environment as well as the potential impact of identified FEPs on safety.

The licensee or applicant shall ensure that assessment scenarios are sufficiently comprehensive to account for all of the present and potential future states of the site and the biosphere.

The safety assessment shall include a base case scenario of the normal, expected or anticipated evolution of the site and the disposal system over time, and additional scenarios that examine the potential impact of disruptive events with a low probability of occurrence.

Each scenario presented in a safety assessment shall include specific information about:

- the time frame on which the assessment is based
- the length of time (start to finish) that institutional controls are relied upon as a safety feature
- the identity and characteristics of the assumed receptors and critical groups

A safety assessment should present and justify the techniques and criteria used to develop the scenarios that are analyzed. Scenarios should be developed in a systematic, transparent, and traceable manner through a structured analysis of relevant FEPs that are based on current and predicted future conditions of site characteristics, waste properties, and receptor characteristics and their lifestyles. The approach to scenario development should be consistent with the rigour of the safety assessment, taking into consideration the purpose of the assessment, the hazards of the waste, and the nature of the decision for which the assessment is being undertaken.

For the demonstration of the robustness of a disposal system, the assessment should consider disruptive event scenarios in which the total or partial failure of one or several barriers or safety functions is assumed. These disruptive event scenarios should show that the safety of the overall disposal system is still valid.

"What if" scenarios should be used to exhibit the robustness and performance of various natural and engineered barriers under extreme conditions. It can be instructive to assign parameter values or other properties to parts of the barrier system such that the barrier under consideration is influenced in an exaggerated way. This may show that such exaggerated conditions are impractical, do not negatively impact safety or that they can be avoided by design.

Stylized scenarios are generic representations of a group of scenarios, where part of the disposal system is treated in a standardized or simplified way. The application of stylized scenarios may be useful where site-specific information is lacking, or where the purpose of the safety assessment does not require detailed site-specific information.

The safety assessment should demonstrate that the set of scenarios developed is credible and comprehensive. Some FEPs or scenarios may be excluded from the assessment if these are extremely unlikely or would have trivial impact.

An alternative method for developing scenarios is based on an analysis of how the safety functions are influenced by possible FEPs. This may be followed by a process of auditing the scenarios developed against an appropriate list of the FEPs.

The approach and screening criteria used to exclude or include scenarios should be justified and well documented.

8.1.3.1 Normal evolution scenario

The licensee or applicant shall present a normal evolution scenario in the post-closure safety assessment. The normal evolution scenario should be based on reasonable extrapolation of current site features and receptor lifestyles. It should include the expected evolution of the site and the degradation of the disposal system (gradual or total loss of barrier function) as it ages. Evolution scenarios are not expected to include biological evolution of individual receptor species, which can be assumed to be static for the purposes of the post-closure safety assessment.

Depending on site-specific conditions and the time frame for the safety assessment, a normal evolution scenario should include expected conditions or events such as, earthquakes, climate shifts or the onset of glaciation. Similarly, periodic natural events such as floods or forest fires, if they are expected to occur during the time frame, should be part of the normal evolution scenario. Their effects on barrier performance should be considered. These scenarios may be analyzed separately as variants of the normal evolution scenario.

The decision about which natural events should be included is based on the assessment of FEPs and the probability of their occurrence within the time frame of the safety assessment.

Normal evolution scenarios should also take into account the failure modes of the containment and isolation systems. These failures can result not only from natural degradation of barriers, but from events that might be expected to occur once or more during the assessment time frame, including penetration of the barriers by intrusion.

The safety assessment should model the biosphere, which will be the receiving environment for the contaminants, based as much as possible on the site specific information in the system description. Alternatively, when-site specific information is not adequate to make reasonable or conservative extrapolations from the characteristics of the current biosphere, a stylized approach to defining the biosphere may meet the purpose of the safety assessment.

8.1.3.2 Disruptive event scenarios, including human intrusion

The licensee or applicant shall postulate disruptive event scenarios leading to possible penetration of barriers and abnormal loss of containment. The occurrence of events such as fire, flood, seismic activity, volcanism and human intrusion cannot be predicted accurately, even in cases where they can be associated with an annual probability of occurrence or a return period. Disruptive events – that are more severe than the events considered in normal evolution scenarios to which barriers are designed and assumed to resist – should be considered. The inclusion of disruptive event scenarios will demonstrate the principle of defence in depth and the robustness of the overall disposal system.

Intrusion not only breaches containment barriers, but also may result in waste being redistributed outside the barriers, potentially exposing the public and the environment. Assessment of human intrusion therefore needs to estimate the exposure of persons and the environment that would result from waste redistribution. Scenarios of inadvertent intrusion, where the intruder is not aware of the hazards of the waste, should estimate the exposure of the intruder. However, intentional human intrusion, where the intruder is assumed to be aware of the hazard of the waste, need not be considered.

Scenarios for inadvertent intrusion should be case-specific, based on the class of waste and the design of the disposal system, and should consider both the probability of intrusion and its associated consequences. Surface and near-surface disposal facilities (e.g., tailings sites) are more likely to experience intrusion than deep geological repositories. Acceptance criteria for human intrusion should be defined. In case the criteria cannot be met, even after optimization of the design and siting, management of the waste at greater depths should be considered.

Reasonable efforts should be made to limit the dose from a high-consequence intrusion scenario and to reduce the probability of the intrusion. The consequences of intrusion could be reduced by controlling the form and properties of the waste accepted. Design modifications to reduce the likelihood of inadvertent intrusion should be undertaken. This may include the choice of site (where site selection options are feasible), siting the disposal facility at a depth that discourages intrusion, incorporating robust design features that make intrusion more difficult, and implementing active or passive institutional controls, as appropriate.

For near-surface disposal, in addition to design and optimization, assessment of human intrusion scenarios also contributes to the development of waste acceptance criteria, to the development of the time frames necessary for institutional controls, and to the determination of whether specific waste streams require deeper disposal.

For deep geological repositories – where the site characteristics, and the depth and the design of the facility have already been optimized to reduce the likelihood of the intrusion – the assessment results of human intrusion scenarios should be used for illustrative purposes. Scenarios concerning inadvertent human intrusion into such repositories could estimate doses that are greater than the regulatory limit. Such results should be interpreted in light of the degree of uncertainty associated with the assessment, the conservatism in the dose limit, and the likelihood of the intrusion. Both the likelihood and the consequences from the intrusion should therefore be reported.

8.1.3.3 Assessment time frames

The licensee or applicant shall ensure that future impact that may arise from the radioactive waste includes the period of time during which the maximum impact is predicted to occur.

A rationale for the time frame associated with the safety assessment shall be given. The approach taken to determine respective periods of time used in the safety assessment should take into account the following elements:

- hazardous lifetime of the contaminants associated with the waste
- duration of the operational period (before the disposal facility reaches its end state)
- design life of engineered barriers
- duration of both active and passive institutional controls
- frequency of natural events and human-induced environmental changes (e.g., seismic occurrence, flood, drought, glaciation, climate change)
- the degree of protection and isolation required against inadvertent intrusion over the long term

The licensee or applicant should document and justify the assumed performance time frames of engineered barriers and the evolution of their safety functions over time. Depending on the purpose of the assessment, it might be convenient to divide the overall time frame into several shorter time windows for modelling or presentational reasons. Different end points can also be used for different time windows.

With long time frames, more severe events (associated with lower annual probability of exceedance) should be considered in the design of the disposal system and its components. For example, the design earthquake to be chosen for a system or its component depends on the likelihood and consequences of failure should a more severe earthquake occur during the time frame. If the consequences are high, the design earthquake should be chosen such as its probability of exceedance during the time frame would be smaller. A design earthquake is often associated with a return period (in years), which is the inverse of its annual probability of exceedance. For example an earthquake with a return period of 10,000 years has an annual probability of exceedance of 1/10,000. Therefore, for any given year, there is a probability of 1/10000 (0.01%) that a more severe earthquake might occur. For a time frame of 10,000 years, that probability increases to 63% and for a time frame of 100,000 years, this probability is near 100%.

8.1.4 Development and use of assessment models

In developing assessment models, the licensee or applicant should employ a variety of computational tools (conceptual and mathematical models) to predict future conditions for comparison to acceptance criteria.

The licensee or applicant should develop a conceptual model, which is a representation of the behaviour of the disposal system that includes the description of the components of the system and the interactions between these components. It should also include a set of assumptions concerning the geometry of the system and the chemical, physical, biological, mechanical and geological behavior of the facility or activity, consistent with the information and knowledge available.

The conceptual models of the site and the disposal system often need to be simplified to correspond to the limitations of the mathematical equations and the capabilities of computer models. A mathematical model is a representation of the features and processes included in the conceptual model in the form of mathematical equations.

The level of accuracy needed in the post-closure safety assessment models, and the degree of conservatism desired in the results, are determined by:

- the purpose of the safety assessment
- the importance of the model results with respect to indicating expected performance and safety

8.1.4.1 Confidence in safety assessment models

The licensee or applicant should ensure that safety assessment models are fit for purpose. The input parameters, the scenarios analyzed, and the results should be shown to be consistent with the assumptions and limitations of the model.

The licensee or applicant should keep records of how site-specific and system-specific characterization data have been used to derive input parameters.

The safety assessment model evaluation process should concentrate on identifying and understanding the key radiological, physical, chemical and biological processes that are important to safety at the various spatial and temporal scales of concern in the safety assessment. Sophisticated detailed models of processes can be used to determine if those processes are sufficiently influential to include them in the post-closure safety assessment model, or if they can be simplified or ignored with no detriment to the reliability of the predictions.

Model evaluation should include sensitivity analyses to show whether the model output responds as expected to variations in the model input parameter. Model evaluation should also include uncertainty and importance analyses to show which parameters control the variability in model output. These analyses should demonstrate how well the model replicates what is known and understood about the processes being simulated. The results obtained from these analyses should be shown to conform to the limitations and restrictions of the assumptions in the safety assessment model.

The need to evaluate the uncertainty in the safety assessment models is determined by the level of confidence needed in the modelling results. The acceptable level of confidence is governed by the purpose of the safety assessment, the safety factor built into the acceptance criteria for safety indicators, and the importance of the safety assessment model results to the safety case.

Neither sensitivity studies nor uncertainty analyses of deterministic or probabilistic models can inherently account for uncertainties in the underlying conceptual model, or for uncertainties resulting from limitations of the mathematical model used to describe the processes. Investigation of such uncertainties would require the use of different mathematical and computer models based on alternate conceptual models.

Confidence in the safety assessment model can be enhanced through a number of activities, including (without being limited to):

- performance of independent predictions using entirely different safety assessment strategies and computing tools
- demonstration of consistency between the results of the post-closure safety assessment model and complementary scoping and bounding safety assessment
- application of the safety assessment model to an analog of the disposal system
- performance of model comparison studies of benchmark problems
- scientific peer review by publication in open literature
- other practices in widespread use by the scientific and technical community
- demonstration of consistency between the model results and site-specific field studies

8.1.4.2 Confidence in computing tools

The licensee or applicant should ensure that computer programs are suitable for the given assessment; these may include commercially available software packages or software specifically developed for the assessment in question.

The computer software used for assessment calculations should be qualified in accordance with applicable standards.

Calibration of computer models and verification and validation of software are the main processes involved in software quality assurance. Calibration involves setting adjustable parameters within the mathematical equations to minimize the differences between the calculated and measured responses of the system, with the prior knowledge of the latter.

The licensee or applicant should verify and validate all computer software used for the safety assessment or provide reference to existing validation. Verification ensures that the program functions as designed and intended (i.e., that the mathematical equations in the computer model are solved correctly). This can be tested using benchmark problems specific for the type of model being assessed. Validation is meant to ensure that the mathematical equations in the computer model simulate, with reasonable accuracy, the processes and conditions they are supposed to represent.

8.1.5 Interpretation of results

When interpreting the safety assessment results, the applicant should demonstrate a thorough understanding of the underlying science and engineering principles that are controlling the safety assessment results. Interpretation should include evaluation of compliance with the acceptance criteria and analysis of the uncertainties associated with the safety assessment.

The results of the safety assessment should also be analyzed to show consistency with system performance expectations and with the complete set of assumptions and simplifications used in developing the models and scenarios. Any unexpected results or discrepancies should be documented, investigated and explained.

8.1.5.1 Comparing safety assessment results with acceptance criteria

One of the aims of the safety assessment is to compare the safety assessment end points with acceptance criteria. Comparison of the safety assessment results with acceptance criteria should include discussion of the conservatism of the model results, and of the conservatism built into the acceptance criteria for the assessment end points.

If the safety assessment results do not demonstrate compliance with the acceptance criteria, the safety assessment shall be revised. Sufficient detail should be provided to enable the CNSC to verify the results.

However, compliance with the acceptance criteria, in itself, is not sufficient for acceptance of a safety case since additional safety requirements must also be shown to be met.

8.1.5.2 Analyzing uncertainties

An uncertainty analysis of the assessment results should be performed to identify the sources and significance of uncertainty. This analysis should distinguish between uncertainties arising from:

- input data or parameters
- scenario assumptions
- the imprecision in the mathematical model
- the conceptual models

Sensitivity analysis is used to identify the relative importance of the uncertainty of each input parameter to the results of the safety assessment.

While acceptance criteria are usually expressed as single values, both deterministic and probabilistic safety assessment results have an associated uncertainty. It is expected that the comparison between the safety assessment end points and the acceptance criteria will explicitly take the uncertainty in the safety assessment into account, as follows:

- for deterministic safety assessments, the range of uncertainty in the calculated result as determined by a sensitivity analysis (or importance analysis) is expected to be explicitly included in the comparison
- for probabilistic safety assessments, the likelihood of exceeding the acceptance criteria should be determined from the calculated results distribution; if the range of safety assessment results from deterministic uncertainty analysis or from the probabilistic results distribution shows that part of the results may exceed the acceptance criteria, the applicant should demonstrate that these results will not represent unreasonable risk to the environment or to the health and safety of persons, taking into account the conservatism built into the safety assessment calculations and the likelihood of the circumstances leading to these results

Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

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19. CSA Group. CSA N288.6, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills*. Mississauga, 2012.

20. IAEA. IAEA TECDOC No. 1077, *Critical Groups and Biospheres in the Context of Radioactive Waste Disposal*. Vienna, 1999.

21. IAEA. IAEA BIOMASS-6, "*Reference Biospheres" for Solid Radioactive Waste Disposal*. Vienna, 2003.

Additional Information

The CNSC may recommend additional information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Webpage on its "How to gain free access to all nuclear-related CSA standards" Web page.

The following documents are not referenced in this regulatory document but contain information that may be useful to the reader:

- CNSC. REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*. Ottawa, 2018.
- CNSC. REGDOC-2.11.2, *Decommissioning*. Ottawa, TBD
- CSA Group. CSA N286, *Management System Requirements for Nuclear Facilities*. Mississauga, 2012.
- CSA Group. CSA N288.4, *Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills*. Mississauga, 2010.
- CSA Group. CSA N288.5, *Effluent Monitoring programs at Class I Nuclear Facilities and Uranium Mines and Mills*. Mississauga, 2011.
- CSA Group. CSA N288.6, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills*. Mississauga, 2012.
- CSA Group. CSA N288.7, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills*. Mississauga, 2015.
- CSA Group. CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*. Mississauga, 2014.
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L'organisme de réglementation nucléaire du Canada

Gestion des déchets

Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs

REGDOC-2.11.1, Gestion des déchets, tome III, version 2

Mai 2020

ÉBAUCHE

Commission canadienne de sûreté nucléaire

Canadian Nuclear Safety Commission

Canada

Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs, version 2
Document d'application de la réglementation REGDOC-2.11.1, tome III, version 2

Nº de cat. XXXXXXXX
ISBN XXXXX

Also available in English under the title: Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste

Disponibilité du document

Les personnes intéressées peuvent consulter le document sur le site Web de la CCSN ou l'obtenir, en français ou en anglais, en communiquant avec la :

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Twitter : @CCSN_CNSC
LinkedIn : linkedin.com/company/cnsc-ccsn

Historique de publication

Mai 2018 Évaluation de la sûreté à long terme de la gestion des déchets radioactifs, Version 1

Préface

Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Gestion des déchets, qui porte également sur le déclassement. La liste complète des séries figure à la fin de ce document et elle peut être consultée sur le site Web de la CCSN.

Le document d'application de la réglementation REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs*, version 2, énonce, à l'intention des demandeurs et des titulaires de permis de la CCSN, les exigences et l'orientation concernant l'élaboration d'un dossier de sûreté et l'évaluation complémentaire de la sûreté pour une installation, un emplacement ou un site d'évacuation.

Le présent document constitue une deuxième version et remplace le REGDOC-2.11.1, *Gestion des déchets, tome III : Évaluation de la sûreté à long terme de la gestion des déchets radioactifs*, publié en mai 2018.

Pour en savoir plus sur la mise en œuvre des documents d'application de la réglementation et sur l'approche graduelle, veuillez consulter le REGDOC-3.5.3, *Principes fondamentaux de réglementation*.

Le terme « doit » est employé pour exprimer une exigence à laquelle le demandeur ou le titulaire de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites de ce document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucune information contenue dans le présent document ne doit être interprétée comme libérant le titulaire de permis de toute autre exigence pertinente. Le titulaire de permis a la responsabilité de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et d'y adhérer.

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Dossier de sûreté pour l’évacuation ou le stockage définitif des déchets radioactifs

1. Introduction

1.1 Objet

Le présent document énonce, à l’intention des demandeurs et des titulaires de permis, les exigences et l’orientation concernant l’élaboration d’un dossier de sûreté et l’évaluation complémentaire de la sûreté ou le stockage définitif des déchets radioactifs de toutes les catégories.

1.2 Portée

Le présent document d’application de la réglementation (REGDOC) porte sur l’élaboration du dossier de sûreté et l’évaluation de la sûreté à l’appui de la phase post-fermeture des installations d’évacuation, qui comprennent les emplacements ou les sites, pour toutes les catégories de déchets radioactifs. Le document s’applique également aux installations, emplacements ou sites de gestion à long terme des déchets radioactifs pour lesquels il n’est pas prévu de retirer les déchets. **Remarque** : Dans le présent document d’application de la réglementation, le terme « installations d’évacuation » comprend également les emplacements et sites qui ne sont pas désignés comme des « installations nucléaires » en vertu de la LSRN.

Le dossier de sûreté pour la phase post-fermeture tient compte des renseignements provenant de la phase préfermeture (préparation de l’emplacement, construction, exploitation et déclassement) dans la mesure où ces renseignements ont une incidence sur la sûreté post-fermeture.

Dans le cas des installations d’évacuation qui étaient exploitées ou qui ont été déclassées ou fermées avant 2020, le présent REGDOC doit être traité comme un document d’orientation.

D’autres documents d’application de la réglementation de la CCSN s’ajoutent au présent document, notamment le REGDOC-2.9.1, *Protection de l’environnement : Principes, évaluations environnementales et mesures de protection de l’environnement* [1].

Les exigences et l’orientation que présente ce document d’application de la réglementation devraient aussi être adoptées pour l’évacuation des déchets radioactifs aux mines et usines de concentration d’uranium, s’il y a lieu. Le titulaire du permis doit justifier à la CCSN les exigences qui ne s’appliquent pas. Le REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d’uranium et des résidus des usines de concentration d’uranium* [2] contient des exigences et de l’orientation supplémentaires relatives à la gestion des déchets dans les mines et usines de concentration d’uranium.

1.3 Législation pertinente

Les dispositions de la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et des règlements connexes qui s’appliquent au présent document sont les suivantes :

- article 26 de la LSRN
- alinéas 4d) et 12(1)c) du *Règlement général sur la sûreté et la réglementation nucléaires*
- alinéas 3k), 4e), 5f), i), j), k), 6c), h), i), j), 7f), k) et 8a) du *Règlement sur les installations nucléaires de catégorie I*

- alinéas 4t), 5i) et 5k) du *Règlement sur les installations nucléaires et l'équipement réglementé de catégorie II*
- article 1 du *Règlement sur les substances nucléaires et les appareils à rayonnement*
- sous-alinéas 3a)viii), 3c)iii), 3d)i) et alinéas 7d) et 8b) du *Règlement sur les mines et les usines de concentration d'uranium*

2. Cadre de règlementation de la gestion des déchets de la CCSN

Outre le présent document d'application de la réglementation, le cadre de réglementation de la CCSN en matière de gestion des déchets comprend les documents suivants :

- REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada*
- REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs*
- REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium*
- REGDOC-2.11.2, *Déclassement*

Les normes CSA suivantes constituent un complément au cadre de réglementation de la CCSN :

- CSA N286, *Exigences relatives au système de gestion des installations nucléaires*
- CSA N288.4, *Programmes de surveillance de l'environnement aux installations nucléaires de catégorie I et aux mines et usines de concentration d'uranium*
- CSA N288.5, *Programmes de surveillance des effluents aux installations nucléaires de catégorie I et usines de concentration d'uranium*
- CSA N288.6, *Évaluation des risques environnementaux aux installations nucléaires de catégorie I et aux mines et usines de concentration d'uranium*
- CSA N288.7, *Programmes de protection des eaux souterraines aux installations nucléaires de catégorie I et aux mines et usines de concentration d'uranium*
- CSA N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié*
- CSA N292.1, *Entreposage humide du combustible irradié et d'autres matières radioactives*
- CSA N292.2, *Entreposage à sec provisoire du combustible irradié*
- CSA N292.3, *Gestion des déchets radioactifs de faible et de moyenne activité*
- CSA N292.5, *Ligne directrice sur l'exemption ou la libération du contrôle réglementaire des matières contenant ou susceptibles de contenir des substances nucléaires*
- CSA N292.6, *Gestion à long terme des déchets radioactifs et du combustible irradié*
- CSA N294, *Déclassement des installations contenant des substances nucléaires*

3. Approche graduelle

Le présent REGDOC peut être appliqué de manière graduelle en fonction du risque. Avec cette méthode, toutes les exigences s'appliquent, mais à des degrés divers selon l'importance de la sûreté et la complexité des travaux exécutés. Le niveau d'analyse, la profondeur de la documentation et l'étendue des mesures nécessaires pour se conformer aux exigences réglementaires sont proportionnels à la nature et au degré des dangers, à la complexité de l'installation ou des activités, ainsi qu'aux caractéristiques des déchets.

Pour en savoir plus sur l'approche graduelle, veuillez consulter le REGDOC-3.5.3, *Principes fondamentaux de réglementation* [3].

4. Définition du dossier de sûreté et de l'évaluation de la sûreté

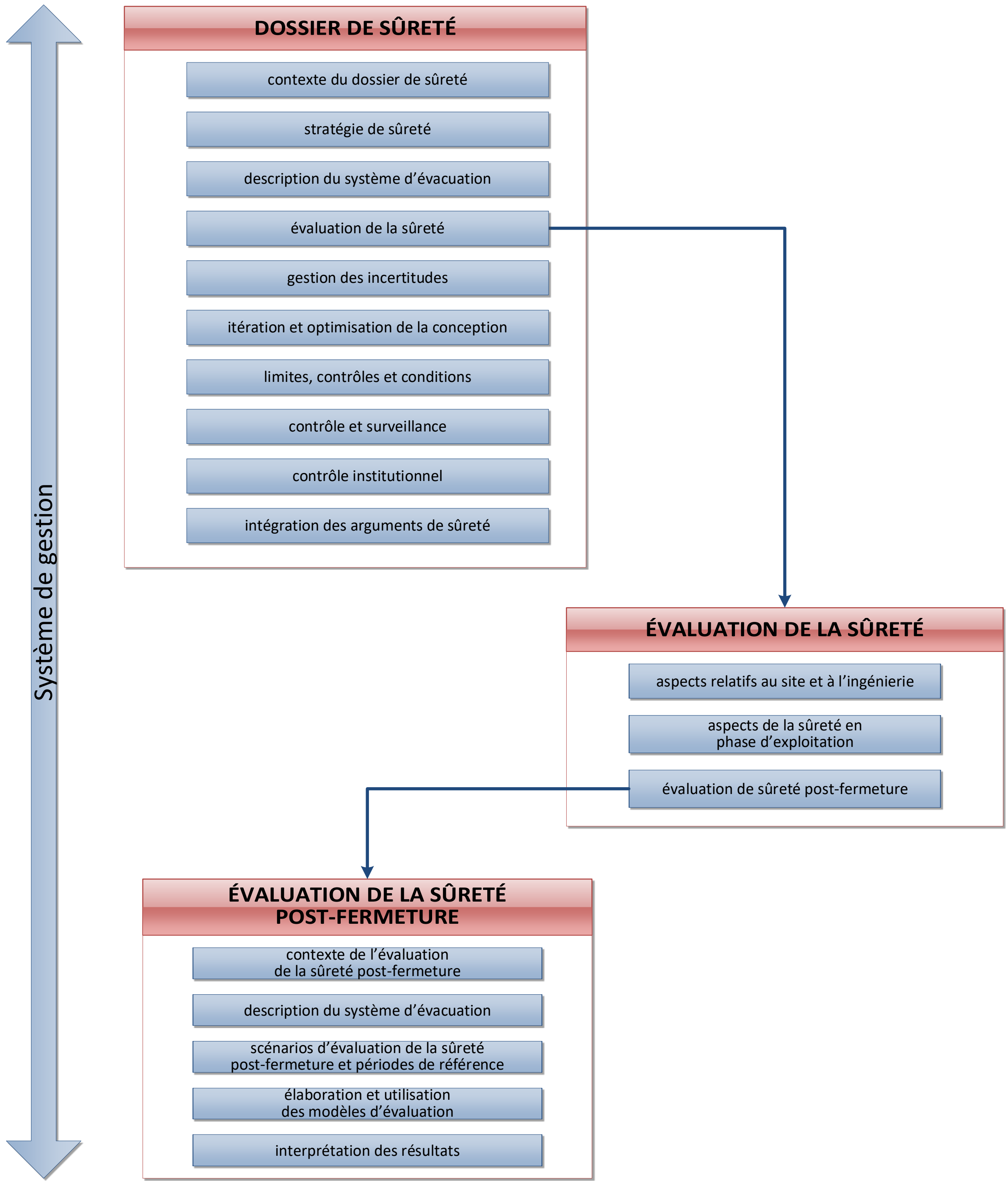
Un dossier de sûreté se définit comme un ensemble intégré d'arguments et d'éléments probants servant à démontrer qu'une installation est sûre et qu'elle satisfait à toutes les exigences réglementaires applicables. Un dossier de sûreté comprend normalement une évaluation de la sûreté, mais il peut aussi comprendre des renseignements (notamment des preuves et un raisonnement) concernant la solidité et la fiabilité de l'évaluation de la sûreté et des hypothèses qui y sont formulées.

Dans le cas d'une installation d'évacuation, le dossier de sûreté peut étayer la décision de passer à un stade de développement particulier. Dans ce cas, le dossier de sûreté devrait reconnaître l'existence de toute incertitude restante et fournir une orientation concernant les travaux visant à gérer ces incertitudes lors des stades de développement ultérieurs.

Une évaluation de la sûreté se définit comme une évaluation de tous les aspects pertinents pour assurer la sûreté d'une installation nucléaire. Il s'agit d'un processus systématique qui comprend des analyses quantitatives et l'interprétation des résultats de ces analyses. L'évaluation de la sûreté suit une approche itérative qui se poursuit tout au long du processus de conception et du cycle de vie de l'installation ou de l'activité, afin de s'assurer que toutes les exigences de sûreté pertinentes sont respectées. L'évaluation de la sûreté et l'analyse de la sûreté sont des termes souvent utilisées de manière interchangeable.

La figure 1 présente un aperçu des éléments d'un dossier de sûreté et d'une évaluation de la sûreté.

Figure 1. Éléments d’un dossier de sûreté et d’une évaluation de la sûreté



5. Rôle et élaboration du dossier de sûreté

5.1 Rôle du dossier de sûreté

Le dossier de sûreté couvre tous les dangers et constitue le principal outil utilisé pour documenter et démontrer qu’une installation protégera de manière adéquate les personnes et l’environnement pendant tout son cycle de vie (préparation de l’emplacement, construction, exploitation et déclassement) et pendant la période post-fermeture. Dans une évaluation de la sûreté post-fermeture, l’accent est mis sur le rendement de l’installation d’évacuation et sur l’évaluation de son effet après la fermeture. Le dossier de sûreté est un cadre structuré permettant de documenter et de présenter de manière consolidée tous les renseignements concernant la sûreté d’une installation d’évacuation.

Le dossier de sûreté soutient le processus réglementaire, y compris la prise de décisions, et constitue un moyen de communication et de consultation avec les parties intéressées à différents moments du cycle de vie de l’installation.

Le dossier de sûreté peut servir à diverses fins :

- vérifier un concept
- soutenir la sélection d’un emplacement
- optimiser la conception
- établir des limites, des contrôles et des conditions
- concevoir le programme de surveillance
- orienter l’exploitation, le déclassement et la fermeture
- prioriser les programmes de recherche et de développement

5.2 Élaboration du dossier de sûreté

Dans le cas d’une installation d’évacuation, il est nécessaire d’établir un dossier de sûreté post-fermeture tout au long de son cycle de vie – au début de chaque phase d’autorisation importante, depuis la préparation de l’emplacement jusqu’au déclassement (qui comprend la fermeture et le déclassement des installations auxiliaires). Ce dossier englobe la période post-fermeture, jusqu’à la libération du contrôle réglementaire. Le dossier de sûreté post-fermeture évolue tout au long du cycle de vie de l’installation d’évacuation selon une approche itérative.

Dans la phase précédant l’autorisation, il peut être nécessaire de formuler des hypothèses concernant l’élaboration du concept et le choix de l’emplacement. Ces activités n’ont pas à être autorisées par la CCSN, mais comme elles prennent beaucoup de temps, habituellement plusieurs dizaines d’années, il est recommandé de les lui soumettre tôt durant la période préalable à l’autorisation. À mesure que progressent les phases d’élaboration du concept et de sélection de l’emplacement, des données spécifiques au le site sont nécessaires, et, le cas échéant, on doit élaboré plus en détail les diverses activités : la conception, la construction, l’exploitation, le déclassement, la fermeture et la post-fermeture. Les problèmes pourront ainsi être traités plus en détail dans le dossier de sûreté.

Le dossier de sûreté est mis à jour progressivement tout au long du cycle de vie de l’installation d’évacuation, et pour ce faire on recueille, analyse et interprète systématiquement les données scientifiques et techniques nécessaires. La portée et le niveau des détails techniques dépendront du stade de développement auquel est rendu l’installation d’évacuation. Les données utilisées dans le dossier de sûreté peuvent provenir de diverses sources, y compris l’échantillonnage sur le site, les études sur terrain au niveau régional, la littérature scientifique et les exemples analogues. Ces mises à jour reflètent les commentaires formulés durant les examens techniques et réglementaires, l'avancement des connaissances et l'expérience en exploitation, ainsi que les résultats des programmes de surveillance et des activités de recherche. L'approche du cycle de vie pour élaborer un dossier de sûreté permet de mobiliser de façon continue le public et les groupes autochtones et d'intégrer les commentaires des parties intéressées.

À la fermeture de l'installation d'évacuation, le dossier de sûreté contiendra des renseignements dont les générations futures pourraient avoir besoin (p. ex., des plans de contrôle institutionnel, un plan de surveillance à long terme, etc.).

6. Exigences générales relatives au dossier de sûreté

À l'appui d'une demande de permis pour des activités concernant une installation d'évacuation, le demandeur ou le titulaire de permis doit soumettre un dossier de sûreté à la CCSN pour qu'elle l'accepte. Le dossier de sûreté doit répondre aux critères suivants :

- démontrer que toutes les exigences de sûreté seront respectées
- être détaillé et complet afin de fournir l'assise technique nécessaire à la prise de décisions
- comporter une documentation clairement rédigée, y compris des arguments justifiant les approches utilisées dans le dossier de sûreté, sur la base de renseignements traçables et crédibles
- évaluer la sûreté de l'installation selon une approche graduelle
- décrire tous les aspects touchant la sûreté de l'emplacement, de la conception, de la construction, de l'exploitation, du déclassement, de la fermeture et de la post-fermeture (y compris le contrôle institutionnel) de l'installation ou du site, le cas échéant
- être périodiquement réexaminé et mis à jour à toutes les phases de l'autorisation et chaque fois que des changements importants sont apportés à l'installation d'évacuation
- comprendre la mise en œuvre des principes des systèmes de gestion. On trouvera à ce sujet de plus amples renseignements et une orientation dans le REGDOC-2.1.1, *Système de gestion* [4]

7. Éléments du dossier de sûreté

Le dossier de sûreté doit comprendre les éléments suivants, comme il est illustré à la figure 1 :

- contexte du dossier de sûreté
- stratégie de sûreté
- description du système d'évacuation
- évaluation de la sûreté
- gestion des incertitudes
- itération et optimisation de la conception
- limites, contrôles et conditions
- contrôle et surveillance
- caractéristiques de sûreté durant la période de contrôle institutionnel
- intégration des arguments de sûreté

Remarque : Il existe de nombreuses façons de structurer et de documenter le dossier de sûreté.

7.1 Contexte du dossier de sûreté

Dans le dossier de sûreté, le demandeur ou le titulaire de permis doit :

- définir la portée et l'objet du dossier de sûreté
- énoncer les exigences à respecter pour démontrer la sûreté de l'installation d'évacuation

Les limites et les interfaces avec les installations et activités à proximité immédiate, tant à l'intérieur qu'à l'extérieur du site, devraient être prises en compte dans le dossier de sûreté.

La portée devrait décrire clairement la phase visée du cycle de vie de l'installation, les modifications apportées au dossier de sûreté par rapport aux versions antérieures et la façon dont les prochaines révisions seront intégrées.

Les exigences de sûreté sont celles qui garantissent que les activités autorisées proposées n'entraînent pas de risque déraisonnable pour l'environnement ni pour la santé et la sécurité des personnes. Les exigences comprennent habituellement des critères d'acceptation (voir la section 8.1.1.1) pour certains indicateurs de sûreté (notamment la dose, le risque, la concentration de radionucléides), en plus des principes de confinement, d'isolement, de défense en profondeur et de robustesse. Les exigences de sûreté devraient être élaborées en consultation avec la CCSN et les autres parties intéressées.

7.2 Stratégie de sûreté

Le demandeur ou le titulaire de permis doit concevoir et adopter une stratégie de sûreté qui décrit l'approche intégrée qui sera appliquée pour respecter les exigences de sûreté. La stratégie devrait être établie au début de l'élaboration du dossier de sûreté.

La stratégie doit définir et décrire un certain nombre d'éléments clés permettant d'assurer la confiance à l'égard de la sûreté, notamment :

- le confinement et l'isolement des déchets
- les fonctions de sûreté multiples, la défense en profondeur, et les dispositifs passifs de sûreté
- la robustesse
- la démontrabilité et la faisabilité
- les interdépendances des diverses étapes de la gestion des déchets
- d'autres éléments qui contribuent à la sûreté et donnent confiance en celle-ci

La stratégie de sûreté devrait indiquer les périodes de référence associées aux principaux éléments de la stratégie.

Confinement et isolement

Il doit être démontré, preuves à l'appui, que les exigences en matière de confinement et d'isolement seront respectées et que l'ensemble du système de barrières conservera ses fonctions de sûreté pendant la durée visée par le dossier de sûreté. Pour chaque barrière, il faut indiquer les fonctions de sûreté, le rendement attendu et la durée de vie nominale. La dégradation de ces fonctions de sûreté, en raison d'une évolution normale ou d'événements perturbateurs, doit être prise en compte. Il faut également démontrer que, malgré cette dégradation, le confinement et l'isolement ainsi que toutes les autres exigences de sûreté, y compris les critères d'acceptation (notamment la dose, le risque ou la concentration de contaminants), seront respectés.

Fonctions de sûreté multiples et défense en profondeur

Le principe de défense en profondeur doit être appliqué de manière à ce que le rendement de l'installation d'évacuation, décrit à la section 7.3, ne repose pas indûment sur une seule barrière. Le principe de défense en profondeur est généralement appliqué aux installations d'évacuation ou de stockage définitif en mettant en place des barrières multiples ayant plusieurs fonctions de sûreté qui contribuent au confinement et à l'isolement des déchets.

Les fonctions de sûreté de chaque barrière, ainsi que sa durée opérationnelle prévue, devraient être indiquées et justifiées. Les fonctions de sûreté devraient, dans la mesure du possible, être indépendantes les unes des autres, afin de s'assurer qu'elles sont complémentaires et pour que les barrières ne risquent pas d'entrer en mode de défaillance unique. Le nombre et l'étendue des barrières nécessaires devraient être proportionnels aux dangers que présentent les déchets à évacuer.

Les fonctions de sûreté doivent être assurées par des moyens passifs, dans la mesure du possible. Les contrôles actifs, tels que la surveillance, peuvent contribuer à la confiance à l'égard des barrières passives et des fonctions de sûreté, mais on ne doit pas se fier uniquement à ces systèmes pour assurer une défense en profondeur. Le système de barrières multiples devrait offrir une résistance à la migration des radionucléides, principalement par des moyens passifs.

Robustesse

La robustesse de l'ensemble du système d'évacuation des déchets et de chacune de ses barrières doit être démontrée. L'ensemble du système d'évacuation est robuste s'il peut être démontré qu'aucune des exigences de sûreté ne serait compromise si une ou plusieurs barrières ou fonctions de sûreté venaient à défaillir. La robustesse des barrières est démontrée en prouvant que les perturbations anthropiques ou les processus naturels prévus ne les empêcheront pas de remplir leurs fonctions de sûreté.

L'effet du temps sur la robustesse devrait être pris en compte. Dans le cas des installations d'évacuation ou de stockage définitif à long terme, il est fort probable que les processus naturels ou les perturbations puissent affecter le rendement des barrières individuelles ou de l'ensemble de l'installation d'évacuation.

Période de référence

Le demandeur ou le titulaire de permis doit définir cette période de référence, qui est la période couverte par l'évaluation de la sûreté. Les périodes de référence établissent les conditions limites de la longévité et du rendement des barrières visant à isoler et à confiner les déchets.

Le demandeur ou le titulaire de permis doit justifier la période de référence associée au rendement requis de l'ensemble de l'installation d'évacuation et de ses composants individuels, dans le cadre de la stratégie de sûreté. Cette justification doit être proportionnelle à la classe de déchets à stocker ou à entreposer, et également à la période de référence associée aux dangers que présentent les déchets.

La période de référence doit refléter au minimum les facteurs suivants :

- le moment où l'effet radiologique devrait culminer selon l'évaluation de la sûreté

- l’évolution normale (prévue) du système d’évacuation ou de stockage définitif, compte tenu de la désintégration des substances radioactives associées aux déchets et de la stabilité du milieu géologique ou du site
- le type et la gravité des événements évalués dans l’évaluation de la sûreté

Pour justifier la période de référence, le demandeur ou le titulaire de permis devrait aussi envisager de fournir les éléments de preuve supplémentaires suivants :

- l’utilisation d’analogues naturels appropriés (p. ex., caractéristiques géologiques, hydrogéologiques et géochimiques semblables à celles du site)
- les niveaux naturels des contaminants radiologiques et non radiologiques sur le site

Il pourrait être nécessaire de définir plusieurs périodes de référence dans un même dossier de sûreté afin de démontrer le respect des exigences de confinement selon différents scénarios. Par exemple, en plus de la période de référence du scénario d’évolution normale, il serait possible d’utiliser d’autres périodes de référence pour illustrer la robustesse du système d’évacuation après que les effets prévus auront atteint leur maximum. Le demandeur ou le titulaire de permis pourrait définir des périodes de référence additionnelles afin d’illustrer le rendement de barrières particulières en réponse à des événements perturbateurs (p. ex., séismes, glaciations, changements climatiques) susceptibles de se produire dans le futur. La conception de l’installation du système d’évacuation devrait tenir compte des événements perturbateurs pertinents pour la période de référence du scénario d’évolution normale. Dans d’autres cas (p. ex., l’évacuation ou le stockage définitif des déchets de moyenne ou haute activité dans des formations géologiques profondes), les prévisions des effets sur des horizons de temps atteignant des dizaines de millions d’années pourraient illustrer les capacités de confinement des barrières, malgré d’importantes perturbations environnementales ou géologiques qui pourraient survenir. L’évolution de l’installation d’évacuation doit être prise en compte dans l’établissement de la période de référence, et le scénario d’évolution normale utilisé dans l’évaluation de la sûreté devrait être défini en conséquence.

7.3 Description du système d’évacuation

Le demandeur ou le titulaire de permis doit décrire le système d’évacuation dans le dossier de sûreté. Le système d’évacuation se définit comme l’ensemble des propriétés du site pour l’installation d’évacuation des déchets, la conception du système d’évacuation, les structures et éléments physiques, les procédures de contrôle, ainsi que les caractéristiques des déchets et les autres éléments qui contribuent, de diverses façons et pendant diverses périodes de référence, au bon fonctionnement des fonctions de sûreté pour l’évacuation ou le stockage définitif. La description devrait également comporter des renseignements quantitatifs et qualitatifs. Selon le cas, elle doit aussi comprendre les éléments suivants :

- la description précise des caractéristiques, événements et processus (CEP) associés au site et à l’installation d’évacuation
- l’information relative aux déchets (p. ex., les quantités et les propriétés des déchets et l’inventaire des radionucléides)
- les critères d’acceptation des déchets à l’installation d’évacuation
- la description de la biosphère, y compris le biote humain et non humain et l’environnement physique
- les caractéristiques du site, y compris, le cas échéant, les unités géologiques en profondeur et près de la surface sur le site, notamment :

    - la description des conditions en surface et dans le sous-sol (p. ex., géologie, hydrogéologie, hydrologie, géochimie, tectonique, sismicité, géomorphologie, climat, écologie)
    - l'utilisation actuelle et prévisible des terres
    - la détermination et la description de l'évolution naturelle et des événements perturbateurs prévus
- la conception et les hypothèses sous-jacentes à la conception
- la description des structures, systèmes et composants (SSC) du système d'évacuation, y compris les barrières techniques et naturelles, leurs fonctions de sûreté, leurs interfaces, les incertitudes connexes et le rendement au fil du temps[1]
- la description des processus radiologiques, thermiques, hydrauliques, mécaniques, chimiques et biologiques qui pourraient avoir une incidence sur le système d'évacuation et ses composants, ainsi que l'interaction possible entre ces composants

Le demandeur ou le titulaire de permis doit démontrer que la criticité nucléaire a été prise en compte, le cas échéant. L'analyse de la sûreté-criticité nucléaire à la phase de post-fermeture doit reposer sur les critères d'acceptation et les pratiques techniques fournies dans le document REGDOC-2.4.3, *Sûreté-criticité nucléaire* [5].

Selon une approche graduelle en matière de sûreté, la rigueur et l'exhaustivité de la description du système et de ses composants devraient être proportionnelles aux dangers des déchets, ainsi qu'à la phase du cycle de vie et à l'étape du processus d'autorisation de l'installation. Par exemple, même si des données génériques suffisent lors de la phase de développement du concept, il faut être en mesure de fournir davantage de données sur le site aux phases suivantes, notamment lors du choix de l'emplacement, de la construction et de l'exploitation. Le dossier de sûreté devrait être mis à jour de manière à refléter l'avancée des connaissances sur le comportement du système d'évacuation, lesquelles sont obtenues par l'intermédiaire d'un programme de recherche et de développement systématique.

Le demandeur ou le titulaire de permis doit déterminer les fonctions de sûreté de l'ensemble du système d'évacuation et des SSC individuels, et évaluer le rendement sur le plan de la sûreté en se basant sur leur capacité à remplir les fonctions de sûreté. Le dossier de sûreté et l'évaluation de sûreté complémentaire devraient expliquer et justifier les fonctions de sûreté de l'ensemble du système d'évacuation et de chaque barrière individuelle.

Pour en savoir plus sur la caractérisation des dépôts géologiques en profondeur, veuillez consulter le REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* [6].

7.4 Évaluation de la sûreté

Le demandeur ou le titulaire de permis doit effectuer une évaluation de la sûreté qui tient compte des répercussions sur les personnes et l'environnement pouvant résulter de l'évolution normale du site et des événements perturbateurs potentiels relevés dans l'analyse des CEP. L'analyse des CEP peut s'appuyer sur la Liste internationale des CEP de l'Agence de l'énergie nucléaire.

[1] En matière d'évacuation ou de stockage définitif, le rendement des installations devrait tenir compte de la dégradation des barrières pendant la période de référence associée à l'installation d'évacuation.

7.4.1 Éléments de l'évaluation de la sûreté

Selon le cas, l'évaluation de la sûreté doit comprendre les éléments suivants :

- les aspects relatifs au site et à l'ingénierie
- les aspects de la sûreté en phase d'exploitation
- l'évaluation de sûreté post-fermeture

7.4.1.1 Aspects relatifs au site et à l'ingénierie

Le demandeur ou le titulaire de permis doit fonder son évaluation de la sûreté sur les données tirées de la description du système d'évacuation, et indiquer les conditions limites utilisées dans les modèles d'évaluation quantitative (point traité à la section 8.1.1.2).

Le demandeur ou le titulaire de permis devrait utiliser les résultats de l'évaluation de la sûreté pour démontrer le caractère adéquat et fiable du site et de la conception technique.

Caractéristiques de sûreté passives

Le demandeur ou le titulaire de permis doit prévoir des moyens de sûreté passifs dans la conception de l'installation afin de réduire la dépendance à l'égard des systèmes actifs de sûreté.

Fonctions de sûreté multiples

Le demandeur ou le titulaire de permis doit évaluer la défense en profondeur par rapport au site et à l'ingénierie. Pour ce faire, il doit démontrer que l'installation offre des fonctions de sûreté multiples.

Principes scientifiques et techniques

Le demandeur ou le titulaire de permis devrait tirer profit des techniques et matériaux de construction établis et des leçons apprises par l'expérience. S'il veut utiliser d'autres techniques et matériaux, il devrait présenter une justification à cet effet.

Qualité de la caractérisation du site

Le demandeur ou le titulaire de permis doit s'assurer que l'évaluation de la sûreté décrit ou cite en référence l'approche et les critères utilisés pour sélectionner le site, et démontre que le site choisi est conforme à la stratégie de sûreté et à tous les critères établis.

Dans le cas des installations d'évacuation, les activités de caractérisation du site couvriront plusieurs années et devraient être réalisées selon un plan officiel de caractérisation du site qui comprend des protocoles d'assurance et de contrôle de la qualité afin de vérifier les données.

7.4.1.2 Aspects de la sûreté en phase d'exploitation

Bien que les aspects de la sûreté en phase d'exploitation ne relèvent pas du présent document, le titulaire de permis doit s'assurer que tout effet négatif des activités préfermeture sur la sûreté post-fermeture est évalué et minimisé.

7.4.1.3 Évaluation de la sûreté post-fermeture

Le demandeur ou le titulaire de permis doit effectuer une évaluation de la sûreté post-fermeture. Cette évaluation constitue le cœur de l'évaluation de la sûreté d'une installation d'évacuation. Elle comprend une analyse de l'évolution normale prévue du système d'évacuation, des événements perturbateurs possibles et des potentielles répercussions radiologiques et non radiologiques sur les personnes et l'environnement, ainsi que l'interprétation des résultats. Des scénarios sont utilisés pour décrire les évolutions possibles du système d'évacuation et de son environnement, ainsi que leurs effets.

Les effets sont déterminés quantitativement au moyen de modèles mathématiques. Cela comprend une analyse de la migration possible des substances radioactives et dangereuses depuis l'installation d'évacuation, de leur mouvement dans l'environnement et des effets qui en résultent. Les exigences et l'orientation concernant la réalisation d'une évaluation de la sûreté post-fermeture figurent à la section 8 du présent document.

7.5 Gestion des incertitudes

Dans le dossier de sûreté, le demandeur ou le titulaire de permis doit caractériser les incertitudes par rapport à leur source, à leur nature et à leur ampleur en utilisant des méthodes quantitatives et son jugement professionnel.

Le demandeur ou le titulaire de permis doit s'assurer que le dossier de sûreté décrit la façon dont les incertitudes sont gérées, par exemple :

- en modifiant la stratégie de sûreté pour réduire les incertitudes
- en démontrant que les incertitudes n'ont aucune incidence sur la sûreté
- en ayant recours à des hypothèses prudentes pour délimiter les incertitudes et démontrer qu'une marge suffisante demeure pour respecter les exigences de sûreté

Le demandeur ou le titulaire de permis devrait réduire les incertitudes tout au long de l'élaboration du dossier de sûreté. De plus, il devrait déterminer les incertitudes restantes dans le dossier de sûreté, et la façon dont ce dossier demeure valable malgré ces incertitudes.

Les incertitudes restantes qui ont une incidence sur la sûreté devraient faire l'objet d'analyses des incertitudes et de la sensibilité. De plus, on pourrait élaborer des programmes de surveillance et de recherche et développement pour réduire davantage ces incertitudes.

7.6 Itération et optimisation de la conception

Le demandeur ou le titulaire de permis devrait s'assurer que la conception du système d'évacuation et ses composants sont optimisés, en utilisant un processus itératif et bien défini. À mesure que le projet progresse et que les connaissances s'améliorent, les résultats initiaux devraient se préciser et remplacer les données génériques ou par défaut, réduisant ainsi le recours aux hypothèses.

Dans le dossier de sûreté, le demandeur ou le titulaire de permis devrait expliquer comment la conception choisie et ses composants ont été optimisés. Le processus de conception devrait comprendre une comparaison des différentes options envisagées, une évaluation de leurs avantages et de leurs inconvénients, ainsi qu'une justification de l'option choisie. L'optimisation peut être démontrée au moyen d'une comparaison entre les versions antérieures de la conception et la conception finale.

7.7 Limites, contrôles et conditions

Le demandeur ou le titulaire de permis doit établir des limites, des contrôles et des conditions en utilisant le dossier de sûreté. Ceux-ci doivent être appliqués à toutes les activités qui influent sur la sûreté post-fermeture de l'installation et sur les déchets qui seront évacués dans cette installation.

Les limites, contrôles et conditions établis d'après l'évaluation de la sûreté pour les déchets doivent comprendre les critères d'acceptation des déchets tant pour les colis individuels que pour l'ensemble de l'installation, et pour l'inventaire de déchets acceptables ou les concentrations admissibles de radionucléides dans les déchets.

Le demandeur ou le titulaire de permis doit utiliser les limites, contrôles et conditions établis afin d'élaborer les procédures et programmes opérationnels qui sont compatibles avec la sûreté post-fermeture. Par exemple, il devrait s'appuyer sur le dossier de sûreté et sur les limites, conditions et contrôles établis pour élaborer un programme de surveillance du site et des environs adaptés à l'installation.

7.8 Contrôle et surveillance

Le REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* [7] présente les exigences relatives à la surveillance des installations de gestion des déchets.

7.9 Contrôle institutionnel

Le demandeur ou le titulaire de permis doit définir le rôle que jouent les contrôles institutionnels dans la sûreté de l'installation d'évacuation et expliquer comment ce rôle est pris en compte dans le dossier de sûreté et l'évaluation complémentaire de la sûreté. L'existence de contrôles institutionnels ne devrait pas être invoquée pour justifier une conception moins robuste du système de confinement et d'isolement.

La sûreté à long terme de l'installation d'évacuation des déchets radioactifs ne devrait pas dépendre principalement des contrôles institutionnels, mais il faudrait y recourir dans la mesure du possible pour confirmer que le système d'évacuation fonctionne comme prévu.

Compte tenu des incertitudes associées aux activités humaines futures et à l'évolution et à la stabilité des sociétés, le demandeur ou le titulaire de permis devrait limiter son recours aux contrôles institutionnels pour assurer la sûreté à quelques centaines d'années, tout au plus. Dans le cas des déchets des mines et usines de concentration d'uranium, le volume important de déchets et la longévité de certains radionucléides peuvent nécessiter des périodes de contrôle institutionnel plus longues pour assurer leur sûreté. Le recours à un contrôle institutionnel de longue durée (plus de quelques centaines d'années) devrait être justifié dans le dossier de sûreté, au moyen d'un processus d'optimisation qui tient compte des facteurs techniques et socioéconomiques.

L'orientation relative au contrôle institutionnel est présentée dans le REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* [7].

7.10 Intégration des arguments de sûreté

Le demandeur ou le titulaire de permis devrait veiller à ce que le dossier de sûreté présente une synthèse des preuves, des arguments et analyses disponibles. Cette synthèse devrait être bien structurée, transparente et traçable.

Le demandeur ou le titulaire de permis devrait :

- démontrer que toutes les exigences de sûreté ont été respectées
- fournir des indicateurs de sûreté complémentaires, comme les concentrations et les flux de radionucléides dans chacune des barrières
- fournir des arguments de sûreté complémentaires, comme les résultats de l'étude paléohydrogéologique du site et de l'étude des analogues naturels du système d'évacuation des déchets ou de chacun de ses composants
- indiquer l'incidence potentielle sur l'environnement des substances dangereuses contenues dans les déchets radioactifs

De plus, le demandeur ou le titulaire de permis devrait :

- décrire comment les incertitudes sont gérées dans le dossier de sûreté et l'évaluation de sûreté complémentaire
- démontrer la qualité et la fiabilité des travaux scientifiques et la conception sur lesquels repose le dossier de sûreté
- démontrer la qualité et la fiabilité de l'évaluation de la sûreté concernant l'élaboration des scénarios, la pertinence des méthodes, modèles, codes informatiques et bases de données, et la qualité des calculs
- fournir toute conclusion ou tout résultat qui contredit les arguments présentés dans le dossier de sûreté
- reconnaître les limites des preuves, arguments et analyses actuellement disponibles
- consigner tout examen du dossier de sûreté par des pairs et montrer comment les résultats de cet examen ont été pris en compte
- fournir les exigences du système de gestion pour le rendement des calculs de l'évaluation de sûreté afin d'en assurer la qualité

Après l'intégration des arguments de sûreté, le demandeur ou le titulaire de permis devrait justifier la poursuite du projet.

7.10.1 Comparaison avec les critères d'acceptation

Le demandeur ou le titulaire de permis doit comparer les paramètres ultimes sélectionnés pour l'évaluation avec les critères d'acceptation (p. ex., la dose et les concentrations de contaminants). Il convient de noter que le respect des critères d'acceptation ne suffit pas à rendre un dossier de sûreté acceptable, car d'autres exigences de sûreté (p. ex., l'isolement, ou le confinement) doivent également être respectées. De plus, il faudrait démontrer que le système d'évacuation proposé a été optimisé.

7.10.2 Indicateurs de sûreté complémentaires

En plus de comparer les paramètres ultimes de l'évaluation de la sûreté avec les critères d'acceptation, le demandeur ou le titulaire de permis devrait utiliser des indicateurs de sûreté complémentaires (c.-à-d. calculer des valeurs autres que les paramètres ultimes de l'évaluation) afin d’accroître la confiance à l’égard des conclusions du dossier de sûreté. Il faudrait justifier l’utilisation de ces indicateurs de sûreté complémentaires comme arguments additionnels en faveur de la sûreté.

On peut également utiliser les indicateurs complémentaires issus de l’évaluation de la sûreté pour éclairer le programme de surveillance. Cependant, dans de nombreux cas, il est impossible de surveiller directement ou de manière pratique ces indicateurs (p. ex., la vitesse de corrosion des conteneurs), mais on doit les déduire d’après un ensemble de sous-indicateurs qui sont facilement mesurés ou quantifiés. Par exemple, le taux de corrosion dépend de la température et de la composition géochimique des eaux souterraines, alors ces paramètres peuvent faire partie d’un programme de surveillance.

7.10.3 Arguments complémentaires (raisonnement multiples)

Le demandeur ou le titulaire de permis devrait utiliser plusieurs types de raisonnement pour accroître la confiance à l’égard du dossier de sûreté, par exemple, en utilisant des analogues naturels ou anthropiques ou encore des données paléohydrogéologiques.

Les analogues naturels peuvent être utilisés pour démontrer que les composants d’un système d’évacuation restent efficaces sur les grandes échelles temporelles et spatiales prises en compte dans les modèles d’évaluation de la sûreté post-fermeture, et qu’on ne peut reproduire en laboratoire. Ces études peuvent fournir des données permettant de vérifier et de valider les modèles de processus détaillés et d’évaluation simplifiés, ainsi que d’élaborer des modèles du site descriptifs génériques en l’absence de données de caractérisation spécifiques. Il est aussi possible d’utiliser des analogues anthropiques, le cas échéant, en complément des analogues naturels. Les données paléohydrogéologiques propres à un site permettent d’accroître la confiance à l’égard de la stabilité géologique et de la capacité de confinement du site. Les analogues naturels et les données paléohydrogéologiques peuvent contribuer aux évaluations complémentaires de la sûreté à long terme, et être inclus dans le dossier de sûreté afin d’accroître la confiance à l’égard des conclusions tirées de l’évaluation de la sûreté.

8. Évaluation de la sûreté post-fermeture

Le demandeur ou le titulaire de permis doit s’assurer que l’évaluation de la sûreté post-fermeture d’un système d’évacuation comprend une analyse quantitative systématique de l’évolution du système d’évacuation et de son environnement, des événements perturbateurs possibles et des effets radiologiques et non radiologiques potentiels qui pourraient en résulter pour les personnes et l’environnement. L’interprétation des résultats quantitatifs devrait être claire.

Le demandeur ou le titulaire de permis doit élaborer et utiliser des scénarios pour décrire l’évolution possible de l’installation et de son environnement, ainsi que l’effet possible des CEP sur la sûreté.

Le demandeur ou le titulaire de permis devrait appliquer des modèles à chaque scénario afin d’évaluer ce qui suit :

- l’évolution de la forme des déchets et de l’activité ou des concentrations des contaminants associés au fil du temps
- le taux de rejet des contaminants
- l’évolution des barrières artificielles
- l’évolution des barrières naturelles

- le transport des contaminants traversant les barrières artificielles, la géosphère et la biosphère
- l'exposition des récepteurs
- les effets potentiels de l'exposition

Le demandeur ou le titulaire de permis doit s'assurer que l'évaluation de la sûreté post-fermeture démontre qu'il comprend bien le système d'évacuation, grâce à une méthode bien structurée, transparente et traçable.

La documentation de l'évaluation de la sûreté post-fermeture devrait fournir un compte rendu clair et complet des décisions prises et des hypothèses formulées lors de l'élaboration du modèle du système d'évacuation. Les paramètres et les variables appliqués au modèle pour obtenir un ensemble de résultats donnés devraient être consignés et justifiés. Ces données devraient être tirées des études spécifiques sur le site et des résultats de recherche.

Les hypothèses et les données de l'évaluation de la sûreté post-fermeture doivent être étayées par une évaluation des conditions actuelles et futures du système d'évacuation.

En raison de l'incertitude qui entache les hypothèses concernant les événements futurs, la fiabilité des estimations quantitatives diminue au fil du temps. La démonstration de la sûreté s'appuiera donc moins sur des estimations quantitatives et davantage sur des arguments qualitatifs à mesure que l'horizon temporel augmente. Le demandeur ou le titulaire de permis ne devrait donc pas considérer les estimations quantitatives à long terme comme étant des prédictions exactes, mais plutôt comme des indicateurs de sûreté. Pour renforcer la confiance à l'égard de l'évaluation de la sûreté post-fermeture, on devrait employer une approche qui combine plusieurs types de raisonnement (arguments complémentaires) et plusieurs indicateurs de sûreté dans le contexte du dossier de sûreté.

8.1 Éléments de l'évaluation de la sûreté post-fermeture

Pour réaliser l'évaluation de la sûreté post-fermeture d'un système d'évacuation, le demandeur ou le titulaire de permis devrait utiliser une approche structurée comprenant les éléments suivants :

- le contexte de l'évaluation de la sûreté post-fermeture
- la description de l'installation d'évacuation
- les scénarios et les périodes de référence de l'évaluation de la sûreté post-fermeture
- l'élaboration et l'utilisation de modèles d'évaluation de la sûreté
- l'interprétation des résultats

8.1.1 Contexte de l'évaluation de la sûreté post-fermeture

Le demandeur ou le titulaire de permis doit s'assurer que le contexte de l'évaluation de la sûreté permet de :

- définir la portée et l'objet de l'évaluation
- énoncer les critères utilisés dans l'évaluation
- décrire l'approche adoptée pour démontrer la sûreté
- indiquer les paramètres ultimes de l'évaluation (c.-à-d. les résultats de la modélisation qui doivent être comparés aux critères d'acceptation; voir la section 8.1.1.1)

8.1.1.1 Critères d'acceptation utilisés dans l'évaluation

Le demandeur ou le titulaire de permis doit s'assurer que le contexte de l'évaluation de la sûreté contient des critères qui permettent de juger de l'acceptabilité des résultats de l'évaluation de la sûreté. Ces critères doivent être fondés sur des exigences réglementaires ou dérivés d'autres indicateurs de sûreté ou paramètres scientifiquement justifiables, qui démontrent le rendement du système. Le titulaire de permis devrait aussi définir les critères précis du niveau de sûreté à atteindre.

Radioprotection des personnes

L'évaluation de la sûreté post-fermeture d'une installation d'évacuation doit fournir une assurance raisonnable que la limite réglementaire de dose radiologique pour l'exposition du public (actuellement de 1 mSv/an) ne sera pas dépassée dans le scénario d'évolution normale. Pour tenir compte de la possibilité d'exposition à des sources multiples et de leurs effets cumulatifs potentiels, et pour garantir que les doses dues au système d'évacuation sont au niveau le plus bas qu'il soit raisonnablement possible d'atteindre (principe ALARA), on devrait établir une contrainte de dose sous forme d'une fraction de la limite de dose réglementaire. La contrainte de dose n'est pas une limite, mais plutôt un outil de référence dans le processus d'optimisation. Par exemple, aux fins d'optimisation, la Commission internationale de protection radiologique (CIPR) [8] recommande une contrainte de dose de 0,3 mSv/an.

On ne devrait pas utiliser la contrainte de dose pour tenir compte des incertitudes dans les prévisions du modèle d'évaluation de la sûreté. En effet, le simple fait d'atteindre la contrainte de dose ne prouve pas que la conception respecte le principe d'optimisation. La dose devrait être réduite en deçà de la contrainte, pourvu qu'il soit possible de le faire à un coût défendable, compte tenu des facteurs socioéconomiques. L'objectif radiologique nominal devrait être formulé de façon à être cohérent avec l'approche et la stratégie choisies pour l'évaluation de la sûreté post-fermeture.

Pour les scénarios d'intrusion humaine accidentelle, le document SSR-5 de l'AIEA, *Stockage définitif des déchets radioactifs* [9], propose les critères suivants, conformément aux recommandations de la CIPR :

a) La limite de dose aux membres du public pour toutes les situations d'exposition planifiées est une dose efficace de 1 mSv par an. Cette limite et son équivalent en termes de risque sont considérés comme des critères à ne pas dépasser à l'avenir.

b) Pour que cette limite de dose soit respectée, une installation d'évacuation ou de stockage définitif (considérée comme une source unique) est conçue de sorte que la dose ou le risque calculé pour la personne représentative qui pourrait être exposée à l'avenir à la suite de processus naturels possibles affectant l'installation d'évacuation ou de stockage définitif ne soit pas supérieur à une contrainte de dose de 0,3 mSv par an ou à une contrainte de risque de l'ordre de 10^{-5} par an.

c) S'agissant des effets d'une intrusion humaine par inadvertance après la fermeture, si l'on compte que cette intrusion entraînerait une dose annuelle inférieure à 1 mSv pour les personnes vivant autour du site, alors les efforts de réduction de la probabilité d'une intrusion ou de limitation de ses conséquences ne sont pas justifiés.

d) Si l’on compte qu’une intrusion humaine pourrait entraîner une dose annuelle supérieure à 20 mSv aux personnes vivant autour du site, alors d’autres options d’évacuation des déchets doivent être envisagées, par exemple l’évacuation ou le stockage définitif en profondeur ou la séparation des radionucléides causant les doses les plus élevées.

e) Si l’on compte sur des doses annuelles entre 1 et 20 mSv, alors des efforts raisonnables sont justifiés, à la phase de réalisation de l’installation, pour réduire la probabilité d’intrusion ou en limiter les conséquences en optimisant la conception de l’installation.

f) Des considérations similaires s’appliquent lorsque les seuils pertinents pour les effets déterministes dans les organes peuvent être dépassés.

Protection des personnes contre les substances dangereuses

Les valeurs de référence pour la protection contre les substances dangereuses se trouvent dans les recommandations et les objectifs fédéraux et provinciaux en matière d’environnement. Lorsqu’elles sont disponibles, les *Recommandations canadiennes pour la qualité de l’environnement* [10], établies par le Conseil canadien des ministres de l’Environnement (CCME) pour la protection de la santé humaine, devraient être utilisées comme valeurs de référence ou valeurs toxicologiques de référence. Sinon, ce sont les recommandations fédérales ou provinciales sur la santé humaine qui devraient être appliquées. Si aucune valeur de référence n’est disponible, on peut les trouver dans la littérature sur la toxicité ou dans les documents publiés par d’autres organismes de réglementation, ou encore on peut établir ces critères en suivant les protocoles du CCME.

Radioprotection de l’environnement

En ce qui concerne la protection du biote non humain contre la radioexposition, la principale préoccupation doit être la dose de rayonnement totale pouvant entraîner des effets déterministes sur les organismes exposés. Les valeurs de référence pour les doses de rayonnement, en vue d’une analyse quantitative des effets, devraient suivre l’orientation du Comité scientifique des Nations Unies pour l’étude des effets des rayonnements ionisants [11]. Pour les espèces ayant besoin d’une protection spéciale (p. ex., celles qui figurent sur la *Liste des espèces en péril* du gouvernement du Canada), on devrait envisager un critère de débit de dose de référence plus prudent [8]. D’autres valeurs de référence pour des doses de rayonnement moyennes transmises au biote non humain ont été calculées pour différents types d’organismes [12, 13, 14, 15, 16, 17].

Les critères de radioprotection de l’environnement devraient être élaborés selon les protocoles établis pour les substances dangereuses, dont il est question ci-dessous.

Protection de l’environnement contre les substances dangereuses

Les critères d’acceptation non radiologiques pour la protection de l’environnement peuvent comprendre la concentration ou le flux de substances dangereuses. Les *Recommandations canadiennes pour la qualité de l’environnement* [10] sur l’eau, les sédiments et le sol fournissent de bonnes valeurs de référence pour des analyses de la sûreté prudentes. Lorsqu’aucune recommandation fédérale n’a été établie, il est possible d’utiliser les recommandations provinciales.

Les valeurs de référence des substances dangereuses peuvent aussi être calculées à partir des données publiées dans des ouvrages sur la toxicité ou par d’autres organismes de réglementation (p. ex., l’Environmental Protection Agency des États-Unis). Le CCME fournit quant à lui des protocoles de calcul pour les critères de qualité de l’air, du sol et de l’eau. Les protocoles d’élaboration des critères de protection de l’environnement comprennent l’établissement des valeurs de toxicité critique, p. ex., la concentration produisant des effets à 10 % ou 20 %, la dose minimale avec effet nocif observé ou encore la dose sans effet nocif observé, selon les études d’exposition chronique des espèces les plus sensibles. L’évaluation des risques que représentent les substances dangereuses pour le biote non humain est effectuée au niveau de la population, mais pour les espèces nécessitant une protection spéciale (p. ex., celles qui figurent dans la *Loi sur les espèces en péril*), l’évaluation devrait porter sur la protection au niveau individuel.

8.1.1.2 Approche adoptée pour démontrer la sûreté

Le demandeur ou le titulaire de permis devrait utiliser des approches tenant compte du risque pour estimer le rejet et la dispersion des contaminants, ainsi que les concentrations associées dans l’eau, les sédiments, le sol et l’air en fonction des caractéristiques des déchets, des mécanismes et taux de rejet et du taux de transport des contaminants. Il peut s’agir d’une combinaison de modélisations étayée par des données de surveillance.

Le demandeur ou le titulaire de permis devrait évaluer la sûreté post-fermeture en combinant plusieurs approches quantitatives, notamment les suivantes :

- une évaluation de la portée pour illustrer les facteurs qui sont importants pour la sûreté post-fermeture, ainsi qu’une évaluation limitative des effets potentiels
- des calculs donnant une meilleure estimation réaliste du rendement de l’installation ou du système d’évacuation ou des calculs prudents surestimant intentionnellement les effets potentiels
- des calculs déterministes ou probabilistes appropriés, aux fins de l’évaluation de la sûreté, pour refléter l’incertitude des données

Le demandeur ou le titulaire de permis pourrait utiliser n’importe quelle combinaison de ces approches ou bien d’autres stratégies d’évaluation pertinentes et complémentaires afin d’accroître la confiance à l’égard de l’approche pour démontrer la sûreté de l’installation.

Le demandeur ou le titulaire de permis devrait décrire et justifier le choix de l’approche dans la documentation qui démontre la sûreté post-fermeture. On s’attend à ce que l’objectif de l’évaluation de la sûreté justifie également le modèle d’évaluation utilisé (voir la section 8.1.5) et le niveau de confiance nécessaire dans les résultats.

Évaluations de portée et limitative

Le demandeur ou le titulaire de permis peut effectuer une évaluation de la portée pour avoir une compréhension générale de l’ensemble de l’installation d’évacuation, ce qui l’aidera à déterminer les aspects du système qui sont essentiels à la sûreté.

Le demandeur ou le titulaire de permis peut effectuer une évaluation limitative afin d’estimer les limites du rendement de l’installation d’évacuation. Une telle évaluation peut être réalisée à l’aide de modèles mathématiques simples ou de modèles détaillés qui utilisent la valeur limitative des paramètres.

Meilleures estimations réalistes versus surestimations prudentes

Le demandeur ou le titulaire de permis peut réaliser une évaluation basée sur la meilleure estimation réaliste pour comprendre le comportement le plus probable de l'installation d'évacuation. Il devrait alors utiliser les données réelles du site et de l'installation finie, des scénarios adaptés au site et des modèles précis des processus simulés dans l'estimation réaliste.

Il peut aussi réaliser des évaluations prudentes pour surestimer intentionnellement les conséquences futures afin de se donner une marge de sûreté supplémentaire pour les situations où les résultats de l'évaluation ne peuvent pas être considérés comme des estimations précises, mais comme des indicateurs de sûreté. Une approche prudente devrait être utilisée lorsqu'on élabore les codes informatiques et les modèles. Les hypothèses et la simplification des processus ne devraient pas entraîner une sous-estimation des risques ou des effets potentiels. Il se pourrait que les hypothèses ne soient pas toutes prudentes, mais toutes les hypothèses devraient avoir comme résultat net de représenter les effets et les risques à long terme de manière prudente.

Des valeurs prudentes des conditions limites et initiales d'un modèle d'évaluation, ainsi que des données d'entrée, peuvent être utilisées pour surestimer les conséquences futures. Étant donné que les modèles ne répondent pas nécessairement de manière linéaire aux données d'entrée, les valeurs prudentes ne représentent pas forcément les limites maximales ou minimales des données. C'est la valeur du résultat calculé qui détermine si la structure du modèle et les données d'entrée ont produit une surestimation prudente.

Si les résultats de l'évaluation doivent être utilisés pour respecter une mesure numérique ou une norme de rendement, il peut s'avérer approprié d'adopter une approche prudente basée sur des modèles relativement simples. Pour qu'une telle approche soit possible, il doit y avoir une grande marge de sûreté. La prudence est de mise, car en cas d'utilisation abusive, les résultats des scénarios trop prudents ou les plus défavorables peuvent conduire à une mauvaise prise de décisions sur la base des résultats de l'évaluation qui sont peu représentatifs du système d'évacuation réel.

Approche déterministe et probabiliste

Le demandeur ou le titulaire de permis pourrait utiliser un modèle déterministe pour illustrer l'effet de certains types d'incertitude ou des hypothèses alternatives du modèle. Le modèle déterministe utilise des données d'entrée uniques pour calculer un résultat unique qui sera comparé à un critère d'acceptation. Compte tenu de la variabilité des données, les calculs déterministes individuels doivent être effectués à partir de valeurs de paramètres différentes.

C'est l'approche utilisée pour réaliser les analyses de la sensibilité (examen de la variation des prévisions du modèle en fonction des changements des données d'entrée) et les analyses de l'importance (calcul de la plage des valeurs prédites correspondant à la plage des valeurs d'entrée).

Le demandeur ou le titulaire de permis pourrait utiliser des modèles probabilistes, qui effectuent habituellement des calculs déterministes répétitifs à partir de valeurs d'entrée tirées des distributions de paramètres et dont les résultats sont présentés sous forme de distribution de fréquence des conséquences calculées. La fréquence multipliée par la conséquence est interprétée comme étant le risque global de dommages dus à l'installation d'évacuation. Les modèles probabilistes peuvent explicitement tenir compte de l'incertitude associée à la variabilité des données utilisées dans les prévisions de l’évaluation de la sûreté. Ces modèles pourraient aussi être structurés de façon à tenir compte des différents scénarios ou de leur incertitude.

Le risque calculé au moyen d’un modèle probabiliste ne peut pas être comparé directement à un critère d’acceptation, à moins que ce critère ne représente lui-même un risque. Les résultats d’un modèle probabiliste devraient être présentés et discutés. Lorsque le risque est calculé comme étant l’ampleur de la conséquence et la probabilité de sa survenance, le modèle reflétera la probabilité qu’un scénario avec ces données d’entrée particulières se produise réellement.

8.1.1.3 Paramètres ultimes de l’évaluation

Le demandeur ou le titulaire de permis doit démontrer que les paramètres ultimes de l’évaluation sélectionnés sont conformes à l’objectif de l’évaluation et aux exigences réglementaires pertinentes, notamment les exigences relatives à la dose radiologique.

D’autres indicateurs de sûreté complémentaires, notamment ceux qui reflètent l’efficacité des barrières de confinement ou les effets sur les espèces non humaines, peuvent également être présentés pour illustrer le rendement à long terme d’un système d’évacuation. Voici quelques exemples d’indicateurs de sûreté complémentaires :

- le taux de corrosion des conteneurs
- le taux de dégradation des déchets
- l’âge des eaux souterraines et leur temps de déplacement
- les flux de contaminants provenant d’une installation d’évacuation ou de stockage définitif
- les effets du système sur la flore et la faune du site
- les concentrations de contaminants dans un milieu donné (p. ex., concentration de radium dans les eaux souterraines)
- la variation de la toxicité des déchets

Le demandeur ou le titulaire de permis devrait établir et justifier les critères d’acceptation à l’égard desquels ces indicateurs de sûreté complémentaires seront jugés, en fonction de la relation entre l’indicateur de sûreté complémentaire et les paramètres ultimes plus directs de l’évaluation. Par exemple, si la concentration d’une substance dangereuse dans l’environnement est directement liée à la vitesse des eaux souterraines à proximité d’une installation d’évacuation ou de stockage définitif, alors la vitesse des eaux souterraines pourrait servir de critère de sûreté post-fermeture en complément à une évaluation de la sûreté exhaustive qui utilise les effets sur l’environnement, notamment la concentration dans l’environnement, comme paramètres ultimes.

Définition des récepteurs humains et environnementaux

Pour l’analyse de la sûreté, le demandeur ou le titulaire de permis doit élaborer des scénarios définissant les récepteurs humains et environnementaux qui pourraient être exposés à des substances radioactives et dangereuses. Comme les doses peuvent être transmises aux personnes et aux divers organismes récepteurs par différentes voies d’exposition, elles seront évaluées selon différents critères d’acceptation, même si tous les récepteurs sont présents dans le même milieu au même moment.

Les récepteurs humains et environnementaux devraient être identifiés selon l’orientation fournie dans les normes CSA N288.1, *Guide de calcul des limites opérationnelles dérivées de matières radioactives dans les effluents gazeux et liquides durant l’exploitation normale des installations* *nucléaires* [18] et CSA N288.6, *Évaluation des risques environnementaux aux installations nucléaires de catégorie I et aux mines et usines de concentration d'uranium* [19].

Le document IAEA-TECDOC-1077, *Critical Groups and Biospheres in the Context of Radioactive Waste Disposal* [20] fournit l'orientation nécessaire à l'évaluation de l'exposition des groupes critiques durant la période de référence du scénario d'évolution normale. Dans le cas des longues périodes de référence, le promoteur pourrait choisir d'utiliser une biosphère de référence comme groupe critique. On trouvera une orientation supplémentaire concernant l'utilisation des biosphères de référence dans le document BIOMASS-6 de l'AIEA, *Reference Biospheres for Solid Radioactive Waste Disposal* [21] publié en 2003.

8.1.2 Description du système d'évacuation

Le titulaire de permis doit inclure la description du système d'évacuation. Cette description, qui est une composante du dossier de sûreté, devrait être réitérée pour montrer comment les caractéristiques sont pertinentes pour l'évaluation de la sûreté. Elle devrait présenter à la fois les caractéristiques du site et la conception des SSC importants pour la sûreté, ainsi qu'une description des déchets à gérer.

À mesure que l'installation avancera dans son cycle de vie autorisé, on recueillera des renseignements sur l'installation construite et des données d'exploitation. Ces deux sources de données permettront de mieux comprendre le système d'évacuation. Les évaluations de la sûreté réalisées plus tard dans le cycle de vie de l'installation reposeront donc sur des données et des modèles actuels et précis. On utilisera de moins en moins les données par défaut, génériques ou hypothétiques, et les résultats des modèles seront donc plus fiables.

8.1.2.1 Caractérisation du site

Le demandeur ou le titulaire de permis doit inclure les données de caractérisation du site dans son évaluation de la sûreté.

Le demandeur ou le titulaire de permis devrait s'assurer que les caractéristiques du site sont suffisamment définies pour permettre une description précise des conditions actuelles du site et une projection crédible de leur évolution future.

Pour en savoir plus sur la caractérisation des dépôts géologiques en profondeur, veuillez consulter le REGDOC-1.2.1, *Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur* [6].

8.1.3 Scénarios d'évaluation de la sûreté post-fermeture et périodes de référence

Le titulaire de permis doit élaborer et utiliser des scénarios pour décrire l'évolution possible du système d'évacuation et de son environnement, ainsi que l'effet potentiel des CEP répertoriés sur la sûreté.

Le demandeur ou le titulaire de permis doit veiller à ce que les scénarios de l'évaluation de la sûreté tiennent compte de tous les états actuels et futurs ou potentiels du site et de la biosphère.

L'évaluation de la sûreté doit comprendre un scénario de base de l'évolution normale, attendue ou prévue du site et du système d'évacuation au fil du temps, ainsi que des scénarios supplémentaires qui examinent l’effet possible d’événements perturbateurs ayant une faible probabilité d’occurrence.

Chaque scénario présenté dans une évaluation de la sûreté doit comporter des renseignements précis sur les points suivants :

- la période de référence sur laquelle l’évaluation est basée
- la durée (du début à la fin) pendant laquelle les contrôles institutionnels seront utilisés comme caractéristique de sûreté
- la définition et les caractéristiques des récepteurs et groupes critiques présumés

L’évaluation de la sûreté devrait présenter et justifier les techniques et les critères d’élaboration des scénarios analysés. Ces scénarios devraient être élaborés de manière systématique, transparente et traçable au moyen d’une analyse structurée des CEP pertinents basée sur les conditions actuelles et futures prévues des caractéristiques du site, les propriétés des déchets et les caractéristiques et modes de vie des récepteurs. L’approche d’élaboration des scénarios devrait correspondre à la rigueur de l’évaluation de la sûreté, compte tenu de l’objectif de l’évaluation, des dangers que représentent les déchets et de la nature de la décision pour laquelle l’évaluation est réalisée.

Afin de démontrer la robustesse d’un système d’évacuation, l’évaluation devrait envisager des scénarios d’événements perturbateurs dans lesquels on fait l’hypothèse d’une défaillance totale ou partielle d’une ou plusieurs barrières ou fonctions de sûreté. Ces scénarios devraient montrer que, dans de telles circonstances, le système d’évacuation demeurera sûr.

Des scénarios hypothétiques devraient être utilisés pour démontrer la robustesse et l’efficacité des différentes barrières naturelles et artificielles dans des conditions extrêmes. Il peut être instructif de modifier les valeurs des paramètres ou autres propriétés dans différentes parties du système de barrières de façon à ce que chaque barrière soit sollicitée de manière exagérée. On pourrait alors démontrer que de telles conditions exagérées sont irréalistes, qu’elles n’ont aucun effet négatif sur la sûreté ou qu’elles peuvent être évitées dans la conception.

Les scénarios stylisés sont la représentation générique d’un groupe de scénarios dans lesquels une partie du système d’évacuation des déchets est uniformisée ou simplifiée. Les scénarios stylisés pourraient être utiles si les données sur le site sont insuffisantes ou que l’évaluation de la sûreté ne nécessite pas de données détaillées sur le site.

L’évaluation de la sûreté devrait démontrer que l’ensemble des scénarios élaborés est crédible et complet. Certains CEP ou scénarios peuvent être exclus de l’évaluation s’ils sont extrêmement peu probables ou s’ils ont un effet négligeable.

Une autre méthode d’élaboration des scénarios consiste à analyser la façon dont les fonctions de sûreté sont influencées par les éventuels CEP. Les scénarios élaborés pourraient ensuite être vérifiés par rapport à une liste de CEP appropriés.

L’approche et les critères de sélection utilisés pour exclure ou inclure des scénarios devraient être justifiés et bien documentés.

8.1.3.1 Scénario d’évolution normale

Le demandeur ou le titulaire de permis doit présenter un scénario d’évolution normale dans l’évaluation de la sûreté post-fermeture. Ce scénario devrait être basé sur l’extrapolation raisonnable des caractéristiques actuelles du site et des modes de vie des récepteurs. Il devrait inclure l’évolution prévue du site et la dégradation du système d’évacuation (perte progressive ou totale de la fonction de protection assurée par les barrières), au fur et à mesure de son vieillissement. Les scénarios d’évolution n’ont pas à tenir compte de l’évolution biologique des espèces de récepteurs individuelles; elle peut donc être considérée comme étant statique dans le cadre de l’évaluation de la sûreté post-fermeture.

Dépendamment des conditions particulières du site et de la période de référence utilisée pour l’évaluation de la sûreté, un scénario d’évolution normale devrait inclure les conditions ou les événements prévus, tels que les séismes, les changements climatiques ou la glaciation. Le scénario d’évolution normale devrait aussi tenir compte des événements perturbateurs naturels périodiques attendus durant la période de référence, comme des inondations ou des feux de forêt, ainsi que de leurs effets sur l’efficacité des barrières. Leurs effets sur le rendement de la barrière devraient être pris en compte. Ces différents événements pourraient être analysés séparément en tant que variantes du scénario d’évolution normale.

Le choix des événements naturels qui devraient être pris en compte repose sur l’évaluation des CEP et sur la probabilité qu’ils se produisent durant la période de référence de l’évaluation de la sûreté.

Le scénario d’évolution normale devrait aussi tenir compte des modes de défaillance des systèmes de confinement et d’isolement. Ces défaillances peuvent résulter non seulement de la dégradation naturelle des barrières, mais des événements qui pourraient se produire une ou plusieurs fois durant la période de référence de l’évaluation, y compris les intrus qui traversent les barrières.

L’évaluation de la sûreté devrait comprendre un modèle de la biosphère, c’est-à-dire l’environnement récepteur des contaminants, reposant le plus possible sur les données du site fournies dans la description du système. Si les données du site ne permettent pas de faire des extrapolations raisonnables ou prudentes à partir des caractéristiques de la biosphère actuelle, on pourrait envisager une approche stylisée pour définir la biosphère conformément à l’objet de l’évaluation de la sûreté.

8.1.3.2 Scénarios d’événements perturbateurs, y compris l’intrusion humaine

Le demandeur ou le titulaire de permis doit postuler les scénarios d’événements perturbateurs menant à la pénétration possible des barrières et à une perte de confinement anormale. Les événements comme les incendies, les inondations, les séismes, les éruptions volcaniques et les intrusions humaines ne peuvent pas être prédits avec exactitude, même lorsqu’ils sont associés à une probabilité annuelle ou à une période de récurrence. Les événements perturbateurs plus graves que ceux prévus dans les scénarios d’évolution normale pour lesquels les barrières sont conçues et auxquels elles sont censées résister devraient être pris en compte. L’inclusion de scénarios d’événements perturbateurs permettra de démontrer le principe de défense en profondeur et la robustesse du système d’évacuation dans son ensemble.

En plus de compromettre les barrières de confinement, les intrusions pourraient entraîner la redistribution des déchets au-delà des barrières, exposant potentiellement le public et l’environnement. Par conséquent, l’évaluation des scénarios d’intrusion humaine doit fournir une estimation de l’exposition des personnes et de l’environnement en cas de redistribution des déchets. Les scénarios d’intrusion involontaire, c’est-à-dire que l’intrus ne connaît pas le danger associé aux déchets, devraient estimer l’exposition de l’intrus. Toutefois, lorsqu’un intrus traverse intentionnellement une barrière et est conscient des dangers des déchets, cette situation n’a pas besoin d’être prise en compte.

Les scénarios d’intrusion involontaire devraient être élaborés au cas par cas, selon la classe de déchets et la conception du système d’évacuation, et devraient tenir compte de la probabilité et des conséquences d’une intrusion. Les installations d’évacuation en surface et près de la surface (p. ex., les parcs de résidus) sont plus susceptibles de faire l’objet d’intrusions que les dépôts géologiques en profondeur. Les critères d’acceptation pour l’intrusion humaine devraient être définis. Si les critères ne peuvent pas être remplis, même après l’optimisation de la conception et du choix de l’emplacement, la gestion des déchets à plus grande profondeur devrait être envisagée.

Dans les scénarios d’intrusion avec conséquences graves, tous les efforts possibles devraient être faits pour limiter la dose et réduire la probabilité d’intrusion. Les conséquences d’une intrusion pourraient être réduites grâce au contrôle de la forme et des propriétés des déchets admissibles. Des modifications à la conception devraient être envisagées afin de réduire la probabilité d’une intrusion par inadvertance. Cela peut inclure le choix du site (lorsque les options relatives à la sélection du site sont réalisables), l’implantation de l’installation d’évacuation à une profondeur qui décourage l’intrusion, l’incorporation de caractéristiques de conception robustes qui rendent l’intrusion plus difficile, et la mise en œuvre de contrôles institutionnels actifs ou passifs, selon le cas.

Pour ce qui est de l’évacuation ou du stockage définitif près de la surface, outre la conception et l’optimisation, l’évaluation des scénarios d’intrusion humaine permet également d’élaborer des critères d’acceptation des déchets, de mettre en place les périodes de référence nécessaires pour les contrôles institutionnels, et de déterminer s’il y a lieu de recourir à une évacuation ou à un stockage définitif plus profond de certains flux de déchets.

Dans le cas des dépôts géologiques en profondeur, où la probabilité d’intrusion a déjà été réduite par l’optimisation des caractéristiques du site, de la profondeur et de la conception de l’installation, les résultats de l’évaluation des scénarios d’intrusion humaine devraient être utilisés à but d’illustration. Dans les scénarios d’intrusion humaine involontaire dans de tels dépôts, on pourrait estimer que les doses sont supérieures à la limite réglementaire. L’interprétation de tels résultats devrait donc tenir compte du degré d’incertitude associé à l’évaluation, du degré de prudence de la limite de dose et de la probabilité d’intrusion. La probabilité et les conséquences de l’intrusion devraient être indiquées.

8.1.3.3 Périodes de référence de l’évaluation

Le demandeur ou le titulaire de permis doit s’assurer que toutes les répercussions futures pouvant découler des déchets radioactifs incluent la période pendant laquelle les effets futurs potentiels des déchets radioactifs culmineront.

On doit justifier la période de référence associée à l’évaluation de la sûreté. L’approche adoptée pour déterminer les différentes périodes de l’évaluation de la sûreté devrait tenir compte des éléments suivants :

- la durée de vie dangereuse des contaminants associés aux déchets
- la durée de la période opérationnelle (avant que l’installation d’évacuation n’atteigne son état final)
- la durée de vie des barrières artificielles
- la durée des contrôles institutionnels actifs et passifs
- la fréquence des événements naturels et des changements environnementaux anthropiques (p. ex., séismes, inondations, sécheresses, glaciations ou changements climatiques)
- le degré de protection et d’isolement requis contre les intrusions involontaires à long terme

Le demandeur ou le titulaire de permis devrait documenter et justifier les périodes de référence des barrières techniques donnant le rendement présumé, ainsi que l’évolution de leurs fonctions de sûreté au fil du temps. Selon l’objectif de l’évaluation, il peut s’avérer utile de diviser la période de référence globale en plusieurs créneaux de temps plus courts, aux fins de modélisation ou de présentation. On peut également utiliser des paramètres ultimes différents pour différents créneaux de temps.

Si les périodes de référence sont longues, on devrait tenir compte des événements plus graves (présentant une faible probabilité de dépassement) dans la conception du système d’évacuation et de ses composants. Par exemple, le séisme de référence qu’on choisira pour un système ou ses composants dépend de la probabilité de dépassement et des conséquences d’une défaillance si un séisme plus grave que celui de référence se produit pendant la période de référence. Si les conséquences sont importantes, la probabilité de dépassement du séisme de référence durant la période de référence devrait être moindre. Un séisme de référence est souvent associé à une périodicité (en années), qui est l’inverse de sa probabilité annuelle de dépassement. Par exemple, la probabilité annuelle de dépassement pour un séisme dont la période de récurrence est de 10 000 ans est de 1/10 000. Par conséquent, pour une année donnée, la probabilité qu’un séisme plus grave que le séisme de référence se produise est de 1/10 000 (0,01 %). Pour une période de référence de 10 000 ans, cette dernière probabilité augmente à 63 % et pour une période de référence de 100 000 ans, elle est proche de 100 %.

8.1.4 Élaboration et utilisation des modèles d’évaluation

Lors de l’élaboration des modèles d’évaluation, le demandeur ou le titulaire de permis devrait employer divers outils de calcul (modèles conceptuels et mathématiques) pour prévoir les conditions futures afin de les comparer aux critères d’acceptation.

Le demandeur ou le titulaire de permis devrait élaborer un modèle conceptuel, qui est une représentation du comportement du système d’évacuation et qui comporte la description des composants du système et leurs interactions mutuelles. Ce modèle devrait aussi comprendre un ensemble d’hypothèses reflétant les données et les connaissances disponibles sur la géométrie du système et le comportement chimique, physique, biologique, mécanique et géologique de l’installation ou de l’activité.

Les modèles conceptuels du site et le système d’évacuation doivent souvent être simplifiés pour correspondre aux limites des équations mathématiques et aux capacités des modèles informatiques. Un modèle mathématique représente les caractéristiques et les processus du modèle conceptuel sous forme d’équations mathématiques.

Le niveau de précision nécessaire dans les modèles d’évaluation de la sûreté post-fermeture et le degré de prudence souhaité dans les résultats sont déterminés par ce qui suit :

- l’objectif de l’évaluation de la sûreté
- l’importance des résultats du modèle pour pouvoir indiquer la sûreté et le rendement prévus

8.1.4.1 Confiance dans les modèles d’évaluation de la sûreté

Le demandeur ou le titulaire de permis devrait s’assurer que les modèles d’évaluation de la sûreté sont adaptés à l’objectif visé. Les paramètres d’entrée, les scénarios analysés et les résultats devraient être conformes aux hypothèses et aux limites du modèle.

Le demandeur ou le titulaire de permis devrait conserver des dossiers sur la manière dont les données de caractérisation propres au site et au système ont été utilisées pour déterminer les paramètres d’entrée.

Le processus d’évaluation des modèles d’évaluation de la sûreté devrait chercher à déterminer et comprendre les principaux processus radiologiques, physiques, chimiques et biologiques qui sont importants pour la sûreté aux différentes échelles spatiales et temporelles associées à l’évaluation de la sûreté. Il est possible d’utiliser des modèles sophistiqués et détaillés des processus pour déterminer si ceux-ci ont suffisamment d’influence pour être intégrés au modèle d’évaluation de la sûreté post-fermeture ou s’ils peuvent être simplifiés ou ignorés sans que cela compromette la fiabilité des prévisions.

L’évaluation du modèle devrait comprendre des analyses de sensibilité indiquant si les résultats produits par le modèle reflètent de manière attendue la variation des paramètres d’entrée. Elle devrait aussi comprendre des analyses des incertitudes et de l’importance pour illustrer les paramètres qui contrôlent la variabilité des résultats du modèle. Ces analyses devraient indiquer si le modèle reproduit bien les faits connus et compris sur les processus simulés. De plus, les résultats de ces analyses devraient être prouvés conformes aux limites et restrictions des hypothèses du modèle d’évaluation de la sûreté.

La nécessité d’évaluer l’incertitude des modèles d’évaluation de la sûreté dépend du niveau de confiance nécessaire à l’égard des résultats de la modélisation. Le niveau de confiance acceptable est régi par l’objectif de l’évaluation de la sûreté, le facteur de sûreté intégré dans les critères d’acceptation des indicateurs de sûreté, et l’importance des résultats du modèle d’évaluation de la sûreté pour le dossier de sûreté.

Les analyses de la sensibilité et des incertitudes des modèles déterministes ou probabilistes ne peuvent pas prévoir en soi les incertitudes du modèle conceptuel sous-jacent ni les incertitudes liées aux limites du modèle mathématique utilisé pour décrire les processus. L’analyse de telles incertitudes nécessiterait l’utilisation de différents modèles mathématiques et informatiques reposant sur d’autres modèles conceptuels.

La confiance à l’égard du modèle d’évaluation de la sûreté peut être améliorée de différentes façons, notamment les suivantes :

- l’exécution de prévisions indépendantes selon des stratégies d’évaluation de la sûreté et des outils informatiques entièrement différents

- la démonstration de la cohérence entre d’une part les résultats du modèle d’évaluation de la sûreté post-fermeture, et d’autre part l’évaluation complémentaire de la portée et des limites de la sûreté
- l’application du modèle d’évaluation de la sûreté à un analogue du système d’évacuation
- des études des problèmes de référence par modélisation
- l’examen scientifique par les pairs, sous forme de publication dans la littérature ouverte
- d’autres pratiques largement utilisées par la communauté scientifique et technique
- la démonstration de la cohérence entre les résultats du modèle et les études sur le terrain propres au site

8.1.4.2 Confiance à l’égard des outils de calcul

Le demandeur ou le titulaire de permis devrait s’assurer que les programmes informatiques sont adaptés à une évaluation donnée. Ces programmes peuvent être des logiciels disponibles dans le commerce ou des logiciels développés expressément pour l’évaluation en question.

Les logiciels utilisés pour les calculs dans l’évaluation devraient être qualifiés conformément aux normes applicables.

L’étalonnage des modèles informatiques et la vérification et la validation des logiciels sont les principaux processus en cause dans l’assurance de la qualité des logiciels. L’étalonnage consiste à modifier les paramètres des équations mathématiques de manière à réduire l’écart entre les réponses calculées et les réponses mesurées du système, ces dernières étant connues.

Le titulaire ou demandeur de permis ou le demandeur devrait vérifier et valider tous les logiciels utilisés pour l’évaluation de la sûreté ou citer en référence des validations existantes. La vérification donne l’assurance que le programme fonctionne comme il se doit (c.-à-d. que les équations mathématiques du modèle informatique sont résolues correctement). Le fonctionnement peut être vérifié au moyen de problèmes de référence conçus pour le type de modèle évalué. La validation sert à confirmer que les équations mathématiques du modèle informatique simulent, avec une précision raisonnable, les processus et les conditions qu’elles sont censées représenter.

8.1.5 Interprétation des résultats

Lors de l’interprétation des résultats de l’évaluation de la sûreté, le demandeur devrait démontrer qu’il comprend à fond les principes scientifiques et techniques sous-jacents qui influent sur les résultats de l’évaluation de la sûreté. L’interprétation devrait comprendre l’évaluation du respect des critères d’acceptation et l’analyse des incertitudes associées à l’évaluation de la sûreté.

Les résultats de l’évaluation de la sûreté devraient aussi faire l’objet d’une analyse montrant leur conformité avec les attentes à l’égard du rendement du système et l’ensemble des hypothèses et simplifications utilisées dans l’élaboration des modèles et des scénarios. Tout résultat ou écart inattendu devrait être consigné, examiné et expliqué.

8.1.5.1 Comparaison des résultats de l’évaluation de la sûreté aux critères d’acceptation

L’un des objectifs de l’évaluation de la sûreté est de comparer les paramètres ultimes de l’évaluation de la sûreté avec les critères d’acceptation. Cette comparaison devrait comporter une discussion sur le degré de prudence des résultats du modèle, et sur le degré de prudence intégré dans les critères d’acceptation des paramètres ultimes de l’évaluation.

Si les résultats de l'évaluation de la sûreté ne démontrent pas le respect des critères d'acceptation, l'évaluation de la sûreté doit être révisée. Il devrait y avoir suffisamment de détails pour que la CCSN puisse vérifier les résultats.

Toutefois, le respect des critères d'acceptation n'est pas suffisant en soi pour qu'un dossier de sûreté soit accepté, car on doit également démontrer que les exigences de sûreté additionnelles sont respectées.

8.1.5.2 Analyse des incertitudes

Une analyse des incertitudes entourant les résultats de l'évaluation devrait être effectuée pour relever les sources et l'importance des incertitudes. Cette analyse devrait faire la distinction entre les incertitudes attribuables à diverses sources :

- les données ou les paramètres d'entrée
- les hypothèses des scénarios
- l'imprécision du modèle mathématique
- les modèles conceptuels

Afin de déterminer l'importance relative de l'incertitude d'un paramètre d'entrée pour les résultats de l'évaluation de sûreté, il faut réaliser une analyse de la sensibilité.

Alors que les critères d'acceptation sont habituellement exprimés sous forme de valeurs uniques, les résultats des évaluations déterministes et probabilistes de la sûreté comportent une incertitude inhérente. Il est prévu que la comparaison entre les paramètres ultimes de l'évaluation de la sûreté et les critères d'acceptation tiendront compte explicitement des incertitudes dans l'évaluation de la sûreté, à savoir :

- dans le cas des analyses déterministes de sûreté, le degré d'incertitude des résultats obtenus dans le cadre d'une analyse de la sensibilité (ou d'une analyse de l'importance) doit être explicitement indiqué dans la comparaison
- dans le cas des études probabilistes de sûreté, la probabilité de dépasser les critères d'acceptation devrait être déterminée à partir de la distribution des résultats calculés. Si la plage des résultats de l'évaluation de la sûreté, obtenus par une analyse déterministe des incertitudes ou par une distribution probabiliste des résultats, montre qu'une partie des résultats peut dépasser les critères d'acceptation, le demandeur devrait démontrer que ces résultats ne représenteront pas un risque déraisonnable pour l'environnement ou pour la santé et la sécurité des personnes, compte tenu du degré de prudence intégré dans les calculs de l'évaluation de la sûreté et de la probabilité que surviennent les circonstances menant à ces résultats.

Glossaire

Les définitions des termes utilisés dans le présent document figurent dans le REGDOC-3.6, *Glossaire de la CCSN*, qui comprend des termes et des définitions tirés de la *Loi sur la sûreté et la réglementation nucléaires*, de ses règlements d’application ainsi que des documents d’application de la réglementation et d’autres publications de la CCSN. Le REGDOC-3.6 est fourni à titre de référence et pour information.

Références

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2. CCSN. REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d’uranium et des résidus des usines de concentration d’uranium*, Ottawa, 2018.

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16. Environnement et Changement climatique Canada. Liste de substances d’intérêt prioritaire, *Rejets de radionucléides des installations nucléaires (effets sur les espèces autres que l’être humain)*, Ottawa, 2003.

17. CIPR. ICRP Publication 108, *Environmental Protection – the Concept and Use of Reference Animals and Plants*, Royaume-Uni, 2008.

18. Groupe CSA. CSA N288.1, *Guide de calcul des limites opérationnelles dérivées de matières radioactives dans les effluents gazeux et liquides durant l'exploitation normale des installations nucléaires*, Mississauga, 2019.

19. Groupe CSA. CSA N288.6, *Évaluation des risques environnementaux aux installations nucléaires de catégorie I et aux mines et usines de concentration d'uranium*, Mississauga, 2012.

20. AIEA. IAEA TECDOC-1077, *Critical Groups and Biospheres in the Context of Radioactive Waste Disposal*, Vienne, 1999.

21. AIEA. IAEA BIOMASS-6, *Reference Biospheres for Solid Radioactive Waste Disposal*, Vienne, 2003.

Renseignements supplémentaires

La CCSN pourrait recommander d'autres documents sur les pratiques exemplaires et les normes, comme ceux publiés par le Groupe CSA. Avec la permission du Groupe CSA, qui en est l'éditeur, toutes les normes de la CSA associées au secteur nucléaire peuvent être consultées gratuitement à partir de la page Web de la CCSN « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au secteur nucléaire ».

Les documents suivants ne sont pas cités dans le présent document d'application de la réglementation, mais ils renferment des renseignements qui pourraient être utiles au lecteur.

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- AIEA. Guide de sûreté SSG-31, *Monitoring and Surveillance of Radioactive Waste Disposal Facilities*, Vienne, 2014.
- AIEA. Collection Rapports de sûreté nº 389, *Radiological characterization of shut down nuclear reactors for decommissioning purposes*, Vienne, 1998.
- Organisation internationale de normalisation. ISO 21238:2007, *Énergie nucléaire – Technologie du combustible nucléaire – Méthode des ratios pour déterminer la radioactivité des colis de déchets de faible et moyenne activité produits par les centrales nucléaires*, Genève, 2007.

Série de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la CCSN. En plus de la *Loi sur la sûreté et la réglementation nucléaires* et de ses règlements d'application, il pourrait y avoir des exigences en matière de conformité à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Les documents d'application de la réglementation préparés par la CCSN sont classés en fonction des catégories et des séries suivantes :

1.0 Installations et activités réglementées

Séries
- 1.1 Installations dotées de réacteurs
- 1.2 Installations de catégorie IB
- 1.3 Mines et usines de concentration d'uranium
- 1.4 Installations de catégorie II
- 1.5 Homologation d'équipement réglementé
- 1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Séries
- 2.1 Système de gestion
- 2.2 Gestion de la performance humaine
- 2.3 Conduite de l'exploitation
- 2.4 Analyse de la sûreté
- 2.5 Conception matérielle
- 2.6 Aptitude fonctionnelle
- 2.7 Radioprotection
- 2.8 Santé et sécurité classiques
- 2.9 Protection de l'environnement
- 2.10 Gestion des urgences et protection-incendie
- 2.11 Gestion des déchets
- 2.12 Sécurité
- 2.13 Garanties et non-prolifération
- 2.14 Emballage et transport

3.0 Autres domaines de réglementation

Séries
- 3.1 Exigences relatives à la production de rapports
- 3.2 Mobilisation du public et des Autochtones
- 3.3 Garanties financières
- 3.4 Séances de la Commission
- 3.5 Processus et pratiques de la CCSN
- 3.6 Glossaire de termes de la CCSN

Remarque : Les séries de documents d'application de la réglementation pourraient être modifiées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste des documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2

Rapport de consultation: REGDOC-2.11.1, tome III: *Dossier de sûreté pour l'évacuation ou le stockage définitif des déchets radioactifs*, version 2

Introduction

REGDOC-2.11.1, Volume III provides requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment activities pertaining to the disposal of all types of radioactive waste.

This REGDOC addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal systems (facilities, locations or sites) for all classes of radioactive waste. This document also applies to long-term radioactive waste management facilities where there is no intention to retrieve the waste.

Introduction

Le REGDOC-2.11.1, tome III, énonce, à l'intention des demandeurs et des titulaires de permis, les exigences et l'orientation concernant l'élaboration d'un dossier de sûreté et l'évaluation connexe de la sûreté pour l'évacuation ou le stockage définitif de tous les types de déchets radioactifs.

Ce REGDOC porte sur l'élaboration du dossier de sûreté et l'évaluation de la sûreté à l'appui de la phase post-fermeture des systèmes d'évacuation ou de stockage définitif (lesquels comprennent les installations, les emplacements ou les sites) pour toutes les catégories de déchets radioactifs. Le document s'applique également aux installations de gestion à long terme des déchets radioactifs pour lesquels il n'est pas prévu de retirer les déchets.

Consultation process

CNSC staff have extensively engaged with stakeholders on the waste management and decommissioning framework.

On May 24, 2019, a draft version of REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2, was issued for public consultation until September 16, 2020.

During the consultation period, the CNSC received 126 comments from 11 respondents: Bruce Power, Cameco, Canadian Nuclear

Processus de consultation

Le personnel de la CCSN a mené de vastes consultations auprès des parties intéressées sur le cadre de déclassement et de gestion des déchets.

Le 24 mai 2019, une version provisoire du REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation ou le stockage définitif des déchets radioactifs*, version 2, a été publié aux fins de consultation publique jusqu'au 26 septembre 2020.

Pendant cette période, la CCSN a reçu

Association (CNA), Canadian Nuclear Laboratories (CNL), Concerned Citizens of Renfrew County and Area, Dr. Sandy Greer, New Brunswick Power, Northwatch, Nuclear Waste Management Organization (NWMO), Ontario Power Generation (OPG) and Dr. J.R. Walker.

Following public consultation, the submissions received were posted on the CNSC's website to allow the public to provide feedback from October 16 to November 5, 2019. 14 new comments were received during this period from 4 respondents: Canadian Association of Physicians for the Environment, Dr. Sandy Greer, Ralliement contre la pollution radioactive and Michael Stevens.

Civil society organizations (CSOs) and industry requested workshops to discuss REGDOCs from the waste management and decommissioning series, including this one.

CNSC staff held a workshop with industry on February 5, 2020 and a webinar with CSOs on February 26. Due to technical difficulties, a second webinar with members of the public and CSOs was held April 23, 2020. The purpose of the webinars was to explain the changes made to the document following public consultation and to discuss outstanding issues and how comments were dispositioned.

The following organizations participated for the February 5 workshop with industry:

- Bruce Power
- BWX Technologies
- Cameco
- CNA
- CNL
- CANDU Owners Group
- Hydro-Québec
- Kinetrics
- New Brunswick Power
- NWMO

126 commentaires provenant de onze répondants : Bruce Power, Cameco, l'Association nucléaire canadienne (ANC), les Laboratoires Nucléaires Canadiens (LNC), Concerned Citizens of Renfrew County and Area, Sandy Greer, Énergie du Nouveau-Brunswick, Northwatch, la Société de gestion des déchets nucléaires (SGDN), Ontario Power Generation (OPG) et J.R. Walker.

À la suite de la consultation publique, les commentaires reçus ont été affichés sur le site Web de la CCSN afin de permettre au public de fournir de la rétroaction, du 16 octobre au 5 novembre 2019. La CCSN a reçu 14 nouveaux commentaires de la part de quatre répondants : l'Association canadienne des médecins pour l'environnement, Sandy Greer, Ralliement contre la pollution radioactive et Michael Stevens.

Des organisations de la société civile (OSC) et l'industrie ont demandé des ateliers pour discuter des REGDOC faisant partie de la série sur la gestion des déchets et le déclassement, y compris ce REGDOC.

Le personnel de la CCSN a tenu un atelier avec l'industrie le 5 février 2020 et un webinaire avec les OSC le 26 février. En raison de difficultés techniques, le second webinaire avec les membres du public et les OSC a eu lieu 23 avril 2020. Ces webinaires avaient pour objectif d'expliquer les modifications apportées au document à la suite de la consultation publique et de discuter des questions en suspens et de la manière dont les commentaires ont été pris en compte.

Les entités suivantes ont participé à l'atelier du 5 février avec l'industrie :

- Bruce Power
- BWX Technologies
- Cameco

- OPG
- Orano

The following commenters participated in the CSO webinar, either in person or through written submissions:

- Algonquin Eco Watch
- Canadian Environmental Law Association
- Concerned Citizens of Renfrew
- Dr. Frank Greening
- Dr. Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Regional Municipality of Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

The full responses to stakeholder feedback on individual REGODCs, including comments received during public consultation or in advance of the workshops, can be found in the associated detailed comments table included as part of the Commission Member Document package.

Key comments

The following summarizes the key comments received during the consultation period and provides the CNSC's responses:

- ANC
- LNC
- Groupe des propriétaires de CANDU
- Hydro-Québec
- Kinetrics
- Énergie du Nouveau-Brunswick
- SGDN
- OPG
- Orano

Les commentateurs suivants ont participé, en personne ou par le biais d'un mémoire, au webinaire organisé pour les OSC :

- Algonquin Eco Watch
- Association canadienne du droit de l'environnement
- Concerned Citizens of Renfrew
- Frank Greening
- Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Municipalité régionale de Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

Les réponses complètes aux commentaires des parties intéressées sur les différents REGDOC, y compris les commentaires reçus lors de la consultation publique ou avant les ateliers, se trouvent dans le tableau connexe des commentaires détaillés qui fait partie de la trousse de documents remise aux commissaires.

Principaux commentaires

Les paragraphes suivants résument les principaux commentaires reçus au cours de la période de consultation, et indiquent les réponses de la CCSN.

Comment 1:

Industry requested clarity on the scope, specifically on the distinction between facility types and the timing of the different requirements at various phases of a facility lifecycle.

Commentaire 1 :

L'industrie a demandé des précisions sur la portée, et plus particulièrement sur la distinction entre les types d'installations et le moment d'application des diverses exigences aux différentes étapes du cycle de vie d'une installation.

CNSC staff response:

The scope was revised to clarify its application for the post-closure phase of disposal facilities which includes locations or sites, for all classes of radioactive waste. This document also applies to long-term radioactive waste management facilities, locations or sites where there is no intention to retrieve the waste.

The post-closure safety case considers information from the pre-closure phase (site preparation, construction, operation, decommissioning) insofar as this information impacts post-closure safety.

Réponse du personnel de la CCSN :

La portée a été révisée pour préciser son application à la phase post-fermeture des installations d'évacuation ou de stockage définitif, qui incluent les emplacements ou les sites, pour toutes les catégories de déchets radioactifs. Le REGDOC s'applique également aux installations de gestion à long terme des déchets radioactifs pour lesquels il n'est pas prévu de retirer les déchets.

Le dossier de sûreté pour la phase post-fermeture tient compte des renseignements provenant de la phase préfermeture (préparation de l'emplacement, construction, exploitation et déclassement) dans la mesure où ces renseignements ont une incidence sur la sûreté post-fermeture.

Comment 2:

Industry and CSOs noted the absence of some definitions, as well as misalignment between definitions and terminology from the REGDOC with CSA standards or the IAEA glossary.

Commentaire 2 :

L'industrie et les OSC ont soulevé l'absence de certaines définitions, ainsi que le manque d'harmonisation entre les définitions et la terminologie du REGDOC et les normes du Groupe CSA ou le glossaire de l'AIEA.

CNSC staff response:

The document was reviewed to ensure that key terms are found in either REGDOC-3.6, *Glossary of CNSC Terminology* or the CSA

Réponse du personnel de la CCSN:

Le document a été révisé afin de s'assurer que les principaux termes figurent, soit dans le REGDOC-3.6, *Glossaire de la CCSN*, soit standards that compliment this REGDOC. The definitions were reviewed for alignment with the IAEA safety glossary.

dans les normes du Groupe CSA qui complètent ce REGDOC. Les définitions ont été révisées pour qu'elles s'alignent sur le glossaire de sûreté de l'AIEA.

Comment 3:

Both CSOs and industry submitted comments on the use of a graded approach. CSOs suggested that the use of a graded approach could mean a relaxation of requirements. Meanwhile, industry requested clarity on the applicability of the graded approach in the document.

Commentaire 3 :

Les OSC et l'industrie ont soumis des commentaires sur l'utilisation d'une approche graduelle. Les OSC ont suggéré que l'utilisation d'une approche graduelle pourrait constituer un assouplissement des exigences, tandis que l'industrie a demandé des précisions sur l'applicabilité de l'approche graduelle dans le document.

CNSC staff response:

A section on the graded approach was added to the document to give clarity on the definition of a graded approach and how it applies to waste management.

The use of a graded approach is not a relaxation of requirements, but rather the application of requirements in a manner commensurate with the risks and characteristics of a facility or activity.

Réponse du personnel de la CCSN :

Une section sur l'approche graduelle a été ajoutée au document afin de préciser la définition de l'approche graduelle et d'expliquer comment ce concept s'applique à la gestion des déchets.

L'approche graduelle ne signifie pas un relâchement des exigences, mais plutôt une application de ces exigences de façon proportionnelle au risque et aux caractéristiques de l'installation ou de l'activité.

Comment 4:

Industry and CSOs requested additional clarity on acceptance criteria to be used in the post-closure safety assessment.

Commentaire 4:

L'industrie et les OSC ont demandé plus de précisions sur les critères d'acceptation à utiliser dans l'évaluation de la sûreté post-fermeture.

CNSC staff response:

A definition of safety requirements was included in the document in addition to outlining that safety requirements be developed in consultation with the CNSC and other stakeholders. Furthermore, the section on acceptance criteria was expanded.

Réponse du personnel de la CCSN :

Une définition des exigences en matière de sûreté a été ajoutée au document en plus d'expliquer que ces exigences doivent être établies en consultation avec la CCSN et d'autres parties intéressées. En outre, plus de renseignements ont été ajoutés à la section sur les critères d’acceptation.

The CNSC expects that disposal facilities be developed in such a way that people and the environment are protected both now and in the future. In this regard, the prime consideration is the radiological hazard presented by radioactive waste. The ICRP developed the System of Radiological Protection that applies to all facilities and activities; this system was adopted in the International Basic Safety Standards and the CNSC has included the criteria in this REGDOC.

La CCSN s’attend à ce que les installations d’évacuation ou de stockage définitif soient conçues de manière à protéger les personnes et l’environnement, aujourd’hui et dans l’avenir. À cet égard, la principale considération est le risque radiologique présenté par les déchets radioactifs. La CIPR a élaboré le système de protection radiologique qui s’applique à toutes les installations et activités; ce système a été adopté dans les normes fondamentales internationales de l’AIEA et la CCSN a inclus les critères dans ce REGDOC.

Comment 5:

CSOs raised concerns regarding the reliance on computer modelling for the development of the safety case and for the post-closure safety assessment.

Commentaire 5:

Les OSC ont soulevé des préoccupations quant à la dépendance à la modélisation informatique pour l’élaboration du dossier de sûreté et l’évaluation de la sûreté post-fermeture.

CNSC staff response:

Computer modelling is only one of many means to provide confidence in a post-closure safety assessment. Paleohydrogeology, natural analogs, conservative assumptions, robustness of the design of the system and its components, are some examples of other means to provide complementary arguments for post-closure safety. Computer modelling outputs used in post-closure safety assessment are not considered as predictions but as estimates of possible future impact. Confidence that these estimates would be below acceptance criteria has to be provided in the safety case using multiple lines of reasoning, evidence and arguments. All arguments and lines of evidence derived by a multiple approach, including computer modelling, are documented.

Réponse du personnel de la CCSN :

La modélisation informatique est un des nombreux outils utilisés pour fournir une assurance dans l’évaluation de la sûreté post-fermeture. La paléohydrogéologie, les analogues naturels, les hypothèses prudentes et la robustesse dans la conception du système et de ses composants sont quelques exemples d’autres moyens d’apporter des arguments complémentaires pour la sûreté post-fermeture. Les extrants de la modélisation informatique utilisés dans l’évaluation de la sûreté post-fermeture ne sont pas considérés comme des prévisions, mais plutôt comme des estimations de futures incidences potentielles. La confiance que ces estimations seraient inférieures aux critères d’acceptation doit être fournie dans l’analyse de la sûreté en utilisant de multiples raisonnements, preuves et arguments. Tous les arguments et raisonnements découlant d’une approche multiple, incluant la modélisation informatique, doivent être documentés.

Concluding remarks

This project has undergone extensive stakeholder consultations. CNSC staff have listened to concerns and the document has been modified, as appropriate.

Mot de la fin

Ce projet a fait l'objet de vastes consultations auprès des parties intéressées. Le personnel de la CCSN a entendu les préoccupations et a modifié le document, au besoin.

REGDOC-2.11.1, *Waste management, Volume III: Safety Case for Long-Term Radioactive Waste Management*, Version 2
REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour la gestion à long terme des déchets radioactifs*, version 2
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

NOTE: Draft REGDOC-2.11.1, Volume III has gone through an iterative consultation process with stakeholders involving three distinct phases and three separate draft versions of the document being created. Therefore changes noted in Tables A, B and C reflect document modifications that were used for further stakeholder comments in Table D. As a result, only the changes noted in the final table (Table D) are reflected in the final draft version of the document submitted to the Commission for approval.

Comments received:
- Table A: on the Request for Information document: No comments received
- Table B: public consultation period (May 24 to September 16, 2019): 126 comments from 11 reviewers
- Table C: feedback on comments period (October 16 to November 5, 2019): 14 comments from 4 reviewers
- Table D: workshop with industry and civil society organizations on February 5, 2020 and April 23, 2020: 25 comments received

Commentaires reçus :
- Tableau A: sur le document Demande d'information : Aucun commentaire reçu
- Tableau B : période de consultation publique (24 mai au 16 septembre 2019) : 126 commentaires reçus de 11 examinateurs
- Tableau C : période des observations (16 octobre au 5 novembre 2019) : 14 commentaires reçus de 4 examinateurs
- Tableau D : atelier avec l'industrie et avec des organisations de société civile du 5 février 2020 et du 23 avril 2020 : 25 commentaires reçus

Table A: Comments on the "Request for Information" / Tableau A : Sur le document Demande d'information

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
No comments received.				

Table B: Public consultation period / Tableau B : Période de consultation publique

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
1	Ontario Power Generation	General	The language in some sections of the draft REGDOC is either unclear or imprecise. Clear, accessible language leads to improved compliance by licensees.	As a result of the comment, the document has undergone a thorough review and editing. The changes are noted in this disposition table.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
2	Ontario Power Generation	General	The draft REGDOC does not clearly distinguish between facility types or the requirements that apply to them at various times in their lifecycle, which can lead to unclear expectations for licensees and challenge compliance.	As a result of the comment, the following changes were made: • the purpose and scope were revised to: "1.1 Purpose: The purpose of this document is to provide requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment for disposal of all types of radioactive waste. 1.2 Scope: This regulatory document addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal systems (facilities, locations or sites) for all classes of radioactive waste. This document also applies to storage facilities without the intention of retrieval of the waste. The post-closure safety case considers information from the pre-closure phase (site preparation, construction, operation, decommissioning) only as it impacts post-closure safety. For disposal systems that have been operating, decommissioned or closed before 2020, this document is to be considered as guidance." • text was added to section 5.2, Development of the safety case: "A post-closure safety case is required for a radioactive waste disposal system throughout its entire lifecycle – at the start each major licensing stage from site preparation through to decommissioning (which includes closure and decommissioning of ancillary facilities) - and post-closure period until release from regulatory control."
3	Bruce Power	General	The editorial quality of this document below the CNSC's usual standards for drafts issued for industry or public review. While we appreciate this is an early version and subject to further editing, reviewers were challenged to provide concise, meaningful; feedback due to the volume of inconsistent	See response to comment #1.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			wording, undefined terms, repetitive themes and redundant sections.	
4	Bruce Power	General	The document does not clearly define the lifecycle phases of a facility or the requirements that apply to each phase. As currently written, it is not always clear which licensees or what type of radioactive waste management (low, intermediate, or high level), this document applies to.	See response to comment #2.
5	Bruce Power	General	While the graded approach to the application of this document is clearly required, there are only a couple of references to it and no meaningful discussion in this draft. The guidance provided represents a significant and perhaps unnecessary undertaking for some of the lower-risk licensees, who appear to be captured in the scope.	As a result of the comment, the document was revised for clarity and precision: a new section was added on the graded approach.
6	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	General	**Issue (Major)** Licensees found the editorial quality of this document below the CNSC's usual standards for drafts issued for industry or public review. While industry appreciates this is an early version and subject to further editing, reviewers were challenged to provide concise, meaningful feedback due to the volume of inconsistent wording, undefined terms, repetitive themes and redundant sections. There are also several references to draft REGDOCs that have not yet been published, which means requirements may not be fully understood and informed comments difficult to provide. To ensure a better understanding of the REGDOC and its requirements, industry requests the CNSC circulate a revised version for further review by subject matter experts prior to publication. **Suggested change** Please see specific examples in the table below where licensees have suggested wording changes to improve the document. Generally, licensees believe future drafts could make better use of Appendix A to align the document's sections and titles to areas being discussed. As currently laid out, reviewers found it is easy to get lost in the sections. **Impact on industry**	See response to comment #1. Only REGDOCs that are already published or will be published at the same time as REGDOC-2.11.1, Volume III will be referenced in the published version. Commenters will be provided with a revised version of this REGDOC prior to its presentation to the Commission. Information contained in Appendix A is now incorporated in the body of the document, specifically in section 4, Definition of Safety Case and Safety Assessment. CNSC staff have endeavored to align the documents sections and titles with the figure where possible.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			REGDOCs that are clearly written in an easy-to-read, logical format promote better understanding for all stakeholders. In turn, this leads to better compliance and improved nuclear safety.	
7	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	General	**Issue (Major)** The document does not clearly define the lifecycle phases of a facility or the requirements that apply to each phase. Specifically, licensees found operational concepts for assessing a typical nuclear facility have been added to this draft. However, a disposal facility generally has the following lifecycle phases: siting; construction; operation; pre-closure monitoring; closure; decommissioning of ancillary facilities; post-closure. While some concepts can be applied to the operational phase of a waste management or disposal facility, they cannot be directly applied to the unique aspects or post-closure timeframe of a repository. **Suggested change** Applicability of requirements for specific timeframes need to clear and should not inadvertently create other safety issues. For example, Section 3 should clarify if lifecycle incudes closure and post-closure. **Impact on industry** Unclear expectations could challenge compliance verification. Stakeholders are best served if there is a clear and common understanding as to which radioactive waste management facilities this guidance applies to.	See response to comment #2.
8	Northwatch	General	On May 24, 2019 the Canadian Nuclear Safety Commission issued an invitation to comment on the "*revised version of REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management*". The invitation posted on the CSNC web site as a "news" item included a link to a web page which included the document history of REGDOC 2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management*, version 2. A summary was posted on the	No changes were made to the document as a result of the comment. Consultation with the public, licensees and other stakeholders is an integral component of developing the CNSC's regulatory framework. The CNSC's general practice is to consult on documents that contain new requirements, new areas of oversight or when exercising its existing regulatory authority in a new manner. REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* was published as part of the CNSC's initiative to bring

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			same page, as follows: *REGDOC-2.11.1, Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management, version 2, provides requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment for the long-term management of radioactive waste.* *REGDOC-2.11.1, Waste Management, Volume III, v2 will supersede: • REGDOC-2.11.1, Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management • G-320, Assessing the Long term Safety of Radioactive Waste Management • P-290, Managing Radioactive Waste* The following table was also included, showing "document milestones": ***Document Milestone*** / ***Dates*** / ***Links*** *Consultation* / *May 24 to September 16, 2019* / *View the consultation version of (HTML version of Draft REGDO III, v2) (PDF version of Draft RE Volume III, v2)* *Publication* / *TBD* / *TBD* *Consultation of G-320* / *June 2005* / *View comments received from pu (PDF)* *Publication of G-320* / *December 2006* / *View G-320 (PDF)* *Publication of REGDOC- 2.11.1, Volume III* / *May 3, 2018* / *View regulatory document* We were unable to find on this page or in the draft "revised" version of	regulatory documents that were published before the current framework was adopted into the new system. REGDOC-2.11.1, Volume II updates information from RD/GD-370, *Management of Uranium Mines Waste Rock and Mill Tailings* (published in March 2012) and P-290, *Managing Radioactive Waste* (published in July 2004). The requirements and guidance in this document have not changed and remain relevant. The publication reflects administrative changes, which were made to align existing content with the CNSC's updated naming convention and format for regulatory documents. Given the nature of these changes, the document was not posted for public consultation. P-290, *Managing Radioactive Waste* was also incorporated into REGDOC-2.11, *Framework Radioactive Waste Management and Decommissioning In Canada*. An email was sent to subscribers and posted on the CNSC website to inform of the numbering change of the 2.11 REGDOC series.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			REGDOC-2.11.1, Volume III any note clarifying that in fact that the document which is the subject of public comment was published in May 2018 not as Volume III, but as Volume II. We find this type of simple misrepresentation to be frustrating and, frankly, annoying. While we remain unconvinced of any benefit of inserting what is currently referred to as “REGDOC-2.11.1, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings” into the suite of documents which current comprise REGDOC-2.11.1, we see definite benefit in providing on the summary page and then in the “revised” an identification that the current document being referred to as Volume III was previously published as Volume II of REGDOC 2.11.1.	
9	Northwatch	General	The table of “Document milestones” raises questions about what consultations took place but which are not reported in the table, or what the CNSC basis was for the revisions that have been made. In particular and for example: • Twelve years passed between the publication of G-320 in December 2006 and the publication of REGDOC-2.11.1, Volume III in May 2018 but there is no indication of what related consultations or policy development occurred during this 12 year period which informed or motivated the CNSC development of REGDOC-2.11.1, Volume II (now known as Volume III) in May 2018 • While other consultations are identified (for example on G-320) there is no consultation period, focus or findings identified in relation to the development and publication of REGDOC-2.11.1, Volume II (now known as Volume III) in May 2018 • There are an estimated 849 amendments or changes between REGDOC-2.11.1, Volume II (now known as Volume III) as published in May 2018 and the draft revised REGDOC-2.11.1, Volume III as released for public comment in May 2019, but there is no record or accounting of what consultation occurred during that year and what input may have been sought that lead	No changes were made to the document as a result of the comment. All consultations related to the development of this REGDOC were done publically. See response to comment #8. There was also a public consultation for the waste management and decommissioning regulatory documents in 2016. The CNSC discussion paper DIS-16-03, *Radioactive Waste Management and Decommissioning* was opened for public consultation from May 13, 2016 to September 12, 2016. Comments were received from 18 organizations and individuals, and were posted on the CNSC website for feedback between October 13 and November 2, 2016. Comments were received from civil society groups, environmental non-government organizations, members of the general public, government organizations and industry. These comments were included in a What We Heard Report, which is published on the CNSC website. All comments were duly considered in the development of the waste management and decommissioning regulatory documents.

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			to the 849 amendments	
10	Northwatch	General	The following comments are general and preliminary in nature. Northwatch has an intention to provide supplementary comments in the near future, but time constraints and other demands preclude our providing a specific time frame for those supplementary comments. Our preliminary comments include the following: - The repeated emphasis is on demonstrating that a waste management facility's operation will be adequate, rather than determining whether that will be the case	As a result of the comment, Section 5.2, Development of the safety case was changed to: "In the pre-licensing phase, assumptions may be necessary regarding concept development and site selection. These activities do not require licensing from the CNSC; however, due to their very long time spans, typically several decades, early engagement during the pre-licensing period with the CNSC is encouraged. As concept development and site selection proceeds, site-specific data is necessary and details of the proposed design, construction, operation, decommissioning, closure and post-closure, as appropriate, have to be developed. This will allow specific issues to be addressed in more detail in the safety case." This documented provides requirements and guidance to licensees and applicants for developing a safety case. Following the submission of the safety case documentation, the CNSC will perform technical assessments to determine whether submitted documents and supporting evidence presented to the CNSC by any applicants or licensees have a sound technical basis. Assessments address the completeness (coverage and adequacy), comprehensiveness (depth) and the validity of the rationale and technical justification provided in submissions, and are also used to verify licensee compliance with regulatory requirements.

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11	Northwatch	General	• The document acknowledges that concept development and site selection decisions will rely on assumptions rather than a demonstration of safety, but makes no clear statement as to the point in time / operation when the concept must be supported with evidence	No changes were made to the document as a result of the comment. The safety case is updated progressively throughout the lifecycle of the facility or site by the systematic collection, analysis, and interpretation of the necessary scientific and technical data. The level of technical detail will depend on stage of development of the facility.”
12	Northwatch	General	• The document claims that “at the end of the facility’s lifetime, the safety case will contain all of the information that future generations should require (e.g., institutional control plans, long-term monitoring plan)” but is silent on what worst scenarios or project reversals this information would support	No changes were made to the document as a result of the comment. The CNSC does not include prescriptive requirements for reversibility. However, the development of disposal facilities may incorporate provisions in design or operation for facility reversibility, including retrievability. It would have to be ensured that any such provision would not have an unacceptable adverse effect on safety or on the performance of the disposal system. This is in alignment with IAEA Safety Standard SSR-5, *Disposal of Radioactive Waste*. As part of the safety case, the long-term safety assessment must include very unlikely disruptive event scenarios and worst case scenarios to demonstrate robustness of the disposal system.
13	Northwatch	General	• The document uses undefined terms the definition of which may be fundamental to evaluating the approach set out in the document; for example “ unreasonable risk” is a highly subjective term and one which could be interpreted very differently in different circumstances or by different parties	No changes were made to the document as a result of the comment. The CNSC have reviewed the document to verify that definitions are found in the Act, regulations, REGDOC-3.6, *Glossary of CNSC Terminology* and CSA standards on waste management. The CNSC will include the specific definitions that are not included in this REGDOC in the next revision for REGDOC-3.6. Canada’s political and legal system has established the independent CNSC

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				Commission Members as the final arbitrators of what represents reasonable risk when it comes to the development and use of nuclear energy and sources. The Nuclear Safety and Control Act (NSCA) does not provide an explicit definition of "unreasonable risk". Section 9(a)(i) of the Act states that it is an object of the Commission to determine what constitutes unreasonable risk. As such the Commission alone has the ability to determine what constitutes unreasonable risk in different circumstances or by different parties. The Commission uses a transparent public process to engage and promote public participation in their decision making.
14	Northwatch	General	• The CNSC use of the term "graded approach" implies that there are some circumstances, even in the management of radioactive wastes, where less rigour is required for some facilities; this notion is unacceptable	As a result of the comment, a new section was added on the graded approach.
15	Northwatch	General	• The document states that "The licensee or applicant shall ensure that the safety case demonstrates that sound management practices have been applied to its development and the development of the facility"; it may be the responsibility of the licensee of the applicant to compile the safety case, but it is the role and responsibility of the regulator to assess the safety case, and so any "ensuring" is the responsibility of the regulator	As a result of the comment, this requirement was deleted.
16	Northwatch	General	• CNSC regulations and the meeting of its regulatory responsibilities should not rely on rules, policies, standards or guidelines which have been established by the licensees; this very much applies to the Canadian Standards Association standards, which are set by technical advisory committees populated almost entirely by the nuclear industry and their hired "specialists", and which exclude independent and public interest participants	No changes were made to the document as a result of the comment. The description of the CSA standards process in the question is not accurate. Recognized experts develop nuclear standards through a transparent consensus process that provides opportunities for meaningful public involvement. Committees are comprised of members representing varied viewpoints including the CNSC, government, industry, academia, and general interest groups. This system prevents any single group from dominating the final product. Before a standard can become part of the licensing basis for a facility it has to be approved by the Commission through its hearing process. The public can appear before the Commission and express any concerns they may have at that point with the content of a standard. Standards are referenced if the Commission views a

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				standard as essential to promoting safety. The Commission can assign additional conditions it deems necessary to reduce risks to a reasonable level The CNSC maintains an efficient and streamlined regulatory framework by making appropriate use of standards created by independent, third-party standard-setting organizations such as the CSA Group, the American Society of Mechanical Engineers, the International Commission on Radiological Protection and the Institute of Electrical and Electronics Engineers. Together with regulatory documents, standards provide additional clarity to licensees and applicants by explaining how to meet the requirements set out in the *Nuclear Safety Control Act* and the regulations made under it. CSA standards complement regulatory documents that are developed by CNSC staff. All nuclear-related CSA standards may be viewed at no cost through the CNSC Webpage on its "How to gain free access to all nuclear-related CSA standards" Web page. All the hyperlinks to CSA standards in REGDOC-2.11.1, Volume III direct to that page.
17	Northwatch	General	• Northwatch agrees that the containment and isolation of radioactive wastes is the object of waste management, including over the very long term	Comment noted.
18	Northwatch	General	• The stating of the requirement that "Containment and isolation shall be shown to be provided by presenting evidence that the barrier systems retain their safety functions, under the effects of design basis events during the safety case time frame" is too general and lacks rigour; this section should be set out in detail, and should include the requirements for disclosure of the basis for any of the proponents' claims with respect to the performance of the various barriers in the multi-barrier system	As a result of the comment, a new requirement was added: "For each barrier, the safety functions, the expected performance, and design life shall be provided."
19	Northwatch	General	• The requirement to present evidence that the barrier systems retain their safety functions should not be limited to "under the effects of design-basis events"; beyond design basis events are of the greater concern, and should be fully documented	As a result of the comment, the term 'design basis events' was replaced by 'normal evolution' and 'disruptive events scenarios'.

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20	Northwatch	General	• Limiting the requirement to present evidence that the barrier systems retain their safety functions to “during the safety case time frame” is too subject to interpretation on the part of the proponent	No change was made as a result of the comment. The determination of time frames is detailed in Section 8.1.3.3 Assessment time frames.
21	Northwatch	General	• It appears that the intention is to have the time frames determined by the proponent, presumably the outcome of estimates and modeling on the proponent’s part; this is unacceptable and lacks the necessary rigour	No change was made as a result of the comment. The time frame is a distinct period of time that has to be justified through the use of multiple lines of reasoning. The time frame is waste-specific and site-specific and could not be universally specified for all types of installations. CNSC staff will review and assess any time frame put forth by the proponent.
22	Northwatch	General	• As in other areas, the document suggests that the licensee or applicant will make all determinations related to assessing safety and acceptability of both facility design and site; the licenses will determine the approach and criteria used in site characterization, and then demonstrate that they have met that criteria, seemlingly with no outside interference from the regulatory, civil society, outside experts, or potentially impacted communities; this approach is unacceptable	As a result of the comment, the following text was added: “The iterative approach to the development of the safety case enables engagement with the public and Indigenous groups and the incorporation of stakeholder feedback.” Furthermore, it should be noted that the design and site selection will form part of the licence application and as such, be part of CNSC’s decision making process.
23	Northwatch	General	• The document states that “… impacts shall be determined quantitatively by means of conceptual and mathematical models” but conceptual and mathematical rely on estimates and assumptions, and so are not quantitative by their very nature	As a result of the comment, the following text was added: “The licensee or applicant should develop a conceptual model, which is a representation of the behavior of the waste disposal system that includes the description of the components of the system and the interactions between these components. It should also include a set of assumptions concerning the geometry of the system and the chemical, physical, biological, mechanical, and geological behavior of the facility or activity, consistent with the information and knowledge available.” As outlined in 1-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, once scenarios have been developed, the corresponding assessments should be carried out. An assessment model includes conceptual models and mathematical models. These models provide an analysis based quantitative and qualitative information,

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				including input parameter values and scenarios. The interpretation of model outputs involve a qualitative assessment. A safety assessment includes one or more safety analyses (which are usually quantitative, necessitating the use of mathematical models), plus an evaluation of confidence the assumptions, input data and the results of the analysis(es), and a discussion of the margin of safety with respect to the acceptance criteria.
24	Northwatch	General	• While the document states that “The licensee or applicant should ensure that the facility design and its components are optimized using a well-defined and iterative process” the process appears to remain insular and the sole domain of the proponent • The development / determination of the criteria by which the safety analysis results will be deemed acceptable is also left in the sole domain of the proponent; this is unacceptable on several grounds, but including and perhaps most importantly that it excludes those who will be subjected to results, i.e. the public	See response to comment #22.
25	Northwatch	General	• In describing key areas of safety analysis such as *Confidence in computing tools* and *Confidence in safety analysis models* and *Interpretation of results***,** among others, the document again leaves these in the sole domain of the applicant; this is unacceptable	See response to comment #22.
26	Northwatch	General	Our advice moving forward is consistent with that offered with respect to next steps in our comments on *Draft REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste* the development of the suite of documents that comprise REGDOC-2.11.1, Waste Management: • Provide a complete record with respect to the revision process – including any comments received or input sought from stakeholders during the period of May 2018 to May 2019 –with respect to REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long Term Radioactive Waste Management, Version 2	See response to comment #9.

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27	Northwatch	General	• Complete a dispositioning of comments received on each of the draft REGDOCs in REGDOC-2.11.1 and make those public	See responses to comments #9.
28	Northwatch	General	• Prepare a second draft on each of the draft REGDOCs in REGDOC-2.11.1 and make those public • Convene a workshop with balanced participation on REGDOC-2.11.1, Waste Management (Framework and Volumes I to III) • Invite feedback on second draft of the Framework and each of the REGDOCs in REGDOC-2.11.1, Waste Management second draft REGDOCs • Provide participant funding to support public participation with technical support • Complete a dispositioning of comments received on the second draft of each of the framework and the draft REGDOCs in REGDOC-2.11.1 and make those public • Consider next steps (final draft, final version, additional consultation)	In response to requests from industry and civil society stakeholders, the CNSC arranged to hold two separate workshops concerning the REGDOC-2.11 series of documents in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April and discuss how stakeholder comments were taken into consideration. Draft REGDOCs and the associated detailed comments tables will be sent to all stakeholders and invitees in advance of the workshops. The second draft of the document and the dispositioning of comments will be distributed to participants in advance of the workshop.
29	Northwatch	General	This is an extremely important suite of regulatory documents, and their development merits the CNSC taking a thoughtful and measured approach which includes public and Indigenous participation and is undertaken in an iterative and responsive fashion.	Comment noted. The CNSC as an Agent of the Crown has the responsibility for carrying out the duty to consult should its regulatory decisions or activities potentially affect potential or established Indigenous and treaty rights. Should an application be received for a waste project, the CNSC, in collaboration with its partners in the federal government or other jurisdictions as appropriate (Provincial or Territorial government) would conduct extensive consultation and engagement activities with potentially affected and interested Indigenous communities, ensuring that they have the information and support they need in a timely manner in order to participate meaningfully in the regulatory review process. When developing regulatory documents, the CNSC provides opportunities for the public and Indigenous peoples to submit their comments on draft documents through

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<tr><td></td><td></td><td></td><td></td><td>its public consultation process.

These regulatory documents are also intended to be complimentary to the relevant CSA standards, which are also open to the public for consultation.</td></tr>
<tr><td>30</td><td>Concerned Citizens of Renfrew County and Area</td><td>General</td><td>Section 3 of the Nuclear Safety and Control Act refers to limitation of risks of nuclear substances to persons and the environment “in a manner that is consistent with Canada’s international obligations.

“Section 9(a)(iii) of the Act lists as an object of the Commission to “achieve conformity with measures of control and international obligations to which Canada has agreed.”

One such international obligation is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, a 1997 International Atomic Energy Agency (IAEA) treaty to which Canada is a Party.

The Joint Convention should be the starting point for this regulatory document on long-term radioactive waste management. The IAEA’s extensive collection of related safety requirements and safety guides – particularly those for pre-disposal management and disposal of radioactive waste - should be drawn upon and referenced throughout the regulatory document.

The Joint Convention is mentioned nowhere in the regulatory document. IAEA safety requirements and safety guides are not referenced (although it is noted under “Additional Information” that some “may be useful to the reader”).

This raises doubt that this regulatory document has been prepared “in a manner that is consistent with Canada’s international obligations,” or that it conforms to “international obligations to which Canada has agreed.”</td><td>No changes were made to the document as a result of the comment.

As outlined in section 2 of the REGDOC, the CNSC’s waste management framework includes several regulatory documents specific to waste management, including REGDOC-2.11, Framework for Radioactive Waste Management and Decommissioning in Canada. REGDOC-2.11 expresses Canada’s international obligation to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The CNSC conducted a gap analysis between IAEA safety standards and the regulatory framework as part of the analysis phase for this REGDOC. SSG-23, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste was used as the basis for this REGDOC. Additional IAEA documents were used for the development of this REGDOC and are referenced. The following table provides the safety standards used for the development of the waste management regulatory documents.

<table>
<tr><th>REGDOC #</th><th>Title</th><th>Safety Standards Referenced or Influenced By</th></tr>
<tr><td>1.2.1</td><td>Guidance on Deep Geological Repository Site Characterization</td><td>SSR-5, SSG-14</td></tr>
<tr><td>2.11</td><td>Waste Management: Framework for Radioactive Waste Management and Decommissioning in Canada</td><td>GSR-5, GSG-1, SSR-5, GSR-6</td></tr>
<tr><td>2.11.1 Volume I</td><td>Waste Management, Volume I: Management of Radioactive Waste</td><td>GSR-5, GSG-1, SSG-40, SSG-41, WS-G-6.1, SSR-5, SSG-15, SSG-29, SSG-31, SSG-14</td></tr>
<tr><td>2.11.1 Volume II</td><td>Waste Management: Management of Uranium Mine Waste Rock and Mill Tailings</td><td>WS-G-1.2, NF-T-1.2</td></tr>
<tr><td>2.11.1 Volume III</td><td>Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2</td><td>GSR-5, SSR-5, SSG-23, GSG-3</td></tr>
<tr><td>2.11.2</td><td>Decommissioning</td><td>GSR-6, GSR-4, WS.G-2.4, WS-G-2.1, WS-G-5.2</td></tr>
<tr><td>3.3.1</td><td>Financial Guarantee for Decommissioning of Nuclear Facilities and Termination of Licensed Activities</td><td>GSR-6</td></tr>
</table></td></tr>
<tr><td>31</td><td>Concerned Citizens of</td><td>General</td><td>A detailed comparison of the IAEA’s requirements and those contained in REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-</td><td>As a result of the comment, the text was changed to:</td></tr>
</table>

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	Renfrew County and Area		*Term Radioactive Waste Management*, Version 2 is beyond our ability. However, we note the regulatory document lacks general principles or objectives – such as the objective of the *Joint Convention* that "individuals, society and the environment are protected from harmful effects of ionizing radiation, now and in the future." Instead, the regulatory document would allow the licensee or licence applicant to prepare its own safety case that would state "the safety principles to be applied, the safety requirements, objectives, and criteria to be met, and the safety standards to be used ." (Section 6.1) Allowing nuclear industry proponents to state the safety principles, objectives and standards that they would use in developing a radioactive waste management facility is an astounding abdication of responsibility by the CNSC - and by the Government of Canada, as the signatory to the *Joint Convention*.	"Safety requirements should be developed in consultation with the CNSC and other stakeholders." The text is not intended for licensees or applicants to develop regulatory requirements or acceptance criteria but rather state which ones are to be used to demonstrate safety. This REGDOC is complement by other CNSC regulatory documents, such as REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*. It provides principles the CNSC considers when making regulatory decisions about the management of radioactive waste, such as: • The assessment of future impacts of radioactive waste on the health and safety of persons and the environment encompasses the period of time during which the maximum impact is predicted to occur. • The predicted impacts on the health and safety of persons and the environment from the management of radioactive waste are no greater than the impacts that are permissible in Canada at the time of the regulatory decision.
32	Concerned Citizens of Renfrew County and Area	General	Even the rather weak principles found in section 4.2 of the CNSC's December 2006 Regulatory Guide G-320, *Assessing the Long Term Safety of Radioactive Waste Management*, and in section 5.0 of the July 2004 Regulatory Policy P-290, *Managing Radioactive Waste*, are lacking in the draft regulatory document, which is intended to supersede both of these existing documents.	See response to comment #9. The principles found in section 4.2 of G-320, *Assessing the Long Term Safety of Radioactive Waste Management* and in section 5 of P-290, *Managing Radioactive Waste* are found in REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*.
33	Concerned Citizens of Renfrew County and Area	General	Our final comment is that the CNSC's use of "regulatory documents" rather than legally binding regulations is inconsistent with IAEA requirements. For example, Requirement 19: Facility Operation of the IAEA's General Safety Requirements for *Predisposal Management of Radioactive Waste* (GSR-5) states: Predisposal radioactive waste management facilities shall be operated in accordance with national regulations and with the conditions imposed by the regulatory body. There are currently no regulations specific to radioactive waste management under the *Nuclear Safety and Control Act*. Furthermore, the CNSC apparently does not intend to impose controls on radioactive waste	As a result of the comment, additional references were added to the document. In addition to the NSCA and the regulations made under it, the CNSC develops regulatory documents, which are a key part of its regulatory framework for nuclear activities in Canada. They provide additional clarity to licensees and applicants by explaining how to meet the requirements set out in the NSCA and the regulations made under it. The CNSC has a systematic approach for reflecting IAEA safety standards and best practices within the CSNC's regulatory framework. Regulatory documents are mandatory when referenced as compliance verification

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<tr><td></td><td></td><td></td><td>management facilities, but would give licensees free rein in this area as well. The draft regulatory document says

“The licensee or applicant shall establish limits, controls and conditions using the safety case” (Section 6.7). If the CNSC persists in this “deregulatory” approach, it will generate ongoing conflict with domestic civil society groups and damage Canada’s international reputation.

Given the fundamental flaws in this draft regulatory document, we do not intend to provide further comments</td><td>criteria for licensees.

IAEA documentation is considered throughout the regulatory process. The CNSC confirms that a gap analysis was conducted between IAEA safety standards and the regulatory framework as part of the analysis phase for this REGDOC. SSG-23, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste was used as the basis for this REGDOC.

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</table>

Specific to the comment on establishment of limits, controls and conditions. This wording is in alignment with SSG-23.</td></tr>
<tr><td>34</td><td>Cameco</td><td>General</td><td>Cameco Corporation (Cameco) participated in the industry review of the draft REGDOC-2.11.1. Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management (the REGDOC) and supports the detailed comments made by the Canadian Nuclear Association in its September 16, 2019 letter. Cameco would like to emphasize its concern with specific aspects of the REGDOC as summarized below.</td><td>Comment noted. See responses to the specific comments below.</td></tr>
<tr><td>35</td><td>Cameco</td><td>General</td><td>In general, Cameco notes that this REGDOC continues the negative trends in REGDOC drafting we have commented on before with respect to the addition of requirements to legislated requirements when REGDOCs should be used to provide guidance on how licensees may meet the legislated requirements. This creates uncertainty and inconsistency with respect to compliance expectations and enforcement without the necessary checks and</td><td>No changes were made to the document as a result of the comment.

In addition to the NSCA and the regulations made under it, the CNSC has developed regulatory documents, which are a key part of its regulatory framework for nuclear activities in Canada. They provide additional clarity to licensees and applicants by explaining how to meet the requirements set out in the NSCA and the regulations</td></tr>
</table>

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			balances.	made under it. CNSC undertakes rigorous consultation with all stakeholders to ensure that REGDOCs achieve their intended objective including providing opportunities through the Request for Information document that is issued at public consultation, for stakeholders, particularly industry commenters to provide impact information including costs of implementation and to provide alternatives to meet the regulatory objectives. This REGDOC is based on Version 1 of REGDOC-2.11.1, Volume III, which was a rebrand of the earlier document, G-320, *Assessing the Long term Safety of Radioactive Waste Management* as well as IAEA SSG-23.
36	Cameco	General	Another trend is the reference to draft REGDOCs (see Sections 1.2., 1.3, 2, 5.0, 6.4.2, 6.4.3, 6.9, 6.10 and 7.1.3.1). Cameco believes that only published REGDOCs should be referenced to permit a thorough review of a draft REGDOC and its implications.	See response to comment #6.
37	Cameco	General	Cameco also found this REGDOC to be particularly difficult to follow and understand because the language used is inconsistent, many undefined terms and acronyms are used, there are redundant sections, and the body of the document does not align with the form of the appendices.	See response to comment #1.
38	Cameco	General	Exacerbating this is the use of operational concepts for assessing a nuclear facility that do not apply to some or all life cycle phases of a waste management facility. These ambiguities prevent a consistent and common understanding between and among licensees and regulatory staff and this, in turn, creates unclear expectations and compliance uncertainty. As a result, this REGDOC creates ambiguity and confusion and Cameco strongly recommends that the REGDOC be substantially revised in light of licensee comments and then be released for a further consultation.	See response to comment #1. Further consultation through workshops with commenters are planned in early 2020. The document, as well as the comments disposition table will be circulated before the workshop.

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39	Nuclear Waste Management Organization	General	The document should be clear on requirements, the licensing phase(s) when they apply and remain consistent with requirements in the regulations.	As a result of the comment, text was added to indicate that a post closure safety case is required for a radioactive waste disposal facility throughout its entire lifecycle – at the start each major licensing stage from site preparation through to decommissioning (which includes decommissioning of ancillary facilities and closure) - and post-closure period until release from regulatory control.
40	Nuclear Waste Management Organization	General	There are a places in the draft document that suggest that meeting criteria is not sufficient to meet the "requirements" but does not identify the latter. In particular, NWMO suggests that Section 5 on the Safety Case may be the best place for listing all the requirements, and that this be clearly referenced in later text if needed.	No change was made to the document as a result of the comment. To provide clarity and coherence to the document, the REGDOC is organized by topic rather than requirements and guidance.
41	Nuclear Waste Management Organization	General	The document should remain focused on the long-term safety aspects and remove operational aspects that were not included in the previous version of this document.	See response to comment #2 on the scope.
42	Nuclear Waste Management Organization	General	There are detailed design requirements in some sections of the document that should be removed.	As a result of the comment, design requirements were removed. This REGDOC is not prescriptive and does not specify detailed design requirements, but provides requirements and guidance which align with international standards, with increased clarification of CNSC regulatory expectations.
43	Nuclear Waste Management Organization	General	The expectations around design dose targets are not clear. The wording from the previous version of this document and G-320, Assessing the Long Term Safety of Radioactive Waste Management, on dose constraints and the related discussion should continue to be used.	As a result of the comment, the term 'dose target' was replaced with 'dose constraint'.
44	Nuclear Waste Management Organization	General	Expectations around acceptance criteria for disruptive or what-if scenarios, including in particular inadvertent human intrusion, should be provided.	As a result of the comment, the sub-section of acceptance criteria on radiological protection of persons was expanded to include: "For inadvertent human intrusion scenarios, the IAEA Safety Standard *Disposal of Radioactive Waste* (SSR-5), following ICRP's recommendations (ICRP-122 and ICRP-103) proposes the following criteria: a) if the expected annual dose of less than 1 mSv to those living around the site, then efforts to reduce the probability of intrusion or to limit its consequences are not

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				warranted b) if the expected annual dose is more than 20 mSv to those living around the site, then alternative options for waste disposal are to be considered, for example, disposal of the waste below the surface, or separation of the radionuclide content giving rise to the higher dose. (c) In relation to the effects of inadvertent human intrusion after closure, if such intrusion is expected to lead to an annual dose of less than 1 mSv to those living around the site, then efforts to reduce the probability of intrusion or to limit its consequences are not warranted (d) If human intrusion were expected to lead to a possible annual dose of more than 20 mSv to those living around the site, then alternative options for waste disposal are to be considered, for example, disposal of the waste below the surface, or separation of the radionuclide content giving rise to the higher dose (e) If annual doses in the range 1–20 mSv are indicated, then reasonable efforts are warranted at the stage of development of the facility to reduce the probability of intrusion or to limit its consequences by means of optimization of the facility's design. (f) Similar considerations apply where the relevant thresholds for deterministic effects in organs may be exceeded."
45	Canadian Nuclear Laboratories	General	The major concerns identified could result in a misalignment between public understanding of requirements and the understanding by both the CNSC and CNL with respect to the management of radioactive waste. Please give due consideration as to how the draft regulatory document might be revised to avoid this potential concern with respect to the understanding of requirements.	Comment noted.
46	Canadian Nuclear Association	General	The CNA appreciates the CNSC's desire to provide early drafts to industry, but our members felt that perhaps more time could have been spent improving the editorial quality of the document. Our members felt that it would have been much easier to provide constructive feedback with more consistent wording, better definition of terms and less repetition of themes.	See response to comment #1.

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			Members also noted several redundant sections. CNA notes that this has not been a significant issue in the past and that it is rare to have a significant number of editorial concerns in a document.	
47	Canadian Nuclear Association	General	The CNA feels that the document does not clearly define the lifecycle phases of a facility or the requirements that apply to each phase. In our view the document also fails to make it clear which waste storage facilities are included in this document. This lack of clarity is likely to result in challenges to compliance. Safety compliance is best served through clarity.	See response to comment #2 on the scope.
48	Canadian Nuclear Association	General	A graded approach to the application of this document is clearly required but there are only a couple of references to it and no meaningful discussion in this draft. The guidance provided represents a significant and perhaps unnecessary undertaking for some of the lower-risk licensees, who appear to be captured in the scope.	As a result of the comment, a new section was added on the graded approach.
49	Canadian Nuclear Association	General	CNA members are of the view that this REGDOC should not apply to radioactive waste management at uranium mines and mills. It is our view that the nature of the wastes created and appropriate facilities for the long-term storage of wastes at uranium mines and mills require specific assessments which are covered in REGDOC 2.11.1. Waste Management, Volume II: management of Uranium Mine Waste Rock and Mills Tailings.	As a result of the comment, a new section was added on the graded approach. Uranium mines and mills have not been removed from this REGDOC and they are currently considered in the IAEA safety guide SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste* which was the international basis for this document. The following text was added to the document: “For disposal systems that have been operating, decommissioned or closed before 2020, this document is to be considered as guidance.”
50	Canadian Nuclear Association	General	There are detailed design requirements in various sections of the document. CNA members believe these are unnecessary for this document and risk creating confusion. CNA has noted a number design requirements that we believe should be removed from the document.	See response to comment #42.
51	Dr. Sandy Greer	General	PREAMBLE The draft of REGDOC-2.11.1-vol3-ver2 is very concerning for a list of reasons that will be discussed throughout this citizen response. Among the	This REGDOC was developed using international guidance, namely SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste.* As described in section 7.10, Integration of safety argument, the safety case should provide a synthesis of the available evidence, arguments and analyses. The quality

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			themes of concern include: the reliance upon computer modelling; the pattern of contradiction about expected robustness of safety versus the continuing uncertainties and; last but not least - after looking up a few bibliographic references upon which CNSC arguments are based – no progress within the body of CNSC regulations in moving beyond a "site-specific" focus to an "ecosystem approach," the latter which has been advocated by various international organizations engaged with the nuclear industry through some years. I would be happy if anything that I argue can be proven to be inaccurate. Frankly, I am beginning to wonder whether the independent voices of concern are heeded at all or, alternatively, the CNSC is hell-bent on a trajectory to licence the proposed deep geological repositories (DGRs) – the latter as my longstanding foremost concern - despite the lack of scientific evidence about authentic safety, now or ever. But then, in this draft document, the CNSC does declare, repeatedly, that there are uncertainties, and risks, which apparently we - the collective "we" as per the larger public - now and forever, must accept. Fundamentally, that assumption is what I challenge and, further, raise the question why other possible resolutions about what to do with nuclear waste for the long-term consistently are ignored, while CNSC continue to beat the drum in supporting DGRs (and other related facilities) similarly experimental and yet unproven to be viable, the latter beyond the scope of my critique on this specific draft document.	and reliability of the safety assessment with respect to the derivation of scenarios, the adequacy of methods, models, computer codes and databases, and quality management of the calculations. This is in alignment with IAEA safety standard SSG-23. Computer modelling is only one tool of many to provide arguments in support of long-term safety. Paleohydrogeology, natural analogs, conservative assumptions, robustness of the design of the system and its components, are some examples of other means to provide complementary arguments for long-term safety. All arguments and lines of evidence derived by a multiple approach, including computer modelling, are documented in the safety case. There is no contradiction in acknowledging remaining uncertainties, and yet being confident on the robustness of a disposal system. As stated in section 7.5, Management of uncertainties, by identifying uncertainties, the licensee or applicant shall show how they are handled in the safety case: • by modifying the safety strategy, in order to reduce the uncertainties • by showing that the uncertainties do not have implications on safety • by using conservative assumptions to bound the uncertainties and showing that there is a sufficient margin for safety requirements to still be met. The applicant or the licensee must show that the remaining uncertainties do not affect the decision to proceed to the next phase of development of the facility. To that effect, robustness could be used as a tool to handle uncertainties. For example, there might be uncertainties associated with one or several safety functions of a component, The overall system robustness can be demonstrated by assuming the failure of the above safety functions, and yet being able to show despite this failure none of the safety requirements would be jeopardized. The use of a site specific approach is in alignment with IAEA safety standard SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*.
52	Dr. Sandy	General	**PROVOCATIVE INSIGHTS IN INTERNATIONAL RESEARCH** My critical perspective continues to be influenced by the diversity of science	No changes were made to the document as a result of the comment.

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	Greer		articles and news items, often published outside of North America yet occasionally on this continent too, which pursue investigations that expose the flaws, and inherent bias, within the nuclear industry. As well, I read research by organizations who work with the nuclear industry, often European, who appear to be much more transparent about the limitations of science than what I have been able to find within Canada. Scepticism about the accuracy of climate models, for example, has been expressed by various scientists in other countries, who sometimes work collaboratively. One major problem, apparently, is that the outcomes from different computer programs working on the same investigation contradict each other. (I am unable to name the sources investigating that problem, which I outlined in a few previous submissions currently inaccessible, on my desktop computer in storage during this period between two homes. For this submission, I am working on a new laptop.) More importantly, however, is a very recent piece of research published in the journal ***Geophysical Research Letters***, cited by Yale University at https://e360.yale.edu/digest/europe-is-warming-faster-than-even-climatemodels-projected. The article also quotes Geert Jan van Oldenborgh, a climate analyst whose independent findings agree with the aforementioned research, who says: *"In the Netherlands, Belgium, France, the model trends are about two times lower than the observed trends."* The above not so surprising discoveries illustrate the problem in reliance by CNSC and the nuclear industry upon computer modelling, given current, increasingly disruptive, as well as yet unknown future planetary changes, that appear to be accelerating beyond what our technological tools can predict. As for studies more specific to ionising radiation, a position paper prepared for the 4th IUR Workshop in June 2018, by the International Union of Radioecology addresses the inadequacy of "treating radiation as a single or unique stressor" and called for "the development of a multidisciplinary approach...to address key concerns about multiple stressors in the ecosphere." The position paper is titled: "The tubercular badger and the uncertain curve:- The need for a multiple stressor approach in environmental	See response to comment #51.

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			radiation protection."	
53	Dr. Sandy Greer	General	**WHY DOES CNSC STLL IGNORE `ECOSYSTEM APPROACH?** I became aware of the `ecosystem approach' while preparing my oral interventions and written submissions for the two public hearings (in 2013 and 2014) on the deep geological repository for low-and-intermediate level radioactive waste proposed by Ontario Power Generation. The primary source that I cited as an intervenor was a document produced by the International Commission for Radiological Protection (ICRP), in which CSNC is a longstanding member. Why, therefore, do you not develop research methodologies based on an `ecosystem approach,' which are being pursued by various international researchers and organizations? A few examples follow.  The International Union of Radioecology (IUR) produced a `statement of work' titled **"Ecological risk assessment of radiation - putting the ecosystem approach into practice"** some years ago in collaboration with the Centre for Environmental Radioactivity (CERAD), outlined on www.iur-uir.org/en/task-groups/id-2d-joint-iur-cerad-ecosystem-approac h-task-group. The latest research done by CERAD, which is located at the Norwegian University of Life Sciences, continues to evolve thanks to funding by the Research Council of Norway, identified on a web page for the university at https://www.nmbu-no/en/services/centers/cerad, in the right sidebar: *"CERAD CoE will develop an ecosystem based scientific approach to help protect people and the environment from ionizing radiation, with a programme of targeted focused long term research."* The ***Journal of Environmental Radioactivity*** provides scientific investigations that cover a range of topics and perspectives. I will cite two articles that mention why an `ecosystem approach' is more accurate to determine the extent of contamination. Here is an excerpt from the Abstract for "Challenges associated with the behaviour of radioactive particles in the environment," Volume 186, June 2018, Pages 101-115: *"... When radioactive particles are deposited in the environment, weathering processes occur and associated radionuclides are subsequently mobilized, ... Thus,*	No changes were made to the document as a result of the comment. The use of a site specific approach is in alignment with IAEA safety standard SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*. The CNSC periodically reviews and updates regulatory documents. These comments were added as a parking lot item for the next time REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures* comes up for review.

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			particles retained in soils or sediments are unevenly distributed, and dissolution of radionuclides from particles may be partial. For areas affected by particle contamination, the inventories can therefore be underestimated, and impact and risk assessments may suffer from unacceptable large uncertainties if radioactive particles are ignored. To integrate radioactive particles into environmental impact assessments, key challenges include the linking of particle characteristics to specific sources, to ecosystem transfer, and to uptake and retention in biological systems. …" Another article in the same journal is titled "A modelling approach to assess the environmental/radiological impact of C-14 release from radioactive waste repositories," Volumes 205-206, September 2019, Pages 61-71, in which the Abstract identifies uncertainties discovered through disparities among different models. Its closing sentence sums up an imperative: *"This modelling work illustrates also the importance of far field parameters, such as the rock permeability and the release area of gas pathway, to the assessment of effective dose."* More international examples that advocate for an `ecosystem approach' could be named. But my purpose in showing a few examples is to show that the **CNSC REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures** (April 2017) is not following international practice as per the recognition of an `ecosystem approach.' REGDOC-2.9.1 is one among several bibliographic references for draft document REGDOC-2.11.1-vol3-ver2 that seem to me to be dated. But my critique here raises the serious question why CNSC has created a regulatory document in 2017 - to which it continues to refer as guidance - which is frozen in time as far back as 2013, if not earlier?	
54	Dr. Sandy Greer	General	Doing so brings into question the trustworthiness of CNSC as regulator. For example, within REGDOC-2.9.1, under section **2.1 The CNSC's guiding principles for protection of the environment**, the CNSC stipulates that a licence application shall demonstrate (various) assessments with "performance indicators and targets that are **based on sound science** [my bold]," which I challenge as simply not a fact. Instead the basis seems to be scientific experimentation that might perhaps eventually create "sound	See response to comment #53 on REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*.

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			science." Another simply incorrect point of guidance is written in REGDOC-2.9.1, under section **3. Environmental Assessments**, reads as follows: *"... the Commission must determine whether the completion of a proposed project is likely to cause significant adverse environmental effects, in accordance with section 67 of CEAA 2012."* But a serious truth revealed during the period of the two aforementioned public hearing for the proposed OPG DGR is that CEAA 2012 did not give a clear definition for "significant adverse environmental effects," and because the Joint Review Panel shamelessly accepted OPG's declaration that none existed (in reference to its proposed DGR), the OPG was allowed to avoid carrying out due diligence, until the Ministry of Environment and Climate Change (ECC) made further demands from OPG, based partly upon Saugeen Ojibway Nation's dissatisfaction with OPG, shared with ECC, in regard to OPG's major information gaps. More of REGDOC-2.9.1's content could be challenged, but why bother when it undoubtedly will be rewritten in the near future to accommodate the upcoming federal Impact Assessment Act which will replace CEAA 2012, or will it do so only partially? What will need to be clarified by the CNSC at that time, in a range of documents, is whether the proposed OPG DGR, and already-existing nuclear facilities still must adhere to the regulations in CEAA 2012 or adapt to a newer set of regulations created for the Impact Assessment Act.	
55	Dr. Sandy Greer	General	**CLOSING COMMENTS** Among various sources that I researched online, I did look up a 2008 article in the ***Journal of Environmental Radioactivity*** titled "Addressing uncertainties in the ERICA Integrated Approach." In the Abstract which was accessible on my personal computer (but the full article was not), I recognize that the CNSC is following a protocol that fits with one international line of thinking that is a technologically-based approach, here identified as: "the [ecological risk] assessment is dependent on models, scenarios, assumptions and extrapolations." The Abstract also states: *"Throughout its development, ERICA has recommended that assessors deal openly with the deeper dimensions of uncertainty and acknowledge that*	This comment is noted, however no changes were made to the document as a result of the comment. Questions related to the access of scientific literature are beyond the mandate of CNSC to address. Public libraries often have access to scientific subscription based articles.

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			uncertainty is intrinsic to complex systems." Therefore, in fairness I do give credit to the CNSC for spelling out its awareness about uncertainties so very clearly in this draft document. Nevertheless, I still challenge what I believe is sorely misguided confidence in relying so heavily on a technologically-based approach vis à vis the perilous road ahead for our planet's survival and well being. For a concerned citizen who seeks deeper understanding on complex issues, I would like to take this opportunity that pertains to the better inclusion of other citizens in public comment participation on government decisions. A wealth of information is available online, but significant sources are not accessible because of the huge expense to download, for example, science journal articles. To prepare this submission, car troubles and lack of money disallowed me travelling from Lake Huron to the University of Toronto, where I do have access on the university computers as a graduate. There I pay only the modest cost of printed pages, instead of prohibitive costs per article charged by academic publishers on privately owned computers. This dilemma is undemocratic and elitist, excluding citizens from participating more actively, because of financial costs pertaining to accessibility. I mention my own situation only to illustrate what is a much larger inequity that undoubtedly limits the number of submissions to government departments and agencies in which the citizen can cite deeply informed source materials to reinforce their genuine concerns.	
56	Dr. Sandy Greer	General	But, in preparing this submission, what actually made me angry was being obstructed from looking up one of this draft document's bibliographic references - namely a document produced by the CSA Group - which source works hand-in-hand with government authorities to produce standards. I refer to the document **CSA N288.6 "Environment risk assessment at Class 1 nuclear facilities and uranium mines and mills**." While searching where to simply read it, and not necessarily download it, the cost was more than $1000. How can this price be justified, and who benefits? Therefore, I advocate that this unacceptable cost, hence creating a lack of transparency so close to government authorities be changed, so that CSA Group documents are accessible to the wider public. The reason is, for	All nuclear-related CSA standards may be viewed at no cost through the CSA Communities Webpage. Instructions can be found on the CNSC webpage, "How to gain free access to all nuclear-related CSA standards" Web page. All the hyperlinks to CSA standards in REGDOC-2.11.1, Volume III direct to that page.

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			citizens to comment intelligently on serious matters that affect their well being, they require accessibility to any and all documents that provide insights regarding how and why decisions are made that impact the lives of people and all planetary life.	
57	Dr. J.R. Walker	General	**1.0 Introduction** In the CNSC's invitation to comment [2] on the draft Regulatory Document [1], it is stated that: REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management*, version 2, provides requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment for the long-term management of radioactive waste. REGDOC-2.11.1, *Waste Management, Volume III*, v2 will supersede: • REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management* • G-320, *Assessing the Long term Safety of Radioactive Waste Management* • P-290, *Managing Radioactive Waste* **2.0 Deletion of Regulatory Policy P-290, *Managing Radioactive Waste*** The CNSC's invitation to comment [2] states that the reference to Regulatory Policy P-290, *Managing Radioactive Waste* [3] has been deleted as the P-290 content has been included as Appendix A of the draft Regulatory Document [1]. It is inappropriate to delete the regulatory policy and include the text in the REGDOC, since the regulatory policy "... describes the philosophy that underlies the Canadian Nuclear Safety Commission's (CNSC) approach to regulating the management of radioactive waste and the principles that are	See response to comment #9.

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			taken into account when making a regulatory decision concerning radioactive waste management" [3], whereas the REGDOC merely "provides requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment ..." [1]. With the deletion of Regulatory Policy P-290, there would be no policy statement to guide the Commission in making regulatory decisions concerning the management of radioactive waste (see extract from Regulatory Policy P-290 that is appended to these comments). In fact, the statement [2] that the content of Regulatory Policy P-290 has been incorporated into the draft Regulatory Document [1] is incorrect. The draft Regulatory Document [1] does *not* contain the content of Regulatory Policy [3], either in the main text or in an appendix. If the CNSC continue with this proposed course of action, the regulatory philosophy and principles that are taken into account when making a regulatory decision concerning radioactive waste management as currently expressed in P-290 will be entirely deleted from the CNSC's regulatory documentation. **3.0 Damage to Regulatory Credibility** Regulatory Policy P-290 [3] is part of the defence-in-depth that prevents the management of radioactive waste causing an unreasonable risk to the health and safety of persons and the protection of the environment. In deleting this policy, there is an increased likelihood that inappropriate radioactive waste management decisions will be made that result in unsafe facilities and additional remediation costs that would be a burden on the public purse. The deletion of Regulatory Policy P-290 will give succour to those who consider the CNSC to be a captured regulator and will damage the credibility of the CNSC in the eyes of Canadians.	
58	Dr. J.R. Walker	General	**4.0 Damage to the Relationship with International Partners** Noting that Canada has a treaty obligation under the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste*	See response to comment #9. P-290, *Managing Radioactive Waste* was also incorporated into section 3, The

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			Management [4] to pay due regard to internationally endorsed criteria and standards with respect to radioactive waste management, our international partners will likely be concerned over the deletion of a policy (Regulatory Policy P-290 [3]) that was well aligned with international practice. Additionally, Canada has treaty obligations under the *Comprehensive Economic and Trade Agreement* with the European Union (CETA) [5]. In ratifying CETA, Canada has expressly reaffirmed (Article 24.4 of CETA) *its commitment to effectively implement in its law and practices, in its whole territory, the multilateral environmental agreements to which it is party*. This would, of necessity, include its obligations with respect to radioactive waste management under the *Joint Convention* [4]. Additionally, under Article 24.5 of CETA: 1. The Parties recognise that it is inappropriate to encourage trade or investment by weakening or reducing the levels of protection afforded in their environmental law. 2. A Party shall not waive or otherwise derogate from, or offer to waive or otherwise derogate from, its environmental law, to encourage trade or the establishment, acquisition, expansion or retention of an investment in its territory. 3. A Party shall not, through a sustained or recurring course of action or inaction, fail to effectively enforce its environmental law to encourage trade or investment. The deletion of Regulatory Policy P-290 [3] will be seen as a derogation from environmental law that is contrary to Article 24.5 of CETA. **5.0 Damage to the Canadian Nuclear Industry** The deletion of Regulatory Policy P-290 [3] will be seen as a degradation in Canada's commitment to the health and safety of persons and the protection of the environment.	CNSC's Regulatory Framework and Oversight of Waste Management and Decommissioning of REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*. REGDOC-2.11 also expresses Canada's international obligation to the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

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			This will damage the reputation of the Canadian nuclear industry in the eyes of Canadians and our international partners, resulting in reduced investment in the sector. **6.0 Recommendation** I recommend that the Canadian Nuclear Safety Commission cease and desist the deletion of Regulatory Policy P-290 [3]. **Extract from Regulatory Policy P-290 [3]** The following policy statement would be deleted by the CNSC's proposed course of action. POLICY STATEMENT When making regulatory decisions concerning the management of radioactive waste, it is the policy of the Canadian Nuclear Safety Commission to consider the extent to which the owners of the waste have addressed the following principles: a) The generation of radioactive waste is minimized to the extent practicable by the implementation of design measures, operating procedures and decommissioning practices; b) The management of radioactive waste is commensurate with its radiological, chemical and biological hazard to the health and safety of persons and the environment and to national security; c) The assessment of future impacts of radioactive waste on the health and safety of persons and the environment encompasses the period of time when the maximum impact is predicted to occur; d) The predicted impacts on the health and safety of persons and the environment from the management of radioactive waste are no greater than the impacts that are permissible in Canada at the time of the	

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			regulatory decision; e) The measures needed to prevent unreasonable risk to present and to future generations from the hazards of radioactive waste are developed, funded and implemented as soon as reasonably practicable; and f) The trans-border effects on the health and safety of persons and the environment that could result from the management of radioactive waste in Canada are not greater than the effects experienced in Canada. It is also the policy of the CNSC to consult and cooperate with provincial, national and international agencies to: g) Promote harmonized regulation and consistent national and international standards for the management of radioactive waste; and h) Achieve conformity with the measures of control and international obligations to which Canada has agreed concerning radioactive waste.	
59	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	Preface, section 1.2	**Issue (Major)** A graded approach to the application of this REGDOC is clearly required, but there are only a couple of references to it and no discussion. The guidance provided represents a significant and perhaps unnecessary undertaking for some of the lower-risk licensees, who appear to be captured in the scope. Similar to comment #2, and as indicated in industry's previous feedback on *REGDOC 2.11.1 Vol I*, it is not clear which licensees this REGDOC applies to, or what type of radioactive waste (low, intermediate, or high level) management. For instance, in Section 5 it is not clear what is captured by the phrase, "a long-term radioactive waste management facility or site." Is Chalk River Laboratories an example of a long-term radioactive waste management site? Is the existing Western Waste Management Facility a short-term	See response to comment #2.

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			storage facility? Or, if operation is to be continued for 30 to 50 years, would it be re-classified as a "long term" interim storage facility, pending transfer of stored waste into a future permanent waste disposal facility? **Suggested change** Describe how a scaled or graded approach to this guidance should be applied based on the radioactive waste and licensee types. Clarify what type of radioactive waste and waste management facility is being referenced and those that would be excluded (i.e., milling waste). Clarify when a facility transitions from short-term to long-term and ensure all terms are defined and cross-referenced in *REGDOC-3.6, Glossary of CNSC Terminology* as appropriate. **Impact on industry** Without more clarity on the application of a graded approach, there is the potential for licensees to be out of compliance because of a lack of understanding as to which radioactive waste management facilities this guidance applies to.	
60	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	Preface	**Issue (Major)** This draft introduces the term "must" to express requirements in some passages and uses the traditional term "shall" in others. It also uses "should," "may" and "can" to describe various levels of guidance. Licensees appreciate this may be part of a wider move to use plain, everyday language in legal and regulatory documents. However, mixing terms for requirements or guidance inadvertently generates more confusion than clarity. Further, this revision of the REGDOC introduces numerous "shall" statements that merely describe the normal process used in a safety analysis. For example, section 6.4.2 says, "The licensee or applicant *shall* use data obtained from the waste management system description as inputs to the safety analysis, and provide boundary conditions for the quantitative models." The arbitrary use of "shall" statements leads to confusion with respect to what CNSC expectations a licensee/applicant will be required to meet.	As a result of the comment, the following changes were made: • The text has was revised to clarify requirements from guidance. • The "must" statements were changed to statement of facts. The Department of Justice is currently modernizing the nomenclature in Acts and Regulations, to use the term "must" to express legislative requirements. During this transition period, for the purpose of alignment with associated Regulations, REGDOCs use the same term as present in Regulations associated with this particular REGDOC. The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible

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			Suggested change Industry urges the CNSC to choose just one word to signify a requirement and one for guidance and apply them exclusively in this and all other REGDOCs. While "must" is more commonly used in everyday language, "shall" is used in most other REGDOCs and nuclear standards and may be more easily applied across the CNSC's regulatory framework. Also, licensees urge the CNSC to use "will" statements for normal process descriptions such as the one in 6.4.2, which more properly should read, "The licensee or applicant will ~~shall~~ use data …" **Impact on industry** On its surface, the use of different words to express requirements or guidance appears inconsequential. It is not. Readers of this and other recent draft REGDOCs have found it increasingly difficult to determine what is truly obligatory and what is optional. Simple language used consistently – like "shall" for requirements and "may" for guidance – will reduce confusion and inaccurate interpretations.	within the limits of this regulatory document. "Can" is used to express possibility or capability.
61	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	1.1	**Issue (Major)** As per comment #7, the Purpose section does not make it clear which waste storage facilities are included in this draft REGDOC. For long-term radioactive waste management facilities that have been operating, decommissioned or closed before 2020, this document is to be considered guidance. No exemption is provided for interim or short-term radioactive waste management facilities. Lack of clarity generates questions. For instance: Does future storage in the Point Lepreau Nuclear Generating Station (PLNGS) Solid Radioactive Waste Management Facility (SRWMF) fall within the scope of this document? Does storage and disposal include 'in-situ' disposal? Does facility also mean site or contaminated site? **Suggested change** Add an exemption for interim or short-term radioactive waste management	See response to comment #2. The document is completed by CSA N292.0, *General principles for the management of radioactive waste and irradiated fuel* which defined long-term management. Facility is defined in the regulations.

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			facilities. These facilities should only have to implement *REGDOC-2.4.4, Safety Analysis for Class 1B Nuclear Facilities*. Clearly define “long-term waste management” and “facility” and apply them consistently. **Impact on industry** An unclear purpose could lead to incorrect assumptions regarding requirements for facility type – long term storage vs short-term storage.	
62	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	1.2	**Issue (Major)** Licensees strongly disagree that the scope of this REGDOC should apply to radioactive waste management at uranium mines and mills. As recognized in *CSA N292.0-14, General Principles for the Management of Radioactive Waste and Irradiated Fuel* Section 1.4 and A.8, the nature of the wastes generated and the facilities appropriate for the long-term storage of wastes at uranium mines and mills requires specific safety assessments for which sufficient guidance is provided in *REGDOC-2.11.1, Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings (Volume II).* **Suggested change** Remove radioactive waste management at uranium mines and mills from this REGDOC. **Impact on industry** For mines and mill licensees to apply this REGDOC “as applicable” in this case would essentially require mines and mill licensees to translate and re-write a complex and detailed REGDOC creating both uncertainty and a significant administrative burden without any benefit. Should there be any specific guidance regarding the safety case applicable to mines and mill wastes that is not Volume III, it would be more efficient and simpler for that	See response to comment #49 on the inclusion of uranium mines and mills.

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			limited information to be added to Volume II.	
63	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	1.2	**Issue (Major)** As per comment #6, the Scope of this REGDOC is unclear and: 1. Introduces of the term “closure” without defining its context in the Scope, Glossary or within *REGDOC-3.6, Glossary of CNSC Terminology*. 2. Does not recognize that Regulatory and Guidance Documents are no longer differentiated, which effectively makes this REGDOC guidance for all the facilities, locations and sites to which it applies. Regarding the last sentence in the 1st paragraph, not all radioactive waste management facilities require a safety analysis. Nor are they all Class IB licensees. This is related to industry’s concerns cited in comment #7. **Suggested change** For clarity, licensees suggest exclusions should be noted and the Scope amended to read, “The Monitoring and Surveillance component of the safety case and Operational Safety Analysis component of the Safety Assessment are excluded since they are covered in other regulatory documents.” Additionally: 1. A definition of when a nuclear power plant is considered closed should be included in this REGDOC and *REGDOC-3.6.* 2. The 2nd paragraph should be deleted. Licensees further urge the CNSC to clarify where the guidance on safety analysis for radioactive waste management facilities can be found for each of the respective types of licensees and which types of radioactive waste and waste management facilities are excluded from this guidance.	See response to comment #2. The REGDOC is complemented by CSA standards, including CSA N292.6, *Long-term management of radioactive waste and irradiated fuel* that provide a definition for closure. This definition is adapted from IAEA Safety Glossary. This term may be added to REGDOC-3.6, *Glossary of CNSC Terminology*. The following definition will be added to REGDOC-3.6, *Glossary*, for “closure”: “Administrative and technical actions directed at a disposal facility at the end of its operating lifetime to isolate the radioactive material and to physically restrict the facility from accepting new inventory.”

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			Impact on industry Compliance is challenged when there is a lack of clarity regarding which guidance applies to which radioactive waste management facilities.	
64	Cameco	1.2	Cameco's main comment is that radioactive waste management at uranium mines and mills should be exempt from the scope of this REGDOC. As recognized in CSA N292.0-14, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, Section 1.4 and A.8, the nature of the wastes generated and the facilities appropriate for long-term storage of wastes at uranium mines and mills requires specific safety assessments for which sufficient guidance is provided in REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* (Volume II). It is no answer that this REGDOC is intended to apply "as applicable" to mines and mill licensees because this would require licensees to interpret and re-write what is a complex and confusing document thereby creating uncertainty and a significant administrative burden without any corresponding benefit. In the event specific guidance regarding the safety case applicable to mines and mill waste is not currently included in Volume II, it would be simpler and more efficient for such guidance to be added to the next revision of it. Although Volume II is specific to mines and mill waste management, the above comment on "as applicable" applies generally to all licensees because the Scope section does not clearly identify which licensees the REGDOC applies to (e.g. lower-level risk licensees), which type of wastes it applies to (i.e. low, intermediate or high level) and the facilities and sites that are within the scope of "long-term waste management facility or site" (e.g. facilities that do not require a safety analysis). This, in combination with little to no guidance on how the graded approach applies in relevant sections, creates what may have been intended to be a "one size fit all" document that is not helpful to any licensee.	As a result of the comment, a new section was added on the graded approach. See response to comment #49 on the inclusion of uranium mines and mills.
65	Bruce Power, Canadian	1.2, 1.3, 2, 5.0, 6.4.2, 6.4.3, 6.9,	**Issue**	See response to comment #6

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	Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.10, 7.1.3.1	As per comment #6, draft REGDOCs are mentioned in all of these sections. As a matter of principle, draft REGDOCs should only reference other REGDOCs that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and informed comments cannot be provided. For example, since *REGDOC-2.11.2* will supersede *G-219*, is the reference to *G-219* being "under revision" correct? Should *G-219* be alternatively replaced by draft *REGDOC-2.11.2* in Section 2? **Suggested change** Cite only currently published versions of REGDOCs.	The waste suite of documents is being modernized concurrently and therefore referencing published material that is currently being changed and is available, could result in more significant confusion. The series of waste and decommissioning REGDOCs is being updated concurrently and therefore requires referencing other REGDOCs that have not been published. However, it is the intention to publish these documents at the same time.
66	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	1.3	**Issue** As per comment #6: • The bullet list is incomplete • The acronym "NSCA" not spelled out in 1st use • The Class II Nuclear Facilities Regulations title not fully cited **Suggested change** • Add references to the *Nuclear Substances and Radiation Devices Regulations* and the *Nuclear Fuel Waste Act.* • Spell out all acronyms for 1st use • Amend to read, "Class II Nuclear Facilities and Prescribed Equipment Regulations"	As a result of the comment, the references were added as suggested.
67	Bruce Power, Canadian Nuclear Association, Canadian	2	**Issue** As per comment #6, section 2 duplicates information provided in Appendix A.	As a result of the comment, the appendix was removed and the figure was included in section 4, Definition of Safety Case and Safety Assessment.

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	Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		**Suggested change** For ease of reading, remove repetitive passages.	
68	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	3, 6.4	**Issue (Major)** As per comment #6, the definitions of safety case, safety assessment and safety analysis do not clearly distinguish these activities, in particular between assessment and analysis. The previous version of this REGDOC was organized essentially on Safety Case and Safety Assessment and did not try to distinguish Safety Analysis. This version is organized into Safety Case and Safety Analysis. The addition of a third layer in this version is not particularly clear. Analysis should be used to refer to the (various) specific quantitative models or calculations that support a safety assessment. Related to this, in section 6.4, the scope of what is regarded as a safety assessment vs a safety analysis report (SAR) vs a post-closure assessment vs a safety case is unclear. Reviewers found it difficult to determine if safety assessments are considered any analysis and the SAR and safety case are collections of these analyses. This leads to confusion as to expectations of where the different types of analysis should be presented. **Suggested change** Industry urges the CNSC to: • Retain the structure of the previous version of this REGDOC • Refer to items in Section 7 as part of the Safety Assessment rather than Safety Analysis • Keep the REGDOC focused on the long-term aspects	As a result of the comment, the definitions of safety case and safety assessment been modified to align with REGDOC-3.6, *Glossary of CNSC Terminology*, and expanded to provide more context specific to disposal facilities. To align with SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, 'safety analysis' was replaced by 'safety assessment'. Section 7, Long-term Safety Analysis, was changed to section 8, Post-Closure Safety Assessment. See response to comment #2.

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			Impact on industry This REGDOC was previously focused on assessing long-term safety and applied to waste management concepts that required a long-term safety case (e.g., DGRs). The scope appears to have broadened without clarity on what types of facilities this REGDOC applies to and at which part of the lifecycle. It also mixes safety assessment/analysis concepts without clarity on when a safety case, safety assessment or safety analysis are required. Unclear expectations could lead to different approaches, misalignment of expectations and inconsistent submissions to the CNSC from various licensees.	
69	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	3	**Issue (Major)** Further to the comment above, Section 3 does not: 1. Align well with the relevant acts and regulations. For example, a safety assessment does not assess the safety of a facility, its design, siting etc. It assesses the activities carried out for each of the listed aspects. This is important. According to the Nuclear Safety and Control Act, it is the activity that is licenced. It is difficult to show compliance with the Act if the safety assessment doesn't align with the requirements. Also, since *REGDOC-2.11.1, Volume I* seems to align with the IAEA, industry suggests the IAEA definitions should be used, especially since they align better with the Act. 2. Provide consistency with Section 6 regarding the requirement for a safety assessment being included in a safety case. 3. List the applicable regulatory requirements cited in the 1st paragraph. 4. The term "global" is not clearly expressed in the 4th paragraph. 5. Clarify what is meant by lifetime in the phrase "over the lifetime of the facility" in the 3rd paragraph. 6. Clarify between guidance and requirements in the final paragraph, which	As a result of the comment, the following changes were made: Bullet #1: The definitions of safety case and safety assessment were modified to align with REGDOC-3.6, *Glossary of CNSC Terminology* and expanded to provide more context specific to disposal facilities. To align with SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, safety analysis was replaced by safety assessment. In addition, a statement was added to distinguish between safety assessment and safety analysis. This information added is in alignment with IAEA glossary 2018. Bullet #3: Regulatory requirements may vary depending on the type of activity, characterization of waste, etc. A new section was added on the graded approach. Bullet #4: The 4th paragraph was removed. Bullet #5: Lifecycle of a nuclear facility is defined in REGDOC-3.6, *Glossary of CNSC Terminology*. However the following statement was added in role of the safety case: "The safety case relates to all hazards and is the main tool used to document and demonstrate that a facility will adequately protect people and the environment during its entire lifecycle (site preparation, construction, operation, decommissioning) and post-closure period." Bullet #6: The last paragraph was deleted.

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			says Appendix A outlines the components of a safety case, safety assessment and safety analysis. It's unclear if the outline is guidance or requirements since it's under the definitions section of the document **Suggested change** Industry urges the CNSC to: 1. Use the definitions given in the IAEA Radioactive Waste Management Glossary. Where CNSC REGDOC glossary definitions are not aligned with the IAEA, provide additional information for clarity 2. Amend the 2nd sentence to read, "A safety case ~~normally~~ includes a safety assessment supported by additional lines of evidence and the assumptions made therein. (See Section 3, paragraph 3, sentence 1 ("A safety assessment forms the core of") and Section 6, bullet 4 ("safety case shall include a safety assessment") 3. List the applicable regulatory requirements in the 1st paragraph to ensure licensees understand which ones are applicable. 4. Amend the 3rd sentence of the 4th paragraph to read, "…or some other relevant ~~global~~ measure of the overall impact on safety." 5. Define "lifetime of the facility" since it is ambiguous whether the lifetime includes the post-closure stage. Paragraph 4 in Section 4.2 seems to indicate that lifetime excludes post-closure for disposal facilities. (See similar comment on Section 4.2) 6. Delete the last paragraph since it's duplicated in other sections where there is no ambiguity of requirement. **Impact on industry** Unclear expectations could challenge compliance verification and inadvertently result in confusion for members of the public as to expected	The following changes were not made: Bullet #2: 'Normally' was not deleted as it aligns with the definition of safety case in REGDOC-3.6, *Glossary of CNSC Terminology* and IAEA safety glossary.

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			requirements for facilities.	
70	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	4.1	**Issue** As per comment #6, Section 3 defines a Safety Case but Section 4.1 describes it differently. Additional clarity is sought in a number of areas: • The need to identify that a safety case relates to all hazards. • As per the CNSC's definition in Section 3, the safety case would "demonstrate the safety of a facility and the meeting of all applicable regulatory requirements." While a safety case would support the selection of a site, it would not be used to select and characterize the site. • The monitoring program is not used to determine if the safety case is appropriate. The data only shows that the system is performing as expected or there is an issue. • New terminology such as "limits, controls, and conditions" is being used without being defined. In the 2nd paragraph, the term "closure" should be clarified with respect to "post closure" activities (if applicable). **Suggested change** Define the new terminology included in this section and clarify the difference between "closure" and "post-closure" activities. Amend the following passages: • 1st paragraph, "The safety case relates to all hazards and is the main tool to document and demonstrate …" • 2nd paragraph, "support the selection of a ~~and characterize the~~ site"	As a result of the comment, the following changes were made: Bullet #1: The suggested text was added. Bullet #2: The suggested text was added. Bullet #3: The text was changed to: "The safety case can be used to verify a concept; support the selection of a site; perform design optimization; establish limits, controls and conditions; design the monitoring program; guide operation, decommissioning and closure; and prioritize research and development programs." Bullet #4: The text was changed to: "Safety requirements should be developed in consultation with the CNSC and other stakeholders."

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			• 3rd paragraph, "The safety case is also a tool to design the monitoring program and the data obtained from the monitoring program is used to confirm that the assumptions made by the safety case are appropriate ~~or to develop an updated safety case~~. • 4th paragraph, "The safety case supports decision making and is also a means of communication and consultation with interested parties at specific decision points throughout the facility's lifecycle."	
71	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	4.2	**Issue (Major)** Reference to the "lifetime" of the facility in the 4th paragraph is unclear. It infers the release from CNSC licensing after decommissioning, but doesn't clearly state abandonment. If the facility has to be removed because it is at the end of life, then a safety case meeting this requirement is not needed as it will no longer exist. If the facility is abandoned then where will the safety case be kept? Also, licensees cannot know what information future generations will want. **Suggested change** The approach to the release from CNSC licensing after decommissioning needs to be addressed in this REGDOC. A definition of "lifetime of the facility" is needed since it is ambiguous whether the lifetime includes the post-closure stage. The 4th paragraph seems to indicate that lifetime excludes post-closure for disposal facilities. The paragraph should be amended to say the safety case "will contain ~~all the~~ information ~~that~~ future generations may ~~should~~ require …" **Impact on industry** Release from CNSC licensing after decommissioning is allowed under the Regulations, but a lack of clarity on how this is obtained could result in major uncertainty in the design, operation, closure and lifetime of the facility. It is not feasible, credible or sensible to manage a facility in perpetuity especially if, at some point, the hazards associated with facilities	As a result of the comment, the section was changed to: "A post-closure safety case is required for a radioactive waste disposal system throughout its entire lifecycle – at the start of each major licensing stage from site preparation through to decommissioning (which includes closure and decommissioning of ancillary facilities) - and post-closure period until release from regulatory control. The post-closure safety case evolves throughout the lifecycle of the disposal system using an iterative approach."

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			become negligible.	
72	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	5	**Issue (Major)** Section 5 incorrectly infers that a safety case is a standalone document that contains all necessary information. It is not. A safety case is a top-level document that refers out to the technical input. It summarizes the arguments and evidence presented in supporting documents to demonstrate safety. To licence an activity, the safety case points to the evidence given in supporting documents, which is the information relied upon for informing decisions. **Suggested change** Clarify that a safety case is a high-level document that summarizes the detailed analysis that has been undertaken by a licensee to demonstrate an activity is safe. Ensure the REGDOC does not suggest that it needs to be a standalone document, but may be a collection of documents. **Impact on industry** Unclear expectations as to what constitutes a safety case can lead to regulatory challenges and increased resource demands.	No changes were made to the document as a result of the comment. Licensees or applicants must submit their safety case in support of their licence application to the CNSC for acceptance. There are many possible ways of structuring and documenting the safety case. It is up to the licensee to determine a suitable means of presenting this information.
73	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	5	**Issue (Major)** As per comment #6, licensees believe the bullets in Section 5 require several clarifications. These include: 1st bullet - only an activity can be licenced as per governing legislation. 2nd bullet – a safety case cannot *prevent* unreasonable risk. It documents the processes, design, and controls etc. in place to demonstrate the activities undertaken do not present unreasonable risks. In addition, "persons" is not defined and "unreasonable" is vague and open to interpretation. 3rd bullet, what is required by the phrase "ensure that the safety case is	As a result of the comment, the following changes were made: Bullet #1: the text was changed to: "submit a safety case in support of a licence application for activities pertaining to radioactive waste disposal facility, location or site to the CNSC for acceptance " Bullet #2: the text was changed to: "demonstrate through the safety case that all safety requirements will be met" Bullet #3: the text was changed to: "•ensure that the safety case is detailed and comprehensive to provide the necessary technical input for informing the decisions required" Bullet #4: the text was changed to: "ensure that the documentation is clearly written

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			sufficiently detailed and comprehensive" 4th bullet – the phrase "information that is traceable..." does not give any guidance on the quality or veracity of the information required, merely that it can be found. 7th bullet - what is meant by "periodically review?" **Suggested change** Amend: 1. 1st bullet to ensure it's clear that only an activity can be licensed. 2. 2nd bullet, amend to read, "demonstrate through the safety case that the proposed site and facility will be safe. Clarify: 3. What "sufficiently detailed and comprehensive" entails. 4. Expectations for information by providing examples of what is acceptable. 5. How review periods will be established. **Impact on industry** Without clarifying the 1st bullet, stakeholders may be confused over whether it is the activity or the facility that requires a licence. Similarly, without clarifying the 2nd bullet, stakeholders could easily misunderstand that the safety case demonstrates that risk is being effectively managed, *not* prevented. Additional resources would be required to explain the true nature of the safety case. Poorly defined expectations and review periods can result in an excessive burden.	and include arguments justifying the approaches taken in the safety case based on information that is traceable and credible" Bullet #5: the text was changed to: "periodically review and update the safety case at all licensing stages and whenever there are significant changes to the disposal facility"
74	Bruce Power, Canadian	5, 6.2 and 6.11	**Issue**	As a result of the comment, the term 'Safety requirements' was defined.

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	Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		Further to comment #6 and the list above, the term "safety requirements" is not well defined in this document, leading to potential confusion with respect to CNSC expectations. For example, Section 6.2 says, "Overall system robustness can be demonstrated by showing that despite the failure of one or more barriers or safety functions, none of the safety requirements would be jeopardized." Also, Section 6.11, 3rd bullet, says, "… it should be noted that meeting specific criteria… is not sufficient to meet all requirements." *REGDOC-3.6* does not define this term. **Suggested change** Define "safety requirements."	
75	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6	**Issue** As per comment #6: • What is meant by "as applicable" in the 1st sentence when, in this instance, the components have already been identified as requirement by the use of "shall"? • All bullets are not aligned with Appendix A **Suggested change** Clarify the section by: • Amending the 1st sentence to read, "…appendix A ~~(as applicable)~~" Ensure consistency by aligning bullets with Appendix A. Break out the components that are further sub-categorized either here or in Appendix A for ease of use/clarity. Provide a numbering system that can be easily followed.	As a result of the comment, appendix A was removed.

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76	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.1	**Issue** The 2nd sentence appears to be a general statement that should apply to the whole safety case as opposed to just the safety case context. The term "the graded approach" indicates there is a *single* graded approach. If so, this should be provided. As per comment #2, clarity is needed for the final sentence of the 3rd paragraph, which reads, "The scope, extent and level of detail are commensurate with the risk posed by the facility or site and the stage of the facility's development." **Suggested change** Licensees suggest moving the 2nd sentence to the main discussion of Section 6. What is *the* graded approach? If there is a single approach, it should be described. Otherwise, amend to read, "The licensee or applicant should ensure that the safety case applies a ~~the~~ graded approach in its development." Once again, the document needs to clearly define the lifecycle phases of a facility or the requirements that apply to each phase.	As a result of the comment: • the second sentence was deleted • a new section on the graded approach was added See response to comment #71.
77	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2	**Issue (Major)** As per comment #7, it's unclear which lifecycle phase and associated terms are being discussed throughout this section. Nor are "Time frames" listed among the key elements, which licensees believe is an oversight. Also, the section titles do not align naturally with Appendix A, which makes it confusing for the reader. **Suggested change** Industry encourages the CNSC to amend this section to make it clear which life cycle phase is being discussed under each sub-section. "Time frames" should be added to the list of key elements, the section titled renamed to 'Safety Case Strategy' and Appendix A adjusted to align with the sub	As a result of the comment: • The tile was changed to 'Safety case strategy' • The following sentence was added: "The safety strategy should identify the time frames associated with the key elements of the safety strategy." • The figure was updated to align with the components of the safety case See response to comment #71.

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			sections. **Impact on industry** Imprecise language could lead to confusion and compliance issues. Language that is typically applied to different phases needs to be clearly articulated in this document.	
78	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2, 6.3, 6.4	**Issue (Major)** There are detailed ***design requirements*** in various sections of this draft REGDOC. For example: • The final sentence under 6.2 Robustness, which says, “Therefore, the longer the hazardous lifetime of the waste, the more robust the natural and engineered barriers must be.” • The last sentence under 6.2 Time frames, which says, “The design of the facility should be based on design-basis events (such as earthquakes, glaciation, climate change, etc.) that are consistent with the time frame of the normal evolution scenario.” • The final paragraph of 6.3, which says, “The safety case and its supporting safety assessment should explain and justify the safety functions of each barrier. For example, the container or package could have multiple safety functions to prevent the release of radioactive material. If seals and/or welds are used to contain the waste they must be maintained during long-term storage and disposal for as long as practicable. The container may be designed so that the seal can be monitored and repaired or replaced during the operational period.” • Section 6.4, which says, “The licensee or applicant should take into account, in the design of the facility, passive safety measures to minimize the dependence of safety on active systems during operation and after closure, as applicable.” It may not be possible or appropriate to ensure safety through	As a result of the comment, the changes were made as suggested. See response #2 on the scope.

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			passive means for every type of radioactive waste management facility. • All of subsection 6.6 **Suggested change** The cited passages are all design requirements that licensees believe should be removed from this document. Alternatively, a specific chapter for design requirements could be created, which is preferable than having them scattered throughout the document. If they are kept, licensees urge the CNSC to promote clarity by: • Amending the final sentence of section 6.2 to read, “Therefore, the effect of the long time frames on robustness should be considered” • Revising the final paragraph of 6.3 to remove the references to monitor and repair and focus on the requirement to define the safety functions. • Clarifying the scope of application for Section 6.4. Again, as per comment #2, it is not clear which licensees and radioactive waste types this applies to. **Impact on industry** Having design requirements in this document generates confusion for readers, especially when they are spread across numerous sections.	
79	Cameco	6.2, 6.3, 6.4	These sections refer to several design requirements. In Cameco’s view, this REGDOC is not the appropriate document to set out design requirements and we recommend that these references should be removed.	See responses to comment #42.
80	Dr. Sandy	6.2 Safety	PROBLEMATIC ASSUMPTIONS IN SAFETY STRATEGY Under section **6.2 Safety strategy**, subsection `Containment and isolation’ states: “The	As a result of the comment, the following text was added to subsection Radiological

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	Greer	strategy	degradation of these safety functions **under gradual natural processes** [my bold], or after the occurrence of **design-basis events** [my bold], shall be taken into account." • What I observed in the above excerpt and throughout the draft document was a consistent omission of extreme weather events, as well as absolutely no reference to and acknowledgement about `cumulative effects.'	protection of persons: "To account for the possibility of exposure to multiple sources, and their potential cumulative effects, and to help ensure that doses resulting from the facility being assessed are as low as reasonably achievable (ALARA), a dose constraint should be established as a fraction of the regulatory dose limit. Section 8.1.3, Post-closure safety assessment scenarios and time frames, includes requirements for scenarios to describe possible evolutions of the facility and its environment as well as the impact of features, events and processes identified as having potential to impact safety. Section 8.1.3.1, Normal evolution scenario, and section 8.1.3.3, Assessment time frames, include events such as earthquakes, climate shifts and the onset of glaciation.
81	Dr. Sandy Greer	6.2 Robustness	Instead, in section **6.2**, subsection 'Robustness' must be demonstrated by the licensee or applicant "showing evidence that the barrier will fulfil its safety functions under the effects of **the expected** [my bold] natural or anthropogenic disturbances during all phases of the facility." Again, the aforementioned is another (among several more) reference to what is assumed to be anticipated, and measured - ultimately, with major reliance upon computer modelling, based on the rationale of measuring a very long timeframe and, consequently, the limits of shorter term analogues. But, once more, I seriously question the gross assumption that computers, now or in the future, legitimately can provide data anywhere close to the potential risks and dangers endlessly lurking. In a 2015-2016 CNSC research project document, here are a few short excerpts which refer to 'Natural and anthropogenic analogues': *"Most studies define natural analogues as either naturally occurring or anthropogenic (i.e. man-made) systems. This project looked more closely at the differences between these two types of natural analogues and how they can contribute to the safety case of deep geological repository projects."* What I find incredible, and troubling, first of all, is the assumption that such analogues can extrapolate from data that is supposed to cover hundreds to thousands of years. Secondly, for even a longer time span, these analogues	See response to comment #51.

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			are suggested, and rationalized, to be useful as follows: *"As the safety case for deep geological repositories requires scientific information for long-term safety assessment - a million years or longer - naturally occurring analogues can provide information and data over geological time and spatial scales that cannot be extrapolated from laboratory experiments."* Importantly, what follows on the same page of the 2015-2016 research report is one of various clues behind what CNSC communicates as possible in the draft document REGDOC-2.11.1-vol3-ver2: *"A key recommendation from this* [2015-2016 research] *project is that a concerted effort should be made to ensure there is a transfer of data* ***from the complex natural analogue field studies to the simplistic models that, by necessity, are used in performance assessment*** [my bold]. *Field studies should be planned to align with laboratory experiments and, ultimately, field experiments when the final repository site is selected. This will provide a more quantitative use of natural analogue data in support of a deep geological repository concept."* [print page 18, 2015-2016] • The above research project reveals a previous CNSC source where "simplistic models" are recommended explicitly to reduce the complexity of field studies. Meanwhile, the act of gathering baseline information in itself, albeit essential (and not pursued thoroughly enough), already is fraught with challenges, outlined in one of my previous CNSC submissions, "Critique re CNSC Guidance on Deep Geological Repository Site Characterization," the draft document for CNSC REGDOC-1.2.1. As for the 2015-2016 CNSC research report, it elaborates on computer models as justifiable, based upon a single comparison of a safety assessment code, and outlines the purpose of codes as follows: *"Part of the safety assessment for deep geological repositories includes the use of computer modelling - meaning the verification and validation of computer codes are an essential part of a safety assessment evaluation."* [print page 19, 2015-2016] • Without the time to dissect previous document sources, the	

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			fundamental concern remains: reducing the complexity - and continual flux - in the actual physical biological world into humanly constructed equations, in order to argue for what I would characterize as merely a rationalization upon which to try and argue a safety case, but which still does not convince me as credible.	
82	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2, containment and isolation	**Issue (Major)** The document uses the terms "acceptance criteria" throughout without specifying the purpose of the criteria. For example, acceptance criteria can be used when receiving material into a facility or when judging the acceptability of safety assessment results. See comment #47 for additional, related points. **Suggested change** The REGDOC should be clear on what acceptance criteria are to be established and for which point in the lifecycle phase as these are being discussed in different sections of the REGDOC. **Impact on industry** Unclear expectations could challenge compliance verification. This could also inadvertently result in confusion for members of the public as to expected requirements for facilities.	See response to comment #74. The acceptance criteria are further described in section 8.1.1.1, Acceptance criteria used in the assessment. See response to comment #2 on the scope.
83	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management	6.2, Multiple safety functions and defence in depth	**Issue (Major)** As per comment #2, it is not clear whether the REGDOC is referring to establishing "safety functions" for long-term safety or for an operating waste facility. **Suggested change** The REGDOC should clarify the lifecycle phase for which the guidance is being provided. For example, international guidance illustrates how safety	See response to comment #2.

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	Organization, Ontario Power Generation		functions could be assigned for a disposal facility which is different given that the wastes are isolated. E.g., SSG-23 clause 4.29 "if waste packaging is assigned a containment function and degrades more quickly than anticipated, the surrounding backfill material can provide a further element of physical containment to retard the migration of radionuclides by adsorption; or …"; and clause 6.32 "Safety functions are fulfilled by elements of a disposal facility, such as a physical or chemical property of part of the disposal system, or a process or combination of processes, that contribute to containment and isolation of the waste (e.g. low hydraulic conductivity, slow corrosion rates, slow dissolution of the waste matrix, low radionuclide leaching rates, low radionuclide solubility, high sorption)." **Impact on industry** Unclear expectations could challenge compliance verification. Stakeholders are best served if there is a clear and common understanding of the lifecycle phases specific guidance applies to.	
84	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2 Multiple safety functions and defence in depth	**Issue (Major)** As per comment #6, subjective words such as "redundancy" and "additional" promote confusion, not clarity. Additional clarity is also sought as to how defence in depth is achieved and maintained and what is meant by passive barriers and controls. **Suggested change** Amend the 1st sentence to read, "The principle of defence in depth shall be applied in order to provide ~~redundancy and additional~~ a margin of safety." Provide additional guidance on achieving defence in depth and passive barriers and controls. The document should discuss common mode failure rather than the barrier function since diversity in achieving the function is the key to defence in depth.	As a result of the comment, the text was changed to: "The principle of defence in depth shall be applied so that the performance of the disposal system, described in section 7.3, does not unduly rely on a single barrier. The principle of defence in depth is usually applied in disposal facilities by the provision of a system of multiple barriers with multiple safety functions that contribute to the containment and isolation of the waste. The safety functions of the individual barrier, as well as the time frames over which the barrier is expected to perform should be identified and justified. Each safety function should be independent of the others, to the extent possible, in order to ensure that they are complementary and that barriers are unlikely to fail through a single failure mode. The number and extent of the barriers necessary should be commensurate with the hazards of the waste to be disposed of. Safety functions shall be provided, to the extent possible, by passive means. Active controls, such as monitoring, can contribute to the confidence in passive barriers and safety functions although shall not be solely relied on to ensure defence in depth. The multiple barrier system should provide resistance to radionuclides migration mainly

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			Impact on industry Additional clarity can generate opportunities to improve defence in depth. A lack of clarity regarding barriers and controls can result in misalignment of testing and maintenance requirements for SSCs. With clarity, safety features may not meet CNSC's expectations with respect to use of active and passive controls.	by passive means."
85	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2 Robustness	**Issue** Clarity is sought for the 1st sentence of the 2nd paragraph, which says, "For disposal facilities with longer time frames …" **Suggested change** Clarify what constitutes a "longer time frame." Longer than what?	As a result of the comment, the text was changed to: "The effect of long time frames on robustness should be considered. For disposal facilities with long time frames, there is an increased likelihood of natural processes or disturbances that could affect the performance of individual barriers or overall disposal system."
86	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2 Time frames	**Issue (Major)** Editorially, the 1st sentence in the final paragraph is duplicated and clarity is sought for the 3rd bullet, which reads, "type and severity of events considered in the safety analysis." More importantly: 1. This section does not discuss the application of a graded approach (as per comment #3) or how hazards can change over long time frames and so should the consideration of events. 2. The scenarios associated with the DGR's post-closure time frames should be classified as "normal evolution" and "disruptive scenarios" similar to the	As a result of the comment, the following changes were made: Bullet #1: a new section was added on the graded approach. Bullet #2-3: the paragraph was changed to: "The safety assessment shall include a base case scenario of the normal, expected or anticipated evolution of the site and the facility over time, and additional scenarios that examine the potential impact of disruptive events with low-probability of occurrence."

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			current REGDOC. 3. The statement, "The design of the facility should be based on design-basis events (such as earthquakes, glaciation, climate change, etc.) that are consistent with the time frame of the normal evolution scenario" should not apply to some facility types. For example, a surface disposal facility is not designed to withstand glaciation. **Suggested change** Future drafts should remove the duplicate sentence, clarify the CNSC's expectations regarding the 3rd bullet and: 1. Include a meaningful discussion on a graded approach and what is required to enable a licence to be obtained. Application of standards should be commensurate with the hazard to be managed. For instance, hazards for a Low Level Waste facility will be lower than those for a power reactor. The REGDOC should also inform readers how hazard levels change with time, i.e. the hazard assessment should consider hazard reductions that take place due to decay. 2. Remove the term "design basis events" from the section or clarify that it only applies to certain time frames (i.e., in the pre-closure period). 3. Remove the reference to glaciation. **Impact on industry** More clarity would better inform the public, licensees and the regulator so all stakeholders better understand the concept of multiple time frames and how design basis events vary and facility robustness changes over time.	
87	Bruce Power, Canadian Nuclear Association, Canadian	6.3	**Issue** As per comment #6, licensees feel this section requires clarification and editing in the following areas:	As a result of the comment, the following changes were made: Bullet #1: The titles were changed.

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	Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		1. The title of section 6.3 is the same as 7.1.3 2. The bulleted list does not include the typical documents that the safety case would reference to demonstrate the requirements 3. In the 1st bullet, recognize FEPS as a commonly used phrase 4. In the 3rd bullet, the description of biosphere should include surfaces features (such as lakes, rivers) and fields, in additional to human and non-human biota. 5. In the 6th main bullet, explicitly stating "waste package" assumes that all materials are in packages. Waste may not be required to be placed into a waste package, e.g. a LLW waste facility may have design features to allow safe emplacement of bulk waste. 6. What is the difference, if any, between "container" and "package" in terms of this document? Package" is defined in *REGDOC-3.6*, but "container" is not. Where is "container" defined? 7. The term "structure, systems, and components" is first referenced in the 8th bullet, but the acronym SSC not cited until the final paragraph of the section. **Suggested change** Licensees suggest the section be amended for clarity in the following ways: 1. Retitle section 6.3 to avoid duplication 2. Update the list to include the typical information that the safety case would reference. 3. Amend 1st bullet to read, "a specific understanding of features, events and processes (FEPs) …" 4. Amend the 3rd bullet to read: "a description of the biosphere including	Bullet #3: The change was made as suggested. Bullet #4: The change was made as suggested. Bullet #5: The text was changed to: "description of the structure, systems and components (SSC) of the facility, which includes the engineered and natural barriers, their safety functions, interfaces, associated uncertainties and performance as a function of time". Bullet #6: References to 'waste package' and 'waste container' were removed. Bullet #7: 'SSC' was added to the bullet and the second sentence of the final paragraph was deleted. The following change was not made: Bullet #2: There are many possible ways of documenting the safety case and supporting safety assessment. It is up to the licensee to determine the structure and the documentation of the safety case.

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			human and non-human biota and surface features" 5. Amend the 6th bullet to read, "which includes the waste form ~~package~~ …" 6. State the difference between "container" and "package" 7. Include the acronym SSC after in the 8th bullet and simplify the 2nd sentence of the final paragraph to read, "The licensee or applicant shall ~~also~~ identify individual structures, systems and components (SSCs) important to safety. ~~and assess the performance of the waste management system and the SSCs in terms of their ability to fulfil the safety functions"~~	
88	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.3	**Issue (Major)** As per comment #59, a graded approach needs to be discussed in more detail in this section and throughout the document. Editorially, the 2nd paragraph repeats the term "*the* graded approach," which suggests an identified graded approach system, If one has been identified, it should be described. Otherwise, it should be changed to "*a* graded approach" **Suggested change** For low-risk, low-hazard facilities, the level of geological investigations should be commensurate with the risk and clearly stated throughout the document. Amend the 2nd paragraph to read, "a ~~the~~ graded approach" **Impact on industry** Without a true graded approach, additional data and/or investigations could be requested by the CNSC or members of the public that will not impact the design or safety functions and are not commensurate with the level of risk associated with the facility. This can result in an excessive burden with no corresponding improvement to nuclear safety.	As a result of the comment, the following changes were made: • the change was made as suggested • a new section was added on the graded approach
89	Dr. Sandy Greer	6.3	Another problematic issue is CNSC's lenient language (which I have criticized in previous submissions), such as in this passage of section **6.3 Waste management system description**: *"The safety case* ***should*** [my	No change was made as a result of the comment. CNSC's regulatory framework includes requirements language ('shall' and

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			bold] *be updated by taking into account the improved knowledge on the behaviour of the waste management system. … "The container* ***may*** [my bold] *be designed so that the seal can be monitored and required or replaced during the operational period. Other safety functions for the container* ***may*** [my bold] *include: shielding, heat removal, and corrosion resistance."* The CNSC choice of terms truly befuddles me, in accordance with the definitions of terms on the opening page of each of its regulations: *"The words* "shall" *and* "must" *are used to express requirements to be satisfied by the licensee or licence applicant.* "Should" *is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability."* My question to CNSC is why it does not use "must" instead of "may" and "should," in reference to what so obviously are essential safety functions that, logically, to have any credibility at all, must be monitored and repaired through time because of seals, shields and containers inevitably deteriorate.	'must'), as well as guidance language ('may', 'should' and 'can'). Guidance is used to inform the applicant or licensees on how to meet requirements, elaborate further on requirements, or provide best practices. While the CNSC sets requirements and provides guidance on how to meet requirements, an applicant or licensee may put forward a case to demonstrate that the intent of a requirement is addressed by other means. Such a case must be demonstrated with supportable evidence. The CNSC considers guidance when evaluating the adequacy of any case submitted. This does not mean that the requirement is waived; rather, it is an indication that the regulatory framework provides flexibility for licensees to propose alternative means of achieving the intent of the requirement. The Commission is always the final authority as to whether the requirement has been met.
90	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.4	**Issue (Major)** As per comment #1, licensees believe section 6.4 requires clarification in a number of areas, such as: 1. As per the 2nd paragraph, it is not possible to address "all risks". Typically, low risk events are screened out of safety assessments as either low hazard or extremely unlikely to occur. 2. The 2nd paragraph suggests there is a FEPs analysis, but does not explain what that is. Also, recognize that FEPS was defined in Section 6.3. **Suggested change** For clarity, amend the second in the following ways: 1. Remove reference to "all risks"	As a result of the comment, the following were made: Bullet # 1: "All risks" was changed to "those risks" Bullet #2: Reference to "features, events, and processes" was removed, as this was already abbreviated earlier in the document. The following sentence was added "The FEPs analysis may consider the Nuclear Energy Agency (NEA) International FEP List."

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			Explain what a FEPs analysis is and amend the last sentence of the 2nd paragraph to read, "… evolution of the site and the occurrence of any potential disruptive events identified in the ~~features, events, and processes~~ (FEPs) analysis. **Impact on industry** A lack of clarity can result in public perception that there are no risks compared to an understanding that the risks are acceptable	
91	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.4.2	**Issue** As per comment #1, where is "site descriptive model" defined? **Suggested change** Define "site descriptive model"	As a result of the comment, the term 'site descriptive model' was deleted.
92	Dr. Sandy Greer	6.4.2	Regarding the draft document's section **6.4.2 Site and engineering aspects**, I continue to question (as I did in previous submissions) the "site characterization" limits, as per the CNSC guidance: *"The resulting information should be sufficient to develop a site-specific safety analysis."* My critique on the above limit will be described in a later section of my submission, where I give examples of recognition of an ecosystem approach that apparently is rejected by the CNSC.	As a result of the comment, the text was changed to: "The licensee or applicant should use the results of the safety assessment to provide confidence in the adequacy of the site and engineering design."
93	Bruce Power, Canadian Nuclear Association,	6.4.4	**Issue (Major)** The 2nd paragraph should be focused on assessment of consequences (i.e., consistent with the idea of developing normal evolution and disruptive	As a result of the comment, the text was changed from 'resulting risks' to 'resulting impacts'.

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	Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		scenarios in the long-term safety assessment). **Suggested change** Change focus of statement to look at potential consequences taking into account the condition of both the barriers and the hazard as opposed to generally using the term "risks." **Impact on industry** Hazard reduction needs to be considered with the long time frames and with barrier design. Otherwise, it could result in an excessive burden to demonstrate design adequacy and determine compliance.	
94	Dr. Sandy Greer	6.5, 6.6	Next, under section **6.5 Management of uncertainties**, is one of several passages within the draft document where the CNSC, first of all, concedes implicitly, or explicitly as here: "uncertainties can never be fully eliminated," which is truthful. But, this factual honesty then is undercut by what CNSC next communicates, in this instance immediately: *"Therefore, the licensee or applicant should identify the remaining uncertainties within the safety case and how, despite these uncertainties, the safety case is still supported."* Under section **6.6 Iteration and design optimization**, as well as in several other draft document sections, the CNSC reveals a pattern of, on the one hand, identifying what cannot be known, followed by, on the other hand, presenting an ethical dilemma for the prospective licence applicant, as per what the CNSC's expectations to ensure support for a safety case: *"As the project proceeds and additional information is gained, initial results should be refined and should replace the generic or default data, reducing the reliance on assumptions."* What I find fascinating as I studied this draft document is the pattern of contradictions in a back and forth communication that starts with truth telling - i.e. immediately above, the quote in reference to licence applicants' "reliance on assumptions," and then shifts to a storyline that whatever is unknown eventually will be good enough, through the continuing efforts of the CNSC and the respective licensees doing their due diligence to play catch	As a result of the comment, a new section was added on the graded approach. As described in section 5.2 Development of the safety case, the safety case is updated progressively throughout the lifecycle of the disposal system by the systematic collection, analysis, and interpretation of the necessary scientific and technical data. The scope and level of technical detail will depend on stage of development of the disposal system. Updates to the safety case take into account comments from technical, and regulatory reviews, increased knowledge, and operational experience, as well as results from monitoring programs and research activities. The iterative approach to the development of the safety case enables engagement with the public and Indigenous groups and the incorporation of stakeholder feedback.

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			up with never-ending efforts to improve, for example, mitigation strategies (not yet existing and/or proven to be effective) and monitoring, the latter which tragically could be minimized to how much it costs.	
95	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.7	**Issue** As per comment #1, clarification is sought on the determination of limits, controls and conditions. **Suggested change** Is this meant for a specific lifecycle phase i.e. operations or for all phases? Would these limits ultimately be determined by *REGDOC-2.4.4 Safety Analysis for Class IB Nuclear Facilities*?	See response to comment #2.
96	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.8	**Issue** As per comment #6, section 6.8 would benefit from additional clarity. Specifically, it: 1. Introduces the "complementary safety arguments," which seem to be based on the "complementary indicators of safety" used in the previous version. However, "complementary indicators" continue to be used in this document as well. The lack of clarity could lead to potential for confusion with respect to the terms used. 2. It is unclear why the 1st sentence of the 4th paragraph emphasizes that a monitoring program would be a requirement of the licence. 3. 3. It is unclear to what is meant by "trigger criteria" in the final sentence of the 4th paragraph **Suggested change**	As a result of the comment, the following changes were made: Bullet #1: Sections on complementary safety indicators and additional arguments were added as subsections to the integration of safety arguments to provided clarity. Further, terms used in this REGDOC may be added to revision of REGDOC-3.6, *Glossary of CNSC Terminology* Bullet #2: The second sentence was amended as requested Bullet #3: The final sentence of the 4th paragraph was deleted.

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			Provide additional clarity for readers by: 1. Defining and include all terms in the Glossary of this REGDOC and *REGDOC-3.6* 2. Amend the 1st sentence of the 4th paragraph to read, “Complementary indicators as identified from the safety assessment can also be used to derive the monitoring program~~, which would be a requirement of the licence~~.” 3. 3. Delete the final sentence in the 4th paragraph~~, “In such cases, trigger criteria should be determined for the parameters, and courses of action and decisions should be developed in case of deviations from the criteria.”~~	
97	Dr. Sandy Greer	6.8	What also becomes so painfully clear in this draft document is the possibility that various still experimental types of nuclear facilities are likely to be given licences despite the horrible fact that so much important and imperative scientific evidence to verify safety does not need to exist prior to licence applicants being given a licence. For example, under section **6.8 Complementary safety arguments**: *“Complementary indicators as identified from the safety analysis can also be used to derive the monitoring program, which would be a requirement of the licence. In many instances, however**, those indicators cannot be directly or practically monitored, but must be inferred by a set of sub-indicators which are easily measured or quantified*** [my bold]. *For example, container corrosion rates might not be measured during the licensing time frame. … In such cases, trigger criteria should be determined for the parameters, and courses of action and decision should be developed in case of deviations from the criteria.”* Am I correct in interpreting the example above, in reference to “container corrosion rates,” that computer models will be used to determine them, instead of physical tests of containers (such as copper canisters) in underground research laboratories? I would like more clarity in the final document from CNSC, to explain whether physical types of research that could be undertaken are being replaced by computer modelling.	No changes were made to the document as a result of the comment. This REGDOC was developed using international guidance, namely SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*. The demonstration of the safety function associated with the disposal system or its individual component must be demonstrated by multiple means, and not only by computer modelling. With the cited example, one of the safety functions of the waste container is to resist corrosion for a specific time duration. Confidence that this safety function will be fulfilled could be built on: • Performing laboratory tests and physical testing underground to understand the processes responsible for corrosion and to quantify the corrosion rate • Developing mathematical models for the long-term corrosion of emplaced containers, which are calibrated and validated with the above test data • Provide additional confidence in long-term predictions by studying natural analogs related to corrosion of the same types of metal under similar physico-chemical conditions Often in laboratory or underground testing, very extreme physico-chemical

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				conditions must be imposed in order to obtain measurable corrosion rates. The in-situ conditions in a geological disposal facility are in general much less severe, and one does not expect any measurable corrosion rate of the container. Therefore, monitoring of parameters that are determinant to that corrosion rate (such as temperature, groundwater chemistry, etc.) has to be performed instead.
98	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.10	**Issue (Major)** Regarding the 3rd paragraph, institutional controls will be relied on to ensure future land use is managed appropriately and that long-term safety is documented and verified. The document does not recognize that institutional controls are a way to ensure long-term monitoring. The 5th paragraph assumes a complete failure of a system specifically designed to prevent this from happening. An assessment of inadvertent human intrusion is realistic and should be considered in safety assessments but it shouldn't be based on the failure of institutional controls. **Suggested change** The 2nd paragraph cautions against reliance on institutional controls (not be used to justify a reduction in the level of design performance), but the 3rd paragraph undermines the entire premise of institutional controls and should be removed. Amend the 1st sentence of the 5th paragraph to read, "~~With the end of institutional control, T~~There is a risk of future inadvertent human intrusion into the facility, particularly with near-surface facilities." **Impact on industry** This document undermines the process of institutional controls.	As a result of the comment, the following changes were made: • The 2nd paragraph was revised to: "While long-term safety of the radioactive waste disposal facility should not be dependent on institutional control, institutional control should be used to the extent that is practicable to confirm the disposal system is performing as designed." • The 5th paragraph was deleted.
99	Cameco	6.10	The third paragraph states that licensees "should limit reliance on institutional controls as a safety feature to a few hundred years". With respect to mines and mills, it would be preferable to recommend that the "design of new facilities should minimize reliance on institutional controls to	As result of the comment, the 5th paragraph was deleted. The part of the sentence that stated "a few hundred years" was kept. The special case

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			the greatest extent possible" and delete the reference to "a few hundred years" because many passive controls are designed to extend well beyond a few hundred years as is the Saskatchewan institutional control program. Alternatively, Cameco recommends that the third paragraph be deleted in the event that the scope of the document is not revised to exclude its application to uranium mines and mills. Cameco also recommends the deletion of "[w]ith the end of institutional control" from the fifth paragraph because this gives the false impression that institutional control is insufficient to control future risks when the purpose of facility design is to address the risks that will not be managed by institutional controls.	of uranium mine and mill waste is clarified by changing the text to: "Uncertainties associated with future human activities and the evolution and stability of societies, licensees or applicants should limit the reliance on institutional controls as a safety feature to a few hundred years. For uranium mine and mill waste, the large volume of the waste and the longevity of some of the radionuclides might necessitate long periods of institutional control as a mean of providing safety. The reliance on such long-term institutional control should be justified in the safety case through an optimization process taking into account technical and socio-economic factors."
100	Dr. Sandy Greer	6.10	Also worrisome is CNSC, again in a contradictory fashion - first stating the problem but then providing a less than satisfactory or credible so-called safety feature - is the rationale given by CNSC, under section **6.10 Safety features during the period of institutional control** (pointing out it previously laid out this guidance in REGDOC-2.11.1-vol1 : *". .. As a result of the uncertainties associated with future human activities and the evolution and stability of societies, licensees or applicants should limit the reliance on institutional controls as a safety feature to a few hundred years."* As an opponent to the proposed DGRs, to whom DGR supporters always reply that we cannot pass on the problem of nuclear waste to future generations, I consider the previous passage in the CNSC draft document to be hypocritical in focusing on its continual production of a series of documents to justify the push to licence what are nothing more than experimental solutions - and then, having the nerve to propose that licensees are allowed to divest their "institutional" responsibilities (together with government regulators, it appears), and thereby leave everything still unresolved in the hands of future generations, yet by then without even institutional oversight after an oversight period gets curtailed in 300 years.	In accordance with the Government of Canada's Radioactive Waste Policy Framework, waste owners are responsible, in accordance with the "polluter pays" principle, for the funding, organization, management and operation of the facilities required to safely manage their wastes over the short and long terms. REGDOC-2.11, *Framework Radioactive Waste Management and Decommissioning In Canada* stipulates that when making regulatory decisions about the management of radioactive waste, the CNSC considers the extent to which the owners of the waste have addressed the: • measures needed to prevent unreasonable risk to present and future generations from the hazards of radioactive waste are developed, funded and implemented as soon as reasonably practicable. • assessment of future impacts of radioactive waste on the health and safety of persons and the environment encompasses the period of time during which the maximum impact is predicted to occur. • predicted impacts on the health and safety of persons and the environment from the management of radioactive waste are no greater than the impacts that are permissible in Canada at the time of the regulatory decision As result of the comment, the text was changed to: "While long-term safety of the

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				radioactive waste disposal facility should not be dependent on institutional control, institutional control should be used to the extent that is practicable to confirm the disposal system is performing as designed." Uncertainties associated with future human activities and the evolution and stability of societies, licensees or applicants should limit the reliance on institutional controls as a safety feature. This is in alignment with SSG-23, *The safety Case and Safety Assessment for the Disposal of Radioactive Waste/*
101	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.11	**Issue (Major)** As per comment #6, the structure of this section is not clear. The list of items the licensee / applicant should do to integrate the safety arguments is shown immediately after the paragraph referring to limitations on the understanding. These are the kinds of arguments that address the limitations, but this is not clearly drawn out in current wording. Regarding the 1st bullet on page 13, it is unclear what the CNSC staff would consider "sufficient" to meet "all requirements" if meeting regulatory criteria is "not sufficient." Similarly, it is unclear what "fully document" would be considered as acceptable by the CNSC staff as per the 4th bullet on page 13. **Suggested change** Revise this section as follows: • Combine the 2nd paragraph with the 2nd bullet point on page 12 and move this new paragraph to the send of the section. • Replace the last bullet on page 13 identifying things the licensee/applicant should do as part of the integration to read, "Acknowledge their limitations on the understanding of waste management system, its evolution, and its potential impact on people and the environment."	As result of this comment, the following changes were made: Bullet #1: The order of the requirements was adjusted. Bullet #2: The last bullet was not changed since it is in alignment with IAEA SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*. Bullet #3: The changes were made as suggested.

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			• Delete "~~it should be noted that meeting specific criteria such as for dose or risk alone is not sufficient to meet all requirements"~~ from the 1st bullet on page 13 and the word ~~"fully"~~ from the 4th bullet. **Impact on industry** Unclear expectations could challenge compliance verification. Stakeholders are best served if there is a clear and common understanding of the lifecycle phases specific guidance applies to.	
102	Dr. Sandy Greer	6.11	In the section **6.11 Integration of safety arguments**, the CNSC lists eight responsibilities of the licensee or applicant to carry out, preceded by this directive: *"The licensee or applicant should acknowledge their limitations on the understanding of the waste management system, its evolution, and its potential impact on people and the environment. The licensee or applicant should justify, despite these limitations, the rationale for the continuation of the project."* The above directive by the CNSC is not simply unacceptable but, moreover, outrageous. Given the extraordinary limitations of understanding that currently exist, I advocate that CNSC as the regulator will be violating its moral responsibility if it chooses to give out licences for newer, still experimental, types of nuclear facilities - which ought not to be given licences in the first place. How can potential upcoming licences be endowed with any integrity, and the wider public have any trust in either the CNSC as regulator or the nuclear industry, if and when licences will be distributed to upcoming facilities when so much remains unknown as per ensuring more rather than less authentic safety?	As a result of the comment and to align with SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, the text was changed to: "The licensee or applicant should acknowledge any limitations of currently available evidence, arguments and analyses… The licensee or applicant should justify, following the integration of safety arguments, the rationale for the continuation of the project."
103	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories,	7	**Issue** As per earlier comments, it is not clear what constitutes "long-term." **Suggested change** Define or cross-reference in *REGDOC-3.6, Glossary of CNSC Terminology*	As a result of the comment, the title was revised to 'Post-closure safety assessment'. The term 'Long-term management' is defined in CSA N292.0, *General principles for the management of radioactive waste and irradiated fuel*.

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	NB Power, Nuclear Waste Management Organization, Ontario Power Generation		as appropriate.	
104	Dr. Sandy Greer	7	COMPUTER MODELLING LIMITATIONS After reading through most of the draft document, and witnessing a pattern of contradiction about what computer models are and are not able to tell us, the final pages appear to reveal the fundamental flaw in the reliance upon technological tools for safety analysis - indeed, the impossibility for the capacity of predictions - whether within the lifespan of the most immediate upcoming generations of people or through the time frame of thousands of years into the future.	No changes were made to the document as a result of the comment. Computer modelling used in long-term post-closure safety assessment are not considered as predictions but as estimates of possible future impact. Confidence that these estimates would be below acceptance criteria has to be provided in the safety case using multiple lines of reasoning, evidence and arguments. Computer modelling is only one of many means to provide confidence in long-term safety.
105	Dr. Sandy Greer	7	In fact, throughout Section 7, the CNSC provides further insight about the inevitable uncertainties that cannot be either identified nor resolved by computer models. The CNSC indicates international awareness therein: "In addition, experience in international computer model testing projects has shown that due to the complexity and spatial variability of the natural environment, an unambiguous description or model of a system **cannot** [my bold] generally be attained."... [print page 24] The reasons have been known for more than a couple of decades, as indicated in physicist/author Fritjof Capra's book **THE WEB OF LIFE, A New Scientific Understanding of Living Systems**. Below I will cite a passage where he cites an important revelation by computer scientists: "*A computer processes information, which means that it manipulates symbols based on certain rules. The symbols are distinct elements fed into the computer from the outside, and during the information processing there is no change in the structure of the machine. The physical structure of the computer is fixed, determined by its design and construction. "The nervous system of a living organism works very differently… [as Capra explains at length earlier in his book], [I]t interacts with its environment by continually modulating its structure, so that at any moment its physical structure changes. The nervous system does not process information from the outside world but, on the contrary, brings forth a world in the process of cognition.*	No changes were made to the document as a result of the comment. Uncertainties are inevitable in any type of undertaking. However, the existence of uncertainties does not necessarily mean that a project should not continue. For example, if the uncertainty does not affect safety, it does not influence the conclusions of the safety case. If the uncertainty potentially can influence safety, the safety case could bound the uncertainty and if all safety requirements are still met, a decision to proceed with the activity could still be justified. The CNSC, following international best practice, requires that uncertainties, either they influence safety or not, be identified by the licensee or applicant. A rationale must be provided, and accepted by the CNSC, that a decision to proceed is justified, despite the uncertainties. This is in order to provide transparency in the decision-making process. In addition, the applicant or licensee, is required to implement activities to reduce the uncertainties in the next phase of development of the project, should it proceed. Those activities could include monitoring, system and components' further characterization, and research and development.

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			… *"Human decisions are never completely rational but are always colored by emotions, and human thought is always embedded in the bodily sensations and processes that contribute to the full spectrum of cognition. "As computer scientists Terry Winograd and Fernando Flores point out in their book* ***Understanding Computers and Cognition****, rational thought filters out most of that cognitive spectrum and, in so doing, creates a "blindness of abstraction." In a computer program, Winograd and Flores explain, various goals and tasks are formulated in terms of a limited collection of objects, properties and operations, a collection that embodies the blindness that comes with the abstractions involved in creating the program*" [Capra, 1996, p. 274-5]. What is imperative to acknowledge here before continuing and, moreover, why the repetition (by me in various submissions) of Capra's wisdom significantly bears repeating, is the fact that ecological scientists and computer scientists increasingly are sitting together in the spirit of pursuing interdisciplinary methods to address the sorry plight of our global environment. Please know I am open-minded sufficiently to recognize that science continues to evolve, and the most intelligent scientists, such as Capra, always remind us about the limitations of science. Consequently, the imperfections of science today must continuously be challenged and improved yet, always, with the awareness and humility in regard to the inevitable limitations of the human mind. Therefore, I cannot lay blame solely on the nuclear industry for pursuing what I believe is misguided as per so much reliance upon computer modelling to identify the many uncertainties about pathways, for example, when and how radionuclides could be released, as well as the hugely unknown multiple levels of how radionuclides will contaminate numerous life forms, ranging from various organs within organisms to interactions between organisms as well as interactions with environmental media, in order to be named and mitigated effectively - through time and space, with other unknowns such as extreme weather events, etc. Next, I will select passages that illustrate further problematic assumptions by	

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			the CNSC, followed by citations from other scientists, internationally, who point out the limitations of computer models.	
106	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.1	**Issue** As per comment #6, Section 7.1.1 is similar to section 6.1 but worded differently. **Suggested change** For consistency, this section should be laid out similarly to 6.1 as they are similar in content.	As a result of the comment, the section was changed to have a similar layout of section 6.1.
107	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.1.1	**Issue** Paragraphs 1 and 2 appear to be a repeat of summarized information from Section 6 and not need here. However, if kept, licensees cite the following concerns with this section: 1. As per our earlier comments, a safety margin is not an acceptance criterion. The acceptance criteria should be the limit of what is deemed acceptable to ensure the required level of safety/risk. 2. The 3rd paragraph introduces a new definition of “design dose target” from the previous version of this REGDOC and suggests it “should be challenging” without defining what challenging might be. 3. The REGDOC does not suggest alternative methods for determining benchmarks for the protection of person from hazardous substances. 4. Under the ‘Radiological protection of the environment’ subsection,	As a result of the comment, the following changes were made: Bullet #1: The change was made as suggested. Bullet #2: The change was made as suggested. Bullet #3: The change was made as suggested. Bullet #4: The change was made as suggested. Bullet #5: The text was changed to ‘normal evolution scenario’. Bullet #6: See response to comment #6. Bullet #7: Comment noted.

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			licensees suggest referring to the ICRP documentation. 5. Under 'Radiological protection of persons,' there is no mention of extreme scenarios being excluded from the public exposure limit. In the case of a human intrusion scenario, the 1mSv/yr is unlikely to be achievable with ILW and HLW where it is expected that institutional controls will be in place. Also, the 1st sentence of the 2nd paragraph contradicts the above paragraph. As the dose target should be a fraction "to account for the possibility of exposure to multiple sources", it is specifically being used to account for uncertainties. 6. Regarding the final sentence on page 14, licensees anticipate this analysis will be in accordance with *REGDOC-2.4.4* or *REGDOC-2.4.1*. 7. The 2nd paragraph under 'Protection of the environment from hazardous substances' does not specify a boundary for where the benchmarks can end. Without this being defined, analyses may be subject to a moving yardstick, resulting in potential rework each time that a new potential contaminant is identified. **Suggested change** Remove paragraphs 1 and 2 to avoid duplication. If not, 1. Amend the 1st sentence of the 2nd paragraph to read, "The licensee or applicant may choose to apply an additional margin of safety in deriving ~~acceptance criteria, such as~~ a dose target or a safety factor." 2. Remove the subjective word ~~"challenging"~~ from the 3rd paragraph. 3. Add the following paragraph on substances without guidelines to the 'Protection of persons from hazardous substances' section: "If none are available, benchmarks can be derived from the toxicity literature or other regulatory agencies, or from CCME protocols for the derivation of criteria." 4. Add ICRP Publication 108 as a reference, which discusses Derived Consideration Reference Levels and the concept of Reference Animals and	

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			Plants. 5. Add "… for natural evolution scenarios" to the 1st paragraph of the 'Radiological protection of persons' subsection, Clarification needs to be provided as to how uncertainties should be accounted for in the determination of dose targets 6. Clarify that this analysis requirement will be presented in *REGDOC-2.4.4 Safety Analysis for Class IB Nuclear Facilities* 7. The CCME and provincial guides (or equivalents) are used as benchmarks. Other literature may be used as supplemental	
108	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.1.2	**Issue** Licensees seek clarification for the line, "A licensee or applicant should use multiple risk-informed approaches to estimate the release" Are they saying using the correct model for the scenario? Or asking for multiple methods to model the same thing? **Suggested change** Please clarify in the revised REGDOC.	As a result of the comment, the paragraph was changed to: "A licensee or applicant should use risk-informed approaches to estimate the release and dispersal of contaminants and resulting concentrations in water, sediment, soil and air based on waste characteristics, release mechanisms and rates, and contaminant transport rates. This may be a combination of modelling supported by monitoring data."
109	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management	7.1.1.3	**Issue (Major)** Industry has a major concern with the 1st paragraph under "Identification of human and environmental receptors" **Suggested change** The process for receptor selection and characterization has been detailed in CSA documents which include CNSC input and acceptance. Where applicable, human and environmental receptor selection should be consistent	As a result of the comment, the following references were added: • CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operations* • CSA N288.6, *Environmental risk assessment for class I facilities and uranium mines and mills.*

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	Organization, Ontario Power Generation		with receptors identified following CSA N288.6-12 Environmental Risk Assessments at Class1 nuclear facilities and uranium mines and mills. **Impact on industry** Uncertainty created by inconsistent requirements.	
110	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.1.3	**Issue** Other licensee concerns with this section include: 1.The additional parameters listed as "end points" of the safety analysis are in fact complementary indicators of safety. 2.Hazardous material protection" is discussed prior to this section but there is no mention of "environmental protection" until this sentence. 3.Same section title as section 6.3 4.Section 6.3 does not identify criticality safety. 5.Lack of clarity on the definition of "waste management system." The definition in the Glossary seems to allude to the system encompassing the entire phase of the facility (design, operations, post-closure). The 2nd paragraph, 2nd sentence, requires NCS analysis on only post-closure phase. The first sentence does not discriminate. What is the intention here? **Suggested change** Clarify the section by: 1.Moving the list of "additional parameters" to Section 6.8 and combining it with the existing list of complementary indicators of safety. 2.Change ~~"environmental protection"~~ to "hazardous material protection"	As a result of the comment, the following changes were made: Bullet # 2: "for radiological and environmental protection" was deleted. Bullet #4: 'Criticality' was added to section 6.3. Bullet #5: The paragraph on nuclear criticality safety was moved to section 6.3. The title for section 8 was changed to 'Post-closure safety assessment'. The following changes wee not made: Bullet #1: The list of examples of additional parameters are specific parameters whereas those listed in section 6.8 are broader. The list is section 6.8 was consolidate with the integration of safety arguments. Bullet #3: This was done intentionally to align with SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste.*

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			3.Change one title for clarity 4.Update section 6.3 to include criticality 5.Clarify the intention	
111	Cameco	7.1.1.1	The process for receptor selection and characterization is in CSA documents, which were and are developed with the participation and approval of the Canadian Nuclear Safety Commission. Cameco believes that this section should merely reference CSA N288.6-12, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills* to avoid inconsistencies with this standard.	See response to comment #109.
112	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.3	**Issue (Major)** Licensees see a lack of clarity in requirements versus suggestions regarding the need for criticality safety analysis in appropriate waste management systems. **Suggested change** Change the first sentence in the second paragraph to "The waste management system shall ~~also consider~~ demonstrate that criticality safety has been considered as applicable." **Impact on industry** This wording will help to ensure that criticality safety is considered when fissionable material is present in the facility. If no fissionable material is present, it should be a requirement to at least state this is the reason for a lack of criticality safety analysis in the safety case**.**	As a result of the comment, the text was changed as suggested.
113	Bruce Power, Canadian Nuclear Association, Canadian	7.1.3.1	**Issue** As per comment #6, site characterization is covered in 6.4.2. The section is redundant.	As a result of the comment, the site characterization information was revised to focus on the role of site characterization in the post-closure safety assessment.

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	Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		**Suggested change** Delete	
114	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.4	**Issue** Additional clarity is sought on the safety assessment scenarios and time frames. Also, the 2nd last paragraph is incomplete as written and the 1st sentence of the last paragraph on Page 20 does not read correctly. **Suggested change** Licensees suggest splitting this into two sections since they are discussed separately. For example: 7.1.4 Safety Assessment Scenarios 7.1.5 Safety Assessment Time Frames	As a result of the comment, the following changes were made: • The first sentence on page 20 was revised to: “A rationale for the time frame associated with the safety assessment shall be given.” • Time frames were separated from safety assessment scenarios.
115	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power	7.1.4.1	**Issue (Major)** Industry has major concerns with this section as written. As currently written, this section could be interpreted that <u>all</u> analyses, including scoping and bounding analyses, will have to include the period of time during which the maximum impact is expected to occur. Bounding analyses could estimate the maximum impact without the need to include the time dependence. A graded approach is not recognized with respect to the safety analysis. The intent of the last paragraph of this section is particularly unclear. The discussion on design-basis events should be removed since the safety	As a result of the comment, the term ‘design basis accident’ was removed from the document. As the time frame increases in length, it is expected that an external event will be more severe. Therefore if the lifetime of a facility is 1000 years, one should choose at a minimum a design basis earthquake of annual probability of exceedance of 1:1000. If a facility’s lifetime is 10:000 then the event should at a minimum have a probability of exceedance of 1:10000, which is greater than in the previous case. The criteria stated in this document are applicable for disposal systems. Criteria for NPPs separate and distinct.

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	Generation		assessment for the long term considers normal evolution and disruptive event scenarios. For some facility types, events may be considered in relation to the lifetime of the barriers and not necessarily the assessment timeframe. The final paragraph also adds numerical details that lead to misinterpretation. Specifically, licensees have two issues with this final paragraph: 1.“The longer the time frame, the more severe the design-basis events become” is not necessarily true. For example, the magnitude of the earthquake associated with the design basis return period is fixed. It does not change with time. Nor does it change for any other external hazard. Rather, the “likelihood” of the event occurring increases, not the severity. 2.The existing Canadian fleet is designed, for the most part, to a design basis earthquake magnitude equivalent to a 1,000 year return period. The example should be removed or changed to reflect 1,000 years and not 10,000 years to avoid providing a misconception that 10,000 years as a “design” return period is required (recognizing that 10,000 years is required per REGDOC-2.5.2 for new builds). **Suggested change** Industry suggests the following change, based on wording from the previous REGDOC: “Assessments of the future impact that may arise from the radioactive waste would be expected to include the period of time during which the maximum impact is predicted to occur. In some cases, only the magnitude of the maximum impact, independent of time, may be sufficient for the assessment (e.g., in bounding assessments using calculations based on solubility constraints).” Overall, the REGDOC should reflect that the longer post-closure time frame may necessitate examination of the robustness of the waste management facility for disruptive scenarios based on external hazard assessments. Robustness could be demonstrated through fragility assessment of the structure or by other accepted means. The discussion on design-basis events should be removed since the subsections that follow rightfully focus on normal evolution and disruptive scenarios for the long-term safety	

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			assessment. **Impact on industry** This approach provides unnecessarily high design requirements and does not take into account the changing requirements due to normal evolution of the facility over longer timescales. The new requirement could restrict the flexibility of the industry to perform scoping and bounding safety analyses.	
116	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.4.3	**Issue** The sentence in the 3rd paragraph that reads, "Acceptance criteria for human intrusion should be defined" is new compared with the prior version. If there is an expectation on criteria definition, this should be identified in Section 7.1.1.1 Acceptance Criteria. Regarding the 4th paragraph, if a facility is under institutional control, then inadvertent human intrusion should not be a scenario during this period since this would require deliberate attempts to access this waste. Controls and mitigation events are already in place to prevent human intrusion during institutional control. Additional work to prevent this would not be necessary. **Suggested change** Delete the sentence in the 3rd paragraph, ~~"Acceptance criteria for human intrusion should be defined"~~ Clarify that the 4th paragraph applies to post institutional control.	As a result of the comment, a section on inadvertent human intrusion scenarios was added to the sub-section radiological protection of persons under the section of acceptance criteria.
117	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power,	7.1.5	**Issue** As per comment #1, developing and using safety analysis models is discussed earlier in the document and provides no added value here. **Suggested change**	As a result of the comment, the duplicated information in the document was deleted.

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	Nuclear Waste Management Organization, Ontario Power Generation		Delete	
118	Dr. Sandy Greer	7.1.5	First of all, I will cite excerpts from the final pages and then move backward into the previous sections of content. Under section **7.1.5 Developing and using safety analysis models**, read (and reread) these sentences: *"The conceptual models of the site and the waste management system that have been developed often need to be simplified to correspond to the limitations of mathematical equations* [my bold] *and the capabilities of computer models to solve them. A mathematical model is a representation of the features and processes included in the conceptual model in the form of mathematical equations. "Computer models are used to solve the mathematical equations that represent the understanding of the inter-relationships among the major features, processes, and characteristics of the waste management system in its particular environment."...* [print page 23] The fundamental flaw, therefore, that becomes evident in the above information (and as elaborated in the document) appears to be that the actual complex biological environment in our visible (and invisible to the naked eye) physical world must be reduced to fit human-constructed technology, instead of the other way around. Again, I was gobsmacked by the above emphasis that the world of Nature, ultimately, somehow must accommodate our reductionist thinking. Have we become so disconnected from the actual biological planet, and our arrogance become so egregious, that we think we have the intelligence to program technological tools that can fix the human destruction perpetrated by human beings on the planetary life support system?	No changes were made as a result of the comment. Scientists and engineers who use mathematical and computer models, in the post-closure safety assessment of disposal systems, must not consider these tools to predict how the system will exactly behave in the far future. The quoted paragraph from the draft regulatory document 2.11.1, Volume III, to that effect caution modellers that due limitations of mathematical and computer models, not all processes could be included in a conceptualization of the system, and not all processes in that conceptualization can be included in the mathematical and computer models. Therefore simplifications have to be performed, by retaining only the most important processes and those which can conservatively overpredict the impact. The output from the model should not be considered as exact predictions, but as indicators of the level of protection provided by the waste disposal system.
119	Dr. Sandy Greer	7.1.5.1	What also is disturbing, not only in the draft document's sections on safety analysis, yet as well throughout the document, are contradictions, such as illustrated here by a few text examples. Under section **7.1.5.1 Confidence in computer tools**: *"... Validation is meant to ensure that the mathematical*	As a result of the comment, the duplicated information in the document was deleted.

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			equations in the computer model ***simulate, with reasonable accuracy,*** [my bold] *the processes and conditions they are supposed to represent."*...[print page 24]	
120	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.5.1	**Issue (Major)** The 1st sentence implies that commercially available software packages, developed for a variety of non-specific uses, are not allowed to be used in the safety analysis. **Suggested change** Amend the 1st sentence to what was in the previous version of this REGDOC, i.e., "The computing tools used to solve the equations in the assessment model can range from commercially available software packages to computer programs that are developed specifically for the given assessment." **Impact on industry** Not recognizing commercially available software packages could lead to significant limitations to the development of computer models used in safety analysis by the licensee or applicant.	As a result of the comment, the text was changed to: "The licensee or applicant should ensure that computer programs are appropriate for the given assessment, this may include commercially available software packages or software specifically developed for the given assessment."
121	Dr. Sandy Greer	7.1.5.2	Next, under section **7.1.5.2 Confidence in safety analysis models**, see the contradiction below in relation to the above-cited passage on the previous page of the draft document: *"... Although models of individual processes or phenomena can sometimes be validated by experiments and blind predictions, the long-term predictions made by safety analysis models cannot be* ***confirmed*** **[**my bold].*"...*	As a result of the comment, the duplicated information in the document was deleted.
122	Bruce Power, Canadian Nuclear Association, Canadian Nuclear	7.1.5.2	**Issue** This information in the 3rd paragraph is too specific and offers little value. **Suggested change**	As a result of the comment, the paragraph was deleted.

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	Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		Delete the 3rd paragraph	
123	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.6.1	**Issue (Major)** Licensees found several aspects of this section unclear. Specifically: 1.The emphasis on the concept that the criteria are not met in this section is confusing. 2.The last paragraph about levels of protection, etc. is out of place here, as this is the safety analysis discussion, referring to numerical results. 3.The entire "acceptance" discussion needs to fold in likelihoods and safety margins and complementary arguments, which is a safety case discussion, not a safety analysis one. 4.The last paragraph says that simply being below dose limits is not enough as "protection is required to be optimized and demonstrated by multiple lines of evidence." This section is about acceptance criteria though, not dose limits. Section 7.1.1.1 says that a "licensee or applicant may choose to apply an additional margin of safety in deriving acceptance criteria" and "A dose SHOULD be reduced below a target if this can be done at a justifiable cost, taking into consideration social and economic factors." Yet 7.1.6.1 says protection is REQUIRED to be optimized below dose limits. This is inconsistent. **Suggested change** Clarify the section by: 1.Emphasizing that safety analysis must meet the criteria, and not get into	As a result of the comment, the paragraph was changed to: "However, compliance with the acceptance criteria in itself is not sufficient for acceptance of a safety case since additional safety requirements must also be shown to be met."

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			what-if it does not. 2.Remove or move the last paragraph to a more appropriate section. 3.If the CNSC expects the licensee or applicant to do more than meet the current regulatory criteria, then that should be in a single well-marked and discussed section as part of the Safety Case (i.e. Section 5). 4.Remove the last paragraph to address the inconsistencies. **Impact on industry** Unclear expectations could challenge compliance verification. This could also inadvertently result in confusion for members of the public as to expected requirements for facilities.	
124	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1.6.2	**Issue** This information in the 2nd and 4th paragraphs was discussed earlier in the document and provides no additional value here. **Suggested change** Delete	No changes were made as a result of the comment. Uncertainties were earlier discussed in the context of the safety case. This section concerns analyzing the uncertainties associated with the post-closure safety assessment.
125	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories,	Glossary	**Issue** Glossary is incomplete **Suggested change** Add the relevant definitions and/or cross-reference *REGDOC-3.6, Glossary*	No changes were made as a result of the comment. Draft REGDOCs often contain terms that are either new or being revised. Following public consultation and the Commission’s approval, the final terms and definitions are submitted for inclusion in the next version of REGDOC-3.6, *Glossary of CNSC Terminology*.

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	NB Power, Nuclear Waste Management Organization, Ontario Power Generation		*of CNSC Terminology*, where appropriate.	Regulatory document REGDOC-3.6, *Glossary of CNSC Terminology*, provides a list of terms and definitions used in the *Nuclear Safety and Control Act* (NSCA), the regulations made under the NSCA, and CNSC regulatory documents and other publications, such as annual reports and guidance documents. This document is provided for reference and information and serves as the standard for future CNSC regulatory documents and other publications. The CNSC does not plan to hyperlink or reference all definitions in every REGDOC to the appropriate glossary entry.
126	Bruce Power, Canadian Nuclear Association, Canadian Nuclear Laboratories, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	References	**Issue** ICRP Publication 108, Environmental Protection - the Concept and Use of Reference Animals and Plants” is not included in the list of references. **Suggested change** Add ICRP Publication 108 to the list of references.	As a result of the comment, the suggested reference was added.

Table C: Feedback on comments / Tableau C : Période des observations

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1.	Michael Stevens	CNL comment 2 is: "The document does not clearly define the lifecycle phases of a facility or the requirements that apply to each phase. Specifically, licensees found operational concepts for assessing a typical nuclear facility have been added to this draft. However, a disposal facility generally has the following lifecycle phases: siting; construction; operation; pre-closure monitoring; closure; decommissioning of ancillary facilities; postclosure. While some concepts can be applied to the operational phase of a waste management or disposal facility, they cannot be directly applied to the unique aspects or post-closure timeframe of a repository." I agree with this comment, but I think it points to a more fundamental problem in the document – waste storage is conflated with waste disposal. Clause 1.1 Purpose states (with my added underlining): "The purpose of this document is to provide requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment for the long-term management of radioactive waste by means of storage or disposal." However the document does not contain definitions of either storage or disposal. They are not the same thing, have different implications, and the safety case for a disposal facility must extend much further into the future, beyond any period of active institutional control can be maintained in the postclosure phase. The CNSC Glossary (REGDOC 3.6) contains the definitions: **- disposal *(évacuation* or *élimination)*** The placement of radioactive waste without the intention of retrieval **- storage *(stockage)*** With respect to nuclear substances and radiation devices, possession for storage only. (i.e., retrieval is not mentioned, and storage is defined in terms of itself!?). In contrast, The 2003 IAEA Radioactive Waste Management Glossary contains the following definitions (with my added underlining): **- disposa**l. Emplacement of waste in an appropriate facility without the intention of retrieval.	See response to comment #2 in table B on terminology.

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		Some countries use the term disposal to include discharges of effluents to the environment. - **storage**. The holding of spent fuel or of radioactive waste in a facility that provides for its containment, with the intention of retrieval [3]. Storage is by definition an interim measure, and the term interim storage would therefore be appropriate only to refer to short term temporary storage when contrasting this with the longer term fate of the waste. Storage as defined above should not be described as interim storage. (Reference [3] is the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, IAEA, Vienna (1997).) As the CNL suggests, disposal facilities have a different life cycle than storage facilities. The waste contained in a disposal repository remains in place when the facility is closed. The waste contained in a storage facility is retrieved to be dealt with elsewhere before the facility is decommissioned. For example, the Port Hope and Port Granby “Long-Term Waste Management Facilities” must be storage, not disposal facilities because they contain significant quantities of arsenic, which does not decay and constitutes a perpetual hazard in a near-surface facility unless it is under active institutional control.	
2.	Ralliement contre la pollution radioactive	Le *Ralliement contre la pollution radioactive* est d’accord avec toutes les critiques que les autres intervenants ont déjà formulées sur le document réglementaire **REGDOC-2.11.1**. Cependant, nous recommandons que la Commission canadienne de sûreté nucléaire remanie complètement ce document pour mieux aligner ses exigences sur les normes de sûreté de l'Agence internationale de l'énergie atomique (AIEA) et les recommandations de cette agence pour la gestion des déchets radioactifs. L'AIEA a critiqué le Canada pour sa mauvaise gestion des déchets radioactifs. L'AIEA vient de confirmer l'urgence d’améliorer les politiques canadiennes en matière de déchets nucléaires, à l'issue d'une mission d'examen qui s'est poursuivie au Canada pendant onze jours, jusqu'au 13 septembre 2019. L’équipe de 24 spécialistes incluait 20 experts en réglementation issus de 17 pays différents. Selon le communiqué de presse de l’AIEA, le rapport final de son équipe d'évaluation recommandera que "le gouvernement du Canada renforce sa politique et sa stratégie de gestion des déchets radioactifs". Il propose aussi, en matière de radioprotection, "que la Commission canadienne de sûreté nucléaire envisage de mieux aligner ses exigences sur les normes de sûreté de l'AIEA. " Présentement au Canada, il n’y a aucun site de stockage en couche géologique profonde pour	Aucun changement n’a été apporté au document. L’AIEA n’a pas critiqué le Canada pour sa mauvaise gestion des déchets. Au cours de la récente mission du SEIR au Canada, aucune recommandation n’a été formulée à l’organisme de réglementation en ce qui concerne la gestion des déchets. Le REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* fournit des exigences et une orientation sur la classification des déchets. La classification des déchets décrite dans le REGDOC-2.11.1, tome I est conforme aux directives internationales en matière de classification des déchets. La norme de sûreté GSG-1, *Classification des déchets radioactifs* de l’AIEA explique que les limites quantitatives entre les catégories pour diverses installations peuvent différer en fonction des scénarios, des paramètres géologiques et techniques, ainsi que d’autres paramètres pertinents à l’évaluation de la sûreté propre au site. Les documents de l’AIEA sont pris en considération durant le développement de documents d’application de la règlementation (REGDOC). Durant l’étape d’analyse de ce projet de REGDOC, la CCSN a effectué une analyse comparative entre son

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<tr><td></td><td></td><td>
stocker à long terme les déchets radioactifs de moyenne activité et de forte activité. D’autre part, il y a beaucoup de difficulté à classifier quels sont les déchets radioactifs de moyenne activité car leur définition est trop vague. D'où la tentation de mettre des déchets radioactifs de moyenne activité avec ceux de faible activité, faute d’alternative.
Le REGDOC-2.11.1 est comme un vœu pieux sans un site de stockage en couche géologique profonde approprié. Toujours des solutions temporaires dans des contenants de stockage bons pour 50 ans alors que plusieurs déchets ont des durées de vie de l’ordre de centaines de milliers d’années! Ce n’est certainement pas pour le bien et la sécurité à long terme des futures générations ! Ce sont des risques sérieux et les coûts cumulatifs de ce stockage temporaire deviendront énormes avec le temps.
******
The Ralliement contre la pollution radioactive agrees with all the criticisms already made by the other respondents for the draft regulatory document REGDOC-2.11.1. However, we recommend that the Canadian Nuclear Safety Commission completely redesign this document to better align its requirements with the safety standards of the International Atomic Energy Agency (IAEA) and the recommendations of that agency for the management of radioactive waste.
The International Atomic Energy Agency has criticized Canada for its mismanagement of radioactive waste. The IAEA has recently confirmed the urgency of improving Canada's nuclear waste policies, following a review mission in Canada for eleven days until 13 September 2019. The team of 24 specialists included 20 regulatory experts from 17 different countries. According to an IAEA press release, The final report of its evaluation team will recommend that "the Government of Canada should strengthen its policy and strategy for radioactive waste management". It also proposes, with regard to radiation protection, "that the Canadian Nuclear Safety Commission consider better aligning its requirements with the IAEA safety standards."
There is currently no deep geological repository in Canada for the long-term disposal of intermediate-level and high-level radioactive waste. On the other hand, it is very difficult to determine which radioactive waste should be classified as intermediate activity because their definition is too vague. Hence there is a temptation to put intermediate-level radioactive with waste low-level radioactive waste due to the lack of an alternative.
</td><td>
cadre de réglementation et les documents de l’AIEA. Le document SSG-23, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste a été utilisé comme base pour la rédaction de ce REGDOC.
<table>
<tr><th># de REGDOC</th><th>Titre</th><th>Norme de sûreté citée ou utilisée dans le développement du REGDOC</th></tr>
<tr><td>1.2.1</td><td>Orientation sur la caractérisation des emplacements de dépôts géologiques en profondeur</td><td>SSR-5, SSG-14</td></tr>
<tr><td>2.11</td><td>Cadre canadien pour la gestion des déchets radioactifs et les plans de déclassement</td><td>GSR-5, GSG-1, SSR-5, GSR-6</td></tr>
<tr><td>2.11.1, Volume I</td><td>Gestion des déchets radioactifs</td><td>GSR-5, GSG-1, SSG-40, SSG-41, WS-G-6.1, SSR-5, SSG-15, SSG-29, SSG-31, SSG-14</td></tr>
<tr><td>2.11.1, Volume II</td><td>Gestion des stériles des mines d’uranium et des résidus des usines de concentration d’uranium</td><td>WS-G-1.2, NF-T-1.2</td></tr>
<tr><td>2.11.1, Volume III</td><td>Dossier de sûreté pour la gestion à long terme des déchets radioactifs, version 2</td><td>GSR-5, SSR-5, SSG-23, GSG-3</td></tr>
<tr><td>2.11.2</td><td>Déclassement</td><td>GSR-6, GSR-4, WS-G-2.4, WS-G-2.1, WS-G-5-2</td></tr>
<tr><td>3.3.1</td><td>Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées</td><td>GSR-6</td></tr>
</table>
Ressources naturelles Canada est le ministère responsable de l’élaboration et de la mise en œuvre de la politique fédérale sur l’énergie nucléaire pour l’ensemble de la chaîne d’approvisionnement nucléaire – allant de l’extraction minière de l’uranium à l’élimination finale des déchets radioactifs. La CCSN, en tant qu'organisme de réglementation nucléaire, ne détermine pas la politique fédérale sur l’énergie nucléaire.
****
No changes were made to the document as a result of the comment.
The IAEA did not criticize Canada for its mismanagement of radioactive waste. The CNSC did not receive any recommendations on the management of radioactive waste during the last IRRS mission in Canada.
REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste provides requirements and guidance on waste classification. The waste classification presented in REGDOC-2.11.1, Volume I is aligned with international guidelines related to waste classification. The IAEA’s General Safety Guide GSG-1,
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<tr><th></th><th>Organization / Organisation</th><th>Comment / Commentaire</th><th>CNSC Response / Réponse la CCSN</th></tr>
<tr><td></td><td></td><td>REGDOC-2.11.1 is like wishful thinking without an appropriate deep geological repository. Always temporary solutions in storage containers good for 50 years while several radioactive wastes have lifetimes of the order of hundreds of thousands of years! It is certainly not for the good and the long-term security of the future generations! This creates serious risks and the cumulative costs of this temporary storage will be enormous over time.</td><td>Classification of Radioactive Waste explains that the quantitative boundaries of the categories can vary for different facilities, depending on scenarios, geological and technical parameters and other parameters relevant to the safety assessment of the site.

IAEA documentation is considered throughout the development of regulatory documents. The CNSC confirms that a gap analysis was conducted between IAEA safety standards and the regulatory framework as part of the analysis phase for this REGDOC. SSG-23, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste was used as the basis for this REGDOC.

<table>
<tr><th>REGDOC #</th><th>Title</th><th>Safety Standards Referenced or Influenced By</th></tr>
<tr><td>1.2.1</td><td>Guidance on Deep Geological Repository Site Characterization</td><td>SSR-5, SSG-14</td></tr>
<tr><td>2.11</td><td>Waste Management: Framework for Radioactive Waste Management and Decommissioning in Canada</td><td>GSR-5, GSG-1, SSR-5, GSR-6</td></tr>
<tr><td>2.11.1 Volume I</td><td>Waste Management, Volume I: Management of Radioactive Waste</td><td>GSR-5, GSG-1, SSG-40, SSG-41, WS-G-6.1, SSR-5, SSG-15, SSG-29, SSG-31, SSG-14</td></tr>
<tr><td>2.11.1 Volume II</td><td>Waste Management: Management of Uranium Mine Waste Rock and Mill Tailings</td><td>WS-G-1.2, NF-T-1.2</td></tr>
<tr><td>2.11.1 Volume III</td><td>Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2</td><td>GSR-5, SSR-5, SSG-23, GSG-3</td></tr>
<tr><td>2.11.2</td><td>Decommissioning</td><td>GSR-6, GSR-4, WS.G-2.4, WS-G-2.1, WS-G-5.2</td></tr>
<tr><td>3.3.1</td><td>Financial Guarantee for Decommissioning of Nuclear Facilities and Termination of Licensed Activities</td><td>GSR-6</td></tr>
</table>

Natural Resources Canada is the lead government department responsibly for developing and implementing federal nuclear energy policy across the nuclear supply chain – from uranium mining to the final disposition of waste. CNSC, as the nuclear regulator, does not determine Canada’s radioactive waste policy.</td></tr>
<tr><td>3.</td><td>Ralliement contre la pollution radioactive</td><td>Le REGDOC-2.11.1 ne traite pas non plus des obligations financières à long terme des pollueurs de déchets radioactifs. On donne des licences pour des projets nucléaires sans tenir compte du coût de gestion de leurs déchets radioactifs. Il est inacceptable que le REGDOC-2.11.1 exempte les installations de gestion à long terme des déchets radioactifs ainsi que les sites qui ont été en exploitation et déclassés ou fermés avant 2020. Tous ces sites n'ont que des installations temporaires pour isoler les déchets radioactifs ayant une longue durée de vie de plus de 300 ans. Une solution permanente doit être instaurée pour leur gestion à long terme;</td><td>Aucun changement n’a été apporté au document.

Le REGDOC-3.3.1, Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées fournit de l’information sur les garanties financières utilisées pour s’assurer que le titulaire de permis disposera de fonds suffisants pour déclasser un emplacement autorisé et pour éliminer toutes les</td></tr>
</table>

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
		c'est une question de sécurité pour la santé des générations futures. ******** REGDOC-2.11.1 also does not address the long-term financial obligations of radioactive waste polluters. Licenses for nuclear projects are given regardless of the cost of managing their radioactive wastes. It is unacceptable that REGDOC-2.11.1 exempts long-term radioactive waste management facilities as well as sites that have been in operation and decommissioned or closed before 2020. All these sites have only temporary facilities to isolate radioactive waste with a long life of more than 300 years. A permanent solution must be put in place for their long-term management; it is a question of safety for the health of future generations.	substances nucléaires connexes. **** No changes were made to the document as a result of the comment. Regulatory document REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* sets out requirements and guidance for the establishment and maintenance of funding for the decommissioning of facilities and termination of activities. The document states that the cost estimate for decommissioning must address the cost of the long-term management of radioactive waste and used fuel.
4.	Ralliement contre la pollution radioactive	La Commission canadienne de sûreté nucléaire ne semble pas respecter ses obligations internationales énoncées dans la *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, signée en 1997 avec l'AIEA. C'est un moment opportun d'améliorer la classification, la réglementation et la stratégie de gestion des déchets radioactifs qui sont inadéquates au Canada. Ce grave problème traîne depuis trop longtemps et les solutions temporaires ne sont plus acceptables. Il est nécessaire d'agir avec rigueur pour assurer la sûreté à long terme de la population. ****** The Canadian Nuclear Safety Commission does not seem to comply with its international obligations under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, signed in 1997 with the IAEA. This is a timely opportunity to improve the inadequate classification, regulation and management strategy for radioactive wastes in Canada. This serious problem has been dragging on for too long and temporary solutions are no longer acceptable. It is necessary to act rigorously to ensure the long-term safety of the population.	See response to comment #30. Additionally, the waste classification system used by the CNSC is aligned with IAEA guidance.
5.	Canadian Association of	I am writing this document on behalf of Canadian Association of Physicians for the Environment (CAPE) which is an organization of health professionals and concerned citizens,	See response to comment #31 in table B.

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Physicians for the Environment	that addresses environmental impacts on human health. I am a family doctor in Kingston Ontario, and Assistant Professor in the Department of Family Medicine at Queen's University in Kingston. I am responding to an invitation for the public to give feedback on the comments received by the CNSC between May 24 and Sept. 16, 2019 regarding the regulatory document on nuclear waste management, REGDOC-2.11.1-vol3-ver2, on Waste Management: Safety Case for Long-Term Radioactive Waste Management. I have read this draft CNSC document, and have significant concerns about it. In summary, I agree with the comments posted by Northwatch, Sandy Greer and Concerned Citizens of Renfrew County and Area. It is clearly stated in the document that the applicant (the nuclear industry proponent) would be responsible for defining and assessing its own safety case. Instead, the CNSC, as the regulatory body, should be setting strict standards to which the proponent should have to demonstrate adherence. Allowing the industry to establish its own controls and conditions is irresponsible and similar to the fox minding the henhouse.	
6.	Canadian Association of Physicians for the Environment	The document describes continued reliance on computer modeling to assess safety, which is based on assumptions and extrapolation. The fact is that we cannot reliably predict climate/weather patterns, catastrophic events or events "beyond design basis", radionuclide and geological behaviour and container corrosion over many thousands or millions of years, and subsequent radiation doses, and it is unreasonable to think otherwise. To use computer modeling based on these assumptions as a basis to define public safety puts the public at risk, as is tragically illustrated by the accident at Fukushima, and the many extreme weather events witnessed worldwide on a regular basis. There are inevitable uncertainties that cannot be predicted or quantified, and with toxic radioactive waste, we cannot take risks, especially if they will be borne by future generations who will pay for our mistakes and wrong assumptions with their health, and the health of the planet, which are inextricably linked. There is so far no solution worldwide to the problem of nuclear waste and any suggestion, as in this document, that there is any true reliable scientific evidence that a DGR would be safe for thousands or millions of years is misleading and puts our health, and the health of future generations at risk.	See response to comment #51 and 97.

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
7.	Dr. Sandy Greer	**PREAMBLE** The following feedback refers to selected comments primarily from the Nuclear Waste Management Organization (NWMO) industry template comments. Therefore, whenever I refer to the NWMO template/comments, I refer to all of the nuclear industry players in Canada who submitted the same template. My feedback also provides brief references to comments from Northwatch and Dr. J.R. Walker. Interesting to note, and troubling to an already concerned citizen, is the blistering criticism from the nuclear industry in regard to REGDOC-2.11.1, Volume III, version 2. A citizen would assume that it is the Canadian Nuclear Safety Commission (CNSC), in its role as Canada's nuclear regulator, who ought to be giving guidance to the nuclear industry, rather than witnessing the opposite happening. Indeed, the litany of criticism by industry directed at this specific draft document is over and above the usual suggestions from the nuclear industry to limit rather than expand the requirements incrementally updated by CNSC. The NWMO template's pattern of criticism directed at REGDOC-2.11.1, Vol. III, ver. 2, repeatedly identifies lack of clarification, inconsistencies, and various passages characterized as confusing. As one "Impact on Industry" identifies, on the first of 22 pages of industry critique: "Unclear expectations could challenge compliance verification." To sum up the tone and content of criticisms in all submitted comments for this draft document, I will quote from what Bruce Power stated in its introductory letter: "The editorial quality of this document is below the CNSC's usual standards for drafts issued for industry or public review." Speaking as a citizen, my overall criticism of this draft document is that it is trying to embrace too much material in a single document, on a number of levels, such as the widely diverse types of facilities included, multiple time frames, as well as communicate gross assumptions that do *not* demonstrate scientific evidence. Last, but not least, the CNSC seems to offer industry too much leeway in choosing how to proceed, rather than provide much more clear direction. Ultimately, I feel that the CNSC is pushing forward too many documents too quickly, without suitable research, to expedite regulations for what basically are several types of nothing more than experimental facilities at this time (still unproven as safe through time), such as near surface repositories, small modular	See response to comment #1, 2 and 31 in table B.

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
		reactors, and deep geological repositories. The following sections will focus on a few specific points of criticism, which regrettably are not all-inclusive, given the limited timeline to respond constructively during an intense period of transition in my own life.	
8.	Dr. Sandy Greer	**WHAT IS FATE OF 'REGULATORY POLICY P-290?** An astute comment by Dr. J.R. Walker identified several points of concern, one of them being the potential disappearance of a longstanding 'Regulatory Policy P-290. Regarding examples of carelessness in REGDOC-2.11.1, Vol.III, ver. 2, I cannot overlook the incorrect spelling of Dr. J.R. Walker's name in the list of Comments, where he is identified as "Dr. J.R. Waker." More important to note, as per paying attention to his valid criticisms, is the fact that he is a former Director of Safety, Engineering and Licensing at AECL. Below is an excerpt why he believes P-290 must not be discarded: *"Regulatory Policy P-290 is part of the defence-in-depth that prevents the management of radioactive waste causing an unreasonable risk to the health and safety of persons and the protection of the environment."* In his own comment, Dr. J.R. Walker provides a descriptive page of text regarding *P-290*. He mentions that the latter is identified within the draft document as being included in Appendix A, but, in fact, is not included. My investigation discovered that *Regulatory Policy P-290* is supposed to be superseded - according to the 'Summary' section on the web page here: cnsc-ccsn.gc.ca/eng/acts-and-regulations/regulatory-documents/history/r egdoc2-11-1-v3.cfm.	P-290, *Managing Radioactive Waste* was superseded by REGDOC-2.11, *Framework Radioactive Waste Management and Decommissioning In Canada*. REGDOC-2.11 incorporates the full content of what was found in P-290. The typo was corrected.
9.	Dr. Sandy Greer	**A FULLER GLOSSARY WOULD IMPROVE CLARITY** Phrases, such as "unreasonable risk," if included in the Glossary, would provide much more clarity to language that obfuscates important distinctions between what the safety assessments and safety analyses can, and cannot, include. The NWMO template names a number of terms that it suggests ought to be listed and described in the Glossary, if not within pertinent document sections. For example, on page 3, `Suggested	See response to comment #3 in table B. See response to comment #13 in table B on the definition of 'unreasonable risk'. References to REGDOC-2.4.4, *Safety Analysis for Class 1B Nuclear Facilities* were removed.

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
		changes' for Comment #5, doc section 1.1, it reads: *"Clearly define 'long-term waste management' and 'facility' and apply them consistently."* But, the NWMO demonstrates its own lack of due diligence in a couple of sentences preceding the above quote, in which it requests an exemption for interim or short-term radioactive waste management facilities, suggesting that those particular facilities - yet not specifically identified - should only have to implement *REGDOC-2.4.4, Safety Analysis for Class 1B Nuclear Facilities*. But, the status of *REGDOC-2.4.4.* is "Not yet developed." See web page: cnsc-ccsn.gc.ca/eng/acts-and-regulations/regulatory-documents/index.cf m#R19 The NWMO template, which several times criticizes the CNSC for referring to merely draft, rather than finalized and approved, regulatory documents, therefore, illustrates a similar shortcoming in reference to *REGDOC-2.4.4*, when the latter does not yet exist. Among several terms that the NWMO template identifies as too ambiguous and vague, hence needing clear definition, it also points out the lack of conventional insertion of acronyms - which is conventional practice in academia and journalism as well - to insert the acronym following the first use of the fully written reference. Two acronyms that confused me, because the acronyms were used without originally seen attached to their fuller respective references, included: FEPs, which refers to "features, events and processes," and SSC, referring to "structure, systems, and components." A final example, again, in the spirit of improving clarity in the document, is to define "defence in depth" in the Glossary section, because that phrase is used to justify the construction of deep geological repositories (DGRs). The NWMO template even advocates in Comment #24, for CNSC doc section 6.2, under the column "Industry Issue" (designated as a MAJOR comment): *"Additional clarity is also sought as to how defence in depth is achieved and maintained and what is meant by passive barriers and controls."*	
10.	Dr. Sandy Greer	**CLARIFICATION NEEDED FOR "GRADED APPROACH"** In at least three different NWMO template comments - 3, 19, and 28 - the nuclear industry	See response to comment #5 in table B.

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		expresses dissatisfaction with the lack of information in this draft document for "graded approach," asking, for example, whether it refers to one single graded approach or, alternatively, do several graded approaches exist for various types of facilities. Careful reading of this web page for REGDDOC-2.11.1, Vol. III, ver. 2: https://www.cnsc-ccsn.gc.ca/eng/acts-and-regulations/consultation/com ment/regdoc2-11-1-vol3-ver2.cfm, in the 'Preface' section states, however: "For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals.*" Nevertheless, given the fraught, ubiquitous issue regarding lack of clarity throughout the draft document for REGDOC-2.11.1, Vol. III, ver. 2, I do agree with the nuclear industry criticism that appropriate information directly pertaining to safety issue of facilities ought to be properly explained in this current draft -namely, explain 'graded approach.'	
11.	Dr. Sandy Greer	**WHETHER URANIUM MINES AND MILLS BE INCLUDED** Not only the nuclear industry, but also Northwatch, contested the apparent inclusion of uranium mills and mines fitting within the wide range of facilities covered by this draft of REGDOC-2.11.1, Vol. III, ver. 2. The NWMO template comment #6, for doc section 1.2, says: "Licensees strongly disagree that the scope of this REGDOC should apply to radioactive waste management at uranium mines and mills." The reasons given are two-fold: "As recognized in *CSA N292.0-14, General Principles for the Management of Radioactive Waste and Irradiated Fuel* Section 1.4 and A.8, the nature of the wastes generated and the facilities appropriate for the long-term storage of wastes at uranium mines and miles requires specific safety assessments for which sufficient guidance is provided in *REGDOC-2.11.1, Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings (Volume II)."* But I have a few problems with the two aforementioned references. First of all, I do not recall *REGDOC-2.11.1, Volume II* having a public consultation period prior to its publication in November 2018. Perhaps I missed a public notification. Nevertheless, conceding that I have not	See response to comment #49 in table B on the inclusion of uranium mines and mills. See response to comment #8 in table B on REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings*. See response to comment #56 in table B on how to access to CSA standards.

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		yet read *Volume II*, the question remains open whether "sufficient guidance is provided." What concerns me more - as I previously indicated in my own submitted comment - I dislike the lack of accessibility to CSA standards for public citizens to study, in order to be given the same level of transparency to all evidence provided for the decision-making of the nuclear industry. As a result, the playing field for fuller understanding remains unequal between the industry and the public, treating the public input as less valuable. The obstacle is the financial expense to access CSA documents. I advocate again for that dilemma to be addressed, to facilitate full access for citizens to participate fairly in public reviews.	
12.	Dr. Sandy Greer	**INDUSTRY COMMENTS RE. COMPUTER MODELS** The NWMO template, in comment #48, challenges the CNSC's apparent more recent restriction in the use of "commercially available software packages," suggesting that a wider range of available models could enhance the development of models "used in analysis by the licensee or applicant." NWMO template comment #39, however, seems to argue the opposite, in challenging the CNSC statement: "A licensee or applicant should use multiple risk-informed approaches to estimate the release." Industry asks: *"Is the idea to use the correct model for the scenario? Or asking for multiple methods to model the same thing? Industry has a major concern with the 1st paragraph* [within the CNSC draft] *under "identification of human and environmental receptors."* Under 'Suggested Change' for the above identified 'Industry Issue,' the NWMO template states: *"Where applicable, human and environmental receptor selection should be consistent with receptors identified following CSA N288.6-12 Environmental Risk Assessments at Class 1 nuclear facilities and uranium mines and mills."* Above is a clear example of public citizens being shut out of the fuller aspects for decision-making by the Canadian nuclear industry, when we cannot access, and be given full transparency, on the content of CSA standards and, moreover, be able to verify that CSA standards abide by international standards.	See response to comment #105 in table B on computer models.

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		The fact is, through the past several years I have had to resort to research published in international science journals, often focused on European research, because of the lack of in depth research - whether accessible or even being done at all - in North America. What bothers me, as well, in what appears to be industry interrogating the choice between a (so-called) "correct model" versus "multiple methods to model the same thing" is being left with the impression, namely, that the Canadian nuclear industry is not up-to-date with the international literature that reveals problems in computer modelling that call for ongoing exploration, as well as being aware of interdisciplinary activities.	
13.	Dr. Sandy Greer	**CHALLENGING ICRP PUBLICATION 108** I can only conclude that the Canadian nuclear industry is not keeping abreast of the wealth of international research when it advocates in two different comments, both #38 and also its closing comment #53, to add ICRP Publication 108 to the [CNSC draft document's follow up] list of references. ICRP Publication 108 discusses Derived Consideration Reference Levels, and introduced the concept of Reference Animals and Plants (RAP) based upon Reference Man. But since its introduction in 2014 - when I actually cited it in my oral presentation at the second public hearing for the OPG DGR proposed for low-and-intermediate level radioactive waste - other radiological studies point out its deficiencies, and discuss other approaches. The ***Journal of Environmental Radioactivity*** keeps up-to-date on the latest international research. An article in 2016 illustrated one of the first published criticisms of ICRP's RAP, titled **Addressing ecological effects of radiation on populations and ecosystems to improve protection of the environment against radiation: Agreed statements from a Consensus Symposium.** One excerpt reads: *"Statement 6: Reference organism approaches represent an important step to characterize doses to biota, but they have significant limitations. More effort should be placed on understanding mechanisms and processes of how radiation effects are manifested in natural ecosystems, and on quantifying dose in the field."* Another critique of RAP was published in 2018 in the ***Environmental Research*** journal, titled **When a duck is not a duck; a new interdisciplinary synthesis for environmental radiation**	See response to comment #126 in table B.

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		protection (another consensus paper). Here is an excerpt: *"The problem with the current RAP approach is that the organism is considered without reference to the context of its environment. While target shape and volume, and isotope transfer routes may be considered, little attention is given to behavior, lifestyle, lifecycle or position in the ecosystem. We consider however that the whole ecosystem approach, on the other hand, is too complex to allow regulation based on dose limits to be applied.* *"During the meeting the idea of a compromise approach was discussed at length. This 'Landscape approach' represents an attempt to hybridise the two so that selected organisms can be viewed in relation to their actual environment…".* A third sample article, also published in ***Environmental Research***, on September 26, 2018, titled **The tubercular badger and the uncertain curve:-The need for a multiple stressor approach in environmental radiation protection**, included this passage: *"It is clear that there is a need to expand the view of ionizing radiation events leading to the effect on individual organisms to the understanding of the interactions of multiple stressors in ecosystems. A multidisciplinary strategy will, therefore, need to be developed. The participants also recognized important knowledge gap… .* *"Tools need to be developed to tackle the problem of scale (time, space, organization levels). This means, for example, implement tools that will allow scientists to evaluate risk in populations over generations and within a variety of environments."* To sum up the three above excerpts, I believe it is clear that they all recognize the need to pursue ongoing investigative studies in the field, as an essential accompaniment to computer models, the latter ever-evolving for various purposes as well.	
14.	Dr. Sandy Greer	**MY SUMMARY FEEDBACK** Despite the many legitimate criticisms by the nuclear industry in regard to the draft document REGDOC-2.11.1, Vol. III, ver.2, certain comments do not reassure me that industry has sufficient humility, and willingness, to recognize how little is authentically known in these early years of environmental protection research, in regard to the range of impacts of various radionuclides upon multiple levels of the environment, especially through time. The reality is, the learning curve is relentless to replace assumptions with much better evidence, as certain	See responses to comments #44 and 84 in table B and radionuclides.

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		passages within this CNSC draft acknowledge. I distrust an industry attitude that communicates an apparent reluctance to the continual need to improve. For example, comment #38 for CNSC doc section 7.1.1.1, regarding bullet 7 complains: “Without this [benchmarks] being defined, analyses may be subject to a moving yardstick, resulting in potential rework each time that a new potential contaminant is identified.” Well, yes, actually. I have yet to see a proper list of radionuclides, and the evidence is not yet available scientifically about the multiple ways that various radionuclides - once released into watersheds, after containers have eroded and/or other potential mishaps - will impact the environment. Ironically, the ‘Suggested Change’ in comment #35, for CNSC doc section 6.11, gives perhaps the most revelatory insight into the industry mindset: *“Replace the last bullet on page 13 identifying things the licensee/applicant should do as part of the integration to read,* [and the NWMO template shows the following passage in red] ***“Acknowledge their limitations on the understanding of waste management system, its evolution, and its potential impact on people and the environment.”*** To conclude, the above limitations are precisely why I am against the licencing of proposed DGRs, the latter my particular battlefield through six years, given the huge gaps in knowledge, hence basic lack of scientific justification to distribute licences vis à vis the range of potential risks and dangers, known and unknown.	

Table D: Workshop with industry and civil society organizations / Tableau D: Atelier avec l'industrie et avec des organisations de société civile

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1.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	1.1	**MAJOR** While it has been clarified that the REGDOC applies to all types of radioactive waste, and therefore licensees, it should be acknowledged that not all licensees will host to their own disposal facility. **Suggested change:** Add a sentence such as, "This includes waste generated by another licensee and transferred to a waste owner for disposal under a commercial agreement." **Impact on industry:** As issues related to waste management draw increased political and public scrutiny, it's imperative that all readers of this REGDOC understand the relationship between waste producers and owners and their commercial agreements. Plain language helps reduce misunderstandings.	No change made. The requirements of this REGDOC are for the licensee or applicant. The potential transfer of ownership from one licensee to another is outside of the scope of the REGDOC.
2.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	1.2	**MAJOR** Licensees believe the Scope requires further refinements. Specifically: 1) The 2nd sentence of the 1st paragraph adds more confusion than clarity. Are the "long-term radioactive waste management facilities where there is no intention to retrieve the waste" not disposal facilities? What period is considered "long-term?" Clarification is required for times when this REGDOC sets requirements above those in REGDOC 2.11.1 Volume I. 2) CNSC changed the wording in this version. What the difference is between the "type" of waste and "class" of waste? 3) Earlier comments on the need for a glossary of waste management classifications appear to have been disregarded. Even if all waste types are captured, it is still necessary to include a clear definition of disposal. 4) The 2nd paragraph is unclear when it says, "The post-closure safety case considers information from the preclosure phase (site preparation, construction, operation, decommissioning) insofar as this information impacts post-closure safety." **Suggested change:** For clarity:	1)The paragraph was changed to: "This regulatory document addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal systems facilities, which includes locations or sites, for all classes of radioactive waste. This document also applies to long-term radioactive waste management facilities, locations or sites where there is no intention to retrieve the waste. **Note**: In this regulatory document, the term 'disposal facilities' also refers to disposal locations or sites, which are not classified as 'nuclear facilities' under the NSCA." 2)When referring to licensees or wastes, the term "type" was replaced with "class" throughout the document. 3)The definition of disposal is in the CNSC glossary 4)The first paragraph of the section states that "This regulatory document addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal…" Pre-closure or the operational phase is discussed in other regulatory documents and CSA standards on the operation of waste facilities.

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			1) Amend the 1st paragraph to read, "This regulatory document addresses the development of a safety case and supporting safety assessment for the post-closure phase of disposal systems (facilities, locations or sites) for all classes of radioactive waste. This document also applies to longterm radioactive waste management facilities where there is no intention to retrieve the waste" 2) If 'type' and 'class' are intended to mean the same thing, make the wording consistent in all sections. 3) Provide a clear definition of disposal. Waste management and disposal-related definitions should also be consistent (e.g., captured in REGDOC-3.6, Glossary of CNSC Terminology, or simply the same in each of the interdependent REGDOCs). 4) Is there a specific safety case? Is this post-closure only? The comment does not align with the safety case definition and "all aspects" not just post-closure. Is there a pre-closure safety case? The use of the terms 'safety case' vs 'safety assessment' needs to be reviewed. **Impact on industry:** A failure to differentiate long-term waste management and disposal could lead to misunderstandings by licence holders and members of the public. Also, the requirements listed in this document are different than those for an operating waste management facility as defined in REGDOC 2.11.1 Volume I. This may result in expectations that are unclear for both Licensees and interveners. Without more clarity, this REGDOC could result in additional safety cases being developed for the different project lifecycle phases when what is required is a safety assessment and updates to the facility's existing safety case.	
3.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-	2	**MAJOR** As per licensees' general comment, the waste management REGDOCs (2.11.1 Vols I, III and 2.11.2) are clearly interdependent as cited in the 1st list of bullets. However, their review and publication seem independent, or phased. **Suggested change:** Present the complete package of interdependent REGDOCs to the Commission at the same time so that the final, published versions reference	The following draft REGDOCs will be presented to the Commission as a package to complete the CNSC's regulatory framework related to waste management: ● 1.2.1, *Guidance on Deep Geological Repository Site Characterization* ● 2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* ● 2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2* ● 2.11.2, *Decommissioning* ● 3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

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	Québec, Kinetrics, NB Power, NWMO, OPG, Orano		only the published REGDOCs. **Impact on industry:** Draft guidance is subject to change. There are references to both draft and published REGDOCs in this version. Together with the LCH effective dates, these versions make the path (e.g., timing of) to compliance unclear.	
4.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	4	**MAJOR** The 2nd sentence in the 1st paragraph needs to be amended since a safety case will always include some form of safety assessment. **Suggested change:** Amend to read, "A safety case normally includes a safety assessment, but could also typically include information (such as supporting evidence and reasoning) on the robustness and reliability of the disposal system safety assessment and the assumptions made therein." **Impact on industry:** If the intention is the reliability and robustness of the safety assessment then this is a major comment. It is unclear how this requirement can be adequately demonstrated.	The definition aligns with REGDOC 3.6, therefore no change was made. REGDOC 2.11.1, Volume III sections on General Requirements and Components of a Safety Case stipulate that the requirement for a disposal facility safety case include a safety assessment and the safety case strategy include key elements such as robustness.
5.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.2	**MAJOR** The description of containment and isolation should make it clear that it is the overall barrier system that will provide protection over the timeframe of the safety case. **Suggested change:** Amend the 1st sentence under the Containment and Isolation section to read, "…by presenting evidence that the overall barriers system retains its their safety functions during the safety case timeframe." **Impact on industry:** As written, the sentence can be interpreted to apply to each individual barrier.	The change was made as suggested.
6.	Bruce Power, BWXT, Cameco, CNA,	7.2 and 7.4.1.1	**MAJOR** Section 7.2 says the strategy shall identify elements to provide confidence in safety and includes passive safety features among the bullets. In section 7.4.1.1., under Passive Safety, it says "...should take passive safety means	The "should" statement in section 7.4.1.1 was changed to a "shall".

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	CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano		into account in the design of the facility to minimize the dependence of safety on active means, as much as possible." **Suggested change:** Revise section 7.2 to be consistent with 7.4.1.1. **Impact on industry:** Should vs. Shall agreement. Wording needs to be consistent between sections so it's clear how to comply.	
7.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.4.1.1	**MAJOR** Site selection is a separate process that is normally carried out in support of the impact assessment. Site selection findings could contribute to the Safety Case, but there is no need to duplicate the site selection process here. **Suggested change:** Amend the 1st sentence on page 10 to read, "…ensure that the safety assessment describes references the approach and criteria used in site selection…" **Impact on industry:** Introduction of the site selection process duplicates what is an exhaustive process that has already been carried out.	The sentence was changed to: "The licensee or applicant shall ensure that the safety assessment describes and/or references the approach and criteria used in site selection and demonstrate that the site selected is in accordance with the safety strategy and any criteria that have been established."
8.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO,	7.4.1.2	**MAJOR** Licensees believes this passage is too general should be amended for clarity and to better align with IAEA SSR 23 Operational Aspects relevant for longterm safety. **Suggested change:** Amend to read, "While operational safety aspects are outside the scope of this document, the impacts of preclosure activities on the post-closure safety shall be minimized. While operational safety aspects are outside the scope of this document, the licensee shall ensure that post-closure safety will not be impacted by preclosure activities." **Impact on industry:**	The paragraph was changed to: "While operational safety aspects are outside the scope of this document, the licensee shall ensure that the impacts of pre-closure activities on post-closure safety are assessed and minimized."

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	OPG, Orano		The phrasing “not be impacted by pre-closure activities” is too general. For example, the basic pre-closure activity of excavation impacts the post-closure safety, in that the excavation and excavation damaged zone (EDZ) must be accounted for post-closure. The suggested change clarifies that the post-closure safety assessment has considered the operational activities that took place pre-closure.	
9.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.10	**MAJOR** Licensees have the following concerns and suggestions for this section: 1) The 2nd bullet says the licensee should compare end points to acceptance criteria" but 7.10.1 says the licensee or applicant shall compare endpoints to acceptance criteria. 2) The word “any” in the 3rd bullet of the 2nd bullet list is too broad. It should be based on significance. 3) There is no need to divide the list of bullets. Align bullets 3 to 5 of second paragraph with IAEA SSG-23 Paragraph 4.77. **Suggested change:** For clarity, the CNSC is urged to: 1) Remove 2nd bullet (7.10). It is not necessary. 2) Amend the 3rd bullet in the 2nd bullet list to read, “provide significant any findings that…” 3) Deleted the 2nd use of “The licensee or applicant should” and continue the bullets from the previous paragraph. 4) Align with IAEA-SSG-23 Paragraph 4.77, which says, “The bullets listed are sub bullets in the case where there is a contradiction as indicated below: Findings that are in contradiction to arguments made in the safety case and uncertainties should also be discussed and analysed. This necessitates a detailed discussion of the following: — The treatment of uncertainty in the safety case and supporting assessment; — The quality and reliability of the science and the design work that form the basis for the safety case; — The quality and reliability of the safety assessment, including the development of each scenario, the adequacy of the range of scenarios considered, assessments of their likelihood, and the adequacy of the methods, models, computer codes and databases used; **Impact on industry:** Should vs. Shall agreement. Wording needs to be consistent between	1)The second bullet was removed. Bullets in section 10 were revised to incorporate IAEA recommendation. 2)Bullet was changed to: “provide findings that contradict the arguments made in the safety case” 3)The sentence was changed to: “In addition, the licensee or applicant should[…]” 4)No change as this aligns with the CSA standard.

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			sections so it's clear how to comply.	
10.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	8.1.1.1	**MAJOR** Licensees have the following concerns with this section: 1) This section refers to "benchmarks" enabling the licensee to identify likely sources of data, however there is no guidance provided how this data is to be used to derive appropriate requirements and acceptance criteria. 2) Bullets (a) and (b) are essentially duplicates of (c) and (d) 3) The CNSC changed the wording to "if the expected annual dose of less than 1 mSv…" **Suggested change:** For clarity, the CNSC is urged to: 1) Add clarity that the benchmark data does not become the requirement by default. Rather, it is an input to the process that is being used to determine the requirements. Reference RD-2.9.1. 2) Delete (a) and (b) since (c) to (e) are consistent with IAEA SSR-5 3) Change "dose of less than" to "dose is less than". **Impact on industry:** With no guidance, benchmark data may result in overly conservative requirements.	The proposed changes have been incorporated as suggested.
11.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	8.1.4.2	**MAJOR** This section now says, "The licensee should verify and validate all computer software used for the safety assessment." But if this is commercial software being used in accordance with its manual etc., the licensee or applicant should be able to refer to existing validation. Also, 'or applicant' is missing from this line. **Suggested change:** Remove the licensee performed validation from commercial software. Reference to existing validation should be sufficient. Add "or applicant" after "Licensee" **Impact on industry:** Licensee or applicant shouldn't have to validate commercial software that is being used appropriately. References to existing validation should be sufficient.	The change was made as suggested.

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12.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	Figure 1 and 5.2	Confirm that the illustration of a postclosure safety case in Figure 1 and the description in Section 5.2 are aligned with the application requirements in the regulations (e.g., GNSCR and Class I). **Suggested change:** This REGDOC should align with the requirements for submitting safety analysis reports in the Class I Regulations (i.e., preliminary safety analysis with the construction licence application and final safety analysis for operations).	The *Class I Nuclear Facilities Regulations* and this REGDOC are aligned. This regdoc provides greater detail and clarity about how to implement the Class I requirements for the submission of a safety analysis for the post-closure period.
13.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	4	The labels in the Figure 1 headings should be consistent with sections within the REGDOC. **Suggested change:** Please confirm for consistency	The figure was updated accordingly.
14.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-	7	Additional context should be added to the 1st paragraph, which says, “The safety case shall include the following components, as illustrated in figure 1:” **Suggested change:** Add a comment that this information can be combined, e.g. disposal system description could include safety features. This would provide flexibility for licensees to present the required information.	A sentence was added at the end of the section as follows: “Note that there are many possible ways of structuring and documenting the safety case.”

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15.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	7.9	This section title could better reflect its content. **Suggested change:** The focus of this section is on requirements for institutional control vs safety features. Licensees suggest the title be amended to reflect the focus of section.	The title was changed to “Institutional control”.
16.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	8.1.1.3	Under the ‘Identification of human and environmental receptors’ section, the 2nd sentence requires a slight edit since there may not always be a different pathway. **Suggested change:** Amend to read, “The exposures of persons and the various receptor organisms can will occur by different pathways and will be judged by different acceptance criteria even when all receptors are present in the same environment at the same time.”	The change was made as suggested.
17.	Michael Stephens		My comments on the REGDOCs were pretty basic: • The need for a much better definition of “storage” in the CNSC glossary (The IAEA definition is clear.)	Given time constraints, the REGDOC 3.6, *Glossary of CNSC Terminology* will not be part of the workshop but CNSC staff will consider your comments as part of the next revision of the Glossary. This will be done after the suite of REGDOCs is published in order to incorporate the changes in definitions that were included in

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				those five documents. Please note that we are always seeking greater alignment with IAEA definitions but the scope of workshop does not include comments on the glossary or other CNSC REGDOCs as well.
18.	Michael Stephens		Confusion between the terms "long-term waste management" and "disposal" (e.g., Is a "long-term waste management facility" just another term for long-term storage, from which waste is planned to be retrieved – and not disposal. Are the Port Hope and Port Granby facilities considered to be storage or disposal? I have heard people who should know disagree on the point. Is a closed waste repository still a "waste management" facility? I always thought it was.)	The definitions for these terms are found in CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*: **Disposal** — emplacement of radioactive waste or irradiated fuel in a repository without the intention of retrieval and in a way that prevents or limits the release of the radioactive material into the environment. **Long-term management** — a coherent set of activities required to ensure controlled containment and isolation of radioactive material while in long-term storage or in a disposal facility prior to closure. This would include all systematic processes to coordinate, direct, and control operations.
19.	Michael Stephens		Acceptability of "in-situ" decommissioning (e.g., Which types of "legacy" facilities would potentially be acceptable? Why?)	This is covered in REGDOC-2.11.2, *Decommissioning*. In addition to uranium mines and mills, potential legacy facilities for which in-situ may be considered a reasonable decommissioning would be research and demonstration facilities dating back to the birth of nuclear technologies in Canada for which decommissioning was not planned as part of the design. In selecting the appropriate decommissioning strategy, the licensee must consider several factors, such as potential environmental impacts, potential worker and public radiological doses. If the proposed in-situ decommissioning would result in a waste disposal facility, proponents must also demonstrate safety via a safety case and supporting safety assessment meeting the requirements of REGDOC 2.11.1, Volume III.
20.	Ralliement contre la pollution radioactive		Nowhere has the CNSC clearly defined what is "non-prescriptive" regulation. At first glance, the concept seems contradictory: Regulation are normally created to prescribe actions and to dictate obligations, aren't they? We understand that the CNSC's initiative aims to give the greatest possible freedom and the widest possible initiative to nuclear developers so that they can come up with original and safe solutions. In short, proposing objectives and imposing a performance obligation, rather than prescribing pre-defined cast in stone solutions.	The Cabinet Directive on Regulation encourages departments and agencies to make regulations that are "Outcome of performance based" as follows: "Departments and agencies should seek to design outcome, or performance-based, regulations when appropriate, with a view to minimizing the amount of regulatory burden imposed on businesses and Canadians. Outcome, or performance-based, regulations specify the desired result that a regulation intends to achieve, rather than a prescriptive description of compliance.

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			The entire third volume of REGDOC 2.11.1 aims to finely describe the "safety case" with which a promoter should eventually prove that his project is safe. Obviously, the CNSC has done a noteworthy job of detailing with such precision all the required steps in order to credibly demonstrate that a particular project will be safe. That doesn't make it a fascinating read. We would certainly have fallen asleep reading this endless series of guidelines if we had not had the invaluable and exceptional benefit of having already seen it in operation.	This type of regulation increases flexibility for regulated parties as well as departments and agencies, and requires the regulated communities to focus on achieving specific and measurable outcomes" The CNSC's regulatory framework is designed such that greater clarity on regulatory requirements, as well as guidance on how to meet the requirements, is provided in regulatory documents. In applying for a licence or a licence renewal, proponents present details on how they intend to meet these requirements. The Commission considers the applicant's proposal and, if it issues a licence, the licensee is legally bound to the requirements that are included, by the Commission, in the Licence and the Licence Conditions Handbook. Although the NSCA and its regulations are generally non-prescriptive, the radiation protection dose limits under the *Radiation Protection Regulations* are prescriptive and are in alignment with the core radiation protection principle of limitation. A licensee or applicant of any nuclear facility or activity must clearly demonstrate that doses are below their respective dose limits, and that the annual total effective dose received by a member of the public is below 1 mSv/year. This is a regulatory requirement and forms just one of the safety requirements that has to be demonstrated by a safety case.
21.	Ralliement contre la pollution radioactive		Thanks to our multiple Access to Information Act requests, we were able to follow the main technical documents that Canadian Nuclear Laboratories submitted to the CNSC to demonstrate the safety of their project for an aboveground radioactive landfill in Chalk River. We found that this portion of REGDOC has been applied long before its eventual adoption. We can also attest that this evaluation followed the steps provided for in volume 3 of REGDOC 2.11.1. And since the CNL published a revised description of their project for a surface radioactive dump at Chalk River, we must also recognize that this procedure has a certain efficiency: the 2nd version of the NSDF project is clearly safer than the initial version, in 2017. On the other hand, we were also able to observe some weaknesses… and we find the same loopholes in REGDOC 2.11.1.	This draft REGDOC was developed based on REGDOC-2.11.1, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management* Revision 1 (formerly G-320, *Assessing the Long term Safety of Radioactive Waste Management*). REGDOC-2.11.1, Volume III, Revision 1 assists applicants for new licences and for licence renewals in assessing the long-term safety of radioactive waste management. This document describes approaches for assessing the potential long-term impact that radioactive waste storage and disposal methods may have on the environment and on the health and safety of people. This document was also developed using best international practices and requirements from international safety standards, including IAEA SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*. It is CNSC's expectation that licensees comply with applicable regulatory documents and meet international best practices, including safety standards.
22.	Ralliement contre la pollution		First weakness of this 3rd volume of this REGDOC: it does not say anywhere that the safety case negotiation must be done in public. In this actual case, both the CNL and the CNSC have tried to prevent any access to	REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2 outlines that the lifecycle approach to the development of the safety case enables ongoing engagement with the public and Indigenous

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	radioactive		their working papers and to the status reports of their negotiations, as if they had incriminating actions to hide. Although intermittent, our stubborn surveillance could effectively have prevented them from making too many indefensible compromises. Public access helps to restrict arbitrariness. Canada's Access to Information Act only applies to the federal government itself. It’s almost unheard of that we have been able to successfully invoke it against a private consortium. The law certainly would have no control whatsoever over an electricity company or over the private developer of a small modular reactor, for example. This is why the REGDOC must require that all technical studies underlying the safety case be accessible to the public, as well as all the negotiation steps with the CNSC, when the promoter is not covered by Canada’s Access to Information Act.	groups and the incorporation of stakeholder feedback. The safety case provides a basis for decision making and is presented to the Commission for their review and consideration as part of the public Commission process.
23.	Ralliement contre la pollution radioactive		Even if the promoter of a dumping ground can draw up his safety case himself, that does not justify the systematic elimination of any prescriptive provision. In the new formula, the real standards are said to be found in section 8.1.1.1 of volume 3, entitled "Acceptance criteria used in the assessment". This section claims to set the criteria by which the safety results will be deemed acceptable. Unfortunately, the present REGDOC is far too weak and not prescriptive enough here. The first paragraph of section 8.1.1.1 even states that "the license holder should also define the precise criteria of the level of security to be achieved". Thereafter, the regulation "suggests" the rules that should apply. Or, it signals the existence of external "guides", which have no binding value. We completely disagree with such laxity. It is a question here of clearly defining what degree of security the promoter must achieve. **This is a task that clearly belongs to the CNSC. The precise criteria for the level of safety to be achieved must be specified in the REGDOC, explicitly**. In the area of <u>radiological protection of persons</u>, for example, REGDOC first recalls the current rule according to which a radioactive dump site must never expose any member of the public to more than 1 millisievert of radiation per year. In order for the promoter to be sure of always respecting this standard, the REGDOC therefore <u>suggests</u> aiming for a lower target, in the simulations. It states that the International Commission on Radiological Protection (ICRP) and the IAEA document SSR-5 both recommend targeting	The *Radiation Protection Regulations* (RPR) stipulate a dose of 1mSv/yr limit for public protection. The RPR also defines the ALARA principle. However, the need for further conservatism is recognized and a dose constraint is often recommended to take into account the potential for exposure to the representative persons from multiple sources that may be present in the vicinity of the project in question, including potential future sources. External sources that can generate a cumulative impact are specific to each project, therefore the prescription of a dose constraint is not appropriate. However, using the ALARA principle, the acceptance criteria for the protection of the public proposed by the applicants and accepted by the CNSC are a fraction of the public dose limit.

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			a dose constraint of 0.3 mSv per year. Again, it is not enough to point out the existence of these international proposals, especially when they are non-binding. The CNSC must formally assess the validity of these IAEA proposals. And if they are valid, the <u>CNSC must then impose them in its regulations</u>. Otherwise, the CNSC is in serious breach of its obligations to protect the public.	
24.	Ralliement contre la pollution radioactive		On the next page of section 8.1.1.1 of volume 3, REGDOC addresses the risk of human intrusion. This is the main vulnerability of an above-ground dump whose integrity must be preserved for several centuries. Here again, the draft REGDOC settles for a simple reference to the IAEA's SSR-5 document which suggests target doses which should protect the public during a human intrusion into the landfill. Unfortunately, these IAEA proposals turned out to be dangerously inadequate when the CNL attempted to apply them to their Chalk River dump project. **REGDOC will therefore have to strengthen those suggested doses and impose them as mandatory requirement.** In the IAEA proposal, the promoter is not bound to any improvement when he “expects” that the public will not be exposed to more than 1 milliSievert per year due to human intrusion. Also, according to the IAEA, the public dose has to exceed 20 mSv per year before the promoter is invited to exclude the most dangerous radionuclides in his waste acceptance criteria. This is 20 times the maximum radiotoxicity allowed in Canada! Once again, this language is MUCH TOO WEAK, especially if the CNSC settles for quoting these international suggestions, without even adopting and imposing them. Our criticism is not theoretical. Some scenarios from the Canadian Nuclear Laboratories have concluded that future public doses of more than 20 mSv/year could happen at the Chalk River landfill. The proponent tried to ignore its own conclusion and the CNSC had to intervene to lower the acceptance criteria for the problematic radionuclides. There is no reference to these incidents in the revised project description, of course. We also noted with concern that the results of these simulations can change by one or two orders of magnitude, by modifying very slightly the initial hypotheses: if a family built a house on the mound, in a few centuries, would it have a dug out basement? Where exactly would his drinking water well be? What diameter, the borehole? So many nuances that can completely change the conclusions! The CNSC cannot let any promoter adjust these criteria as he sees fit, especially when such "details" threaten the survival of his project!	The CNSC expects that disposal facilities are developed in such a way that people and the environment are protected both now and in the future. In this regard, the prime consideration is the radiological hazard presented by radioactive waste. The ICRP developed the System of Radiological Protection that applies to all facilities and activities, and this system was adopted in the International Basic Safety Standards and the CNSC have included the criteria is this REGDOC. Regarding human intrusion, the criteria recommended by the IAEA, which comply with the ICRP recommendations, in fact stipulates that if the calculated dose is between 1 and 20 mSv that an optimization of the design of the installation should be made to reduce the probability of this intrusion: “If annual doses in the range 1–20 mSv are indicated, then reasonable efforts are warranted at the stage of development of the facility to reduce the probability of intrusion or to limit its consequences by means of optimization of the facility’s design”. As a result of this comment, the third paragraph of the section titled Radiological Protection of Persons has been revised to remove the wording “For inadvertent human intrusion scenarios” to align with SSR-5 *Disposal of Radioactive Waste.* Concerning the evolution scenarios considered in the safety assessment, a normal evolution is defined, along with a series of disruptive scenarios. To define these scenarios, the proponent usually refer to an international FEP list (features, events and processes) published by the NEA and the IAEA. A normal evolution scenario must consider the events and processes that may occur with a significant probability during the useful period of the installation. Disruptive scenarios, including the intrusion scenario, correspond to low probability events and processes. The consequences of these scenarios can result in an impact beyond the dose constraint; however, given the low probability associated with these scenarios, the results should be judged in terms of risk, probability, consequence, rather than focusing on the consequence in absolute terms.

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			Finally, this 3rd volume of REGDOC 2.11.1 systematically transforms into suggestions (i.e.: "the promoter should do such a thing) provisions which have no meaning when they are not mandatory. Section 8.1.2.1 says, for example, that the applicant "must" include site characterization data in his security assessment.	Safety assessment results that are generated by computer models are sensitive to the assumptions and the input data used in the models. REGDOC-2.11.1, Volume III addresses this concern by stipulating that when comparing the results of the assessment to acceptance criteria the licensee should include a discussion of the conservatism of the assumptions and input data as well as how all other safety requirements are met even if the results are acceptable. In other words, the assumptions on the containment capabilities of the disposal system, and on the receptors' lifestyle and habits have to be demonstrated to be sufficiently conservative to come to an overestimate of the impact. This REGDOC also stipulates that the licensee shall use conservative assumptions to bound any uncertainties and show that there remains a sufficient safety margin. The details of all modelling are reviewed by the CNSC and the proponent must submit sufficient information for the CNSC to verify the modelling results independently. Information about a site which is used to inform the safety case and supporting safety assessment include the regional, local, and site-specific characteristics. The level of detail of a site required to support a safety case evolves over-time. Early safety cases, which may be more conceptual, may rely more on information from the regional or local study area, as opposed to site-specific characteristics. For this reason, although it is mandatory that site characterization data be included and inform the safety assessment, the level of detail will also evolve over time and will be site and project specific.
25.	Ralliement contre la pollution radioactive		5) If the CNSC continues to base public safety on the safety case submitted by each applicant, a. It must clearly impose the precise criteria which will define the level of security required of each radioactive waste landfill. b. It must carefully reassess the recommendations of external organizations (international or canadian) and justify their adoption before incorporating them into this REGDOC. c. It must avoid transforming into simple advice any expectation that is essential to obtaining credible conclusions in the safety case. d. It must require that all the elements of the safety case be accessible to the public, as well as all the stages of its evolution during the negotiations between the promoter and the CNSC.	The safety case and supporting safety assessment must show that the facility meets the regulatory dose limit, safety requirements and acceptance criteria, such as any proposed dose constraints. Every facility must also meet all other applicable requirements and regulations. It is CNSC's expectation that licensees comply with applicable regulatory documents and meet international best practices, including safety standards, which are applicable at the time of the application. Please note that quantitative criteria might change with future revisions of the standards. The "shall" and "should" statements in this REGDOC have been carefully considered, they complement CSA and align with IAEA requirements.

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				The safety case provides a basis for decision making and is presented to the Commission for their review and consideration as part of the public Commission process. As outlined in REGDOC-2.11.1, Volume III, CNSC expects that the lifecycle approach to the development of the safety case enables ongoing engagement with the public and Indigenous groups and the incorporation of stakeholder feedback

Canada's Nuclear Regulator

CNSC CCSN

Waste Management

Decommissioning

REGDOC-2.11.2

May 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Decommissioning
Regulatory document REGDOC-2.11.2

Cat. No. NNNNN
ISBN NNNNN

Également publié en français sous le titre : Déclassement

Document availability
This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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YouTube: youtube.com/cnscccsn
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LinkedIn: linkedin.com/company/cnsc-ccsn

Publishing history
[Month year]   Version x.0

Preface

This regulatory document is part of the CNSC's waste management series of regulatory documents, which also covers decommissioning. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-2.11.2, *Decommissioning*, sets out requirements and guidance regarding the planning and preparation for as well as the execution and completion of decommissioning.

This document supersedes G-219, *Decommissioning Planning for Licensed Activities*, published in June 2000.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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Decommissioning

1. Introduction

1.1 Purpose

This regulatory document provides requirements and guidance regarding the planning and preparation for as well as the execution and completion of decommissioning.

The CNSC defines decommissioning as the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility, location or site where nuclear substances are managed, used, possessed or stored. Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination, dismantling or cleanup) that are taken to retire a facility, location or site from service with due regard for the health and safety of people and the environment.

1.2 Scope

This regulatory document provides requirements and guidance for all phases of decommissioning, from planning for to completion of decommissioning.

This document applies to Class I and Class II nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices licensees that are required to have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their licence. For all other licensees, the information in this regulatory document may be used as guidance.

This regulatory document is not intended for the decommissioning of a site following a radiological or nuclear accident, but may be used as guidance. It is also not intended for the remediation of sites or locations contaminated by residual radioactive material arising from past activities that were never subject to regulatory control or subject to regulatory control before the *Nuclear Safety and Control Act* (NSCA) and its associated regulations came into force, but may be used as guidance.

This regulatory document is complemented by the requirements and guidance in CSA N294, *Decommissioning of facilities containing nuclear substances* [1]. Together, this regulatory document and CSA N294 provide requirements and guidance for decommissioning. Furthermore, this regulatory document is complemented by other CNSC regulatory documents.

1.3 Relevant legislation

The following provisions of the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it are relevant to this document:

- NSCA, subsection 24(5) and paragraphs 26(e) and 26(f)
- *General Nuclear Safety and Control Regulations*, paragraph 3(1)(l)
- *Class I Nuclear Facilities Regulations*, sections 7 and 8, subsections 14(3) and 14(4), and paragraphs 3(k), 5(i) and 6(h)
- *Class II Nuclear Facilities and Prescribed Equipment Regulations*, sections 3 and 5
- *Uranium Mines and Mills Regulations*, section 7, paragraphs 8(b), 8.3(2)(c), and 8.3(2)(d), and subparagraph 3(a)(viii)

2. The CNSC's waste management framework

In addition to this regulatory document, the CNSC's regulatory framework regarding waste management, specifically decommissioning, includes:

- REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada* [2]
- REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [3]
- REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [4]
- Draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste* [5]
- Draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* [6]

The following CSA standard complements the CNSC's regulatory framework regarding waste management, specifically decommissioning:

- N294, *Decommissioning of Facilities Containing Nuclear Substances*

3. Background

3.1 The lifecycle approach to decommissioning

The CNSC requires that planning for decommissioning take place throughout the lifecycle of a nuclear facility, location or site or for the duration of a licensed activity.

Lifecycle decommissioning planning is important in:

- ensuring that a nuclear facility is sited, designed, constructed and operated in a manner that will facilitate decommissioning
- ensuring that a licensed activity is conducted in a manner that will facilitate decommissioning
- ensuring that the selected decommissioning strategy is a technically feasible approach that protects health, safety, security and the environment
- ensuring early engagement with surrounding communities on proposed decommissioning plans
- ensuring that licensees are able to prepare for the costs of decommissioning
- ensuring that potentially difficult or challenging technical problems are identified in advance so that solutions can be pursued in a proactive manner
- enabling portions of the facility, location or site to be decommissioned, which will permit the assessment of decommissioning while the licensee continues operations
- estimating the quantities, types and classes of waste that will be generated and managed during decommissioning
- maintaining records
- ensuring that the eventual release from CNSC licensing is considered throughout the lifecycle of the facility, location or site

Throughout the lifecycle of a nuclear facility or for the duration of a licensed activity, except for release from CNSC regulatory control, a decommissioning plan is required. A preliminary decommissioning plan (PDP) is developed during the siting phase for a Class I nuclear facility and uranium mine and mill, the construction phase for a Class II nuclear facility, or prior to submitting an application for a CNSC licence to possess, manage, use or store nuclear substances at a location. The PDP is progressively updated, where needed, to reflect the appropriate level of detail required for the respective licensed activities. Prior to the decommissioning stage, a detailed decommissioning plan (DDP) is developed. The DDP refines and adds details to the PDP.

Decommissioning planning must be applied to all types of licensed activities. The decommissioning plan for a small facility, location or site with few residual hazards (e.g., a particle accelerator) may consist of a brief summary of a single-phase, relatively low-cost project, and employ standard decontamination, dismantling and radiation protection procedures in the completion of one or two work packages. For the larger, more complex facilities, locations or sites (e.g., nuclear power plant), the same planning for decommissioning may generate plans that describe a multi-phase program addressing a variety of different facility, location or site components and/or locations, and employ a number of specialized decommissioning programs and procedures.

The licensee may consider dividing a complex facility, location or site into a number of relatively independent planning envelopes. For example, a large facility may be divided into areas (i.e., planning envelopes) that, from the point of view of decommissioning, are relatively physically independent from one another. It may also be possible to divide a decommissioning plan into relatively independent phases on the basis of requirements for lengthy periods of storage with surveillance, or to include components of the licensed facility that could be decommissioned during its operating life.

A licence to decommission or a licence that authorizes decommissioning activities is required for Class I and Class II nuclear facilities and uranium mines and mills prior to the execution of decommissioning. For sites with more than one facility or location that are at different lifecycle stages, the CNSC may issue a licence that includes multiple activities (e.g., operate and decommission).

3.2 Phases of decommissioning

The typical phases of decommissioning are:

- planning for decommissioning – begins at siting (or construction for Class II nuclear facilities, or prior to conduct of licensed nuclear substance activities) and continues through operation until the preparation for decommissioning phase
- preparation for decommissioning – begins with the decision to cease operations or the conduct of activities, and includes activities for permanent shutdown or cessation and for the transition to a stable state for decommissioning
- execution of decommissioning – begins when decommissioning activities commence, which may include decontamination, dismantling and/or clean-up, and any period of storage with surveillance, until the end state is achieved
- completion of decommissioning – involves verifying that decommissioning activities have been completed and that the end state has been achieved. Decommissioning ends with the release of the facility, location or site from CNSC regulatory control, even if the CNSC subsequently authorizes the site for any other licensed activity in the future, or if unrestricted release cannot be achieved, institutional controls are required to be in place

These phases are discussed in sections 5 to 8, respectively, of this document.

The time period for the conduct of decommissioning actions typically ranges from a few weeks for small and simple facilities, locations or sites to years or decades for larger and more complex facilities, locations or sites. For some small or simple facilities, locations or sites with a very low level of hazard, decommissioning actions may consist only of the removal and return of radioactive sources to the supplier, followed by a survey to verify that there are no areas with residual contamination above end-state conditions.

Assessments of radiological and non-radiological conditions prior to and during decommissioning are an integral part of decommissioning planning and execution. Decommissioning surveys, including characterization, throughout the various stages in decommissioning are described in section 9.

4. Optimization and Graded Approach in Decommissioning

The licensee shall ensure that protection of health, safety, security and the environment is planned and optimized during decommissioning.

The licensee may apply a graded approach in all aspects of decommissioning, commensurate with the type, scale, complexity, maturity, physical state, inventory, uncertainty and reliability of information, and risk associated with the decommissioning of the facility, location or site.

With a graded approach, all of the requirements in this document shall apply, but to varying degrees depending upon the safety significance and complexity of the work being performed. The level of analysis, the depth of documentation and the scope of actions necessary to comply with the requirements of this document shall be commensurate with the nature and level of the hazards, the complexity of the facility, location or site, and the characteristics of the waste.

A graded approach, if utilized, shall be applied in a way that does not compromise the protection of health, safety, security and the environment. Further information on the graded approach can be found in REGDOC-3.5.3, *Regulatory Fundamentals* [7].

5. Decommissioning Strategy

The licensee shall select a decommissioning strategy that will form the basis for planning for decommissioning and facilitate achieving the desired end state of the decommissioning project. For Class I nuclear facilities and uranium mines and mills, the decommissioning strategy shall be selected during the siting stage. For Class II nuclear facilities, the decommissioning strategy shall be selected during the construction stage. Prior to submitting an application for a licence to possess, manage, use or store nuclear substances at a location, the decommissioning strategy shall be selected For existing facilities, uranium mines and mills and nuclear substances and radiation device licensees who are required to have a decommissioning strategy and where there is no decommissioning strategy, the licensee shall select a suitable strategy for decommissioning as soon as possible.

The following decommissioning strategies should be considered individually or in combination:

a) immediate (prompt) decommissioning – to decontaminate, dismantle and/or clean up without any planned delays
b) deferred decommissioning –

   i. to place the facility, location or site in a period of storage with surveillance (sometimes referred to as care and maintenance), followed by decontamination, dismantling and/or clean-up
   ii. to conduct activities directed at placing certain buildings or facilities, locations or sites in a safe and secure interim end state, followed by a period of storage with surveillance, and ultimately, decontamination, dismantling and/or clean-up

c) *in situ* decommissioning – to place the facility, location or site, or portions thereof, in a safe and secure condition in which some or all of the radioactive contaminants are disposed of in place, which may result in the creation of a waste disposal site

When determining the appropriate decommissioning strategy, the licensee should consider the following, as appropriate:

- public and Indigenous engagement
- potential impacts on Indigenous and/or treaty rights
- operational experience and lessons learned
- forms and characteristics of radioactive and non-radioactive contamination
- integrity of containment and other structures, systems and components (SSCs) over time
- availability of decontamination, disassembly and clean-up technologies
- potential for recycling or reuse of equipment and materials
- availability of knowledgeable staff
- potential environmental impacts
- potential worker and public radiological doses
- end-state objectives and site redevelopment plans
- potential revenues, costs and available funding
- availability of waste management facilities, locations or sites
- interdependencies with other facilities, locations or infrastructure located at the same site
- assurance that the facility, location or site will be maintained in a safe configuration at all times
- principles of radiation protection, justification, optimization and application of dose limits

The evaluation method used to select the decommissioning strategy should ensure that the relative advantages and disadvantages of the remaining strategies can be objectively compared in a systematic and traceable fashion.

The decommissioning strategy should be reviewed and updated in light of the following, which may have relevant consequences for decommissioning:

- changes in site conditions, or incidents and events
- changes to the proposed decommissioning objectives
- changes to ownership or management structure
- advances in decommissioning technology
- significant modifications to the facility, location or site
- updated schedule, cost and funding information
- operational experience and lessons learned
- revised regulatory requirements
- availability of facilities, locations or sites for the management of radioactive waste

If shutdown of a facility, location or site is sudden, the decommissioning strategy shall be reviewed on the basis of the situation that initiated the sudden shutdown in order to determine whether a revision of the strategy is required.

5.1 *In situ* decommissioning

In situ decommissioning shall not be considered a reasonable decommissioning option for planned decommissioning of existing nuclear power plants, or for future nuclear facilities and situations where removal is possible and practicable. *In situ* decommissioning may be considered a solution only under exceptional circumstances (e.g., following a severe accident) or for legacy sites. *In situ* decommissioning for legacy sites is only considered viable where the use of *in situ* will be protective of workers, the public and the environment; decommissioning was not planned as part of the design; the fuel has been removed; and the site will remain under institutional control for the period defined in the safety case.

In a case where the end state for *in situ* decommissioning results in a waste disposal facility, location or site, the licensee shall satisfy all regulatory requirements for a radioactive waste disposal facility, location or site and demonstrate safety in a safety case and safety assessment of the disposal facility, location or site. Further information on safety case and safety assessment can be found in draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste* [5].

In situ decommissioning with a disposal end state is an accepted and acceptable practice for uranium mines and mills. Further requirements and guidance for waste management at uranium mines and mills are provided in REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* [4].

Note: In Canada, legacy sites specifically refer to research and demonstration facilities, locations or sites dating back to the birth of nuclear technologies in Canada for which decommissioning was not planned as part of the design.

6. Planning for Decommissioning

Where required by a condition of the licence, a licensee shall maintain a financial guarantee for decommissioning that is acceptable to the CNSC. Requirements and guidance on financial guarantees can be found in draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* [6].

6.1 Preliminary decommissioning plan

The licensee shall prepare a PDP and submit it to the CNSC for acceptance with an application for a licence in respect of a nuclear facility or the conduct of a licensed activity, in accordance with the conditions of their licence. The PDP shall document the selected decommissioning strategy; main decontamination, dismantling and/or clean-up activities; end-state objectives; an overview of the principal hazards and protection strategies; a waste management strategy; a cost estimate; and financial guarantee arrangements.

The licensee shall review and, as necessary, update the PDP and submit it to the CNSC every five years or as requested by the CNSC. The PDP should be updated in light of the following, which may have relevant consequences for decommissioning:

- changes in site conditions, or incidents and events
- changes to the proposed decommissioning objectives
- changes to ownership or management structure
- advances in decommissioning technology
- significant modifications to the facility, location or site
- updated schedule, cost and funding information
- operational experience and lessons learned
- revised regulatory requirements
- availability of facilities, locations or sites for the management of radioactive waste

For licensed sites with more than one facility or location for which the licensee is responsible, the licensee shall submit an overarching PDP to ensure that interdependencies between planning envelopes or facilities, locations or sites are taken into account.

6.1.1 Content of the preliminary decommissioning plan

A PDP for a nuclear facility with a Class I or uranium mines and mills licence shall include, as applicable:

- a description of the location of the facility, including:
  - a map of the facility and its specifications
  - geographic information
  - details regarding the surrounding environment
  - land uses
  - illustrations and maps of the facility in relation to the municipality
- the purpose and description of the facility, including:
  - primary SSCs
  - the building type and construction, including location of any hazardous building materials (e.g., asbestos, polychlorinated biphenyls)
  - the building services (e.g., power, heating, ventilation, sewer, water, fire protection)
  - laboratories and other hazardous handling areas
  - the type, quantity and form of radioactive and hazardous materials managed, stored, produced or used during operation
  - the design features used to reduce the spread of contamination and facilitate decontamination, dismantling and/or clean-up
- the anticipated post-operational conditions, including:
  - a summary of the shutdown process, including planned removal of stored inventories of hazardous or radioactive materials
  - the predicted nature and extent of contamination remaining in the primary SSCs (in list or table format with reference to applicable illustrations)
  - the predicted nature and extent of contamination on floors, walls and work surfaces, in ventilation systems, etc.
  - an overview of the principal hazardous conditions anticipated
  - the identification of any separate planning envelopes
- the decommissioning strategy, including:

  - the final end-state objective
  - the rationale for:
    - the decommissioning strategy selected
    - interim end states
    - periods of storage with surveillance
    - any institutional controls
  - the assessment of alternative strategies (or a rationale for why alternatives do not exist or do not warrant consideration)
- the plan of the decommissioning work, including:
  - a work breakdown structure
  - a summary of the main steps for decontamination, dismantling and/or clean-up, and removal of each of the SSCs, preferably grouped into work packages
  - for each work package, an identification of those types of activities that could pose a significant hazard to workers, the public or the environment
  - the role of existing operational standard procedures for radiation protection, hazardous materials handling, industrial safety, and environmental protection in managing hazards
  - the specific activities for which additional protection/mitigation procedures will be required at the detailed planning stage (preparation for decommissioning phase)
  - a summary of the final dismantlement of the structures
  - a conceptual schedule showing the approximate year of facility shutdown and the approximate sequencing and duration of the decommissioning work packages and, where relevant, storage periods
- the hazardous monitoring and survey commitments, including:
  - a program for conducting periodic contamination surveys and the recording of contamination events during facility operation
  - a commitment to develop plans and protocols acceptable to the CNSC at the detailed planning stage for monitoring:
    - work hazards during decommissioning
    - personnel dosimetry
    - environmental emissions and effluents
    - materials, sites and structures to be cleared from regulatory control
- a waste management strategy specifying:
  - the conservative quantities and characteristics of radioactive and chemically hazardous wastes expected to arise from the decommissioning (tied to specific work packages, if possible)
  - the anticipated final disposition of radioactive and chemically hazardous materials
  - a commitment to segregate as much material as possible for reuse and recycling
- a commitment to prepare a DDP for CNSC acceptance prior to decommissioning
- a commitment to periodically review and update the PDP, in accordance with section 5.1
- the physical state of the facility at:
  - the end of operations (permanent shutdown state)
  - the start of decommissioning (stable state for decommissioning)
- the records required for decommissioning, including a description of the facility's operational records that will be maintained to periodically update the PDP and prepare the DDP(s)
- a public consultation plan, including a public information program and avenues for public participation as per the requirements and guidance of REGDOC-3.2.1, *Public Information and Disclosure* [8]
- an Indigenous engagement plan as per the requirements and guidance of REGDOC-3.2.2, *Indigenous Engagement* [9]

- the conservative cost estimate of decommissioning and a financial guarantee, as described in draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* [6], specifying:
  - an estimate of the total present-value cost of the decommissioning
  - a reasonable basis for how cost estimates were derived
  - a description of how the required funds will be provided

  Note: the cost estimate and financial guarantee could be maintained as part of the PDP or as a stand-alone document

Class II nuclear facilities and nuclear substances and radiation devices licensees may consult the above list for guidance, in accordance with a graded approach.

6.1.2 Uncertainty

The licensee should describe uncertainties in the PDP. Significant uncertainties may exist at the preliminary decommissioning planning stage, particularly where decommissioning is not scheduled to take place for several decades, where highly complex operations may be involved, or where the evolution of regulatory requirements, technologies and waste management services is unknown.

The PDP should be based on the best available conservative information and predictions, and consider any special issues should an earlier, unscheduled facility, location or site closure occur. The PDP should be refined over time as the preparation for and the execution of decommissioning phases approach and the uncertainty decreases.

6.2 Waste management strategy

The licensee shall prepare a waste management strategy that identifies the categories and estimated quantities of all waste streams that will be generated and managed during decommissioning, and the planned disposition path. The waste management strategy can be submitted as a stand-alone document or included in the PDP. Requirements and guidance for radioactive waste management can be found in draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [3].

7. Preparation for Decommissioning

During the preparation for decommissioning phase, the licensee shall review and revise its impacted program documents to ensure that they align with the decommissioning activities.

The licensee shall inform the CNSC, in writing, prior to shutting down a facility, location or site permanently or ceasing to manage, possess, use or store nuclear substances. Prior to the permanent shutdown of a facility, location or site or ceasing to manage, possess, use or store nuclear substances, the licensee should discuss with the CNSC the timing of decommissioning, the proposed decommissioning actions, applicable regulations and guidance, and other considerations raised by the CNSC.

Notification for the permanent shutdown of a facility, location or site or notification for ceasing to manage, possess or store nuclear substances should be:

- two years, at a minimum, before planned shutdown of Class I nuclear facilities and uranium mines and mills

- as soon as practicable for the unplanned shutdown of Class I nuclear facilities and uranium mines and mills
- as soon as practicable for Class II nuclear facilities and nuclear substances and radiation devices licensees

For nuclear facilities with a Class I or a uranium mines and mills licence, the licensee shall submit to CNSC staff, for acceptance, the following documents, in order to transition from operation to decommissioning:

- a permanent shutdown plan – includes the steps to transition the facility from operation to a permanent shutdown state
- a stabilization activity plan – comprises steps for the facility's transition from a permanent shutdown state to a stable state for decommissioning
- a DDP – see section 6.1

Stabilization activities of reactor facilities may include defueling the reactor, draining and storing cooling water from the reactor main systems, draining water from secondary and auxiliary cooling systems, cleaning and decontaminating, maintaining cooling for the irradiated fuel bays, transferring the spent fuel to dry storage, modifying the operating conditions/programs to align with the state of the facility, performing extensive radiological surveys, and maintaining routine surveillance of the facility.

Depending on the site-specific licence, stabilization activities may be performed under either a licence to operate or to decommission.

7.1 Detailed decommissioning plan

Prior to the execution of decommissioning, the licensee shall submit a DDP to the CNSC for acceptance, where required by a condition of the licence. For a Class I nuclear facility, the licensee should typically submit a DDP to the CNSC two to five years prior to executing decommissioning. The DDP shall document the decommissioning strategy; decontamination, dismantling and/or clean-up activities; final end-state objectives; the principle hazards and protection plans; a waste management plan; a cost estimate; and financial guarantee arrangements. Once accepted by CNSC staff, the DDP will be incorporated into a licence authorizing decommissioning.

For immediate (prompt) decommissioning, the licensee shall detail, in the DDP and supporting documents (e.g., safety assessment for decommissioning), the decontamination, dismantling and clean-up.

For deferred decommissioning, the licensee shall detail, in the DDP and supporting documents (e.g., safety assessment for decommissioning), the activities that will be performed during the storage with surveillance period. A graded approach should be applied, during storage with surveillance, to the level of detail in the DDP pertaining to decontamination, dismantling and/or clean-up. Toward the end of the storage with surveillance period, the DDP and supporting documents shall be revised, detailing the decontamination, dismantling work and clean-up activities to be completed and submitted to the CNSC for acceptance.

For *in situ* decommissioning, the licensee shall detail, in the DDP, any decontamination, dismantling, clean-up and storage with surveillance activities, as applicable. In cases where the end-state result is a waste disposal facility, location or site, the licensee shall submit, in addition to a safety assessment for decommissioning, a safety case and supporting post-closure safety assessment. Applicable requirements and guidance can be found in draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste* [5].

Where decommissioning takes longer than five years, the DDP shall be reviewed and, as necessary, updated every five years or as requested by the CNSC. The DDP should be reviewed and updated in light of incidents or events with relevant consequences for decommissioning, revised regulatory requirements, operational experience and lessons learned, and advances in decommissioning technology.

For licensed sites with more than one facility or location preparing to undergo decommissioning for which the licensee is responsible, the licensee shall submit an overarching site DDP to ensure that interdependencies between the individual DDPs (planning envelopes or facilities or locations) are taken into account.

7.1.1 Content of the detailed decommissioning plan

A DDP for a nuclear facility with a Class I or uranium mines and mills licence shall include, as applicable:

- a description of, and diagram showing, the areas, components and structures to be decommissioned, grouped, where appropriate, into logical decommissioning planning envelopes
- the operational history, including incidents or accidents that could affect decommissioning
- the storage with surveillance stage, as applicable, and requirements of the:
  - functional building services
  - monitoring and surveillance activities
  - inspection activities
  - usage boundaries during storage with surveillance
- the final radiological, physical and chemical end-state objectives, and interim end-state objectives, as applicable
- a description of the requirements for any institutional controls
- comprehensive and systematic survey results of radiological and other potentially hazardous conditions, including identification and description of the remaining significant gaps or uncertainties in the measurement or prediction of such conditions
- a decommissioning strategy for each planning envelope that highlights any significant changes from the strategy identified in the PDP
- a description of the decommissioning work packages, including:
  - a step-wise technical approach
  - the nature and source of potential significant risks to workers, the public and the environment (including estimates of doses), as well as species at risk (refer to *Species at Risk Act*)
  - the procedures or technologies proposed to mitigate risks
  - the quantities, characteristics and disposition methods of waste
- a schedule of the execution of decommissioning activities showing:
  - the start date of the proposed execution of decommissioning activities
  - the approximate duration and sequence of work packages (and periods of storage with surveillance, if applicable)
  - the anticipated date of completion of decommissioning activities
- a waste management plan (see section 6.4)

- a characterization of potential environmental effects and the measures to be employed to mitigate and monitor these effects
- a conservative cost estimate (based on the work packages), as described in draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* [6], for labour, materials, equipment, waste management, environmental assessment, monitoring and administration (e.g., training, safety, licensing, project management, government and public liaison)
- financial guarantee arrangements
- a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned
- the project management structure
- applicable programs (e.g., management system, emergency response, site security, radiation protection, environmental protection, fire, and personnel training) (Note: this includes programs applicable during storage with surveillance and decommissioning)
- a human factors program that includes:
  - human factors analysis
  - training provisions
  - use of contractors
  - procedural development
  - ergonomic issues
- conventional occupational health and safety issues and associated training and protection programs
- a list of federal and provincial regulatory agencies involved in the project
- the final survey program with interpretation criteria
- the operating and decommissioning records that will be retained, and the method of retention
- a table of contents for the final end-state report, outlining the topics to be covered
- operational experience and lessons learned from the decommissioning of similar nuclear facilities
- criticality safety assessment, as required, and planned actions involving fissile material

Class II nuclear facilities and nuclear substances and radiation devices licensees may consult the above list for guidance, in accordance with a graded approach.

7.2 Safety assessment for decommissioning

The licensee shall perform a safety assessment to identify any radiological or non-radiological hazards to workers, the environment and the public from both routine decommissioning activities and credible potential accidents during decommissioning. The safety assessment should support the activities listed in the DDP. The safety assessment should be conducted in accordance with a graded approach. The safety assessment may be a stand-alone document or may be included in the DDP.

The results of the safety assessment should be used to:

- support the development of the decommissioning plan and selection of the decommissioning strategy
- specify the program for maintenance, surveillance and inspection
- specify the procedures to be put in place for all decommissioning activities significant to safety for responding to accidents or any identified risks

- specify the necessary competencies for the staff involved in the decommissioning of the facility, location or site
- make decisions using an integrated, risk-informed approach

The safety assessment should be updated as necessary in light of revised regulatory requirements, advances in decommissioning technology, changes in site characteristics, modifications to the design or operations, effects of aging, and operational experience and lessons learned.

For a nuclear facility with a Class I or uranium mines and mills licence, the licensee shall ensure that the safety assessment:

- identifies hazards to workers, the public and the environment from planned decommissioning activities, accidents and natural events that may arise during decommissioning and potential initiating events
- describes the relative importance of the hazards and identifies the methods for mitigating their risks
- determines the safety functions necessary throughout decommissioning, and ensures that the related SSCs are suitable and will deliver these safety functions
- demonstrates adequate defence in depth and defines limits, controls and conditions for managing hazards
- demonstrates that adequate measures have been taken to prevent accident conditions and whether any consequences can be mitigated if accidents do occur
- determines the site characteristics related to the safety of the facility
- demonstrates that adequate measures have been taken to control hazards to an acceptable level, both in the present and in the long term, and to optimize protection and safety in decommissioning
- considers the combined and additive effects of hazards
- demonstrates that interdependencies between planned decommissioning actions are taken into account, and that any negative impacts of one action on another, as well as the possible generation of additional hazards, are properly taken into account

Class II nuclear facilities and nuclear substances and radiation devices licensees may consult the above list for guidance, in accordance with a graded approach.

For *in situ* decommissioning resulting in a disposal facility, location or site, a post-closure safety case (see section 4) shall be provided, in addition to the decommissioning safety assessment.

7.3 Storage with surveillance plan

For deferred decommissioning, Class I nuclear facility and uranium mines and mills licensees shall submit a storage with surveillance plan, in addition to the DDP, to the CNSC for acceptance. The storage with surveillance plan may be submitted as part of the DDP or as a stand-alone document. The storage with surveillance plan should be developed on the basis of the outcomes of the safety assessment. This plan should be updated as necessary and submitted every five years throughout the storage with surveillance phase, or when requested by the CNSC. The storage with surveillance plan should outline:

- a description of the SSCs necessary for the storage with surveillance period, and anticipated for decontamination and dismantling activities
- the process to ensure that changes or modifications to SSCs are controlled

- maintenance, inspection and surveillance activities
- the identification (nature and source) of hazards, both radiological and non-radiological, and procedures or technologies proposed to mitigate them
- a description of the zoning, and means to ensure access control
- environmental protection measures that will be employed to mitigate and monitor environmental effects
- waste management activities necessary to remove waste from operations or to reduce hazards at the facility during the storage with surveillance period, including any secondary wastes
- applicable programs (e.g., management system, training program, emergency preparedness program)
- a description of the records that will be maintained to periodically update the storage with surveillance plan

The licensee shall outline in the storage with surveillance plan any activities envisioned or planned to reduce the risks at the facility.

7.4 Waste management plan

The licensee shall prepare a waste management plan that considers the waste hierarchy, including preventing generation, reducing volume and radioactivity, reusing and recycling materials and components, and disposing of the waste.

The waste management plan shall identify the waste streams together with the estimated quantities and characteristics of the waste.

The waste management plan shall describe the systematic process for how the waste will be moved from the decontamination and dismantling areas to the areas for subsequent steps of waste management. The monitoring and processing areas should be designed and operated to keep recyclable and reusable materials separate from waste materials.

The licensee shall assess the potential for generating non-radiological hazardous substances and incorporate the necessary precautions and reporting into its programs and procedures.

Further information on radioactive waste management and waste management programs can be found in draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [3] and REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine, Waste Rock and Mill Tailings* [4].

8. Execution of Decommissioning

During the execution of decommissioning, the licensee shall:

- conduct decommissioning in accordance with the DDP and associated procedures
- implement a decommissioning process and supporting programs to ensure safety
- ensure that a methodology for issuing, modifying and terminating work procedures is established
- maintain an up-to-date list of SSCs important to safety, as well as surveillance and maintenance plans for these SSCs

As decommissioning actions progress, new hazards could emerge. New hazards should be assessed and addressed to maintain overall safety of the decommissioning actions undertaken.

8.1 Storage with surveillance

For deferred decommissioning, during periods of storage with surveillance, the licensee shall ensure that the facility, location or site is maintained in a safe configuration so that subsequent decontamination, dismantling and/or clean-up can be carried out. The licensee shall implement and maintain appropriate storage with surveillance programs to confirm that the SSCs needed to maintain safe storage are functioning as required. These programs should provide for surveillance, inspection, servicing and maintenance.

During the storage with surveillance period, the licensee may perform activities to reduce risks at the facility, location or site in accordance with the licence and consultation with the CNSC. These may include:

- reduction or removal of combustibles
- removal and recycling of non-contaminated or slightly contaminated equipment
- reduction or isolation of asbestos
- demolition of non-nuclear buildings or facilities, provided that there are no safety impacts to the remainder of the site
- removal of accumulated radioactive waste to an offsite licensed storage or disposal facility, location or site
- reduction or removal of hazardous wastes

8.2 Waste management

Prior to the execution of decommissioning, the licensee shall ensure the availability of packages for radioactive waste, the disposition path of radioactive waste arising from decommissioning activities, and the ability of those disposition paths to accommodate the types and volumes of material.

The licensee shall characterize and manage all remaining operational waste from the facility, location or site and all waste from decommissioning.

The licensee shall ensure the traceability and maintain up-to-date records of the waste generated and managed at the facility, location or site or transferred to another facility, location or site, specifying its quantities, characteristics and destination.

The licensee should optimize the clearance of materials and locations from CNSC regulatory control. Exemption quantities, conditional clearance levels and unconditional clearance levels can be found in the *Nuclear Substances and Radiation Devices Regulations.*

9. Completion of Decommissioning

Upon completion of decommissioning, the licensee shall demonstrate that the end-state criteria specified in the DDP have been met.

The licensee shall submit an end-state report to the CNSC for acceptance. The end-state report should be submitted no more than two years after completing the execution of decommissioning activities.

For a nuclear facility with a Class I or uranium mines and mills licence, the end-state report shall include:

- documentation (e.g., using actual survey results) that the planned end-state conditions have been met, and if not, why not
- any proposed further licence requirements or institutional controls for the site
- the release criteria
- the decommissioning work undertaken, noting any significant deviations from the DDP
- any remaining SSCs
- the final physical and radiological status, including any remaining hazards
- a list of SSCs designated for restricted use
- a summary of the waste quantities generated and managed, and disposition routes
- an inventory of nuclear substances that will remain on site
- a summary of the radiological doses received by workers during the decommissioning activities
- a summary of any abnormal occurrences or incidents that took place during decommissioning activities
- any lessons learned
- references to decommissioning records
- the future use of, or any restrictions on the future use of, the facility and remaining structures, including any institutional controls

Where decommissioning of the facility will take place in discrete stages, an interim end-state report shall be prepared when each planned interim end state is achieved. This report should describe the decommissioning work undertaken, the physical condition of the facility, the remaining hazards, the interim end state achieved, the results of surveys, the hazards and physical condition of the facility, and the remaining decommissioning tasks or work packages to be completed.

Decommissioning ends with the release of the facility from CNSC regulatory control, even if the CNSC subsequently authorizes the site for any other licensed activity in the future. If unrestricted release cannot be achieved, institutional controls are required to be in place and the facility may need to remain under CNSC oversight.

9.1 Institutional controls

If institutional controls are required to be in place, the licensee shall prepare plans to address the completion of decommissioning and submit them to the CNSC for review. Post-decommissioning plans include programs for monitoring and surveillance that will be established and maintained to optimize safety and protection of the public and the environment. The licensee is responsible for implementing and maintaining the post-decommissioning plans and institutional controls unless that responsibility was transferred to a third party with their agreement and the Commission's approval.

If institutional controls are required, the CNSC expects the following actions to be taken by the responsible party, following completion of decommissioning:

- implementation of a visual inspection plan for periodic examination of the facility, location, or site to look for signs of deterioration of the facility, location or site (e.g., slumping of the ground), or erosion of the surface
- operation and maintenance of a monitoring system to detect any radionuclide release within the site boundary
- implementation of any active controls to prevent unrestricted access to the site

10. Radiological and Non-Radiological Surveys

The licensee shall perform radiological and non-radiological surveys throughout the various phases in the lifecycle to support decommissioning.

The licensee should establish the survey objectives to be met by characterization throughout the various stages of decommissioning. These objectives include:

- identifying potential radiological and non-radiological risks for workers, the public and the environment associated with specific decommissioning activities
- identifying contaminants and impacted and non-impacted areas, and providing an estimate of the variability of contamination
- providing a description of the nature, extent and variability of contamination
- obtaining hazard information to support the selection of a decommissioning strategy; sequence of decommissioning activities; decontamination, dismantling and/or clean-up options; selection of dismantlement methods, etc.
- achieving progressive and systematic reductions in radiological and non-radiological hazards
- providing objective evidence that the clean-up of the facility, location or site is sufficient to achieve the desired end state
- supporting clean-up activities and determining when clean-up is complete

10.1 Pre-operational surveys

Prior to the construction of a Class I nuclear facility or uranium mine or mill, baseline surveys should be performed at the proposed site of the facility and the surrounding area. Prior to performing these surveys, the proponent should identify the media to be sampled (e.g., soil, sediment, surface water) and the parameters to be measured (e.g., constituents of potential concern, radionuclides and hazardous chemicals).

This information will be useful for:

- future evaluation of the impact of the facility on the site and the surrounding area from its operation
- establishment of decommissioning end-state criteria

If a pre-construction background survey was not performed for the site, survey data from an undisturbed area with similar characteristics or results of a survey of similar building materials should be used.

Background survey data should also be assessed and updated prior to commissioning the facility, particularly for areas that are not expected to be affected (e.g., activated or contaminated) by future operations.

Prior to commencement of a licensee's operation, samples of non-activated and non-contaminated materials should be collected, retained and assessed to determine the concentrations of naturally occurring radionuclides. Where applicable, materials should also be collected during the pre-operation phase and retained for quantification of chemical impurities. This enables more accurate calculations of activation products for decommissioning.

10.2 Operational surveys

During operational periods, the licensee should retain records of the hazards associated with the facilities, locations or sites, particularly those that may be encountered during decommissioning activities. These may include chemical, biological and industrial hazards, in addition to radiological hazards. They may also include records of clean-up operations undertaken with initial and final decontamination levels achieved.

Detailed characterization surveys should be performed by the licensee during operational periods to support the development of the final DDP. Characterization data should include a description of the area (e.g., the premises of the facility, location or site, the surrounding environment, ground and surface water, soil and sediments, as applicable), contamination levels, dose rates, and chemical and physical forms of materials.

As necessary, characterization surveys should be conducted to establish the penetration depth of contamination or activation in structures, soil and sediments, and the extent of radioactivity. Radioactive contaminants in shielded or self-shielded components, such as inside pipes and other equipment, should be determined to the extent possible.

Characterization surveys should also identify adjacent uncontaminated zones. During planning of decommissioning actions, special attention should be given to preventing cross-contamination of such zones.

10.2.1 Transition from operation to decommissioning surveys

During the preparation for decommissioning phase, surveys should be performed, to the extent necessary, to confirm the state of the facility, location or site following the transition from operation to decommissioning. This information should be used to validate or revise, if necessary, the decommissioning strategy. In the case of deferred decommissioning, surveys should be performed prior to the commencement of or early in the storage with surveillance period to ensure that relevant knowledge from operational conditions is captured.

10.3 Decommissioning surveys

Radiological and non-radiological conditions shall be monitored throughout decommissioning activities to confirm that radiation risks to workers, the public and the environment are being adequately controlled.

Surveys shall be performed throughout decommissioning to confirm the effectiveness of decommissioning activities used to reduce radiological and non-radiological risks (e.g., removal of excess radioactive material, decontamination of process equipment and immobilization of remaining contamination).

Surveys of hazards shall also be performed to support the safe performance of surveillance and maintenance activities during periods when decommissioning is deferred.

Surveys should be performed to demonstrate that adjacent uncontaminated zones remain unaffected by decommissioning activities.

10.4 Decommissioning end-state surveys

The licensee shall conduct a final end-state survey in accordance with a survey plan. The survey plan should define:

- final survey objectives and established acceptance criteria
- methodology for conducting the survey
- sampling parameters and background levels
- equipment, instruments, techniques and procedures
- methodology for evaluating the final survey results

Glossary

For definitions of terms used in this document that are not defined below, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

The following terms are either new terms being defined, or include revisions to the current definition for that term. Following public consultation, the final terms and definitions will be submitted for inclusion in the next version of REGDOC-3.6, *Glossary of CNSC Terminology*.

Decommissioning
Administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility, location or site where nuclear substances are managed, used, possessed or stored. Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination, dismantling or cleanup) that are taken to retire a facility, location or site from service with due regard for the health and safety of people and the environment.

For disposal facilities, with the exception of ancillary facilities, the term "closure" instead of "decommissioning" is used.

Decontamination
The complete or partial removal of contamination by a deliberate physical, chemical or biological process.

Dismantling
The taking apart, disassembling and tearing down of the structures, systems and components of a facility, location or site for the purposes of decommissioning.

Clean-up activities
The removal of contaminated soil from an area within the boundary of the facility, location or site.

Remediation
Any measures that may be carried out to reduce the radiation exposure due to contamination of land areas through actions applied to the contamination itself (the source) or to the exposure pathways to humans. Often remediation is used to restore land areas to conditions suitable for limited use under institutional control.

References

The CNSC may include references to information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Web page "How to gain free access to all nuclear-related CSA standards".

1. CSA Group, CSA N294, *Decommissioning of Facilities Containing Nuclear Substances*, Mississauga, 2009.

2. CNSC, REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada*, Ottawa, 2019.

3. CNSC, draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*, Ottawa, TBD.

4. CNSC, REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings*, Ottawa, 2018.

5. CNSC, draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Ottawa, TBD.

6. CNSC, draft REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*, Ottawa, TBD.

7. Canadian Nuclear Safety Commission (CNSC), REGDOC-3.5.3, *Regulatory Fundamentals*, Ottawa, 2018.

8. CNSC, REGDOC-3.2.1, *Public Information and Disclosure*, Ottawa, 2018.

9. CNSC, REGDOC-3.2.2, *Indigenous Engagement*, Ottawa, 2019.

Additional Information

The following documents provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- CSA N292.0, *General Principles for the Management of Radioactive Waste and Irradiated Fuel*, Mississauga, 2014.
- CSA N292.5, *Guideline for the Exemption or Clearance From Regulatory Control of Materials That Contain, or Potentially Contain, Nuclear Substances*, Mississauga, 2011.
- CNSC, REGDOC-2.1.1, *Management System*, Ottawa, 2019.
- CNSC, REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*, Ottawa, 2016.
- CNSC, REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*, Ottawa, 2018.
- CNSC, REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices*, Ottawa, 2020.
- International Atomic Energy Agency (IAEA), IAEA Safety Standards, General Safety Requirements Part 6, *Decommissioning of Facilities*, Vienna, 2014.
- IAEA, IAEA Safety Standards, General Safety Requirements Part 4, *Safety Assessment for Facilities and Activities*, Vienna, 2016.
- IAEA, IAEA Safety Standards, Specific Safety Guide No. SSG-47, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities*, Vienna, 2018.
- Nuclear Energy Agency (NEA), *Radiological Characterisation for Decommissioning of Nuclear Installations*, Paris, 2013.
- NEA, *Preparing for Decommissioning During Operation and After Final Shutdown*, Paris, 2018.
- NEA, *Decommissioning Nuclear Power Plants*, Paris, 2003.

CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

CNSC regulatory documents are classified under the following categories and series:

1.0 Regulated facilities and activities

Series 1.1 Reactor facilities
1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

2.0 Safety and control areas

Series 2.1 Management system
2.2 Human performance management
2.3 Operating performance
2.4 Safety analysis
2.5 Physical design
2.6 Fitness for service
2.7 Radiation protection
2.8 Conventional health and safety
2.9 Environmental protection
2.10 Emergency management and fire protection
2.11 Waste management
2.12 Security
2.13 Safeguards and non-proliferation
2.14 Packaging and transport

3.0 Other regulatory areas

Series 3.1 Reporting requirements
3.2 Public and Indigenous engagement
3.3 Financial guarantees
3.4 Commission proceedings
3.5 CNSC processes and practices
3.6 Glossary of CNSC terminology

Note: The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. Visit the CNSC's website for the latest list of regulatory documents.

Gestion des déchets

Déclassement

REGDOC-2.11.2

Mai 2020

ÉBAUCHE

Commission canadienne de sûreté nucléaire
Canadian Nuclear Safety Commission

Canada

Déclassement
Document d'application de la réglementation REGDOC-2.11.2

Nº de cat. NNNNN
ISBN NNNNN

Also available in English under the title: REGDOC-2.11.1, Decommissioning

Disponibilité du document
Les personnes intéressées peuvent consulter le document sur le site Web de la CCSN ou l'obtenir, en français ou en anglais, en communiquant avec la :

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Historique de publication
[Mois 20xx] Version x.0

Préface

Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Gestion des déchets, qui porte également sur le déclassement. La liste complète des séries figure à la fin de ce document et elle peut être consultée à partir du site Web de la CCSN.

Le document d'application de la réglementation REGDOC-2.11.2, *Déclassement* énonce les exigences et l'orientation relatives à la planification et à la préparation ainsi que pour l'exécution et l'achèvement du déclassement.

Ce document remplace le guide d'application de la réglementation G-219, *Les plans de déclassement des activités autorisées*, publié en juin 2000.

Pour en savoir plus sur la mise en œuvre des documents d'application de la réglementation et sur l'approche graduelle, consultez le REGDOC-3.5.3, *Principes fondamentaux de réglementation*.

Le terme « doit » est employé pour exprimer une exigence à laquelle le demandeur ou le titulaire de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites de ce document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucune information contenue dans le présent document ne doit être interprétée comme libérant le titulaire de permis de toute autre exigence pertinente. Le titulaire de permis a la responsabilité de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et d'y adhérer.

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Déclassement

1. Introduction

1.1 Objet

Le présent document d'application de la réglementation énonce les exigences et l'orientation relatives à la planification et à la préparation du déclassement ainsi qu'à son exécution et à son achèvement.

La CCSN définit le déclassement comme étant les mesures administratives et techniques prises pour permettre de lever en tout ou en partie les contrôles réglementaires visant une installation, un emplacement ou un site où l'on gère, utilise, possède ou stocke des substances nucléaires. Ces mesures englobent les procédures, processus et activités (p. ex., stockage sous surveillance, décontamination, démantèlement ou nettoyage) mis en œuvre pour retirer du service une installation, un emplacement ou un site dans le respect de l'environnement et de la santé et de la sûreté des personnes.

1.2 Portée

Le présent document d'application de la réglementation énonce des exigences et de l'orientation relatives à toutes les phases du déclassement, allant de la planification à l'achèvement.

Ce document s'adresse aux titulaires de permis d'installations nucléaires de catégorie I et de catégorie II, de mines et usines de concentration d'uranium, de substances nucléaires et d'appareils à rayonnement qui sont tenus de disposer de plans ou stratégies de déclassement pour se conformer aux exigences réglementaires ou pour respecter une condition de leur permis. Pour tous les autres titulaires de permis, les renseignements que contient le présent document d'application de la réglementation peuvent servir d'orientation.

Le présent document d'application de la réglementation n'est pas destiné au déclassement d'un site à la suite d'un accident radiologique ou nucléaire, mais peut servir d'orientation. De même, il n'est pas destiné à la remise en état des sites ou emplacements contaminés par les matières radioactives résiduelles découlant d'activités antérieures qui n'ont jamais été assujetties au contrôle réglementaire ou qui l'ont été avant l'entrée en vigueur de la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et de ses règlements d'application, mais il peut servir d'orientation.

Les exigences et l'orientation énoncées dans la norme CSA N294, *Déclassement des installations contenant des substances nucléaires* [1] s'ajoutent au présent document. Ensemble, le présent document d'application de la réglementation et la norme CSA N294 établissent des exigences et de l'orientation relatives au déclassement. En outre, d'autres documents d'application de la réglementation de la CCSN donnent un complément au présent document d'application de la réglementation.

1.3 Législation pertinente

Les dispositions de la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et des règlements connexes qui s'appliquent au présent document sont les suivantes :

- LSRN, paragraphe 24(5) et alinéas 26(e) et 26(f)

- *Règlement général sur la sûreté et la réglementation nucléaires*, alinéa 3(1)l)
- *Règlement sur les installations nucléaires de catégorie I*, articles 7 et 8, paragraphes 14(3) et 14(4) et alinéas 3(k), 5(i) et 6(h)
- *Règlement sur les installations nucléaires et l'équipement réglementé de catégorie II*, articles 3 et 5
- *Règlement sur les mines et les usines de concentration d'uranium*, article 7, alinéas 8(b), 8.3(2)c) et 8.3(2)d) et sous-alinéa 3(a)viii)

2. Cadre de gestion des déchets de la CCSN

En plus du présent document d'application de la réglementation, le cadre de réglementation de la CCSN visant la gestion des déchets, en particulier le déclassement, comprend les documents suivants :

- REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada* [2]
- REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* [3]
- REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium* [4]
- Ébauche, REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs, version 2* [5]
- Ébauche, REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* [6]

La norme CSA qui suit constitue un complément au cadre de réglementation de la CCSN en matière de gestion des déchets, plus particulièrement le déclassement :

- N294, *Déclassement des installations contenant des substances nucléaires*

3. Contexte

3.1 Approche du déclassement fondée sur le cycle de vie

La CCSN exige que le déclassement soit planifié tout au long du cycle de vie de l'installation nucléaire, de l'emplacement ou du site ou pendant la durée de l'activité autorisée.

La planification du déclassement durant le cycle de vie est importante pour assurer que :

- l'emplacement du site de l'installation nucléaire est choisi, et l'installation est conçue, construite et exploitée d'une manière qui facilitera le déclassement
- l'activité autorisée est effectuée d'une manière qui facilitera le déclassement
- la stratégie de déclassement retenue est techniquement faisable, assure la santé, la sûreté et la sécurité du public et protège l'environnement
- les collectivités voisines sont mobilisées tôt dans le processus à l'égard des plans de déclassement proposés
- le titulaire de permis est capable de se préparer à assumer les coûts du déclassement
- les problèmes techniques potentiellement complexes ou difficiles sont décelés suffisamment tôt pour qu'il soit possible de chercher activement des solutions

- le titulaire de permis peut continuer à exploiter des portions de l'installation, de l'emplacement ou du site ou à réaliser des parties de l'activité pendant l'évaluation du déclassement
- les quantités, les types et les catégories de déchets qui seront générés et gérés durant le déclassement sont estimés
- les dossiers sont tenus à jour
- la levée future du contrôle de la CCSN est prise en compte tout au long du cycle de vie de l'installation, de l'emplacement ou du site

Un plan de déclassement est requis durant tout le cycle de vie d'une installation nucléaire ou pour la durée d'une activité autorisée, à l'exception de la levée du contrôle réglementaire de la CCSN. Le plan préliminaire de déclassement (PPD) est élaboré au cours de la phase du choix de l'emplacement pour une installation nucléaire de catégorie I ou pour une mine ou usine de concentration d'uranium, au cours de la phase de construction pour une installation nucléaire de catégorie II, ou avant de présenter à la CCSN une demande de permis de possession, de gestion, d'utilisation ou de stockage de substances nucléaires dans un emplacement donné. Le PPD est actualisé au fil du temps, au besoin, afin de refléter le niveau de détail requis pour chaque activité autorisée. Avant le déclassement, le titulaire de permis élabore un plan détaillé de déclassement (PDD), qui permet de peaufiner et d'ajouter des détails au PPD.

La planification du déclassement doit être appliquée à tous les types d'activités autorisées. Le plan de déclassement d'une installation, d'un emplacement ou d'un site modeste présentant peu de dangers résiduels (p. ex., un accélérateur de particules) peut consister en un résumé d'un projet à une seule phase et à coût relativement faible, et utiliser des procédures normalisées de décontamination, de démantèlement et de radioprotection en vue de l'achèvement d'un ou deux ensembles de travaux. Pour les installations, emplacements ou sites plus grands et plus complexes (p. ex., une centrale nucléaire), le même exercice de planification du déclassement pourrait aboutir à des plans qui décrivent un programme à phases multiples visant divers composants ou zones d'une installation, d'un emplacement ou d'un site et mettant à profit des programmes et procédures spécialisés.

Le titulaire de permis peut envisager de diviser le déclassement d'une installation, d'un emplacement ou d'un site complexe en plusieurs enveloppes de planification relativement indépendantes. Par exemple, une grande installation peut être divisée en zones (c.-à-d. en enveloppes de planification) qui, au point de vue du déclassement, sont relativement indépendantes physiquement les unes des autres. Il pourrait également être possible de diviser un plan de déclassement en phases relativement indépendantes en fonction des exigences relatives aux longues périodes de stockage sous surveillance, ou d'inclure des éléments de l'installation autorisée qui pourraient être déclassés durant la phase d'exploitation.

Un permis de déclassement ou un permis qui autorise des activités de déclassement est requis pour les installations nucléaires de catégorie I et de catégorie II ainsi que les mines et usines de concentration d'uranium avant l'exécution du déclassement. En ce qui concerne les sites comprenant plusieurs installations ou emplacements à différentes étapes de leur cycle de vie, la

CCSN peut émettre un permis qui autorise multiples activités (p. ex., exploitation et déclassement).

3.2 Phases de déclassement

Les phases typiques de déclassement sont:

- la planification du déclassement : débute lors du choix de l'emplacement (ou encore à la phase de construction en ce qui a trait aux installations nucléaires de catégorie II ou avant l'exécution d'activités autorisées visant des substances nucléaires) et se poursuit jusqu'à la la phase de préparation du déclassement
- la préparation du déclassement : débute avec la décision de cesser l'exploitation ou l'exécution des activités, et comprend les activités visant l'arrêt permanent ou la cessation définitive et la transition vers un état stable en vue du déclassement
- l'exécution du déclassement : débute lorsque commencent les activités de déclassement, lesquelles peuvent comprendre la décontamination, le démantèlement ou le nettoyage ainsi que toute période de stockage sous surveillance, et se poursuit jusqu'à l'atteinte de l'état final
- l'achèvement du déclassement : vise à vérifier que les activités de déclassement ont été achevées et que l'état final a été atteint. Le déclassement prend fin lors de la levée du contrôle réglementaire de l'installation, de l'emplacement ou du site par la CCSN, même si la CCSN autorise ensuite toute autre activité autorisée sur le site dans l'avenir. Toutefois, si la levée inconditionnelle du contrôle ne peut se faire, des contrôles institutionnels doivent être mis en place.

Ces phases sont décrites dans les sections 6 à 9, respectivement, du présent document.

Le durée d'exécution des activités de déclassement est généralement d'environ quelques semaines pour les installations, emplacements ou sites modestes et simples à plusieurs années, voire des dizaines d'années pour les grandes installations, emplacements ou sites complexes. En ce qui concerne certaines installations, emplacements ou sites modestes et simples présentant un faible danger, les activités de déclassement peuvent consister simplement en l'enlèvement des sources radioactives et leur renvoi au fournisseur, suivi d'un contrôle visant à vérifier qu'aucune zone ne présente de contamination résiduelle supérieure aux conditions relatives à l'état final.

Les évaluations des conditions radiologiques et non radiologiques avant et pendant le déclassement font partie intégrante de la planification et de l'exécution. Les divers relevés, y compris la caractérisation, effectués tout au long des étapes du déclassement sont décrits à la section 9.

4. Optimisation du déclassement et approche graduelle

Le titulaire de permis devra assurer que la protection de l'environnement et de la santé, la sûreté et la sécurité des personnes est planifiée et optimisée durant le déclassement.

Le titulaire peut appliquer une approche graduelle à tous les aspects du déclassement, proportionnellement au type, à l'échelle, à la complexité, à l'âge, à la capacité, à l'état physique, à l'inventaire, à l'incertitude et à la fiabilité de l'information, ainsi qu'au risque associé au déclassement de l'installation, de l'emplacement ou du site.

Dans le cadre d’une approche graduelle, toutes les exigences du présent document s’appliqueront, mais dans diverses mesures, selon l’importance pour la sûreté et la complexité des travaux exécutés. Le niveau d’analyse, l’exhaustivité de la documentation et la portée des mesures nécessaires pour se conformer aux exigences du présent document seront proportionnels à la nature et à l’importance des dangers, à la complexité de l’installation, de l’emplacement ou du site ainsi qu’aux caractéristiques des déchets.

Une approche graduelle, le cas échéant, sera appliquée de manière à ne pas compromettre la protection de la santé, de la sûreté et de la sécurité des personnes ainsi que de l’environnement. Le REGDOC-3.5.3, *Principes fondamentaux de réglementation* [7] présente davantage de renseignement sur l’approche graduelle.

5. Stratégie de déclassement

Le titulaire de permis doit choisir une stratégie de déclassement qui servira de fondement à la planification du déclassement et permettra au projet d’atteindre l’état final désiré. Dans le cas des installations nucléaires de catégorie I ainsi que des mines et usines de concentration d’uranium, la stratégie de déclassement doit être choisie au cours de la phase du choix de l’emplacement. Dans le cas des installations nucléaires de catégorie II, la stratégie de déclassement doit être choisie au cours de la phase de construction. Avant de présenter une demande de permis de possession, de gestion, d’utilisation ou de stockage de substances nucléaires en un emplacement donné, la stratégie de déclassement devra être choisie. Le titulaire de permis d’installations, de mines et usines d’uranium ou de substances nucléaires et appareils à rayonnement déjà existants, qui est tenu de disposer d’une stratégie de déclassement, mais qui n’en a pas, devra choisir une stratégie de déclassement appropriée le plus rapidement possible.

Les stratégies de déclassement suivantes peuvent être envisagées seules ou combinées :

a) déclassement immédiat (rapide) : décontamination, démantèlement et nettoyage sans délai prévu dans l’exécution
b) déclassement différé :
   i. activités visant à amener l’installation, de l’emplacement ou du site dans une période de stockage sous surveillance (parfois appelée « état de surveillance et d’entretien »), suivie de la décontamination, d’un démantèlement ou d’un nettoyage
   ii. activités visant à placer certains bâtiments ou certaines installations, emplacements ou sites dans un état final intérimaire sûr et sécuritaire, suivies d’une période de stockage sous surveillance, et ultimement d’une décontamination, du démantèlement ou du nettoyage
c) déclassement *in situ* : activités visant à placer l’installation, l’emplacement ou le site, en tout ou en partie, dans un état sûr et sécuritaire, pour lequel certains ou l’ensemble des contaminants radioactifs sont stockés définitivement sur place, ce qui peut conduire à la création d’un site d’évacuation ou de stockage définitif des déchets

Lors de la sélection de la stratégie de déclassement, le titulaire de permis devrait prendre en considération ce qui suit, s’il y a lieu :

- mobilisation du public et des Autochtones
- incidence potentielle sur les droits ancestraux ou issus de traités des peuples autochtones
- retour d’expérience et leçons apprises
- formes et caractéristiques des contaminants radioactifs ou non radioactifs

- intégrité des barrières de confinement et des autres structures, systèmes et composants (SSC) au fil du temps
- disponibilité des technologies de décontamination, de démontage et de nettoyage
- potentiel de recyclage ou de réutilisation de l'équipement et des matériaux
- disponibilité de personnel qualifié
- impacts environnementaux potentiels
- doses radiologiques potentielles aux travailleurs et au public
- objectifs de l'état final visé et plans de réaménagement du site
- revenus potentiels, coûts et financement disponible
- disponibilité d'emplacements, sites ou installations de gestion des déchets et disponibilité d'une capacité de stockage définitif
- interdépendances avec d'autres installations, emplacements ou infrastructures sur le même site
- assurance qu'une configuration sûre de l'installation, de l'emplacement ou du site sera maintenue en tout temps
- principes de radioprotection, de justification, d'optimisation et d'application des limites de dose

La méthode d'évaluation utilisée pour choisir la stratégie de déclassement devrait favoriser la comparaison objective, systématique et traçable des avantages et inconvénients relatifs des autres stratégies.

La stratégie de déclassement devrait être révisée et mise à jour dans les circonstances suivantes, qui peuvent avoir des conséquences sur le déclassement :

- changement d'état du site, incident ou événement
- modification des objectifs de déclassement proposés
- changement de propriétaires ou de la structure hiérarchique
- percées technologiques relatives au déclassement
- modifications importantes à l'installation, à l'emplacement ou au site
- actualisation des renseignements sur l'échéancier, les coûts et le financement
- expérience de l'exploitation et leçons apprises
- révision des exigences réglementaires
- disponibilité des installations, emplacements ou sites de gestion des déchets radioactifs

Si l'installation, l'emplacement ou le site est mis à l'arrêt de manière soudaine, il faut réexaminer la stratégie de déclassement en fonction de la situation à l'origine de cet arrêt pour déterminer si elle doit être modifiée.

5.1 Déclassement *in situ*

Le déclassement *in situ* ne sera pas considéré comme une option raisonnable de déclassement pour le déclassement prévu des centrales nucléaires existantes ou pour les futures installations nucléaires et les situations où l'enlèvement est possible et réalisable. Le déclassement *in situ* pourrait être envisagé dans des circonstances exceptionnelles seulement (p. ex., à la suite d'un accident grave) ou pour les sites hérités. Le déclassement *in situ* des sites hérités est considéré viable seulement s'il permet de protéger les travailleurs, le public et l'environnement, si le déclassement n'était pas prévu dans la conception, si le combustible a été enlevé et si le site demeura sous contrôle institutionnel pour la période établie dans le dossier de sûreté.

Lorsque l’état final du déclassement *in situ* consiste en une installation, un emplacement ou un site d’évacuation ou de stockage définitif des déchets, le titulaire de permis devra satisfaire à toutes les exigences réglementaires relatives à une installation d’évacuation t en démontrer la sûreté au moyen d’un dossier de sûreté et d’une évaluation de la sûreté. L’ébauche du REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l’évacuation des déchets radioactifs* [5] comprend davantage de renseignements sur le dossier de sûreté et l’évaluation de la sûreté.

Le déclassement *in situ* dont l’état final est l’évacuation ou le stockage définitif constitue une pratique acceptée et acceptable pour les mines et usines de concentration d’uranium. Le REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d’uranium et des résidus des usines de concentration d’uranium* [4] comprend davantage d’exigences et d’orientation à l’égard de la gestion des déchets dans les mines et usines de concentration d’uranium.

Remarque : Au Canada, les sites hérités désignent spécifiquement les installations, emplacements et sites de recherche et de démonstration remontant au tout début des technologies nucléaires au Canada et pour lesquelles le déclassement n’était pas prévu dans le cadre de la conception.

6. Planification du déclassement

Lorsqu’une condition de permis l’exige, un titulaire de permis doit maintenir pour le déclassement une garantie financière jugée acceptable par la CCSN. Des exigences et de l’orientation sur les garanties financières se trouvent dans le projet de document d’application de la réglementation REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* [6].

6.1 Plan préliminaire de déclassement

Le titulaire de permis doit préparer un PPD et le soumettre à l’approbation de la CCSN dans le contexte d’une demande de permis visant une installation nucléaire ou une activité autorisée, conformément aux conditions de permis. Le PPD devra documenter la stratégie de déclassement retenue, les principales activités de décontamination, de démantèlement ou de nettoyage, les objectifs relatifs à l’état final, un aperçu des principaux dangers et stratégies de protection, la stratégie de gestion des déchets, un estimé des coûts et les dispositions relatives aux garanties financières.

Le titulaire de permis doit revoir et, si nécessaire, mettre à jour le PPD et le soumettre à la CCSN tous les cinq ans ou à la demande de la CCSN. Le PPD devrait être mis à jour en fonction des considérations suivantes, qui pourraient avoir des conséquences sur le déclassement :

- changements sur le plan de l’état du site ou incident et événement
- changements aux objectifs proposés du déclassement
- changement de propriétaires ou de la structure de gestion
- percées technologiques relatives au déclassement
- modifications importantes à l’installation, à l’emplacement ou au site
- actualisation des renseignements sur l’échéancier, les coûts et le financement
- retour d’expérience et leçons apprises
- révision des exigences réglementaires
- disponibilité des installations, à l’emplacement ou au site de gestion des déchets radioactifs

En ce qui concerne les sites autorisés comprenant plus d'une installation ou d'un emplacement, le titulaire de permis responsable devra présenter un PPD global afin de veiller à prendre en compte les interdépendances entre les enveloppes de planification ou installations, emplacements ou sites.

6.1.1 Contenu du PPD

Un PPD pour une installation nucléaire possédant un permis de catégorie I ou de mines et usines de concentration d'uranium doit comprendre, le cas échéant :

- la description de l'emplacement de l'installation, y compris :
  - une carte de l'installation et de ses caractéristiques
  - l'information géographique
  - les détails au sujet du milieu environnant
  - l'utilisation des terres
  - des illustrations et des cartes de l'installation par rapport à la municipalité
- le but et la description de l'installation, y compris :
  - les principaux SSC
  - le type et la construction des bâtiments, y compris l'emplacement des matériaux de construction dangereux (p. ex., l'amiante, les biphényles polychlorés)
  - les services (p. ex., l'alimentation électrique, le chauffage, la ventilation, les égouts, l'eau et la protection-incendie)
  - les laboratoires et les autres zones de manutention dangereuses
  - le type, la quantité et la forme des matières radioactives ou dangereuses gérées, stockées, produites ou utilisées durant l'exploitation
  - les caractéristiques incorporées dans la conception pour réduire la propagation de la contamination et faciliter la décontamination, le démantèlement ou le nettoyage
- les conditions anticipées après l'exploitation, y compris :
  - le résumé du processus d'arrêt, y compris l'enlèvement planifié des matières dangereuses et radioactives en inventaire
  - la nature et l'étendue prévues de la contamination restante dans les SSC primaires (sous forme de liste ou de tableau avec renvoi aux illustrations pertinentes)
  - la nature et l'étendue prévues de la contamination sur les planchers, les murs, les surfaces de travail, les systèmes de ventilation, etc.
  - un aperçu des principales conditions dangereuses anticipées
  - l'identification des divers enveloppes de planification
- la stratégie de déclassement, y compris :
  - l'objectif en matière d'état final
  - la justification :
    - de la stratégie de déclassement retenue
    - des états finaux provisoires
    - des périodes de stockage sous surveillance
    - de tous les contrôles institutionnels
  - l'évaluation des stratégies de rechange (ou la justification de la raison pour laquelle il n'existe pas de solution de rechange ou qu'aucune solution de rechange ne peut être envisagée)
- le plan des travaux de déclassement, y compris:
  - la structure de répartition du travail
  - le résumé des principales étapes de la décontamination, du démantèlement ou du nettoyage et de l'enlèvement de chacun des SSC, préférablement regroupés en ensembles de travaux

  - pour chaque ensemble de travaux, l’identification des types d’activités qui pourraient présenter un danger important pour les travailleurs, le public ou l’environnement
  - le rôle des procédures d’exploitation normalisées utilisées pour la radioprotection, la manutention des matières dangereuses, la sécurité industrielle et la protection de l’environnement dans le contexte de la gestion des dangers
  - les activités précises pour lesquelles des mesures supplémentaires de protection ou d’atténuation seront requises à l’étape de la planification détaillée (préparation en vue de la phase de déclassement)
  - le résumé du démantèlement final des structures
  - un échéancier conceptuel montrant l’année approximative de la mise à l’arrêt de l’installation ainsi que l’ordre et la durée approximative des ensembles de travaux de déclassement et, le cas échéant, des périodes de stockage
- les engagements en matière de surveillance et de contrôle des substances dangereuses, y compris :
  - un programme de relevés périodiques de la contamination et la consignation des événements de contamination durant l’exploitation de l’installation
  - l’engagement d’élaborer, au stade de planification détaillée, des plans et des protocoles acceptables pour la CCSN relativement à la surveillance :
    - des risques durant le déclassement
    - de la dosimétrie du personnel
    - des émissions dans l’environnement et des effluents
    - des matériaux, des sites et des structures à libérer du contrôle réglementaire
- une stratégie de gestion des déchets précisant :
  - des évaluations prudentes des quantités approximatives et les caractéristiques des déchets radioactifs ou des produits chimiques dangereux qui pourraient découler du déclassement (liées à des ensembles de travaux déterminés, si possible)
  - l’élimination ou le stockage définitif final prévu des matières radioactives ou des produits chimiques dangereux
  - l’engagement de séparer le plus de matériaux possible pour réutilisation ou recyclage
- l’engagement de préparer un PDD pour acceptation par la CCSN avant le déclassement
- l’engagement de réviser et de mettre à jour périodiquement le PPD, conformément à la section 6.1
- l’état physique de l’installation :
  - à la fin de l’exploitation (état d’arrêt permanent)
  - au début du déclassement (état stable aux fins de déclassement)
- les registres requis pour le déclassement, y compris la description des dossiers d’exploitation de l’installation qui seront conservés pour permettre la mise à jour périodique du PPD et la préparation du ou des PDD
- un plan de consultation publique, y compris un programme d’information publique et des possibilités de participation du public, conformément aux exigences et à l’orientation du document REGDOC-3.2.1, *L’information et la divulgation publiques* [8]
- un plan de mobilisation des Autochtones conformément aux exigences et à l’orientation du document REGDOC-3.2.2, *Mobilisation des Autochtones* [9]
- une estimation prudente du coût du déclassement et une garantie financière, tel qu’il est décrit dans l’ébauche du document REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* [6], précisant ce qui suit :
  - l’estimation du coût du déclassement en valeur actuelle
  - un fondement raisonnable pour la façon dont les coûts estimatifs ont été établis

- la description de la façon dont les fonds requis seront fournis

  Remarque : l'estimation du coût et la garantie financière pourraient être présentées dans leur propre document ou faire partie du PPD

Les titulaires de permis d'installations nucléaires de catégorie II, de substances nucléaires et d'appareils à rayonnement peuvent consulter la liste ci-dessus à titre indicatif, dans le cadre d'une approche graduelle.

6.1.2 Incertitude

Le titulaire de permis devrait décrire toutes les incertitudes liées au PPD. Il peut y avoir des incertitudes importantes à l'étape de la planification préliminaire du déclassement, en particulier si le déclassement n'est pas prévu avant plusieurs décennies, si l'installation comporte des activités très complexes ou si l'évolution des exigences réglementaires, des technologies et des services de gestion des déchets est inconnue.

Le PPD devrait être fondé sur les meilleures données et prévisions prudentes disponibles et tenir compte de tout problème particulier advenant la fermeture prématurée d'une installation, d'un emplacement ou d'un site. Le PPD devrait être amélioré au fil du temps, à mesure que les étapes de préparation et d'exécution du déclassement approchent et que les incertitudes diminuent.

6.2 Stratégie de gestion des déchets

Le titulaire de permis devra préparer une stratégie de gestion des déchets qui établit les types et les quantités estimées de toutes les flux de déchets qui seront générés et gérés durant le déclassement, ainsi que la solution d'évacuation prévue. La stratégie de gestion des déchets peut être présentée dans son propre document ou faire partie du PDD. L'ébauche du REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* [3] comprend des exigences et de l'orientation à l'égard de la gestion des déchets radioactifs.

7. Préparation en vue du déclassement

Pendant la phase de préparation du déclassement, le titulaire de permis devrait examiner et réviser les documents programmatiques affectés pour s'assurer qu'ils correspondent aux activités de déclassement.

Le titulaire de permis doit informer la CCSN par écrit avant d'arrêter l'exploitation d'une installation, d'un emplacement ou d'un site de façon définitive ou avant de cesser de gérer, de posséder, d'utiliser ou de stocker des substances nucléaires. Avant l'arrêt permanent d'une installation, d'un emplacement ou d'un site ou avant de cesser de gérer, de posséder ou de stocker des substances nucléaires, le titulaire de permis devrait discuter avec la CCSN de l'échéancier du déclassement, des activités de déclassement proposées, des règlements et orientations applicables ainsi que des autres considérations soulevées par la CCSN.

Une notification en vue de l'arrêt permanent d'une installation, d'un emplacement ou d'un site ou de la cessation de la gestion, de la possession ou du stockage de substances nucléaires devrait avoir lieu :

- au moins deux ans avant l'arrêt prévu pour des installations nucléaires de catégorie I ou pour des mines et usines de concentration d'uranium

- le plus tôt possible en cas d'arrêt imprévu d'installations nucléaires de catégorie I et de mines et usines de concentration d'uranium
- le plus tôt possible pour les titulaires de permis d'installations nucléaires de catégorie II, de substances nucléaires et d'appareils à rayonnement

Pour les installations nucléaires assujetties à un permis de catégorie I ou de mines et usines de concentration d'uranium, le titulaire de permis pour acceptation doit soumettre les documents suivants au personnel de la CCSN afin d'être autorisé à passer de l'exploitation au déclassement :

- un plan d'arrêt permanent, qui comprend les étapes à suivre pour faire passer l'installation de l'exploitation à l'état d'arrêt permanent
- un plan d'activités de stabilisation, qui comprend les étapes à suivre pour faire passer l'installation de l'état d'arrêt permanent à l'état stable aux fins de déclassement
- un PDD (voir la section 6.1)

Les activités de stabilisation des installations dotées de réacteurs peuvent comprendre les suivantes : le déchargement du combustible du réacteur, le drainage et le stockage de l'eau de refroidissement des principaux systèmes du réacteur, le drainage de l'eau des systèmes de refroidissement secondaires et auxiliaires, le nettoyage et la décontamination, le maintien du refroidissement des piscines de stockage du combustible irradié, le transfert du combustible épuisé vers l'aire de stockage à sec, la modification des programmes et des conditions d'exploitation afin qu'ils correspondent à l'état de l'installation, la réalisation de relevés radiologiques rigoureux et le maintien de la surveillance régulière de l'installation.

Selon le permis propre au site, les activités de stabilisation peuvent être réalisées en vertu d'un permis d'exploitation ou de déclassement délivré par la CCSN.

7.1 Plan détaillé de déclassement

Avant l'exécution du déclassement, le titulaire de permis présentera un PDD à la CCSN aux fins d'acceptation, lorsque requis par une condition de permis. Pour une installation nucléaire de catégorie I, le titulaire de permis devrait en général présenter un PDD à la CCSN de deux à cinq ans avant de procéder au déclassement. Ce PDD devra documenter la stratégie de déclassement, les activités de décontamination, de démantèlement ou de nettoyage, les objectifs de l'état final, les principaux dangers et le plan de protection associé, le plan de gestion des déchets, un estimé des coûts et les dispositions relatives aux garanties financières. Une fois accepté par le personnel de la CCSN, le PDD sera intégré à un permis autorisant le déclassement.

En cas de déclassement immédiat (rapide), le titulaire de permis devra décrire dans le PDD et les documents à l'appui (p. ex., l'évaluation de la sûreté pour le déclassement) les activités de décontamination, de démantèlement et de nettoyage.

En ce qui concerne le déclassement différé, le titulaire de permis devra détailler dans le PDD et les documents à l'appui (p. ex., l'évaluation de la sûreté pour le déclassement) les activités qui seront réalisées au cours de la période de stockage sous surveillance. Une approche graduelle devrait être appliquée, durant le stockage sous surveillance, au niveau de détail dans le PDD en ce qui à trait à la décontamination, au démantèlement ou au nettoyage. Vers la fin de la période de stockage sous surveillance, le PDD et les documents à l'appui devront être révisés afin d'y décrire en détail les activités de décontamination, de démantèlement et de nettoyage à exécuter, puis il devra être présenté à la CCSN pour acceptation.

Pour ce qui est du déclassement *in situ*, le titulaire de permis devra décrire dans le PDD toute activité de décontamination, de démantèlement, de nettoyage et de stockage sous surveillance, le cas échéant. Lorsque l'état final prévu consiste en une installation, un emplacement ou un site d'évacuation ou de stockage définitif des déchets, le titulaire de permis devra présenter, en plus d'une évaluation de sûreté pour le déclassement, un dossier de sûreté et l'évaluation de la sûreté post-fermeture à l'appui. L'ébauche du REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* [5] établit les exigences applicables et de l'orientation.

Lorsque le déclassement prend plus de cinq ans, le PDD sera revu et, le cas échéant, mis à jour tous les cinq ans ou à la demande de la CCSN. Le PDD devrait être révisé et mis à jour à la lumière des incidents ou des événements ayant des conséquences pour le déclassement, des exigences réglementaires révisées, du retour d'expérience et des leçons apprises, ainsi que des percées technologiques relatives au déclassement.

En ce qui concerne les sites autorisés comprenant plus d'une installation ou d'un emplacement se préparant au déclassement, le titulaire de permis responsable devra présenter un PDD global afin de veiller à prendre en compte les interdépendances entre chaque PDD (enveloppes de planification ou installations ou emplacements).

7.1.1 Contenu du plan détaillé de déclassement

Un PDD pour une installation nucléaire possédant un permis de catégorie I ou de mines et usines de concentration d'uranium doit comprendre :

- une description accompagnée d'un schéma montrant les zones, composants et structures qui feront partie du déclassement, groupés, s'il y a lieu, en fonction d'enveloppes de planification logiques
- un historique de l'exploitation comprenant les incidents ou accidents pouvant affecter le déclassement
- le plan de stockage sous surveillance, le cas échéant, qui devrait décrire :
  - les services fonctionnels des bâtiments
  - les activités de contrôle et de surveillance
  - les activités d'inspection
  - les limites d'utilisation durant le stockage sous surveillance
- les objectifs de l'état final définitif sur les plans radiologique, physique et chimique ainsi que les objectifs des états finaux provisoires, le cas échéant
- la description des besoins de contrôles institutionnels
- les résultats de relevés complets et systématiques des conditions radiologiques et des autres conditions possiblement dangereuses y compris l'identification et la description des lacunes ou incertitudes dans la mesure ou la prévision de ces conditions
- la stratégie de déclassement de chaque enveloppe de planification, soulignant tout changement important par rapport à la stratégie retenue dans le PPD
- la description de chaque ensemble de travaux de déclassement, y compris :
  - l'approche technique étape par étape
  - la nature et la source de tout risque important pour les travailleurs, le public et l'environnement (y compris une estimation des doses de rayonnement) ainsi que les espèces en péril (consulter la *Loi sur les espèces en péril*)
  - les procédures ou les technologies proposées pour atténuer les risques
  - les quantités, les caractéristiques et le mode d'évacuation des déchets

- un calendrier de l'exécution des activités de déclassement indiquant :
  - la date de début de l'exécution des activités de déclassement proposées
  - la durée approximative et la séquence des ensembles de travaux (et des périodes de stockage sous surveillance, s'il y a lieu)
  - la date d'achèvement prévue des activités de déclassement
- un plan de gestion des déchets (voir la section 7.4)
- la caractérisation des effets que pourra avoir sur l'environnement le programme de déclassement proposé, ainsi que les mesures que à prendre pour atténuer et surveiller ces effets
- une estimation de coûts prudente (basée sur les ensembles de travaux), tel qu'il est décrit dans l'ébauche du document REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* [6], en ce qui concerne la main-d'œuvre, les matériaux, l'équipement, la gestion des déchets, l'évaluation environnementale, la surveillance et l'administration (p. ex., formation, sûreté, délivrance de permis, gestion du projet et relations avec le public et les gouvernements)
- les dispositions relatives aux garanties financières
- un rapport sommaire de toute mobilisation du public et des Autochtones entreprise dans la préparation du plan, y compris les préoccupations soulevées, la façon dont celles-ci ont été prises en compte et comment il y fut suite
- la structure de gestion du projet
- les programmes applicables (p. ex., système de gestion, intervention d'urgence, sécurité du site, radioprotection, protection de l'environnement, incendie et formation du personnel) (Remarque : ceci inclut les programmes applicables durant le stockage sous surveillance et le déclassement)
- un programme d'étude des facteurs humains qui inclut :
  - l'analyse des facteurs humains
  - les dispositions relatives à la formation
  - le recours à des entrepreneurs
  - l'élaboration de procédures
  - les questions d'ergonomie
- les questions liées à la santé et à la sécurité classiques au travail, et les programmes de formation et de protection connexes
- une liste des organismes de réglementation fédéraux et provinciaux impliqués dans le projet
- le programme final de relevés radiologiques comportant des critères d'interprétation
- les registres d'exploitation et de déclassement requis aux fins de rétention et la méthode de rétention
- une table des matières pour le rapport d'état final, qui décrit les sujets à traiter
- le retour d'expérience et les leçons apprises du déclassement d'installations nucléaires semblables
- une évaluation de sûreté de la criticité, le cas échéant, et les mesures prévues visant les matières fissiles

Les titulaires de permis d'installations nucléaires de catégorie II, de substances nucléaires et d'appareils à rayonnement peuvent consulter la liste ci-dessus à titre indicatif, dans le cadre d'une approche graduelle.

7.2 Évaluation de la sûreté pour le déclassement

Le titulaire de permis doit effectuer une évaluation de la sûreté pour identifier les dangers radiologiques ou classiques pour les travailleurs, l'environnement et le public découlant à la fois des activités de déclassement courantes et des accidents potentiels crédibles pendant le déclassement. L'évaluation de la sûreté devrait étayer les activités énoncées dans le PDD L'évaluation de la sûreté devrait être effectuée conformément à une approche graduelle. Elle peut être présentée dans un document séparé ou faire partie du PDD.

Les résultats de l'évaluation de la sûreté devraient être utilisés pour :

- étayer l'élaboration du plan de déclassement et le choix de la stratégie de déclassement
- préciser le programme d'entretien, de surveillance et d'inspection
- préciser les procédures à mettre en place pour toutes les activités de déclassement importantes pour la sûreté dans le contexte d'une intervention en cas d'accident ou de tout risque relevé
- préciser les compétences nécessaires du personnel participant au déclassement de l'installation, de l'emplacement ou du site
- prendre des décisions selon une approche intégrée tenant compte du risque

L'évaluation de la sûreté devrait être mise à jour, au besoin, à la lumière des exigences réglementaires révisées, des progrès de la technologie de déclassement, des changements dans les caractéristiques du site, des modifications apportées à la conception ou à l'exploitation, des effets du vieillissement, de l'expérience de l'exploitation et des leçons apprises.

Pour une installation nucléaire de catégorie I ou d'une mine ou usine de concentration d'uranium, le titulaire de permis doit s'assurer que l'évaluation de la sûreté :

- identifie les dangers possibles pour les travailleurs, le public et l'environnement résultant des activités planifiées de déclassement, des accidents et des événements naturels pouvant survenir pendant le déclassement et les événements déclencheurs potentiels
- décrit l'importance relative des dangers possibles et détermine les méthodes d'atténuation de leurs risques
- détermine les fonctions de sûreté nécessaires tout au long du déclassement et veille à ce que les SSC pertinents soient adéquats et assurent ces fonctions de sûreté
- démontre une défense en profondeur adéquate et établit des limites, des contrôles et des conditions en vue de la gestion des dangers
- démontre que des mesures adéquates ont été prises pour prévenir les conditions d'accident et si les conséquences peuvent être atténuées en cas d'accident
- détermine les caractéristiques de l'emplacement relatives à la sûreté de l'installation
- démontre que des mesures adéquates ont été prises pour contrôler les dangers, à l'heure actuelle et à long terme, à un niveau acceptable et pour optimiser la protection et la sûreté lors du déclassement
- tient compte des effets combinés et cumulatifs des dangers
- démontre que les interdépendances entre les mesures de déclassement planifiées sont prises en compte et tout effet négatif d'une mesure sur une autre, ainsi que la génération possible de dangers supplémentaires, sont pris en compte de façon appropriée

Les titulaires de permis d'installations nucléaires de catégorie II, de substances nucléaires et d'appareils à rayonnement peuvent consulter la liste ci-dessus à titre indicatif, dans le cadre d'une approche graduelle.

Pour le déclassement *in situ* aboutissant à une installation, un emplacement ou un site d'évacuation, un dossier de sûreté post-fermeture (voir la section 5) doit être soumis en plus de l'évaluation de la sûreté pour le déclassement.

7.3 Stockage sous surveillance

Pour le déclassement différé d'une installation nucléaire de catégorie I ou d'une mine ou usine de concentration d'uranium, le titulaire de permis devra présenter à la CCSN, pour acceptation, un plan de stockage sous surveillance en plus du PDD. Ce plan peut être présenté dans un document séparé ou faire partie du PDD. Le plan de stockage sous surveillance devrait être élaboré en fonction des résultats de l'évaluation de la sûreté. Le plan devrait être mis à jour au besoin et présenté tous les cinq ans durant la phase de stockage sous surveillance, ou à la demande de la CCSN. Ce plan devrait comprendre :

- la description des SSC nécessaires pour la période de stockage sous surveillance et de ceux prévus pour les activités de décontamination et de démantèlement
- le processus visant à assurer que les changements ou modifications aux SSC sont contrôlés
- les activités d'entretien, d'inspection et de surveillance
- l'identification (nature et source) des dangers, tant radiologiques que non radiologiques, et les procédures ou technologies proposées pour les atténuer
- la description du zonage, et les méthodes de contrôle d'accès
- les mesures de protection de l'environnement qui seront mises en œuvre pour atténuer et surveiller les effets environnementaux
- les activités de gestion des déchets nécessaires pour enlever les déchets découlant de l'exploitation, y compris les déchets secondaires, ou pour réduire les dangers à l'installation durant la période de stockage sous surveillance
- les programmes applicables (p. ex., système de gestion, formation, préparation en cas d'urgence)
- la description des registres qui seront tenus afin de mettre à jour périodiquement le plan de stockage sous surveillance

Le titulaire de permis devra souligner dans le plan de stockage sous surveillance toute activité envisagée ou prévue en vue de réduire les risques à l'installation.

7.4 Plan de gestion des déchets

Le titulaire de permis doit préparer un plan de gestion des déchets qui tient compte de la hiérarchie des déchets, notamment par la prévention de leur génération, la réduction de leur volume et de leur radioactivité, la réutilisation et le recyclage des matériaux et composants ainsi que l'évacuation des déchets.

Le plan de gestion des déchets devra déterminer les flux de déchets ainsi que leurs quantités et les caractéristiques estimées.

Le plan de gestion des déchets devra décrire le processus systématique pour les déplacements de déchets des zones de décontamination et de démantèlement aux zones pour les étapes subséquentes de la gestion des déchets. Les zones de surveillance et de traitement devraient être conçues et exploitées de manière à ce que les matières recyclables et réutilisables soient séparées des déchets.

Le titulaire de permis doit évaluer la possibilité de générer des substances dangereuses non radiologiques et intégrer les précautions et rapports nécessaires dans ses programmes et procédures.

L'ébauche du document d'application de la réglementation REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* [3] et le document REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium* [4] comprennent davantage de renseignements sur les programmes de gestion des déchets et des déchets radioactifs.

8. Exécution du déclassement

Durant l'exécution du déclassement, le titulaire de permis devra :

- exécuter le déclassement conformément au PDD et aux procédures associées
- mettre en œuvre un processus de déclassement et des programmes de soutien pour assurer la sûreté
- veiller à ce qu'une méthodologie d'émission, de modification et de cessation des procédures de travail soit établie
- tenir une liste à jour des SSC importants pour la sûreté, ainsi que des plans de surveillance et d'entretien de ces SSC

À mesure que les activités de déclassement progressent, de nouveaux dangers pourraient apparaître. Ces nouveaux dangers devraient être évalués et tenus en compte de manière à maintenir la sûreté générale des activités de déclassement entreprises.

8.1 Stockage sous surveillance

En cas de déclassement différé, durant les périodes de stockage sous surveillance, le titulaire de permis doit veiller à ce que l'installation, l'emplacement ou le site soit maintenu dans un état sûr de sorte que la décontamination, le démantèlement ou le nettoyage puissent être effectués par la suite. Le titulaire de permis doit mettre en œuvre et tenir à jour des programmes appropriés de stockage sous surveillance pour confirmer que les SSC nécessaires au maintien d'un stockage sûr fonctionnent comme il se doit. Ces programmes devraient prévoir la surveillance, l'inspection et l'entretien.

Durant la période de stockage sous surveillance, le titulaire de permis peut exécuter des activités visant à réduire les risques à l'installation, à l'emplacement ou au site, conformément au permis et aux consultations avec la CCSN. Ces activités peuvent comprendre:

- la réduction ou l'enlèvement des matières combustibles
- l'enlèvement et le recyclage de l'équipement non contaminé ou légèrement contaminé
- la réduction ou le confinement de l'amiante
- la démolition bâtiments ou d'installations conventionnelles, pourvu qu'il n'y ait pas d'impact sur la sûreté du reste du site
- l'enlèvement des déchets radioactifs accumulés vers une installation, un emplacement ou un site autorisé d'évacuation ou de stockage définitif hors site
- la réduction ou l'enlèvement des déchets dangereux

8.2 Gestion des déchets

Avant l'exécution du déclassement, le titulaire de permis devra veiller à la disponibilité de colis pour les déchets radioactifs, à ce qu'il y a des méthodes d'évacuation des déchets radioactifs découlant des activités de déclassement et que celles-ci ont la capacité d'accueillir les types et volumes de matériaux.

Le titulaire de permis devra caractériser et gérer tous les déchets restants découlant de l'exploitation de l'installation, de l'emplacement ou du site ainsi que tous les déchets générés par le déclassement.

Le titulaire de permis devra assurer la traçabilité et l'actualisation des registres relatifs aux déchets générés et gérés à l'installation, à l'emplacement ou au site ou transférés vers un autre installation, emplacement ou site, en spécifiant les quantités, les caractéristiques et la destination des déchets.

Le titulaire de permis devrait optimiser la levée du contrôle réglementaire de la CCSN pour les matières et les emplacements. Le *Règlement sur les substances nucléaires et les appareils à rayonnement* établit les quantités d'exemption, les niveaux de libération conditionnelle et les niveaux de libération inconditionnelle.

9. Achèvement du déclassement

Une fois le déclassement terminé, le titulaire de permis doit démontrer que les critères de l'état final précisés dans le PDD ont été respectés.

Le titulaire de permis devra soumettre un rapport d'état final à la CCSN pour acceptation. Le rapport d'état final doit être soumis au plus tard deux ans après l'achèvement de l'exécution des activités de déclassement.

Le rapport d'état final d'une installation nucléaire de catégorie I ou d'une mine ou usine de concentration d'uranium doit comprendre:

- la documentation (p. ex., en citant les résultats réels des contrôles) que les conditions prévues à l'état final ont été respectées et, dans la négative, expliquer pourquoi elles n'ont pas été respectées
- les autres exigences de permis proposées ou les contrôles institutionnels pour le site
- les critères de rejet
- les travaux de déclassement entrepris, en notant tout écart important par rapport au PDD
- les SSC restantes
- l'état physique et radiologique final, y compris les dangers restants
- une liste des SSC destinés à une utilisation restreinte
- un résumé des quantités de déchets générées et gérées, et les méthodes d'évacuation
- un inventaire des substances nucléaires qui demeureront sur place
- un sommaire des doses radiologiques reçues par les travailleurs au cours des activités de déclassement
- un résumé de tout événement ou incident anormal survenu pendant les activités de déclassement
- les leçons apprises
- des références aux documents de déclassement

- l'utilisation future des installations et des structures restantes, ou toute restriction quant à leur utilisation future, y compris les contrôles institutionnels

Lorsque le déclassement de l'installation doit avoir lieu selon des étapes distinctes, un rapport d'état final intérimaire doit être préparé lorsque chaque état final intérimaire prévu est atteint. Ce rapport devrait décrire les travaux de déclassement entrepris, l'état physique de l'installation, les dangers restants, l'état final intérimaire atteint, les résultats des contrôles, les dangers et l'état physique de l'installation ainsi que les tâches de déclassement restantes ou les ensembles de travaux à réaliser.

Le déclassement prend fin lors de la levée du contrôle réglementaire de l'installation par la CCSN, même si la CCSN autorise ultérieurement le site aux fins de toute autre activité autorisée à l'avenir. S'il n'est pas possible de procéder à la libération inconditionnelle, des contrôles institutionnels doivent être mis en place, et l'installation pourrait devoir demeurer sous la surveillance de la CCSN.

9.1 Contrôle institutionnel

Si des contrôles institutionnels doivent être mis en place, le titulaire de permis doit préparer des plans pour l'achèvement du déclassement et les présenter à la CCSN pour examen. Les plans post-déclassement comprennent des programmes de suivi et de surveillance qui seront établis et actualisés en vue d'optimiser la sûreté et la protection du public et de l'environnement. Le titulaire de permis est responsable de la mise en œuvre et de l'actualisation des plans post-déclassement et des contrôles institutionnels, à moins que cette responsabilité ait été transférée à une tierce partie, sous réserve de l'accord de cette dernière et de l'approbation de la Commission.

Lorsque des contrôles institutionnels sont requis, la CCSN s'attend à ce que le responsable prenne les mesures suivantes à la suite de l'achèvement du déclassement :

- mise en œuvre d'un plan d'inspection visuelle pour l'examen périodique afin de déceler les signes de détérioration de l'installation, de l'emplacement ou du site (p. ex., affaissement du sol) ou d'érosion de la surface
- exploitation et entretien d'un système de surveillance afin de détecter tout rejet de radionucléides à l'intérieur du périmètre du site
- mise en œuvre de contrôles actifs pour empêcher l'accès non restreint au site

10. Relevés radiologiques et non radiologiques

À l'appui du déclassement, le titulaire de permis doit effectuer des contrôles radiologiques et non radiologiques pendant les diverses étapes du cycle de vie.

Le titulaire devrait établir les objectifs des relevés qui doivent être atteints par la caractérisation à toutes les étapes du déclassement. Ces objectifs incluent :

- identifier les risques potentiels, tant radiologiques ou non radiologiques, pour les travailleurs, le public et l'environnement associés à des activités de déclassement spécifiques
- identifier les contaminants et les zones affectées ou non, et fournir une estimation de la variabilité de la contamination
- fournir une description de la nature, de l'étendue et de la variabilité de la contamination

- obtenir des renseignements sur les dangers pour étayer le choix d'une stratégie de déclassement, la séquence des activités de déclassement, les options de décontamination, le démantèlement ou le nettoyage, le choix des méthodes de démantèlement, etc.
- réduire progressivement et systématiquement les dangers radiologiques et non radiologiques
- fournir des preuves objectives que le nettoyage de l'installation, de l'emplacement ou du site est suffisant pour atteindre l'état final souhaité
- étayer les activités de nettoyage et déterminer le moment où ce nettoyage est achevé

10.1 Relevés préalables à l'exploitation

Avant la construction d'une installation nucléaire de catégorie I ou d'une mine ou usine de concentration d'uranium, des relevés de référence devraient être effectués sur le site proposé de l'installation et ses alentours. Avant l'exécution de ces contrôles, le promoteur devrait identifier les milieux à échantillonner (p. ex., sol, sédiments, eaux de surface) et les paramètres à mesurer (p. ex., contaminants potentiellement préoccupants, radionucléides et produits chimiques dangereux). Ces renseignements serviront à:

- l'évaluation future de l'impact de l'exploitation de l'installation sur le site et la zone environnante
- l'établissement de critères relatifs à l'état final du déclassement

Si aucun relevé préalable à la construction n'a été effectué sur le site, les données d'une zone non perturbée présentant des caractéristiques similaires ou les résultats d'un relevé portant sur des matériaux de construction similaires devraient être utilisés.

Les données sur les relevés du rayonnement de fond devraient également être évaluées et mises à jour avant la mise en service de l'installation, en particulier pour les zones qui ne devraient pas être touchées (p. ex., activées ou contaminées) par les activités futures.

Avant qu'un titulaire de permis entame ses opérations, des échantillons de matériaux non activés et non contaminés devraient être prélevés, conservés et évalués afin d'en déterminer les concentrations de radionucléides naturellement présents. Le cas échéant, des matériaux devraient également être prélevés durant la phase préalable à l'exploitation et conservés aux fins de quantification des impuretés chimiques. Cela permet de faire des calculs plus exacts des produits d'activation aux fins de déclassement.

10.2 Relevés pendant l'exploitation

Pendant les périodes d'exploitation, le titulaire de permis documenter les dangers associés aux installations, emplacements ou sites, surtout ceux qui peuvent survenir lors du déclassement. Il peut notamment être question de dangers chimiques, biologiques et industriels en plus des dangers radiologiques. Ces documents peuvent comprendre des registres des activités de nettoyage entreprises de même que les niveaux de contamination initiaux et finaux.

Des relevés de caractérisation détaillés devraient être effectués par le titulaire de permis pendant les périodes d'exploitation pour appuyer l'élaboration du PDD final. Les données de la caractérisation devraient comprendre une description de la zone (p. ex., les lieux de l'installation, de l'emplacement ou du site, le milieu environnant, les eaux souterraines et de surface, le sol et les sédiments, le cas échéant), les niveaux de contamination, les débits de dose et les formes chimiques et physiques des matériaux.

Au besoin, des relevés de caractérisation devraient être effectués pour établir la profondeur de pénétration de la contamination ou de l'activation dans les structures, le sol et les sédiments, et l'étendue de la radioactivité. Les contaminants radioactifs dans les composants blindés ou autoblindés, comme à l'intérieur des tuyaux et d'autres équipements, devraient être déterminés dans la mesure du possible.

Les relevés de caractérisation devraient également identifier les zones non contaminées adjacentes. Lors de la planification des activités de déclassement, une attention particulière devrait être accordée à la prévention de la contamination croisée de ces zones.

10.2.1 Relevés pendant la transition de l'exploitation au déclassement

Durant la phase de préparation du déclassement, des relevés devraient être réalisés, dans la mesure nécessaire, afin de confirmer l'état de l'installation, de l'emplacement ou du site à la suite de la transition de l'exploitation vers le déclassement. Ces renseignements devraient servir à valider ou à réviser, au besoin, la stratégie de déclassement. En cas de déclassement différé, des relevés devraient être réalisés avant le début du déclassement ou au début de la période de stockage sous surveillance pour assurer la documentation des conditions résultant de l'exploitation.

10.3 Relevés pendant le déclassement

Les conditions radiologiques et non radiologiques doivent être surveillées tout au long des activités de déclassement afin de confirmer que les risques radiologiques pour les travailleurs, le public et l'environnement sont adéquatement contrôlés.

Des relevés doivent être effectués tout au long du déclassement pour confirmer l'efficacité des activités de déclassement réalisées en vue de réduire les risques radiologiques et non radiologiques (p. ex., enlèvement des matières radioactives excédentaires, décontamination de l'équipement de procédé et immobilisation de la contamination restante).

Des relevés des dangers doivent également être effectués pour étayer l'exécution sûre des activités de surveillance et d'entretien pendant les périodes où le déclassement est différé.

Des relevés doivent être effectués pour démontrer que les zones non contaminées adjacentes ne sont pas touchées par les activités de déclassement.

10.4 Contrôle pour confirmer l'état final du déclassement

Le titulaire de permis doit effectuer un contrôle de l'état final conformément à un plan de contrôle. Le plan de contrôle devrait définir :

- les objectifs du contrôle radiologique final
- la méthodologie utilisée pour le contrôle
- les paramètres d'échantillonnage et les niveaux de rayonnement naturel
- l'équipement, les instruments, les techniques et les procédures
- la méthodologie d'évaluation des résultats du contrôle final

Glossaire

Les définitions des termes utilisés dans le présent document figurent dans le REGDOC-3.6, *Glossaire de la CCSN*, qui comprend des termes et des définitions tirés de la *Loi sur la sûreté et la réglementation nucléaires*, de ses règlements d'application ainsi que des documents d'application de la réglementation et d'autres publications de la CCSN. Le REGDOC-3.6 est fourni aux fins de référence et d'information.

Les définitions terminologiques ci-dessous sont soit nouvelles, soit révisées. Après la consultation publique, la version définitive sera soumise aux fins d'intégration dans la prochaine édition du REGDOC-3.6, *Glossaire de la CCSN*.

déclassement
Mesures administratives et techniques prises pour permettre de lever en tout ou en partie les contrôles réglementaires visant une installation, un emplacement ou un site où l'on gère, utilise, possède ou stocke des substances nucléaires. Ces mesures englobent les procédures, processus et activités (p. ex., stockage sous surveillance, décontamination, démantèlement ou nettoyage) mis en œuvre pour retirer du service une installation, d'un emplacement ou d'un site dans le respect de l'environnement et de la santé et de la sûreté des personnes.

Pour ce qui est des installations d'évacuation, à l'exception des installations auxiliaires, le terme « fermeture » remplace le terme « déclassement ».

décontamination
L'enlèvement en tout ou en partie de la contamination au moyen d'un procédé physique, chimique ou biologique délibéré.

démantèlement
Le démontage, désassemblage et démolition des structures, systèmes et composants (SSC) d'une installation, d'un emplacement ou d'un site aux fins de déclassement.

nettoyage
L'enlèvement du sol contaminé d'une zone se trouvant à l'intérieur du périmètre de l'installation, de l'emplacement ou du site.

remise en état
Toute mesure potentielle ayant pour but de réduire la radioexposition due à la contamination des terres et étant appliquée à la contamination elle-même (la source) ou aux voies d'exposition humaine. Souvent, la remise en état vise à remettre les terres dans un état adéquat pour une utilisation limitée sous contrôle institutionnel.

Documents de référence

La CCSN pourrait inclure des références à des documents sur les pratiques exemplaires et les normes, comme celles publiées par le Groupe CSA. Avec la permission du Groupe CSA, qui en est l'éditeur, toutes les normes de la CSA associées au nucléaire peuvent être consultées gratuitement à partir de la page Web de la CCSN « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au nucléaire ».

1. Groupe CSA, CSA N294, *Déclassement des installations contenant des substances nucléaires*, Mississauga, 2009.

2. Commission canadienne de sûreté nucléaire (CCSN). REGDOC-2.11, *Cadre de gestion des déchets radioactifs et du déclassement au Canada*, Ottawa, 2018.

3. CCSN, REGDOC-2.11.1, *Gestion des déchets, tome I : Gestion des déchets radioactifs* (ébauche), Ottawa, à déterminer

4. CCSN, REGDOC-2.11.1, *Gestion des déchets, tome II : Gestion des stériles des mines d'uranium et des résidus des usines de concentration d'uranium*, Ottawa, 2018.

5. CCSN, REGDOC-2.11.1, *Gestion des déchets, tome III : Dossier de sûreté pour l'évacuation des déchets radioactifs* (ébauche), Ottawa, à déterminer.

6. CCSN, REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* (ébauche), Ottawa, à déterminer.

7. CCSN, REGDOC-3.5.3, *Principes fondamentaux de réglementation*, Ottawa, 2018.

8. CCSN, REGDOC-3.2.1, *L'information et la divulgation publiques*, Ottawa, 2018.

9. CCSN, REGDOC-3.2.2, *Mobilisation des Autochtones*, Ottawa, 2019.

Renseignements supplémentaires

Les documents suivants fournissent des renseignements supplémentaires qui pourraient être pertinents et faciliter la compréhension des exigences et de l'orientation établies dans le présent document d'application de la réglementation :

- Groupe CSA, N292.0, *Principes généraux pour la gestion des déchets radioactifs et du combustible irradié*, Mississauga, 2014.
- Groupe CSA, N292.5, Ligne directrice sur l'exemption ou la libération du contrôle réglementaire des matières contenant ou susceptibles de contenir des substances nucléaires, Mississauga, 2011.
- CCSN, REGDOC-2.1.1, *Système de gestion*, Ottawa, 2019.
- CCSN, REGDOC-3.1.1, *Rapports à soumettre par les exploitants de centrales nucléaires*, Ottawa, 2016.
- CCSN, REGDOC-3.1.2, *Exigences relatives à la production de rapports, tome 1 : Installations nucléaires de catégorie I non productrices de puissance et mines et usines de concentration d'uranium*, Ottawa, 2018.
- CCSN, REGDOC-3.1.3, *Exigences relatives à la production de rapports pour les titulaires de permis de déchets de substances nucléaires, les installations nucléaires de catégorie II et les utilisateurs d'équipement réglementé, de substances nucléaires et d'appareils à rayonnement*, Ottawa, 2020.
- Agence internationale de l'énergie atomique (AIEA). Normes de sûreté de l'AIEA, Prescriptions générales de sûreté GSR Partie 6, *Déclassement des installations*, Vienne, 2014.
- AIEA, Normes de sûreté de l'AIEA, Prescriptions générales de sûreté GSR Partie 4, *Évaluation de la sûreté des installations et activités*, Vienne, 2017.
- AIEA, Normes de sûreté de l'AIEA, Guide de sûreté particulier SSG-47, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities*, Vienne, 2018.
- Agence pour l'énergie nucléaire (AEN), *Radiological Characterisation for Decommissioning of Nuclear Installations*, Paris, 2013.
- AEN, *Preparing for Decommissioning During Operation and After Final Shutdown*, Paris, 2018.
- AEN, *Démantèlement des centrales nucléaires*, Paris, 2003

Série de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la CCSN. En plus de la *Loi sur la sûreté et la réglementation nucléaires* et de ses règlements d'application, il pourrait y avoir des exigences en matière de conformité à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Les documents d'application de la réglementation préparés par la CCSN sont classés en fonction des catégories et des séries suivantes :

1.0 Installations et activités réglementées

Séries 1.1 Installations dotées de réacteurs
1.2 Installations de catégorie IB
1.3 Mines et usines de concentration d'uranium
1.4 Installations de catégorie II
1.5 Homologation d'équipement réglementé
1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Séries 2.1 Système de gestion
2.2 Gestion de la performance humaine
2.3 Conduite de l'exploitation
2.4 Analyse de la sûreté
2.5 Conception matérielle
2.6 Aptitude fonctionnelle
2.7 Radioprotection
2.8 Santé et sécurité classiques
2.9 Protection de l'environnement
2.10 Gestion des urgences et protection-incendie
2.11 Gestion des déchets
2.12 Sécurité
2.13 Garanties et non-prolifération
2.14 Emballage et transport

3.0 Autres domaines de réglementation

Séries 3.1 Exigences relatives à la production de rapports
3.2 Mobilisation du public et des Autochtones
3.3 Garanties financières
3.4 Séances de la Commission
3.5 Processus et pratiques de la CCSN
3.6 Glossaire de la CCSN

Remarque : Les séries de documents d'application de la réglementation pourraient être modifiées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste de documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC-2.11.2, *Decommissioning*

Rapport de consultation: REGDOC-2.11.2, *Déclassement*

Introduction

REGDOC-2.11.2, *Decommissioning* provides requirements and guidance regarding the planning, preparation, execution and completion of decommissioning.

This document applies to Class I and Class II nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices licensees that are required to have decommissioning plans of strategies as a result of a regulatory requirement or a condition of their licence.

If approved by the Commission, this document will supersede G-219, *Decommissioning Planning for Licensed Activities*.

Consultation process

CNSC staff have extensively engaged with stakeholders on the waste management and decommissioning framework.

On July 16, 2019, a draft version of REGDOC-2.11.2, *Decommissioning* was issued for public consultation until October 16, 2019. During the consultation period, the CNSC received 102 comments from 12 respondents: Bruce Power, Cameco, Canadian Nuclear Association (CNA), Canadian Nuclear Laboratories (CNL), Hydro-Quebec, New Brunswick Power, Nuclear Waste Management Organization (NWMO), Ontario Power Generation (OPG), Region of Durham, Safety Probe International and Dr. J.R. Walker.

Introduction

Le REGDOC-2.11.2, *Déclassement,* énonce les exigences et l'orientation relatives à la planification, à la préparation, à l'exécution et à l'achèvement du déclassement.

Il s'applique aux titulaires de permis d'installations de catégorie I et II, de mines et usines de concentration d'uranium et de substances nucléaires et appareils à rayonnement qui doivent produire un plan ou une stratégie de déclassement en raison d'une exigence réglementaire ou d'une condition de leur permis.

S'il est approuvé par la Commission, ce REGDOC remplacera le document G-219, *Les Plan préliminaire de déclassement des activités autorisées*.

Processus de consultation

Le personnel de la CCSN a mené de vastes consultations auprès des parties intéressées sur le cadre de déclassement et de gestion des déchets.

Le 16 juillet 2019, une version provisoire du REGDOC-2.11.2, *Déclassement*, a été publiée aux fins de consultation publique jusqu'au 16 octobre 2019.

Pendant cette période, la CCSN a reçu 102 commentaires provenant de douze répondants : Bruce Power, Cameco, l'Association nucléaire canadienne (ANC), les Laboratoires Nucléaires Canadiens (LNC), Hydro-Québec, Énergie du Nouveau-Brunswick, la Société de gestion des déchets nucléaires

Consultation submissions were posted for feedback from December 2 to December 20, 2019. The CNSC received 31 comments from 4 respondents: Canadian Environmental Law Association, Concerned Citizens of Renfrew, Northwatch and Dr. Frank Greening.

After the public consultation phase was conducted for REGDOC-2.11.2, the scope was expanded to explicitly list Class II facilities and nuclear substance and radiation devices licensees. The CNSC reached out to a working group representing Class II licensees in the commercial, medical and industrial sectors from across Canada for comments from January 27 to March 2, 2019.No comments were received from this targeted consultation.

Civil society organizations (CSOs) and industry requested workshops to discuss REGDOCs from the waste management and decommissioning series, including this one.

CNSC staff held a workshop with industry on February 5, 2020 and one with CSOs on February 26. Due to technical difficulties, a second webinar with members of the public and CSOs was held on April 23, 2020. The purpose of the webinars was to explain the changes made to the document following public consultation and to discuss outstanding issues and how comments were dispositioned.

The following organizations participated for the February 5 workshop with industry:

- Bruce Power
- BWX Technologies
- Cameco
- CNA
- CNL
- CANDU Owners Group
- Hydro-Québec
- Kinetrics
- New Brunswick Power
- Nuclear Waste Management

(SGDN), Ontario Power Generation (OPG), la région de Durham, Safety Probe International et monsieur J.R. Walker.

Les commentaires reçus lors de la consultation ont été affichés aux fins de rétroaction du 2 au 20 décembre 2019. La CCSN a reçu 31 commentaires supplémentaires provenant de quatre répondants : l'Association canadienne du droit de l'environnement, Concerned Citizens of Renfrew, Northwatch et monsieur Frank Greening.

À la suite de la consultation publique menée pour le REGDOC-2.11.2, la portée du document a été élargie afin d'inclure explicitement les titulaires de permis d'installations de catégorie II et de substances nucléaires et appareils à rayonnement. Du 27 janvier au 2 mars 2019, la CCSN a sollicité les commentaires d'un groupe de travail représentant les titulaires de permis de catégorie II des secteurs commercial, médical et industriel de tout le Canada. Aucun commentaire n'a été reçu à la suite de cette consultation ciblée.

Des organisations de la société civile (OSC) et l'industrie ont demandé des ateliers pour discuter des REGDOC faisant partie de la série sur la gestion des déchets et le déclassement, y compris ce REGDOC.

Le personnel de la CCSN a tenu un atelier avec l'industrie le 5 février 2020 et un webinaire avec les OSC le 26 février. En raison de difficultés techniques, le second webinaire avec les membres du public et les OSC a eu lieu le 23 avril 2020. Ces webinaires avaient pour objectif d'expliquer les modifications apportées au document à la suite de la consultation publique et de discuter des questions en suspens et de la manière dont les commentaires ont été pris en compte.

Les entités suivantes ont participé à l'atelier du

Organization

- OPG
- Orano

The following commenters participated in the CSO webinar, either in person or through written submission, on April 23, 2020:

- Algonquin Eco Watch
- Canadian Environmental Law Association
- Concerned Citizens of Renfrew
- Dr. Frank Greening
- Dr. Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Regional Municipality of Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

The full responses to stakeholder feedback on individual REGODCs, including comments received during public consultation or in advance of the workshops, can be found in the associated detailed comments table included as part of the Commission Member Document package.

5 février avec l'industrie :

- Bruce Power
- BWX Technologies
- Cameco
- ANC
- LNC
- Groupe des propriétaires de CANDU
- Hydro-Québec
- Kinetrics
- Énergie du Nouveau-Brunswick
- Société de gestion des déchets nucléaires
- OPG
- Orano

Les commentateurs suivants ont participé, en personne ou par le biais d'un mémoire, au webinaire organisé pour les OSC le 23 avril 2020 :

- Algonquin Eco Watch
- Association canadienne du droit de l'environnement
- Concerned Citizens of Renfrew
- Frank Greening
- Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Municipalité régionale de Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

Les réponses complètes aux commentaires des parties intéressées sur les différents REGDOC, y compris les commentaires reçus lors de la consultation publique ou avant les ateliers, se trouvent dans le tableau connexe des commentaires détaillés qui fait partie de la trousse de documents remise aux commissaires.

Key comments

The following summarizes the key comments received during the consultation period and provides the CNSC's responses:

Comment 1:

Industry and CSOs expressed concerns over *in situ* decommissioning as a decommissioning strategy.

CNSC staff response:

Additional information on *in situ* decommissioning has been added to the document to provide further clarification on when *in situ* decommissioning could be used, including circumstances for which it is not an acceptable decommissioning strategy.

Comment 2:

Licensees expressed a need for greater clarity of the scope.

CNSC staff response:

The scope of the document was expanded to include Class II nuclear facilities and nuclear substances and radiation devices licensees that are required to have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their licence.

Comment 3:

Industry and CSOs raised concerns over alignment of terminology and definitions with the IAEA definitions, including "decommissioning".

Principaux commentaires

Les principaux commentaires reçus lors de la période de consultation sont résumés ci-après et accompagnés des réponses de la CCSN.

Commentaire 1

L'industrie et les OSC ont exprimé des inquiétudes à l'égard déclassement in situ comme stratégie de déclassement.

Réponse du personnel de la CCSN

Des renseignements supplémentaires sur le déclassement in situ ont été ajoutés au document afin de préciser davantage les cas où le déclassement in situ pourrait être utilisé, y compris les circonstances pour lesquelles il ne constitue pas une stratégie de déclassement acceptable.

Commentaire 2

Les titulaires de permis ont fait part de la nécessité d'une plus grande clarté à l'égard de la portée.

Réponse du personnel de la CCSN

La portée du document a été élargie pour inclure les titulaires de permis d'installations de catégorie I et de substances nucléaires et appareils à rayonnement qui doivent produire un plan ou une stratégie de déclassement en raison d'une exigence réglementaire ou d'une condition de leur permis.

Commentaire 3

L'industrie et les OSC ont soulevé des préoccupations concernant l'harmonisation de la terminologie et des définitions avec les définitions de l'AIEA, y compris le « déclassement ».

CNSC staff response:

The document was reviewed to ensure that key terms are found in either REGDOC-3.6, *Glossary of CNSC Terminology* or the CSA standards that compliment this REGDOC. The definition were reviewed for alignment with the IAEA safety glossary.

The definition of the term 'decommissioning' was revised to further align with the IAEA definition.

The terms "decontamination", "dismantlement", "cleanup" and "remediation" were added to the glossary section of the draft REGDOC.

The new terms defined in the REGDOC will be submitted for inclusion in the next version of REGDOC-3.6, *Glossary of CNSC Terminology*.

Réponse du personnel de la CCSN

Le document a été révisé afin de s'assurer que les principaux termes se trouvent, soit dans le REGDOC-3.6, *Glossaire de la CCSN,* soit dans les normes du Groupe CSA qui complètent ce REGDOC. Les définitions ont été révisées pour qu'elles s'alignent sur le glossaire de sûreté de l'AIEA.

La définition du terme « déclassement » a été révisée pour qu'elle soit davantage conforme à la définition de l'AIEA.

Les termes « décontamination ». « démantèlement », « nettoyage » et « remise en état » ont été ajoutés à la section Glossaire du projet de REGDOC.

Les nouveaux termes définis dans le REGDOC seront présentés aux fins d'inclusion dans la prochaine version du REGDOC-3.6, *Glossaire de la CCSN*.

Comment 4:

Licensees expressed concerns over a lack of alignment with CSA N294, *Decommissioning of facilities containing nuclear substances*.

Commentaire 4

Les titulaires de permis ont fait part de leurs préoccupations à l'égard d'un manque d'harmonisation avec la norme CSA N294, *Déclassement des installations contenant des substances nucléaires*.

CNSC staff response:

CSA N294-19, *Decommissioning of facilities containing nuclear substances* was undergoing an update in parallel with the development of REGDOC-2.11.2. The consultation for CSA N294-19 ended on July 31, 2019 and the public consultation for REGDOC-2.11.2 started on July 16, 2019. Most of the inconsistencies raised by licensees were aligned with the updated version of CSA N294 once it was published.

Réponse du personnel de la CCSN

La norme CSA N294-F19, *Déclassement des installations contenant des substances nucléaires* faisait l'objet d'une mise à jour en parallèle avec l'élaboration du REGDOC-2.11.2. La période de consultation sur la norme CSA N294-F19 a pris fin le 31 juillet 2019 et la période de consultation publique pour le REGDOC-2.11.2 a débuté le 16 juillet 2019. La plupart des incohérences soulevées par les titulaires de permis ont été résolues avec la publication de la version mise à jour de la norme CSA N294.

Comment 5:

CSOs raised concerns about public and Indigenous engagement on decommissioning.

Commentaire 5

Les OSC ont soulevé des préoccupations au sujet de la mobilisation des peuples autochtones et du public à l'égard du déclassement.

CNSC staff response:

The CNSC requires that planning for decommissioning take place throughout the lifecycle of a facility to ensure early engagement with surrounding communities on proposed decommissioning plans.

Preliminary decommissioning plans must include public consultation plans as well as decommissioning strategies that consider public and Indigenous engagement. The DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned.

During CNSC staff review of decommissioning plans, if these considerations are not addressed, the CNSC will request additional information prior to providing acceptance of the decommissioning plan.

Réponse du personnel de la CCSN

La CCSN exige que la planification du déclassement se fasse tout au long du cycle de vie d'une installation afin de garantir une mobilisation précoce des communautés environnantes sur les plans de déclassement proposés.

Les plans préliminaires de déclassement doivent inclure des plans de consultation publique ainsi que des stratégies de déclassement qui tiennent compte de la mobilisation du public et des Autochtones. Le plan de déclassement détaillé doit comprendre un rapport sommaire de toute mobilisation du public ou des Autochtones entreprise dans la préparation du plan, y compris les préoccupations soulevées, la façon dont elles ont été prises en compte et comment on y a donné suite.

Lors de l'examen des plans de déclassement par le personnel de la CCSN, si ces aspects ne sont pas traités, la CCSN demandera des renseignements supplémentaires avant d'accepter le plan de déclassement.

Concluding remarks

This project has undergone extensive stakeholder consultations. CNSC staff have listened to concerns and the document has been modified, as appropriate.

Mot de la fin

Ce projet a fait l'objet de vastes consultations auprès des parties intéressées. Le personnel de la CCSN a entendu les préoccupations et a modifié le document, au besoin.

REGDOC-2.11.2, *Decommissioning*
REGDOC-2.11.2, *Déclassement*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

NOTE: Draft REGDOC-2.11.2 has gone through an iterative consultation process with stakeholders involving four distinct phases and four separate draft versions of the document being created. Therefore changes noted in Tables A, B, C, D and E reflect document modifications that were used for further stakeholder comments in Table F. As a result, only the changes noted in the final table (Table F) are reflected in the final draft version of the document submitted to the Commission for approval.

Comments received:

- Table A on the Request for Information document: No comments received
- Table B: public consultation period (July 16 to October 16, 2019): 102 comments from 12 reviewers
- Table C: feedback on comments period (December 2 to 20, 2019): 31 comments from 4 reviewers
- Table D: targeted consultation with Class II licensees (January 27 to March 2, 2020): No comments received.
- Table E: letters sent to the Hon. Seamus O'Regan, Minister of Natural Resources: 2 comments received
- Table F: workshop with industry and civil society organizations on February 5, 2020 and April 23, 2020: 35 comments received

Commentaires reçus :

- Tableau A: sur le document Demande d'information : Aucun commentaire reçu
- Tableau B : période de consultation publique (16 juillet au 16 octobre 2019) : 102 commentaires reçus de 12 examinateurs
- Tableau C : période des observations (2 au 20 décembre 2019) : 31 commentaires reçus de 4 examinateurs
- Tableau D : consultation ciblée avec les détenteurs de permis de catégorie II (27 janvier au 2 mars 2020) : Aucun commentaire reçu.
- Tableau E : lettres envoyées à l'Honorable Seamus O'Regan, Ministre des Ressources Naturelles : 2 commentaires reçus
- Tableau F : atelier avec l'industrie et avec des organisations de société civile du 5 février 2020 et du 23 avril 2020 : 35 commentaires reçus

Table A: Comments on the "Request for Information" / Tableau A Sur le document Demande d'information

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
No comments received				

Table B: Public consultation period / Tableau B : Période de consultation publique

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	Dr J.R. Walker	General	Canada has a treaty obligation to comply with the provisions of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* [2]. This convention entered into force with respect to Canada in 2001 and has provisions that directly concern the decommissioning of facilities containing	Comment noted. IAEA documentation is considered throughout the regulatory process. The CNSC confirms that a gap analysis was conducted between IAEA safety standards and the regulatory framework as part of the analysis phase for this

REGDOC-2.11.2, *Decommissioning*
REGDOC-2.11.2, *Déclassement*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

<table>
<tr><th></th><th>Organization / Organisation</th><th>Section</th><th>Comment / Commentaire</th><th>CNSC Response / Réponse la CCSN</th></tr>
<tr><td></td><td></td><td></td><td>nuclear substances.

The Joint Convention [2] requires Canada to pay due regard to internationally endorsed criteria and standards. In the context of the scope of this draft regulatory document [1], the appropriate internationally endorsed criteria and standards include the following current relevant standards of the International Atomic Energy Agency (IAEA):

• International Atomic Energy Agency, Decommissioning of Facilities, General Safety Requirements Part 6, GSR Part 6, 2014 [3];

• International Atomic Energy Agency, Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities, Specific Safety Guide SSG-47, 2018 [4];

• International Atomic Energy Agency, Classification of Radioactive Waste, General Safety Guide GSG-1, 2009 [5];

• International Atomic Energy Agency, Disposal of Radioactive Waste, Specific Safety Requirements SSR-5, 2011 [6];

• International Atomic Energy Agency, Near Surface Disposal Facilities for Radioactive Waste, Specific Safety Guide SSG-29, 2014 [7]; and

• International Atomic Energy Agency, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste, Specific Safety Guide SSG-23, 2012 [8].

Regrettably, this draft regulatory document [1] is non-compliant with these international safety standards in at least two critical areas.</td><td>REGDOC. SSG-23, The Safety Case and Safety Assessment for the Disposal of Radioactive Waste was used as the basis for this REGDOC.

<table><tr><th>REGDOC #</th><th>Title</th><th>Safety Standards Referenced or Influenced By</th></tr><tr><td>1.2.1</td><td>Guidance on Deep Geological Repository Site Characterization</td><td>SSR-5, SSG-14</td></tr><tr><td>2.11</td><td>Waste Management: Framework for Radioactive Waste Management and Decommissioning in Canada</td><td>GSR-5, GSG-1, SSR-5, GSR-6</td></tr><tr><td>2.11.1 Volume I</td><td>Waste Management, Volume I: Management of Radioactive Waste</td><td>GSR-5, GSG-1, SSG-40, SSG-41, WS-G-6.1, SSR-5, SSG-15, SSG-29, SSG-31, SSG-14</td></tr><tr><td>2.11.1 Volume II</td><td>Waste Management: Management of Uranium Mine Waste Rock and Mill Tailings</td><td>WS-G-1.2, NF-T-1.2</td></tr><tr><td>2.11.1 Volume III</td><td>Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2</td><td>GSR-5, SSR-5, SSG-23, GSG-3</td></tr><tr><td>2.11.2</td><td>Decommissioning</td><td>GSR-6, GSR-4, WS.G-2.4, WS-G-2.1, WS-G-5.2</td></tr><tr><td>3.3.1</td><td>Financial Guarantee for Decommissioning of Nuclear Facilities and Termination of Licensed Activities</td><td>GSR-6</td></tr></table>
Specific to this REGDOC, both GSR Part 6, Decommissioning of Facilities and SSG-47, Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities were use in the development of this REGDOC. The other safety standards mentioned were used in the development of REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste and Volume III, Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2.</td></tr>
<tr><td>2.</td><td>Dr J.R. Walker</td><td>General</td><td>2.0 Non-Compliances with International Safety Standards
2.1 Use of a Proscribed Decommissioning Strategy
This draft regulatory document [1] promotes the use of an in situ decommissioning strategy (entombment) for “legacy” nuclear facilities (See Sections 4 and 6.3). The use of an in situ decommissioning strategy is specifically proscribed by international standards for planned decommissioning. The International Atomic Energy Agency</td><td>As a result of this comment, the text on in situ has been revised to:

“In situ decommissioning shall not be considered a reasonable decommissioning option for planned decommissioning of existing nuclear power plants, or for future nuclear facilities and situations where removal is possible and practicable. In situ decommissioning may be considered a solution only under exceptional</td></tr>
</table>

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			(IAEA), defining the safety requirements for the decommissioning of facilities in *General Safety Requirements Part 6: Decommissioning of Facilities* [3], describes two possible decommissioning strategies, namely *immediate dismantling* and *deferred dismantling.* In discussing these two strategies, the IAEA notes the inappropriateness of entombment, as follows [3]: 1.10. A combination of these two strategies may be considered practicable on the basis of safety requirements or environmental requirements, technical considerations and local conditions, such as the intended future use of the site, or financial considerations. Entombment, in which all or part of the facility is encased in a structurally long lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g., following a severe accident). Further explanation regarding the inappropriateness of entombment as a decommissioning strategy is provided in the IAEA's Specific Safety Guide SSG-47, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities* [4]: 5.17. Entombment, in which all or part of the facility is encased in a structurally long lived material, should not be considered an acceptable strategy for planned decommissioning. It might be considered as a last option for managing facilities that have been damaged in an accident, if other options are not possible owing to high exposures of workers or technical difficulties. 5.18. Even under exceptional circumstances, the choice of entombment might lead to technical and regulatory difficulties, owing to a lack of specific regulations and guidance in the State and a lack of acceptability of entombment. Additionally, the intention to apply entombment might not be accepted by the public. In this context, all efforts should be made to reduce the parts of the facility that will be subject to entombment and to reduce to the extent possible the radioactive inventory that will be encased on the site, especially the long lived radionuclides. Entombment actions should not reduce the technical feasibility of surveillance and maintenance of the remaining barriers. If entombment is selected, it will impose a burden on future generations owing to the need for long term monitoring of the site and owing to	circumstances (e.g., following a severe accident) or for legacy sites. In situ decommissioning for legacy sites is only considered viable where: the use of in situ will be protective of workers, the public and the environment; decommissioning was not planned as part of the design; the fuel has been removed; and the site will remain under institutional control for the period defined in the safety case." The CNSC does not promote or prescribe decommissioning strategies. Proponents must propose their preferred strategy as part of their decommissioning plan. Any proposed decommissioning strategy will be assessed by the CNSC to ensure the protection of health and safety of the public and the environment, and human health and safety. The CNSC requires that the selection of the decommissioning strategy be justified and that when a licensee is determining the decommissioning strategy, various factors are consider (e.g., availability of knowledgeable staff, the availability of infrastructure for radioactive waste, public and Indigenous engagement, etc.). According to international guidance, *in situ* may be considered a viable option under exceptional circumstances. In the lack of international guidance on what exceptional circumstance includes, Canada has stipulated in draft REGDOC-2.11.2 what circumstances *in situ* confinement could be used in the Canadian context, provided a demonstration of safety via a science based safety case is made. If in situ confinement is used as a decommissioning strategy that results in a waste disposal facility, the CNSC requires all regulatory requirements for that type of facility be met and that safety be demonstrated via a science based safety case and post closure safety assessment.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			possible future actions necessary to prevent and reduce leakages of radioactive material from the facility.	
3.	Dr J.R. Walker	General	2.2 Placing an Undue Burden on Future Generations This draft regulatory document [1], in the context of "legacy" nuclear facilities, promotes the use of institutional controls that are not consistent with internationally-accepted practice. Internationally-accepted practice is that the need for any institutional controls should cease after a period of a few hundred years, as institutional controls cannot be relied upon to ensure safety beyond that period [6 – 8]. This draft regulatory document [1], however, assumes that institutional control of "legacy sites" will be maintained for "the foreseeable future" (See Section 4). As noted above, this will impose a burden on future generations owing to the actions necessary to safely maintain the facility into the indefinite future and prevent intrusion into the site by humans and non-human biota. The maintenance of institutional controls has an associated cost. In admitting to an "indefinite" period of institutional controls, the authors are admitting to an "infinite" cost. The passing on of costs to future generations violates the "polluter pay" principle of the Government of Canada's Radioactive Waste Policy Framework [9]. It would be unwise for Canada to accept this draft regulatory document [1], as Canada would leave itself at risk of "infinite" liabilities.	See response to comment #2 on the revised text for *in situ* decommissioning. In such a case where the end state for *in situ* decommissioning results in a waste disposal site, the licensee must satisfy all regulatory requirements for a radioactive waste disposal facility and demonstrate safety via a post-closure safety case and safety assessment of a disposal facility. Further information on post-closure safety case and safety assessment, including institutional control can be found in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* and REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2. The draft version of REGDOC-2.11.1, Volume III states "The licensee or applicant shall identify the role that institutional controls play in waste disposal system safety, and how that role is taken into account in the safety case and its supporting safety assessment. The presence of institutional control should not be used to justify a reduction in the level of design performance of the containment and isolation system. While long-term safety of the radioactive waste disposal system should not be dependent on institutional control, institutional control should be used to the extent that is practicable to confirm the disposal system is performing as designed. Uncertainties associated with future human activities and the evolution and stability of societies, licensees or applicants should limit the reliance on institutional controls as a safety feature to a few hundred years."
4.	Dr J.R. Walker	General	**3.0 Damage to the Relationship with International Partners** Noting that Canada has a treaty obligation under the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* [2] to	See response to comment #2 on the revised text for *in situ* decommissioning. Canada's 6th National Report to the *Joint Convention on the Safety of Spent Fuel*

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			pay due regard to internationally endorsed criteria and standards with respect to radioactive waste management, our international partners will likely be concerned over Canada's use of a decommissioning strategy that is specifically proscribed by international standards. Additionally, Canada has treaty obligations under the *Comprehensive Economic and Trade Agreement* with the European Union (CETA) [10]. In ratifying CETA, Canada has expressly reaffirmed (Article 24.4 of CETA) *its commitment to effectively implement in its law and practices, in its whole territory, the multilateral environmental agreements to which it is party*. This would, of necessity, include its obligations with respect to radioactive waste management under the *Joint Convention* [2]. The promotion of the use of an *in situ* decommissioning strategy that is specifically proscribed by international standards will be seen as a contravention of Canada's obligations under the *Joint Convention* [2], and, hence, a contravention of Article 24.4 of CETA [10].	*Management and on the Safety of Radioactive Waste Management* demonstrates how Canada continues to meet its obligations under the terms of the Joint Convention. This report is available on the CNSC's website. *In situ* may be considered a viable option under exceptional circumstances, in accordance with IAEA GSR Part 6, *Decommissioning of Facilities*. As a result of the lack of international guidance on what exceptional circumstance includes, Canada has stipulated in draft REGDOC-2.11.2 what circumstances *in situ* confinement could be used in the Canadian context, provided a demonstration of safety via a science based safety case is made. If *in situ* confinement is used as a decommissioning strategy that results in a waste disposal facility, the CNSC requires all regulatory requirements for that type of facility be met and that safety be demonstrated via a science based safety case and post closure safety assessment.
5.	Dr J.R. Walker	General	**4.0 Inequitable Treatment of Rural Canadians** Two Provincially-owned utilities, in Ontario and Québec, have nuclear reactors that have reached, or are close to reaching, end-of-life (Gentilly-2, Pickering). These nuclear reactors are located in urban or extra-urban communities. In both cases, the end state for decommissioning is the removal of the radioactive materials, with subsequent restoration to the initial state or repurposing [11, 12]. In contrast, the Federally-owned "legacy" reactors (NPD, WR-1) are located in rural communities and the currently-planned end state is that a significant amount of low-level and intermediate-level radioactive wastes will be left on-site by the *in situ* decommissioning [13, 14]. The *in situ* decommissioning of these "legacy" nuclear reactors will create near-surface inventories of radioactive materials that will remain radiological hazards for tens of thousands of years (see, for example, Figure G-75 of [15]). This is a period of time that is far in excess of the period in which institutional controls can be relied upon to ensure safety [6 – 8]. Radioactive material will migrate away from the	See response to comment #2.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			entombed reactor and give rise to radiological exposures to humans and non-human biota (see, for example, Table 7.3.8-1 of [14]). Hence, future generations of rural residents will be required to endure the burden of a radiologically-contaminated environment created by the use of this internationally-proscribed decommissioning strategy, in contrast to urban Canadians who are promised an environment free from radiological contamination.	
6.	Dr J.R. Walker	General	**5.0 Damage to Regulatory Credibility** This draft regulatory document [1] promotes the use of an *in situ* decommissioning strategy (entombment) for "legacy" facilities, that: a) is specifically proscribed by international standards for planned decommissioning; b) is fiscally unsound since it places an open-ended financial burden on the taxpayers of Canada; and c) creates an inequitable outcome for rural Canadians. The promotion of an *in situ* decommissioning strategy will damage the credibility of the CNSC in the eyes of Canadians.	See response to comments #2, 3, and 4.
7.	Dr J.R. Walker	General	**6.0 Concluding Remarks and Recommendation** The draft regulatory document [1] should include the Joint Convention [2] and the relevant internationally endorsed criteria and standards, e.g., [3 – 8], as references. The draft regulatory document should be reviewed against these safety requirements and revised, as necessary, to ensure compliance with Canada's treaty obligations and these internationally endorsed standards. In particular, the finalized regulatory document should not allow the use of a decommissioning strategy (*in situ* decommissioning) that is specifically proscribed by international standards for planned decommissioning, is fiscally unsound, and that creates an inequitable outcome for rural Canadians.	As a result of this comment, the suggested references that are relevant to this REGDOC were added to the 'Additional information' section. Some of the suggested references were added to other REGDOCs in the waste management series where they are more applicable (REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* and REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2). See response to comment #1 on the Safety Standards used in the development of this REGDOC. See response to comment #4 on when *in situ* decommissioning may be a viable strategy.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
8.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	General	**Issue (Major)** As currently written, the REGDOC is not clear on the timing of key activities. Specifically: 1) Detailed planning documents (i.e., detailed plans to implement activities covered at a high-level in the PDP) need only be submitted ahead of conducting those activities. Submitting detailed plans too far in advance creates significant time and resource implications for licensees with minimal added value if the activities will not be conducted for several years. The PDP already provides this information at a high level. 2) Reporting requirements as per REGDOC- 3.1.1 and REGDOC-3.1.2 are not referenced. 3) It fails to acknowledge that certain decommissioning activities can take place under an operating licence as well as a decommissioning licence. **Suggested change** For clarity, licensees urge the CNSC to provide a more fulsome discussion of what decommissioning entails in the introductory sections of this document. Future drafts should: 1) Provide more specific guidance on when key detailed implementation documents are required. Describe how detailed decommissioning implementation plan(s) are only required when a licensee is contemplating specific decommissioning activities. The REGDOC should put less emphasis on the titles that have historically been given to these detailed implementation plans (e.g., SAR, SOP, DDP) and focus on the point that detailed planning is needed around the time that specific decommissioning activities are being considered by the licensee. 2) Ensure all reporting requirements are reflected as per *REGDOC- 3.1.1* and *REGDOC-3.1.2* (e.g. DDP, storage with surveillance plan) 3) Describe how activities related to decommissioning can occur under an operating	As a result of this comment, the following changes were made: Bullet #1: The following text was added to section 2: "Throughout the lifecycle of a nuclear facility or for the duration of a licensed activity, except for release from CNSC regulatory control, a decommissioning plan is required. A preliminary decommissioning plan (PDP) is developed during the siting phase for a Class I nuclear facility and uranium mine and mill, the construction phase for a Class II nuclear facility, or prior to submitting an application for a CNSC licence to possess, manage, use or store nuclear substances at a location. The PDP is progressively updated, where needed, to reflect the appropriate level of detail required for the respective licensed activities. Prior to the decommissioning stage, a detailed decommissioning plan (DDP) is developed. The DDP refines and adds details to the PDP." In addition, the following text was added to section on detailed decommissioning plans: "Prior to the execution of decommissioning, the licensee shall submit a DDP to the CNSC for acceptance. For a Class I nuclear facility, the licensee should typically submit a DDP to the CNSC two to five years prior to permanent shutdown. "For immediate (prompt) decommissioning, the licensee or applicant shall detail, in the DDP and supporting documents (e.g., safety assessment for decommissioning), the decontamination, dismantling and clean-up. For deferred decommissioning, the licensee or applicant shall detail, in the DDP and supporting documents (e.g., safety assessment for decommissioning), the activities that will be performed during the SWS period. A graded approach should be applied, during SWS, to the level of detail in the DDP pertaining to decontamination, dismantling and/or clean-up. Toward the end of the SWS period, the DDP and supporting documents shall be revised, detailing the decontamination, dismantling work and clean-up activities to be completed and submitted to the CNSC for acceptance."

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			licence. More context could also be provided regarding other decommissioning strategies (prompt and in situ) since only "deferred" is currently discussed in this draft. **Impact on industry** The preparation and submission of detailed planning documents requires significant resources and has the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare detailed plans.	Bullet #2: REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants, Version 2* and REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills* and REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices* were added in the 'Additional information' section. Bullet #3: The following text was included is section 6, Preparation for Decommissioning: "Depending on the site-specific licence, stabilization activities may be performed under either a licence to operate or to decommission." GSR Part 6, *Decommissioning of Facilities* w used as the basis for the development of this REGDOC.
9.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	General	**Issue (Major)** This language in this draft is unclear in some essential areas and inconsistent with some of the definitions and guidance in its related CSA standard, *N294 - Decommissioning of Nuclear Facilities*. Specifically: 1) The use of "decommissioning" is inconsistent throughout this draft and not used in the context as per the Glossary's definition. Instead, "decommissioning" is most often used when referring to dismantling and demolition. 2) The Glossary definition of "decommissioning" is slightly different from those in *REGDOC-3.6, Glossary of CNSC Terminology* and CSA *N294, Decommissioning of Nuclear Facilities.* Even subtle differences in how terms are defined can generate confusion and questions. **Suggested change** For consistency, the CNSC should ensure definitions and guidance truly align with those in other regulatory documents and related CSA standards. Specifically: 1) Review all references to "decommissioning" and ensure it is being used in the	As a result of this comment, the following changes were made: Bullet #1: The definition was developed using IAEA as the basis in combination with the CSA N294, *Decommissioning of facilities containing nuclear substances* definition. The definition was revised to more precisely align with the IAEA definition. Bullet #2: The definition provided in the glossary section of the REGDOC is a proposed revision to the definition that appears in the current version of the glossary. As stated in the glossary section: "The following terms are either new terms being defined, or include revisions to the current definition for that term. Following public consultation, the final terms and definitions will be submitted for inclusion in the next version of REGDOC-3.6, *Glossary of CNSC Terminology*."

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			proper, defined context. 2) Review definitions of "decommissioning" from sources such as CSA *N294*, the Nuclear Regulatory Commission and Part 6 of the International Atomic Energy Agency's General Safety Requirements. From those, create a definition that can be included in *REGDOC-3.6* and used consistently in all related regulatory documents. **Impact on industry** Clear, consistent language repeated in all related regulatory documents and nuclear standards promotes better compliance.	
10.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	General	**Issue (Major)** There are instances where the CNSC uses the creation of this draft REGDOC to convert clearly-written, highly effective guidance from *G-219, Decommissioning Planning for Licenced Activities and CSA N294* into new requirements. **Suggested change** Review all conversions of previous guidance to new requirements to ensure they are justified and not just blanket changes done as part of the CNSC's document framework project. **Impact on industry** REGODOC changes are not theoretical or academic exercises for licensees. Every new requirement carries a real-life cost, either in hard resources or time. The cumulative impact of ever-increasing requirements means licensees' ability to prioritize their work and distribute their limited resources in areas that truly impact operational nuclear safety is progressively limited.	No changes were made as a result of this comment. REGDOC-2.11.2, *Decommissioning* was developed integrating lessons learned and international best practices since G-219, *Decommissioning Planning for Licensed Activities* was originally published in 2000. This document was developed based on requirements and guidance in international safety standards, such as GSR Part 6, *Decommissioning of Facilities*, SSG-47, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities* and WS-G-5.2, *Safety Assessment for the Decommissioning of Facilities Using Radioactive Material*.
11.	Region of Durham	General	This draft regulation is significant for Durham Region since the Pickering Nuclear Generating Station (PNGS) is scheduled to cease operations in 2024. At that point, it is the Region's understanding that Ontario Power Generation's (OPG) plans to defuel and dewater the reactors and begin undertaking the steps required to place the plant in	No changes were made as a result of this comment. See response to comment #2 on the choice of a decommissioning strategy.

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			"safe storage" (2024-2028). OPG's Preliminary Decommissioning Plan (PDP) takes a "deferred decommissioning approach" under which the plant would be kept in safe storage mode for several decades (2028-2050) before it finally would be dismantled and demolished. A key premise of the PDP is that all used nuclear fuel waste must be removed from the site before dismantling can occur (estimated 2043-2054). Thus, the timeframe for dismantling and demolition likely will not begin until 2055 and will take until the early 2060s. Site restoration is to be completed by 2066 according to OPG's PDP. About the same time (estimated 20), the Darlington station, now undergoing refurbishment, will be nearing the end of its operational period (as currently envisioned). This means that Durham Region, its area municipalities and residents will be living with nuclear decommissioning processes for the next century. Thus, our communities and residents will be greatly affected by the comprehensiveness and effectiveness of the proposed regulatory document.	The specifics of the PNGS decommissioning project are outside the scope of this REGDOC. However, CNSC staff confirm that the site will remain under a CNSC licence and regulatory oversight will be ongoing for this period of decommissioning, including storage with surveillance, dismantling and site clean-up. Licensees will be required to inform and engage surrounding communities, as they are subject to REGDOC-3.2.1, *Public Information and Disclosure*.
12.	Region of Durham	General	The CNSC held hearings in June 2018 to consider the relicensing of the PNGS from 2018 to 2028. At that hearing, the Region's submission (Attachment 1) anticipated the impacts expected to result from the plant closure and decommissioning process as outlined in OPG's preliminary decommissioning plan. We ask that you review pages 7-9 and 13-23 to understand more fully the uncertainties and expected impacts to the Regional community in which a large decommissioning project will shortly begin.	CNSC staff reviewed the recommended sections of the Region of Durham's intervention on the PNGS relicensing hearing and no changes were made to the document as a result. See response to comment #11.
13.	Region of Durham	General	The imminent closure of the PNGS and the subsequent stages of safe storage and decommissioning will have significant physical, fiscal, emergency response and socioeconomic consequences for the surrounding urban community for the next half-century. These anticipated impacts are outlined in detail on pages 14 to 22 of Attachment 1. In Regional staff's view, the draft REGDOC is deficient in recognizing and planning for these consequences "beyond the fence line" of the nuclear facility. The draft regulation is focused on safety and engineering challenges within the confines of the site. PNGS was built in a rural area in the 1970s but the adjacent environment has changed dramatically since then. The station is now in the midst of a growing urban community. However, beyond the need to prepare a consultation plan, the draft REGDOC contains almost no requirement of the licensee to plan for the	See response to comment #11. As outlined in the REGDOC, a DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned. The CNSC reviews decommissioning plans against requirements set out in this REGDOC and CSA N294, *Decommissioning of facilities containing nuclear substances*. During the review, if elements, such as planning considerations, are not addressed, the CNSC will request additional information prior to providing acceptance of the DDP.

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			potentially 50- year decommissioning process **with** the surrounding community. Further, there is no discussion of a process by which the community impacts of decommissioning of a large nuclear plant will be jointly managed or mitigated.	
14.	Region of Durham	General	Despite the project size, complexity and timeframe of decommissioning, existing nuclear generation stations are not included in the new Impact Assessment Act (IA Act) Project List as requiring a full impact assessment. If the IA process had been applied to decommissioning, it would have demanded assessment and mitigation of community and socio-economic impacts. Since an IA is unlikely to be carried out for PNGS decommissioning, it is even more critical that the regulations and licensing processes for decommissioning take into account and plan for community impacts over the full decommissioning period. The CNSC Environmental Assessment process has a very narrow scope. The offsite impacts it considers are largely limited to air and water quality, radiation exposure levels and emergency response plans. The CNSC suggested to the Region at the June 2018 hearing that socio-economic impacts are not their area of expertise and should be discussed with the operator outside the scope of the licensing hearing. While this is possible and has been pursued in the past, unfortunately, the regional municipality is not an equal partner in such a discussion. While OPG does consult with the Region, as a federally regulated provincial agency, it is largely exempt from municipal authority.	No changes were made as a result of this comment. The project list of the IAA is outside the scope of this document. The CNSC assesses the environmental effects of all nuclear facilities or activities at every phase of their lifecycle. A licence under the NSCA can only be granted if the applicant demonstrates to the CNSC that they will make adequate provision for the protection of the environment, health and safety of persons,. Section 4.0, *Decommissioning Strategy* outlines the requirements and guidance for determining the decommissioning strategy that licensee will use. The CNSC evaluates the chosen decommissioning strategy selected by a licensee to determine whether the licensee has considered topics such as: • public and Indigenous engagement • end-state objectives and site redevelopment plans • potential environmental impacts The CNSC must adhere to the legislative framework of the day. Additional information on the CNSC's environmental review processes can be found in REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures.*
15.	Region of Durham	General	The proposed regulation provides no timeframes by which certain deliverables can be expected. For example, the PDP is proposed to contain a commitment to prepare a DDP for CNSC acceptance "prior to dismantling and demolition". No specific timing for demolition is included in the PGNS PDP. The trigger for the demolition step is removal of the used fuel waste from the site for which there is also no firm timeline. Clarification of the timing of major steps is key. Several years ago, OPG engaged the community with the Repurposing Pickering	No changes were made as a result of this comment. The CNSC does not promote or prescribe the decommissioning schedule. Proponents must include their proposed decommissioning schedule as part of their decommissioning plan. These schedules include the sequence of and duration of the work packages. Decommissioning plans are assessed by the CNSC to ensure the protection of

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			exercise. This engagement focused mainly on potential uses after the site was fully restored rather than the decommissioning steps and timeline for getting there. The discussion at that time suggested that progressive reuse of parts of the PNGS site would be possible during decommissioning. If OPG plans to allow for progressive reuse of the site, this should be reflected in an updated PDP. Timelines in the sections of the REGDOC on the detailed decommissioning plan, the safety assessment and the waste management plan should also be clearer and more precise.	health and safety of the public and the environment, and human health and safety. If deferred decommissioning is chosen, the facility is placed into a period of storage with surveillance prior to the decontamination and dismantlement phase. During the period, the licensee is required to perform surveillance, inspection, servicing and maintenance to confirm that the structures, systems and components needed to maintain safe storage are functioning as required. As outlined in in section 6, the CSNC expects the detailed decommissioning plan, storage with surveillance plan, safety assessment and waste management plan during the preparation for decommissioning phases (i.e., prior to the execution of decommissioning phase). As stipulated in the requirements of the PDP and DDP, the licensee is required to engage with the public and Indigenous groups and communities.
16.	Canadian Nuclear Laboratories	General	Previously clearly-written, highly-effective guidance presented in G-219 have been converted into new requirements.	See response to comment #10.
17.	Canadian Nuclear Laboratories	General	There is a need to acknowledge that decommissioning activities can be undertaken during the operating license and continue under a decommissioning license. The timing of submissions should be reflected in Figure 1 to illustrate this option.	The following text is included is section 6, Preparation for Decommissioning "Depending on the site-specific licence, stabilization activities may be performed under either a licence to operate or to decommission." The following text has been added to section 2: "A licence to decommission or a licence that authorizes decommissioning activities is required for Class I and Class II nuclear facilities and uranium mines and mills prior to the execution of decommissioning. For sites with more than one facility or location that are at different lifecycle stages, the CNSC may issue a licence that includes multiple activities (e.g., operate and decommission)."
18.	Canadian Nuclear	General	There is a need to align with CSA N294 including a consistent definition of decommissioning.	See response to comment #9.

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19.	Canadian Nuclear Laboratories	General	Further guidance is required with respect to the application of a "Graded Approach" as it applies to the various decommissioning activities.	As a result of this comment, a new section on the graded approach was added. See section 3 Optimization and Graded Approach in Decommissioning for details.
20.	Canadian Nuclear Laboratories	General	There is a need to provide flexibility for sites with multiple facilities in the provision of a Preliminary Decommissioning Plan (PDP).	As a result of this comment, the following changes were made: • text was added to section 2.1: "A licence to decommission or a licence that authorizes decommissioning activities is required for Class I and Class II nuclear facilities and uranium mines and mills prior to the execution of decommissioning. For sites with more than one facility or location that are at different lifecycle stages, the CNSC may issue a licence that includes multiple activities (e.g., operate and decommission)." • a requirements in the section on PDPs has been revised to "For licensed sites with more than one facility or location for which the licensee is responsible, the licensee shall submit an overarching PDP to ensure that interdependencies between planning envelopes or facilities, locations or sites are taken into account."
21.	Canadian Nuclear Laboratories	General	Ensure that definitions are captured in REGDOC 3.6 and that they are aligned to other Regulatory Documents.	See response to comment #9.
22.	Canadian Nuclear Laboratories	General	Further details for each decommissioning strategy and the associated decommissioning activities, e.g., clause 6.1, Storage with surveillance plan only speaks to deferred decommissioning.	See response to comment #8 on the revised text in the detailed decommissioning plans section.
23.	Safety Probe International	General	In a multiunit nuclear power station, deferred decommissioning may involve the preparation for decommissioning of one or more units while the remaining neighbouring units continue to operate. Since multiunit plants are supported by common services and their containments could share a vacuum building, the challenge here is to address safety issues that may arise from severing units to be	As a result of this comment, the following requirement was added: "For licensed sites with more than one facility or location for which the licensee is responsible, the licensee shall submit an overarching PDP to ensure that interdependencies between planning envelopes or facilities, locations or sites are

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			decommissioned from these common services. In reaching the end state in this case, operating experience showed that the containment boundary and reactor equipments in the units prepared for deferred decommissioning undergo significant changes. The reactor core is defueled, coolant is drained from the heat transport system and the unit containment boundary moves to its Reactor Building Pressure Relief Duct bulkhead. Equipment may be removed, and the remaining ones are drained, disconnected or isolated. Other system components such as the Reactor Building ventilation system are to be de-energized and abandoned in place, but still need to be available for manual operation including the ventilation fans and main filter. Other design changes may also include severing common services and moving alarms and annunciation to panels of operating units.	taken into account." The statement was changed to better align with GSR Part 6, *Decommissioning of Facilities* and CSA N294, *Decommissioning of facilities containing nuclear substances*
24.	Cameco	General	Cameco notes at the outset that this REGDOC continues the negative trends in REGDOC drafting we have commented on before with respect to the addition of requirements to legislated requirements when REGDOCs should be used to provide guidance on how licensees may meet the legislated requirements. In this case, the guidance from G-219, *Decommissioning planning for Licenses Activities* and CSA N294-09, *Decommissioning of facilities containing Nuclear Substances* (CSA N294) has been converted into new requirements. This has a profound impact on resources that a licensee may be required to use without any improvement in safety or environmental benefits while not following the checks and balances that new regulations require.	See response to comment #10 on G-219, *Decommissioning Planning for Licensed Activities*.
25.	Cameco	General	We also note that this REGDOC refers to draft REGDOCs (REGDOC-2.11.1, Vol. I and Vol. III). As stated in previous comment, Cameco believes that only published REGDOCs should be referenced to permit a thorough review of a draft REGDOC and its implications.	As a result of the comment, only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version.
26.	Cameco	5.1.1, 6.2.1,	With respect to this REGDOC specifically, Cameco's main concern is that it is inconsistent with CSA N294. For example: •Section 5.1.1: Content of the PDP ○ The bullet list does not align with CSA N294, Annex A. Of particular concern is the	As a result of the comment, the following changes were made to align with CSA N294, *Decommissioning of facilities containing nuclear substances:* • The text was changed to: "A PDP for a nuclear facility with a Class I or uranium mines and mills licence shall include, <u>as applicable</u>:…"

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			REGDOC's use of \`shall include\`, whereas CSA N294 uses the more appropriate \`may include\` when bullets do not apply to all facilities. •Section 6.2.1: Content of the DDP ○ The bullet list does not align CSA N294, Section 7.8.2 ○ This section does not align with the statement in CSA N294 that \`the detail and complexity of a [detailed] decommissioning plan shall be commensurate with the facility being decommissioned…\` Cameco recommends that the CNSC ensure that the issued REGDOC aligns with CSA N294.	• An additional bullet was added: "criticality safety assessment, as required, and planned actions involving fissile material".
27.	Cameco	General	Further, the language used un the REGDOC is inconsistent with some of the definitions used in other REGDOCs and related CSA standards. In this regard, definitions of the following should be developed in and/or included in REGDOC-3.6: •"decommissioning" should be defined in REGDOC-3.6 and be consistent with CSA N294 and Part 6 of the International Atomic Energy Agency's General Safety Requirements. •"remediation" (Section 1.2) •"legacy sites" (Sections 1.2 and 4) •"defence in depth" (Section 6.3)	As a result of this comment, the following changes were made: •The definition of decommissioning was revised, as described in response to comment #9. •A definition for the term 'Remediation', taken from the IAEA glossary, was added to the glossary. •A definition for the term 'Legacy' is provided under the section of decommissioning strategies and is aligned with CSA N294, *Decommissioning of facilities containing nuclear substances.* •The term 'Defence-in-depth' is defined in the CNSC glossary.
28.	Cameco	General	Given the extent and substance of the comments, Cameco believes that a revised draft of this REGDOC should be published for review and comment before the CNSC proceeds to finalize it.	As a result of this comment, the CNSC arranged to hold two separate workshops concerning the REGDOC-2.11 series in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April and discuss how stakeholder comments were taken into consideration. The revised draft REGDOCs and the associated detailed comments tables will be

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				sent to all stakeholders and invitees in advance of the workshops.
29.	Hydro-Québec	5.1, 6.1, 6.2.1	En plus, des commentaires en pièce jointe, Hydro-Québec a relevé quelques coquilles mineures au niveau de la traduction et souhaite souligner qu'il est important de s'assurer que la version française du document soit conforme à la version anglaise. Voici quelques exemples : • Section 5.1 : Avant-projet de déclassement devrait plutôt être Plan de déclassement préliminaire (à noter que le REGDOC 3.1.1 fait quant à lui référence à Plan de déclassement proposé) ; • Section 6.1 : Le dernier item du plan de stockage sous surveillance « dossiers » devrait probablement être « enregistrements » ; • Section 6.2.1 : Le troisième item du plan de déclassement détaillé est « le plan de stockage sous surveillance devrait décrire », en anglais « the storage with surveillance stage and requirements of the ». La signification n'est pas la même.	Section 5.1 : Aucun changement n'a été apporté au document. Bien que les deux termes sont parfois utilisés de façon interchangeable, nous avons choisi d'utiliser le terme « Avant-projet de déclassement » afin d'être en conformité avec le REGDOC-3.6, *Glossaire de la CCSN* et CSA N294, *Déclassement des installations contenant des substances nucléaires.* Section 6.1: Aucun changement n'a été apporté au document, puisque le terme "dossier" est utilisé dans l'ensemble du document. Section 6.2.1: Nous avons pris note de votre commentaire et la correction sera effectuée lors de la traduction de la nouvelle ébauche du REGDOC.
30.	Bruce Power	1.1	**Issue (Major)** Additional clarity of the document's Purpose is sought in the following ways: 1) The definition in the 2nd paragraph specifies end of decommissioning as when licensed activities cease, but does not clearly indicate when decommissioning begins. 2) The reference to "deferred decommissioning" in the final sentence of the 2nd paragraph does not add value. 3) Regarding the 3rd paragraph, licensees need to demonstrate they no longer require a licence given the surveyed levels of nuclear substances that they are in possession of, per the Nuclear Substances and Radiation Devices Regulations (e.g., levels below the exemption and unconditional clearance levels. Also, is the "end-state criteria" mentioned at the end of 3rd paragraph defined anywhere or prescribed by the CNSC?	As a result of this comment, the following changes were made: Bullet #1: The definition for 'decommissioning' was revised to align with the IAEA glossary definition. Section 2 now outlines the beginning and end of the decommissioning phases. Bullet #2: No change was made as it gives context to the timelines for deferred decommissioning. Bullet #3: The text was changed to "…followed by a survey to verify that there are no areas with residual contamination above end-state conditions". End-state is defined in REGDOC-3.6, *Glossary of CNSC Terminology* and CSA N294, *Decommissioning of facilities containing nuclear substances.*

REGDOC-2.11.2, *Decommissioning*
REGDOC-2.11.2, *Déclassement*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

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			Suggested change Clarify the Purpose to say that decommissioning activities can occur under both operational and decommissioning licences and the phases are not precisely defined. Add further clarity by amending: 1) The 2nd paragraph to stipulate the actual start of decommissioning in a way that aligns with activities covered in the PDP. This definition sets the reference point for the remainder of the document. 2) The final sentence of the 2nd paragraph to read, "The time period for the conduct of decommissioning actions typically range from a few weeks for small and simple facilities, to years or decades for larger and more complex facilities~~, especially in the case of deferred decommissioning~~." If "deferred decommissioning" remains, it should be defined. 3) The 3rd paragraph to read, "…followed by a survey to verify that there are no areas with residual contamination above ~~end-state criteria~~ levels that would require a licence." If not amended, define "end-state criteria." **Impact on industry** It's important to know the actual start of decommissioning from a regulatory perspective. For reference, America's Nuclear Regulatory Commission describes decommissioning as "the process of safely closing a nuclear power plant (or other facility where nuclear materials are handled) to retire it from service after its useful life has ended. This process primarily involves decontaminating the facility to reduce residual radioactivity and then releasing the property for unrestricted or (under certain conditions) restricted use. This often includes dismantling the facility or dedicating it to other purposes. Decommissioning begins after the nuclear fuel, coolant, and radioactive waste are removed." And the Nuclear Energy Association notes that in many cases, the starting point is the	

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			requirement to change from an operating licence to a decommissioning licence. Conceptually, the definition of decommissioning encompasses the lifecycle of a facility. In fact, Figure 1, Phase of decommissioning, in Section 2, is actually a facility lifecycle for-end-of life, of which decommissioning is a critical activity in that lifecycle.	
31.	Cameco	1.1	This section does not recognize that decommissioning is an approved activity under current uranium mine and mills licences and, for other nuclear facilities, decommissioning activities can occur under an operational licence, The second paragraph should be revised to specify that the initiation of decommissioning is triggered by activities set out in a detailed decommissioning plan (DDP) that may be submitted during operations. Further, the undefined term “deferred decommissioning” should be deleted from the last sentence. The third paragraph should be amended to read, “…there are no areas with residual contamination above levels that would require a licence”, or, in the alternative, “end-state criteria” should be defined in REGDOC-3.6.	See response to comment #20 on the changes to section 2. See response to comment #30.
32.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	1.2	**Issue (Major)** Additional clarity of the document’s Scope is sought in the following ways: 1) As per comment #1, the timing of decommissioning phases and issues associated with multi-unit sites should be addressed and a revised Figure 1 in Section 2 referenced in the Scope. 2) “Remediation” is not defined in the Glossary or in *REGDOC-3.6*. 3) It would be helpful to define “legacy,” either by using the words from the note in section 4 or referencing that note here. 4) An additional CSA standard should be added to the final paragraph. **Suggested change**	As a result of this comment, the following changes were made: Bullet #1: See response to comment #20 on the changes to section 2. Bullet #2: A definition of the term ‘Remediation’ was added to the glossary. Bullet #3: The term ‘Legacy’ is defined under the section of decommissioning strategies and aligns with CSA N294, *Decommissioning of facilities containing nuclear substances.* Bullet #4: CSA N292.5, *Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances* was added to the references.

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			Clarify the Scope by: 1) Discussing single versus multi reactor units and the potential staging of shutdown since there may be a need to incorporate a Periodic Safety Review and Aging Management per *REGDOC-2.3.3* and *REGDOC-2.6.3*. 2) Defining "remediation" in the Glossary or *REGDOC-3.6*. 3) Either refer to the note in section 4 for the definition of "legacy" or add the following to the end of the 3rd paragraph, "In Canada, legacy sites specifically refer to research and demonstration facilities or facilities dating back to the birth of nuclear technologies in Canada for which decommissioning was not planned as part of the design." 4) Add *N292.5-11, Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances* to the final paragraph. **Impact on industry** Understanding the document's intended scope is essential to ensuring compliance.	
33.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization,	2	**Issue** Industry believes the bulleted list of items under the subheading 'Lifecycle decommissioning planning assists in' could be clarified in the following ways: 1) Add "located" and "construction" to the 1st bullet. 2) Regarding the 7th bullet, although there will be waste "generated during decommissioning" activities (removal of buildings etc.), waste is generated throughout the lifecycle that will require decommissioning (it is not generated during decommissioning). 3) Add a bullet to the list linked to siting of the facility	As a result of this comment, the following changes were made: Bullet #1: The text was revised as suggested. Bullet #2: The bullet was changed to: "estimating the quantities, types and classes of waste that will be generated and managed during decommissioning". Bullet #3: a bullet was added to the list: "ensuring that the eventual release from CNSC licensing is considered throughout the lifecycle of the facility." Bullet #4: The figure was removed since a similar schematic is adequately illustrated in the latest version of CSA N294, *Decommissioning of facilities containing nuclear substances*.

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	Ontario Power Generation		4) Consider adding "post decommissioning" to the end of the list. **Suggested change** Clarify the bulleted list by: 1) Amending the 1st bullet to read, "ensuring that a nuclear facility is located, designed and constructed in a manner that will facilitate decommissioning." 2) Amending the 7th bullet to read, "estimating the quantities, types and classes of waste that will be managed and recorded ~~generated~~ during decommissioning." 3) Add the following bullet, "ensuring the siting process considers eventual abandonment of the facility if that is the strategy being adopted" 4) If "post decommissioning" is included, amend the sentence before Figure 1 to read, "These phases are discussed in sections 5 to 9 ~~8~~ of this regulatory document."	
34.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	2	**Issue** As per comment #8, the requirements and timing for the preparation of the DDP are problematic based on the options that may exist for the completion of the "Execution of decommissioning" phase in this document. The manner in which the REGDOC is currently written indicates that a DDP is required before the completion of this phase. This is problematic since the decision on how the Execution phase will be implemented can change the requirement for this document. An example of this would be if the licensee is indicating through the PDP and SAP that they are going to choose the deferred decommissioning format. In this case, the CSA standard and the REGDOC indicate that a Storage with Surveillance Plan (SWS) is required. It is industry's position that the SWS document should be used exclusively to set out the conditions for how the SSC's will be managed during this phase. During the SWS phase, there may be some elements – as highlighted in section 7.1 of the REGDOC - that may be possible to support a good SWS strategy. These types of activities need to be considered when the SWS plan is being developed. It should be recognized that the actual licence transition should also take into consideration the type of functions that	As a result of the comment, the following changes were made: The figure was removed since a similar schematic is adequately illustrated in the latest version of CSA N294, *Decommissioning of facilities containing nuclear substances*. The REGDOC defines decommissioning as the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility, or location where nuclear substances are managed, possessed or stored. Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination and/or dismantling of structures, systems and components, and cleanup activities) that are taken to retire a facility from service with due regard for the health and safety of people and the environment.

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			will be completed during this phase. Currently, Section 6.1 of the REGDOC requires a SWS plan and a DDP at the same time and this is not likely possible in terms of meeting the requirements that are expected in the DDP at this time. When the licensee transitions into the Decontam and Demolition (D&D) phase of the “Execution of decommissioning,” it is clear that a DDP will be required for this phase and the prescriptive elements that are indicated in section 6.2 and Section 6.2.1. It would be more appropriate to prepare this plan for the D&D phase closer to when this work would be completed. Until specific decisions on “the when and how” of the D&D work are available, this may only be possible when a contracting strategy and inputs from the contractor are available. It is also likely that the licence for these activities will be quite different from this phase of the work, as there would be significantly different conditions and training that would be required to support this phase of the work. Figure 1 does not match the narrative in the REGDOC, which makes it difficult to follow and creates more confusion than clarity in the following ways: 1) Fundamentally, licensees do not agree that decommissioning is a phase that encapsulates the facility lifecycle. Industry’s view is that decommissioning is a *defined activity* which supports the facility lifecycle from beginning to end. As depicted in Figure 1, the lifecycle approach to decommissioning phases creates confusion in terms of our initial comment on when decommissioning commences. In addition, it conflicts with CSA N286-12, Management system requirements for nuclear facilities, which refers to the lifecycle of a facility and decommissioning as part of that lifecycle. 2) Some items appear to be in the wrong spot and others are missing. Specifically, a DDP is normally prepared for the execution of decommissioning and should precede the phase. Note, for deferred decommissioning, a storage with surveillance plan is prepared after operations and a DDP is prepared prior to dismantling. This is shown definitively in Figure 1 of N294-19 where a line separates storage with surveillance and dismantling. A PDP is prepared during siting, not at the end of design/construction as the figure shows (i.e. prior to operation). As well, in the case of in situ decommissioning, there would be a phase of institutional control (IC). Since	

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			completion of decommissioning results in release from CNSC regulatory control, then IC would fall under completion of decommissioning. However, preparation and submission of an end-state report is only at the end of this phase. Although this figure is true for buildings/areas, it seems to lack the future thought of decommissioning a waste management disposal area. 3) It is not clear where the triple asterisk following “surveillance plan” is directing the reader to, as there is no note at the bottom of the figure with a triple asterisk.\ 4) The graphic would benefit from adding the radiological and hazardous surveys required at each stage. 5) Acronyms PDP and DDP are not defined but used in the figure. **Suggested change** Figure 1 could be a helpful visual guide if amended to more closely match the corresponding Figure 1, Phases of decommissioning on page 11 of CSA *N294* and reconfigured to*:* 1) Show decommissioning as a separate activity within the operational history of a facility. 2) Move DDP to the start of the execution phase and/or show storage with surveillance plan at the start of executive and DDP at the start of dismantling. Review for where institutional controls may fall and adjust the figure accordingly. Although text in section 9 suggests it’s in Post-Decommissioning, there’s no additional step for releasing from institutional control and moving to a licence to abandon (if applicable) at the end of post decommissioning. 3) If required, add a note with a triple asterisk to the bottom of the figure (which will be associated with the wording on the decommissioning plans timeline ending with “surveillance plan” and three asterisks). Otherwise, delete the three asterisks following “surveillance plan.”	

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			4) Add the radiological and hazardous surveys required at each stage. 5) Spell out PDP and DDP, perhaps in a footnote to the figure. **Impact on industry** Decommissioning is a separate activity within the operational history of a facility and must be considered as such. As currently configured, the items do not align with expectations for submissions to the CNSC. This would result in mismatches and potential delays to users of document. It is unclear how “other regulatory controls” are to be applied, which leads to unclear expectations for licensees.	
35.	Cameco	2	As stated above, Cameco’s view is that decommissioning is part of the lifecycle of a facility and the operational phase of a facility is not a phase of decommissioning as depicted in Figure 1.	See response to comment #34.
36.	Cameco	2	The bulleted list should be revised as follows: •First bullet:”…nuclear facility is located, designed and constructed in a manner…” •Seventh bullet:”…waste that will be managed and recorded during decommission” because it is waste that is generated throughout the lifecycle of the facility that will require decommissioning and not wastes generated through decommissioning. •Add “post decommissioning” as a bullet and revise the sentence before Figure 1 to read “…in sections 5 to 9…” The acronyms PDP and DDP used in Figure 1 are not defined, which may cause confusion for some stakeholders.	See response to comment #33.

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37.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	3	**Issue (Major)** Licensees recognize the Preface and Section 3 both direct readers to *REGDOC-3.5.2, Regulatory Fundamentals*, for more information on a graded approach. However, users believe this section would benefit from more direct discussion on the topic since: 1) It is not immediately clear which licensees, facilities or type of radioactive waste (low, intermediate, or high level) management this REGDOC applies to. 2) There is unclear wording in the 1st paragraph. What are the criteria for optimization? What is the expectation for demonstration of optimization? 3) It's not clearly stated that the regulator must agree to the graded approach chosen by the licensee. **Suggested change** Licensees request the CNSC: 1) Clarify which licensees this REGDOC applies to and which ones it excludes. Where licensees are excluded or addressed in another REGDOC (e.g., *REGDOC 2.1.1 VolumeII*), the reader should be redirected to that REGDOC. The REGDOC should address or redirect readers to the requirements of all licensees as captured by *REGDOC 3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*. 2) Amend the 1st paragraph to read, "The licensee shall ensure ~~that~~ the protection and safety of workers, the public and the environment during decommissioning ~~is planned and optimized~~." 3) Amend the 2nd paragraph to read, "The licensee should ~~shall~~ apply a graded approach that covers ~~in~~ all aspects of decommissioning, commensurate with the type, scale, complexity, maturity, physical state, inventory, uncertainty and reliability of information, and risk associated with the decommissioning of the facility or activity."	As a result of the comment,, the following changes were made: Bullet #1: The scope was changed to "This document applies to Class I and Class II nuclear facilities, uranium mines and mills and nuclear substances and radiation devices licensees that are required to have decommissioning plans or strategies due to a regulatory requirement or a condition of their licence. For all other licensees, the information in this regulatory document may be used as guidance." Bullet #3: See response to comment #19 on the graded approach. The following change was not made: Bullet #2: the requirement on optimization was not removed since it aligns with GSR Part 6, *Decommissioning of Facilities*.

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			As per comment #8, for consistency, the CNSC is urged to match the definition of graded approach in *REGDOC-3.6* with the one in *N286-12*, which says, "With a graded approach, all requirements shall apply but to varying degrees depending upon the safety significance and complexity of the work being performed. If such an approach is used, the criteria and process used for grading shall be defined." **Impact on industry** There is a potential for licensees to be out of compliance because of the lack of clarity regarding which radioactive waste management facilities this guidance applies to.	
38.	Safety Probe International	3	A graded approach shall be applied in a way that does not compromise the security, the protection and safety of workers, the public and the environment.	As a result of this comment, the sentence was changed to: "A graded approach, if utilized, shall be applied in a way that does not compromise the protection of health, safety, security and the environment. Further information on the graded approach can be found in REGDOC-3.5.3, *Regulatory Fundamentals* [2]."
39.	Cameco	3	The first sentence should be revised to "…shall ensure the protection and safety of workers, the public and the environment during decommissioning."	See response to comment #38.
40.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	4	**Issue** Additional clarity is required in a number of areas in section 4. Specifically: 1) The section mentions three types of decommissioning strategies, but does not provide details for their associated decommissioning activity. Later in the document, section 6.1 speaks only to deferred decommissioning. 2) As per comment #8 on a lack of clarity regarding timing, what is meant by "early" in the 1st paragraph, which reads "…the decommissioning strategy shall be selected *early* in the lifecycle of the facility." 3) Bullet B, which supports the 2nd paragraph, should recognize that "storage with surveillance" can also be referred to as "care and maintenance" for uranium mines and mills. 4) The 3rd paragraph references a draft REGDOC. As a matter of principle, draft	As a result of this comment, the following changes were made: Bullet #1: As a non-prescriptive regulator, it is up to the licensee to propose the details for decontamination, dismantlement and clean-up. Definitions for decontamination, dismantling, cleanup and remediation were added to the glossary section of the REGDOC. Furthermore, Section 8 of CSA N294, *Decommissioning of facilities containing nuclear substances* outlines methods for these decommissioning activities. Bullet #2: The sentence was changed to: "For Class I nuclear facilities and uranium mines and mills, the decommissioning strategy shall be selected during the siting stage. For Class II nuclear facilities, the decommissioning strategy shall be selected during the construction stage. Prior to submitting an application for a licence to possess, manage, use or store nuclear substances at a location, the decommissioning strategy shall be selected."

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			REGDOCs should only reference other REGDOCs or standards that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and informed comments cannot be provided. 5) The 3rd paragraph repeats a requirement already in *REGDOC-2.11.1, Volume III*. Eliminate repetition to ensure the requirement in *REGDOC-2.11.1 Volume III* is applied consistently. 6) The 1st sentence in the final paragraph on page 4 on strategies is not needed since it is already a requirement of the PDP. 7) Similarly, the final paragraph on page 5 related to strategy is unclear. Under what scenario would the decommissioning strategy have to be revised? Does the decommissioning strategy refer to the PDP? Also, this is specific to Class I facilities only, but that is not clear in this draft. 8) The 15th bullet beneath the 1st paragraph on page 5, “other political, social and economic considerations” is broad and open to variations in interpretation. It should be removed. **Suggested change** Licensees urge the CNSC to: 1) Provide further details for each decommissioning strategy and their associated activities. 2) Clarify what constitutes “early” in terms of this requirement. 3) Amend Bullet B to read, “… period of storage and surveillance (or care and maintenance)…” 4) Remove references to draft REGDOCs or any standards that have not been published. Cite existing, published documents or don’t cite them at all. 5) Amend the 3rd paragraph to read, “Further information on safety case and safety	Bullet #3: The sentence was changed to: “i.to place the facility or location in a period of storage with surveillance (sometimes referred to as care and maintenance), followed by decontamination, dismantling and/or clean-up.” Bullet #4: See response to comment #25 on referencing unpublished REGDOCs. Bullet #5: The sentence was removed. Bullet #6: The sentence was removed. The following changes were not made: Bullet #7: The paragraph in section 5 refers to the waste management strategy, not the decommissioning strategy. Bullet #8: The requirement is currently in alignment with N294, *Decommissioning of facilities containing nuclear substances* which had a public review in 2019. To ensure consistency and to avoid confusion between this REGDOC and CSA N294, no change was made to ensure the list remains in alignment.

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			assessment can be found in draft REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2 [3]. ~~For waste with other hazardous properties, the licensee shall ensure that the safety case and supporting safety assessment encompasses those hazards and is in compliance with applicable regulatory requirements regarding such hazards.~~ 6) Amend the 1st sentence of the final paragraph on page 4 to read, "~~The licensee shall justify the selected strategy and should conduct a comparison of alternative decommissioning strategies.~~ The evaluation method used to select …" 7) Move the wording about strategy from the 2nd paragraph of section 5 to here, the first reference to a decommissioning strategy. Clarify that it applies only to Class I facilities. 8) Remove the 15th bullet, " ~~other political, social and economic considerations"~~	
41.	Safety Probe International	4	In a multiunit nuclear power station, deferred decommissioning may involve the preparation for decommissioning of one or more units while the remaining neighbouring units continue to operate. Since multiunit plants are supported by common services and their containments could share a vacuum building, the challenge here is to address safety issues that may arise from severing units to be decommissioned from these common services. In reaching the end state in this case, operating experience showed that the containment boundary and reactor equipments in the units prepared for deferred decommissioning undergo significant changes. The reactor core is defueled, coolant is drained from the heat transport system and the unit containment boundary moves to its Reactor Building Pressure Relief Duct bulkhead. Equipment may be removed, and the remaining ones are drained, disconnected or isolated. Other system components such as the Reactor Building ventilation system are to be de-energized and abandoned in place, but still need to be available for manual operation including the ventilation fans and main filter. Other design changes may also include severing common services and moving alarms and annunciation to panels of operating units. **Comments and changes proposed by SPI**	This comment was initially submitted as a response to the request for information document that was attached to the draft REGDOC during public consultation. However, the comment does not address potential impacts and is meant to address specifically section 4b) of the REGDOC. Hence, it is listed in the main comments table. See response to comment #40, bullet #8. With respect to sites with more than on facility, the following text was added to the Background section as a result of this comment: "A licence to decommission or a licence that authorizes decommissioning activities is required for Class I and Class II nuclear facilities and uranium mines and mills prior to the execution of decommissioning. For sites with more than one facility or location that are at different lifecycle stages, the CNSC may issue a licence that includes multiple activities (e.g., operate and decommission)."

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			Comments by SPI presented here are aimed at clarifying certain sections in the Draft REGDOC 2.11.2 to adequately address one of the decommissioning strategies where portions of the nuclear facility are selected for "deferred decommissioning" while the remaining part of the facility continues to operate under an operating license. This strategy is described in section 4 b) as "storage with surveillance". **Proposed Changes in Section 4 b)** This section should make it clear that portions of the nuclear facility to be selected for “storage with surveillance” could possibly be connected physically (such as the situation described in the Background) and not necessarily separate buildings within the same facility. We propose changing the wording of section 4 b) to read: “*b) deferred decommissioning – to place the facility in a period of storage with surveillance followed by decontamination and dismantlement, or to conduct activities directed at placing certain independent or relatively-independent buildings or facilities in a safe, secure interim end state, followed by a period of storage with surveillance, and ultimately decontamination and dismantlement*”	
42.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	4	**Issue** Licensees have several questions related to the 4th paragraph on in situ decommissioning. Specifically: 1) The 1st sentence recognizes in situ decommissioning as an acceptable practice for uranium mines and mills and includes a consideration for other facilities under exceptional circumstances. It does not make reference to facilities that were initially designed to be disposal facilities. 2) The 3rd sentence uses the term “foreseeable future” which is vague and open to interpretation. The sentence would also benefit from an example of when in situ may be considered acceptable. 3) As per comment #2, the last sentence of the 4th paragraph and the following Note (5th paragraph) currently align with the wording in the new revision of CSA *N294*. However, future revisions could misalign these two documents so it must be clear the	As a result of this comment, the following changes were made: Bullet #1: ‘Decommissioning of auxiliary facilities at a disposal facility’ is covered within the document. The closure of disposal facilities are covered in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*. The following text was added to the definition of decommissioning: “For disposal facilities, with the exception of ancillary facilities, the term closure instead of decommissioning is used.” Bullet #2: The text was changed as suggested. Bullet 4: The text was changed as suggested. The following change was not made: Bullet #3: As noted in the scope, this document is complemented by the CSA standard.

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			REGDOC is setting the requirements, not the CSA standard. 4) The last sentence also says, "...in situ decommissioning should not be considered …where removal is practicable" but not what is to be removed. **Suggested change** Licensees encourage the CNSC to: 1) Amend the 1st sentence in the 4th paragraph to read, "In situ decommissioning with a disposal end-state is an accepted and acceptable practice for uranium mines and mills and disposal facilities." 2) Amend the 3rd sentence to read, "… and which will remain under institutional control for the period defined in the safety case ~~foreseeable future~~." Also, provide an example of when in situ may be considered acceptable. 3) Amend section 4 to make it clear the REGDOC sets requirements and the CSA standard offers guidance on how requirements can be achieved by licensees. 4) Consider whether the final sentence should explicitly say what is to be removed.	
43.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power	4	**Issue** Licensees have some questions and suggestions to clarify the bullet list on page 5 under the subhead, "The decommissioning strategy should be reviewed and updated in light of;" Specifically: 1) Where is this strategy documented? Are licensees expected to capture the strategy in the PDP? 2) The 3rd bullet, "management structure" is subjective and should be removed. 3) The 9th bullet implies there will be a common facility for the disposal of irradiated fuel and radioactive waste.	As a result of this comment, the following changes were made: Bullet #3: To provide consistency with the CSA standard, the bullet was changed to "availability of facilities for the management of radioactive waste" The following changes were not made: Bullet #1: The decommissioning strategy forms the basis for the planning for decommissioning. It appears in both the PDP and DDP, as such it has it owns section. This aligns with the IAEA safety standards. Both the PDP and DDP must include the decommissioning strategy. This is outlined in sections on content of the PDP and DDP.

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	Generation		**Suggested change** Licensees encourage the CNSC to: 1) Clarify where the decommissioning strategy is captured. 2) Remove the 3rd bullet. "~~management structure~~" 3) Amend the 9th bullet to read, "availability of a facility for the disposal ~~management~~ of irradiated fuel and a facility for the disposal of radioactive waste"	Bullet #2: See response to comment #40, bullet #8.
44.	Region of Durham	4	In section 4 (p.5), the draft regulation suggests that when determining the appropriate decommissioning strategy (i.e. prompt, deferred, in situ), the licensee "should consider" public and Indigenous engagement, potential impacts on Indigenous and or treaty rights and other political, social and economic considerations. OPG selected deferred decommissioning as their strategy in the 1980s. We are not aware of engagement at that time that considered these factors. "The decommissioning strategy should be reviewed and updated in light of changes in site conditions…with relevant consequences for decommissioning". We agree that the PDP and subsequently, the Detailed Decommissioning Plan (DDP), should be reviewed and updated every five years. The growth of an urban community surrounding a facility should be a reason to regularly revisit the decommissioning strategy and revise the PDP and/or DDP for any nuclear generating station. We also recommend that the REGDOC be much clearer in stating when the PDP must be transformed into the DDP.	No changes were made as a result of this comment. The specifics of OPG's engagement on decommissioning strategies are outside the scope of this REGDOC. However, it is the CNSC's expectation that public and Indigenous engagement be conducted as when determining the decommissioning strategy. This expectation is provided in Section 4, *Decommissioning strategy*. The decommissioning strategy should be reviewed and updated in light of changes in site conditions or events with relevant consequences for decommissioning. As outlined in section 7.1.1 of CSA N294, *Decommissioning of facilities containing nuclear substances*, preparation for decommissioning shall include further development of the PDP into the DDP. Prior to executing decommissioning, licensees prepare and submit a DDP to the CNSC for acceptance. The timing for submission would be based on a graded approach.
45.	Safety Probe International	4	Comments by SPI presented here are aimed at clarifying certain sections in the Draft REGDOC 2.11.2 to adequately address one of the decommissioning strategies where portions of the nuclear facility are selected for "deferred decommissioning" while the remaining part of the facility continues to operate under an operating license. This strategy is described in section 4 b) as "storage with surveillance".	See response to comment #40, bullet #8.

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			Proposed Changes in Section 4 b) This section should make it clear that portions of the nuclear facility to be selected for "storage with surveillance" could possibly be connected physically (such as the situation described in the Background) and not necessarily separate buildings within the same facility. We propose changing the wording of section 4 b) to read: "*b) deferred decommissioning – to place the facility in a period of storage with surveillance followed by decontamination and dismantlement, or to conduct activities directed at placing certain independent or relatively-independent buildings or facilities in a safe, secure interim end state, followed by a period of storage with surveillance, and ultimately decontamination and dismantlement*"	
46.	Safety Probe International	4	b) deferred decommissioning – to place the facility in a period of storage with surveillance followed by decontamination and dismantlement, or to conduct activities directed at placing certain buildings or portion of facilities in a safe, secure interim end state, followed by a period of storage with surveillance, and ultimately decontamination and dismantlement	See response to comment #40, bullet #8.
47.	Safety Probe International	4	When determining the appropriate decommissioning strategy, the licensee should consider the following, as appropriate: […] • the availability of ~~knowledgeable~~ qualified staff […] • the principles of radiation protection, justification, optimization and application of dose limits • human and organisational factors involved in the decommissioning activities The decommissioning strategy should be reviewed and updated in light of: • changes in site conditions, or incidents and events with relevant consequences for	See response to comment #40, bullet #8.

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			decommissioning • changes to the planning envelope	
48.	Cameco	4	Cameco recommends the following: 1. Subparagraph (b) in the second paragraph should state that "storage with surveillance" can also be referred to as "care and maintenance" for uranium mines and mills. 2. The third paragraph should state expressly that it applies to Class I facilities by, for example, revising the paragraph to read "…for *in situ* decommissioning results in a waste disposal site at a Class I facility, the licensee shall…" 3. The fourth paragraph should be revised as follows: • The first paragraph should state the *in situ* decommissioning is an acceptable practice for uranium mines and mills <u>and</u> disposal facilities • The third sentence should replace "foreseeable future" with "period defined in the safety case" 4. Bullet 15 in the first list on page 5 should be deleted because "political, social and economic" considerations are too vague and broad to be meaningful.	As a result of this comment, the following changes were made: Bullet #1: The change was made as suggested. Bullet #3: 'Decommissioning of auxillary facilities at a disposal facility' is covered within the document. The closure of disposal facilities are covered in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*. The following text was added to the definition of decommissioning: "For disposal facilities, with the exception of ancillary facilities, the term 'closure' instead of 'decommissioning' is used." 'Foreseeable future' was changed change to the 'period defined in the safety case'. The following changes were not made: Bullet #4: This aligns with the CSA standard. Bullet #2: This is not limited to Class I nuclear facilities (e.g., a waste nuclear substance licence).
49.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power,	5	**Issue** Industry has two concerns with the 2nd paragraph, which requires licensees to prepare a waste management strategy "in compliance with the applicable clauses of **draft** *REGDOC-2.11.1 Waste Management, Volume I: Management of Radioactive Waste*." 1) As per our earlier comment and as a matter of principle, draft REGDOCs should only reference other REGDOCs or standards that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and	As a result of this comment, the following changes were made: Bullet #1: See response to comment #25 on referencing unpublished REGDOCs. The CSA standard N294, *Decommissioning of facilities containing nuclear substances* was published at the time REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2 was released for public consultation. It has since been updated by the CSA Group. Bullet #2: Reference to REGDOC-2.11.1, *Waste Management, Volume I:*

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	Nuclear Waste Management Organization, Ontario Power Generation		informed comments cannot be provided. 2) It is not clear what the applicable clauses would be in REGDOC-2.11.1, which is only for radioactive waste. Decommissioning will have some clean waste streams for which REGDOC-2.11.1 is not applicable. Further, REGDOC-2.11.1 does not define what is required for a waste management strategy. **Suggested change** Licensees encourage the CNSC to: 1) Cite only currently published versions of REGDOCs and CSA standards. 2) Otherwise, identify the clauses in *REGDOC- 2.11.1* that apply in this instance.	*Management of Radioactive Waste* was change to: "Requirements and guidance for radioactive waste management can be found in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [6]."
50.	Region of Durham	5	It would also help build community confidence to know that funds have been set aside for the decommissioning process and how they are being protected for future use. Explaining how the funds will be applied, by time period and major activity would demonstrate that there is a budget and an achievable plan. For example, how much will be allocated during the dismantling phase for engineering, skilled labour, equipment, disposal and treatment of hazardous wastes, security, etc.? How much is demolition, disposal of the low and intermediate level waste, and site restoration to the final state expected to cost? This would highlight both the activities and the notion that enough funding has been set aside. This kind of information might also support the development of supply chain companies to support the future activity.	As a result of this comment, a reference to REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* was added to the document. REGDOC-3.3.1 that sets out requirements and guidance for the establishment and maintenance of funding for the decommissioning of facilities and termination of activities. As outline in REGDOC-2.11.2, the PDP must include a conservative cost estimate of decommissioning and a financial guarantee, as described in REGDOC-3.3.1, specifying: • an estimate of the total present-value cost of the decommissioning • a reasonable basis for how cost estimates were derived • a description of how the required funds will be provided The DDP must include a conservative cost estimate, as described in REGDOC-3.3.1 (based on the work packages) for labour, materials, equipment, waste management, environmental assessment, monitoring and administration (e.g., training, safety, licensing, project management, government and public liaison)

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51.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	5.1	**Issue (Major)** As per comment #8, this section is not clear on the timing of key activities like the submission of a PDP. Specifically: 1) The 1st sentence does not seem to reflect the current process. Nor is it helpful to vaguely say "…submit it to the CNSC for acceptance as early as possible …" 2) It's unclear from the 2nd paragraph whether a PDP requires an update if, upon review, changes are *not* required. In those instances, a submission every five year should not be required. 3) The 3rd paragraph would be better suited at the beginning of section 4. 4) The 4th paragraph, when read in conjunction with the 2nd paragraph, results in the need to update an entire site PDP every five years. **Suggested change** Licensees encourage the CNSC to: 1) Provide more specific guidance on when key planning documents like a PDP should be submitted for review. The wording should reflect that a PDP is required as part of the current licensing process for a new facility. Also, clarify what constitutes "as early as possible" in terms of this requirement. 2) Amend the 2nd paragraph to read, "The licensee should review the PDP in light of the considerations listed at the end of section 4 every five years, or as requested by CNSC staff. If changes are identified during the review, the licensee shall submit an updated PDP to the CNSC." 3) Move the 3rd paragraph to the beginning of section 4. 4) Clarify that an entire site PDP is not required every five years as per the 2nd paragraph.	As a result of this comment, the following changes were made: Bullet#1: The text was changed to: "The licensee shall prepare a PDP and submit it to the CNSC for acceptance with an application for a licence in respect of a nuclear facility or the conduct of a licensed activity, in accordance with applicable regulations." Bullet #2: This requirement is in alignment with IAEA safety standard requirements. The text was changed to: "The licensee shall review and, as necessary, update the PDP and submit it to the CNSC every five years or as requested by the CNSC." Bullet #3: The change was made as suggested. The following change as not made: Bullet #4: This requirement is in alignment with IAEA safety standard requirements.

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			Impact on industry The preparation and submission of key planning documents like PDPs and DDPs require significant resources and have the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare the plans.	
52.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	5.1	**Issue (Major)** The last two paragraphs are contradictory. One says, "The licensee may consider dividing a complex site or facility into a number of relatively independent decommissioning projects. For example, a large facility may be divided into areas (i.e., planning envelopes) that, from the point of view of decommissioning, are relatively physically independent from one another." The other says, "For sites with more than one facility, the licensee shall submit a PDP for the entire site to the CNSC for acceptance. In such cases, the site PDP should be prepared to cover all planning envelopes. The sequence of executing the planning envelopes and any interdependencies would also be included in both the site PDP and the facility-specific PDPs." This is problematic in the following ways: 1) This could be interpreted that a site like Bruce Power's is required to have a single site decommissioning plan for all of the facilities (i.e. Bruce A, Bruce B, Douglas Point, Western Waste MF, etc.) where the preceding paragraph indicates these may be separated. This could also be interpreted as requiring a site PDP. 2) Currently. PDPs are facility specific. Interdependencies are already discussed between facilities in the PDPs. Production of an entirely separate document (for acceptance) is unwarranted given the information will be repeated multiple times for the site plus each facility. There may also be a large gap in the timeline for decommissioning facilities on a site and very few interdependencies may be applicable.	As a result of this comment, the following changes were made: Bullet #1 and #2: See response to comment #23. Bullet #3: The PDP includes the cost estimate which is the basis for the financial guarantee. As outlined in the REGDOC, PDPs shall be submitted to the CNSC for acceptance.

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			3) PDPs are currently not accepted (they are notification only documents per licence condition hand books). Does the CNSC intend to make them acceptance documents? **Suggested change** The CNSC is strongly encouraged to: 1) Clarify what is meant by a site PDP and whether it is intended to cover the facilities on site or the site itself. If it is the site itself, this should be removed from the document as the CNSC has no regulatory jurisdiction for areas outside of licensed facilities. To eliminate the issue, the CNSC should amend the 1st sentence of the 4th paragraph to read, "For sites with more than one facility, the licensee shall may submit a PDP for the entire site to the CNSC ...." 2) Keep the current practice of facility PDPs with interdependencies noted. 3) Clarify if the CNSC intends PDPs to be acceptance documents. **Impact on industry** The wording in this section needs to be able to be applied to all facilities. While it may work for a mining site, or for a site like Chalk River's National Laboratories, it will not work for a site like Bruce Power. This will cause confusion over requirements and possibly require unnecessary plans to be developed. Additional resources would also be required to produce documentation which is already covered more efficiently in the current structure (i.e., facility-only PDPs).	
53.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB	5.1.1	**Issue (Major)** Licensees have several questions and suggestions to improve the section on content of the PDP, which is formatted poorly with a series of bullets and sub bullets. More specifically: 1) The content/requirements of the PDP should be somewhat flexible as the PDP evolves over the life of the facility. Some requirements may not be applicable for some facilities or may not have been developed depending on the life stage of the	As a result of this comment, the following changes were made: Bullet #1, #3 and #6: Section 2 now includes "For facilities, with the exception of class II nuclear facilities), a preliminary decommissioning plan (PDP) is developed for the siting, construction and operation stages and progressively updated to reflect the appropriate level of detail required for the respective licensed activities." In addition a section has been added on factors affecting level of detail and plan flexibility.

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	Power, Nuclear Waste Management Organization, Ontario Power Generation		facility. 2) Bullet 2, sub-bullet 5, says "the type, quantity, and form of radioactive and hazardous materials stored, produced *or* used during operation." Does the word "or" imply only one of the three options (i.e. stored, produced, or used) since more than one of these options could apply to a given nuclear facility? 3) Bullet 2, sub-bullet 6 says, "the design features used to reduce the spread of contamination and facilitate decontamination and dismantling." This seems to be a new requirement. This can be a very extensive list as many design features systems could be classified this way. 4) Bullet 3 and it's sub-bullets on the requirements for 'post-operational conditions' is very detailed and would be better suited for a detailed plan. 5) Bullet 3, sub-bullet 1, references "hazardous materials." Does this include radioactive materials? 6) Bullet 3, sub-bullets 2 and 3 says, "the predicted nature and extent of contamination" for primary systems and walls, floors and ventilation. It is against ALARA to get samples for some of the systems. This type of information is too detailed for a PDP and should be included as a DDP-type requirement. 7) Bullet 3, sub-bullet 4, says, "an overview of the principal chemical conditions anticipated to exist." What is meant by "chemical conditions"? 8) Bullet 4, sub-bullet 2, should include in situ decommissioning concepts in the list beneath "the rationale for:" 9) Bullet 5 and its sub-bullets on the requirements for 'work breakdown structure' are very detailed and would be better suited for a DDP. 10) For bullet 5, sub-bullet 4, what is the "detailed planning stage" and where is this defined? 11) For bullet 5, sub-bullet 5, is structure dismantlement not grouped into work	Bullet #2: 'or' was deleted. Bullet #4: This wording aligns with CSA N294, *Decommissioning of facilities containing nuclear substances*. However, the term 'anticipated' was added before post-operational conditions. Bullet #5: The term 'Radioactive materials' was added to align with CSA N294, *Decommissioning of facilities containing nuclear substances*. Bullet #7: The term 'chemical' was replaced by 'hazardous' to align with CSA N294. Bullet #8: The term 'dismantling and demolition' was changed to 'decommissioning' Bullet #9: This change was made to align with CSA N294. Bullet #10: The following information was added after the detailed planning stage: "(preparation for decommissioning phase)" The following changes were not made: Bullet #11: Structure dismantlement may be a work packaged depending of the facility end-state. However, this wording remains unchanged to align with CSA N294, *Decommissioning of facilities containing nuclear substances*. Bullet #12: Agreed that this is already part of the Regulations however it has been reiterated to align with CSA N294. Bullet #13: The requirement is for a commitment, not the details and protocols themselves. This wording aligns with CSA N294. Bullet #14: This wording aligns with CSA N294. However, the document, as well as REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*, includes a section on optimization.

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			packages? 12) Bullet 6 says, “the radiological monitoring and survey commitments…” Radiological monitoring is already a part of the regulations. 13) Bullet 6, sub-bullet 2, says, “a commitment to develop plans and protocols acceptable to the CNSC…” Is the PDP the place to make all these commitments? What is the purpose of the operational radiological data referenced? Is it to give baseline data prior to the onset of shut down and decommissioning? 14) Bullet 7, sub-bullet 3, says, “a commitment to segregate as much material as possible for reuse and recycling.” Processing can reduce amounts of radioactive waste but can be expensive and dose intensive to implement. The statement “as much as possible” should be clarified. **Suggested change** Licensees urge the CNSC to: 1) As per comment #3, ensure this REGDOC is consistent with *N294* Annex A and does not inappropriately convert effective, existing guidance into new requirements. 2) Clarify what is meant by “or” 3) Clarify what level of detail/explanation is needed to meet the requirement outlined in bullet 2, sub-bullet 6. 4) Replace with wording from *G-219* (Section 6.1.2, bullet 2). 5) Clarify whether hazardous materials include radioactive materials in this reference. 6) Clarify what level of detail/explanation is needed to meet the requirements of bullet 3, sub-bullets 2 and 3. Amend sub-bullet 3, to read, “the predicted nature and extent of contamination on floors, walls, work surfaces, ventilation systems, etc., if anticipated that contamination would be outside of normal levels in these areas”	

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			7) Clarify what is meant by "chemical conditions"? 8) Add the following sub-bullet, "- in situ decommissioning concepts" 9) Replace with wording from *G-219* (Section 6.1.2, bullets 7 and 8). 10) Clarify what the "detailed planning stage" is and where it is defined. 11) Clarify if structure dismantlement is grouped into work packages. 12) Consider whether the PDP is the place to make the commitment tied to bullet 6. 13) Consider whether the PDP is the place to make the commitments tied to bullet 6, sub bullet 2. 14) Amend bullet 7, sub-bullet 3, to read, "a commitment to segregate as much material as possible for reuse and recycling based on social and economic factors" **Impact on industry** Licensees may not be able to meet CNSC expectations/REGDOC requirements without precisely defining requirements. The content of the PDP should not be too prescriptive and should allow some flexibility to meet requirements. The PDP may not be the place to make all the commitments related to the bullet points in this section. Depending on the level of plans and protocols the CNSC wants to accept, it can cause a large regulatory burden/schedule impact. It could also stop work if plans need to be revised during execution. Licensees would need to understand the full impacts of these bullets prior to implementation of this document.	
54.	Canadian Nuclear Association, Canadian	5.1.1	**Issue (Major)** As per comments #1 and #7 on timing of key activities, several bullets in section 5.1.1	As a result of this comment, • The third bullet on page 7 was changed to "a commitment to prepare a

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	Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		raise questions and potential confusion. For instance: • The 3rd last bullet on page 7 says "a commitment to prepare a detailed decommissioning plan (DDP) for CNSC acceptance prior to dismantling and demolition." However, the timing of the DDP submission would be far too late in the process. • The last bullet on page 7 says, "the physical state of the facility at: o the end of operations o the start of decommissioning" Is this the end of Commercial Operations SOP phase? When is the "start of decommissioning"? It should be consistent with the initial activities proposed in the PDP. **Suggested change** Provide more specific guidance on the timing of key phases. **Impact on industry** The preparation and submission of detailed planning documents requires significant resources and has the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare detailed plans.	DDP for CNSC acceptance prior to decommissioning" • The first sub-bullet was changed to "the end of operations (permanent shutdown state)" • The second sub-bullet was changed to "the start of decommissioning (stable state for decommissioning)"
55.	Region of Durham	5.1.1	Section 5.1.1 states that the PDP should identify "any features of the surrounding natural and social environment that could be significantly affected by the decommissioning process". This is a vital first step, but it needs to go further.	This requirement is now incorporated into considerations when selecting a decommissioning strategy.

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56.	Region of Durham	5.1.1	The definition of decommissioning is critical. From the community perspective, decommissioning begins with the end of commercial operations. This is when the ongoing changes that will affect the host community, such as the loss of direct and indirect jobs and shifts in property tax revenues, will begin.	As a result of the comment, the definition of decommissioning has been revised.
57.	Region of Durham	5.1.1	The content of the PDP should be amended to include the need for all parties to study and understand how conditions in the surrounding community will be changed by the plant closure and subsequently at each stage of the decommissioning and create plans for mitigation. The licensee should be required to do this investigation and planning in partnership with the community. These steps should begin in advance of the plant closure. We recommend adding mechanisms for determining how community impacts will be monitored, measured and mitigated at each step. Decommissioning is a long process. There should be formal mechanisms for ongoing dialogue and learning by the licensee and the Region and area municipalities throughout the process. This could include agreements to jointly study issues raised by the community, discuss findings and develop solutions. It would also involve freely sharing the information necessary for the affected municipalities to understand and plan for: • changes in property tax assessment at the point of plant closure and during the decommissioning period, • changes to emergency response planning, • shifting employment patterns and loss of employee spending in the local economy, • impact of the loss of corporate and employee donations on community organizations,	The PDP must include: • a public consultation plan, including a public information program and avenues for public participation as per the requirements and guidance of REGDOC-3.2.1, *Public Information and Disclosure* • an Indigenous engagement plan as per the requirements and guidance of REGDOC-3.2.2, *Aboriginal Engagement* [8] Furthermore, the PDP must include a decommissioning strategy that includes considerations such as • public and Indigenous engagement • potential impacts on Indigenous and/or treaty rights political, social and economic considerations • the availability of waste management facilities and disposal capacity The specifics of the PNGS decommissioning project are outside the scope of this REGDOC. However, CNSC staff confirm that the site will be remain under a CNSC licence and regulatory oversight will be ongoing for this period of decommissioning, including storage with surveillance, dismantling and site clean-up.

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			• timing of impacts on the transportation system from moving waste, used fuel, etc. and • opportunities for new activities or progressive redevelopment at the site to mitigate economic impacts and stigma related to nuclear waste. In Durham Region, land use, energy, transit and infrastructure planning, is being done for time horizons extending from 2030 to 2050 and beyond. To be effective, the Region needs to know what to expect, from the end of commercial operations to the ultimate repurposing of the site. For such a lengthy project to be successfully conducted in a busy urban area (i.e. with minimal disruption to the surrounding Region), both the licensee and regulator need to be attentive to the context in which decommissioning is occurring. The REGDOC should require the licensee to outline in the PDP and DDP how they will partner with the host communities to mitigate impacts and tap into new opportunities related to decommissioning.	
58.	Region of Durham	5.1.1	Section 5.1.1. contains a requirement for the PDP to include a public consultation plan, including a public information program and avenues for public participation. REGDOC 3.2.2 outlines the Communication and Disclosure protocols that guide licensees. It requires that “Each public information program and its disclosure protocol should be designed to address the information needs of its target audience.” “Target audiences shall include the general population of the local community and other communities impacted by the licensee’s nuclear facility…including key opinion and political leaders.” The protocol further suggests that the scope of communications to the public should be determined by first doing a survey to find out what the audience wants to know and then limits the resulting communication to activities being licensed. Decommissioning is a long, complex and very technical process. Even though the licensees may post all technical documentation available on their website, this practice	Licensees are required to inform and engage surrounding communities, as they are subject to REGDOC-3.2.1, *Public Information and Disclosure*. REGDOC-2.11.2 cannot impose additional requirements than the ones that are currently found in REGDOC-3.2.1. The CNSC periodically reviews and updates regulatory documents. Your comments were added as a parking lot item for the next time REGDOC-3.2.1 comes up for review.

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			is not a substitute for building community understanding and interest. The public will require education sessions (at the beginning and throughout) to understand the changes to operations and stages the site will go through. Then they can formulate questions requiring further response from the licensee. Working with the *Region of Durham Comments on CNSC Draft REGDOC 2.11.2 - October 2019* 5 host communities well would allow the licensee to take advantage of established communications and engagement tools to reach citizens. We recommend that the communications goal for the decommissioning process be to have the best-informed public and host communities possible, by providing information in clear and accessible language and formats, well in advance of the activities to be undertaken, and in an ongoing way throughout the decommissioning process. Providing opportunities to hear from the community is also critical. At the recent 4th Canadian Nuclear Waste and Decommissioning Conference in Ottawa, presenters from decommissioning projects at Chalk River and Whiteshell Labs pointed to the need and value of engaging the local community and getting their input on process, storage options, and desired outcomes. During the same session, presentations by staff of Hydro Quebec and OPG regarding decommissioning plans for Gentilly 2 and PNGS indicated that in both cases little consideration has been given yet to community impacts as part of project planning. A presentation on a decommissioning roadmap by the CANDU Owners Group also did not include a work bundle related to community engagement. These presentations stood in contrast to the presentations by the Nuclear Waste Management Organization (NWMO) on the siting of deep geological repository (DGR) where working with the communities and hearing from them is seen as a core element of the process. It is a core element because they need to build trust and establish a social contract with the future host community to accept the waste. It is recommended that the preliminary and detailed decommissioning plans for nuclear facilities specifically include a bundle of work to build community awareness of and engagement in the decommissioning process. This could be done through a	

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			"learn about" initiative similar to that conducted by the NWMO in potential Deep Geological Repository (DGR) host communities. This effort would provide a foundation for building community support of the decommissioning process. The regulators, the licensees and communities can work together to build a true partnership.	
59.	Safety Probe International	5.1.1	A PDP for a nuclear facility with a Class I or uranium mines and mills licence shall include: […] • the post-operational conditions, including: […] • the identification of any separate planning envelopes and any interdependence between enveloped areas • the decommissioning strategy, including: […] • any institutional controls including assurance of adequate and qualified staff	This list aligns with CSA N294, *Decommissioning of facilities containing nuclear substances* that was recently published following consultation. No changes were made to avoid misalignment between these documents. See response to comment #23.
60.	Region of Durham	5.1.2	The current PDP is written as if few uncertainties exist. However, based on the decommissioning experiences at the Chalk River and Whiteshell labs, dismantling a nuclear facility designed, built and used decades ago when safety standards had not evolved to today's standards, is fraught with uncertainty. These projects require constant innovation by the decommissioning crews to develop solutions for dismantling safely and with a view to minimizing nuclear waste. A key uncertainty from the Region's perspective is the notion that a decommissioning plan for a large nuclear generating station can be premised on the future existence of a storage facility – a facility for which a site has been selected or any approval given. The timely completion of Canada's used fuel DGR is a risky bet at this time. Given	A component of the PDP is to include a waste management strategy specifying: •the conservative quantities and characteristics of radioactive and chemically hazardous wastes expected to arise from the decommissioning (tied to specific work packages, if possible) •the anticipated final disposition of radioactive and chemically hazardous materials •a commitment to segregate as much material as possible for reuse and recycling

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			this uncertainty, the licensee should state how the waste will be managed if a DGR is not available so that the host community and public is aware of this potential outcome.	In addition, this document is complemented by CSA N294 that specifies additional requirements and guidance on the waste management strategy. No change was made as a result of this comment.
61.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		**Issue** The section on Uncertainty is not needed. **Suggested change** Remove section 5.1.2 as this is captured in last bullet in Section 4.	No change was made as a result of this comment. CNSC staff find this information gives context to factors affecting the level of detail and decommissioning plan flexibility.
62.	Safety Probe International	5.1.2	5.1.2 Uncertainties and risks The licensee should describe uncertainties and any anticipated risks in the PDP.	The topic of risk is covered as a required element of a PDP and DDP. Therefore, no change was made as a result of this comment as.
63.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power,	6	**Issue (Major)** Licensees found several items in section 6 could be improved for clarity. Specifically: 1) As written, industry is unsure how the requirement in the 1st sentence can be implemented when a utility has other facilities under operation using the same governance set. There is no value updating *all* program documents, just those that are impacted or, where appropriate, just the licensee's management system. 2) Does "program" as referenced in this section refer to the "decommissioning	As a result of this comment, 1)The requirement has been revised as suggested 2) The term program has been removed based on the proposed changed to 1) 3)These terms may not be covered in a licence/LCH. To formalize the requirements, they will remain in this REGDOC. 4)See response to comment #8 on the revised text in the detailed

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	Nuclear Waste Management Organization, Ontario Power Generation		program"? 3) Regarding the 4th paragraph and its supporting bullets, licensees believe a "permanent shutdown plan" and a "stabilization activity plan" are not required in this REGDOC since they are already covered in a license application/LCH. 4) As per comment #1 and the timing of key activities, when specifically is the DDP referenced in the second bullet on Page 9 to be submitted to the CNSC. Clarity is also needed on what DDP is expected if the facility is using a deferred decommissioning strategy. For a deferred strategy, instead of a DDP, a storage with surveillance plan should be required. 5) Also in reference to comment #1, the 3rd paragraph on page 9 needs to be amended to clarify that timing requirements needs to be reviewed against/align with existing and proposed regulatory documents like *REGDOC 1.1.4 License Application Guide: Licence to Decommission Reactor Facilities*. **Suggested change** Licensees urge the CNSC to: 1) Amend the 1st sentence to read, "During the preparation for decommissioning phase, the licensee shall review and revise its management system, or impacted ~~as appropriate, all~~ program documents, as appropriate, to ensure ~~that~~ they align with the decommissioning activities." 2) Clarify what is meant by program. 3) Delete the requirement to prepare permanent shutdown and stabilization activity plans or replace with detailed plans for the activities being proposed in the licence application. 4) Specify when the referenced DDP in the 2nd bullet on page 9 is to be submitted. Identify a storage with surveillance plan is required (with reference to section 6.1) for a deferred strategy, while a DDP is required for prompt decommissioning.	decommissioning plans section. 5)No change was made as a result of this comment. This section will be reviewed during the development of REGDOC-1.1.4, *License Application Guide: Licence to Decommission Reactor Facilities*.

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			5) Amend the 3rd paragraph and supporting bullets on page 9 to read, "Notification timelines for facility decommissioning activities should align with requirements in existing regulatory documents." This will need to be updated upon publication of *REGDOC 1.1.4* **Impact on industry** Licensees may not be able to meet CNSC expectations/REGDOC requirements without precisely defining requirements.	
64.	Safety Probe International	6	Specifically, the stabilization of reactor facilities includes the following key activities: defueling the reactor, draining and storing of the cooling water from the reactor main systems, draining water from secondary and auxiliary cooling systems, protecting or moving radioactive equipment, cleaning and decontaminating, maintaining cooling for the irradiated fuel bays, transferring the spent fuel to dry storage, modifying any inter-dependency other planning envelopes and the operating conditions/programs to align with the state of the facility, performing extensive radiological surveys and maintaining routine surveillance of the facility.	No change was made as a result of this comment. Examples of stabilization of activities for reactor facilities are included in the REGDOC. However, this list was not intended to cover all possible stabilization activities, as these will be facility-specific. The licensee must state the required stabilization activities in the DDP, which may include the additions proposed in the comment. The DDP is reviewed by CNSC staff prior to decommissioning.
65.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.1	**Issue (Major)** As per comments #1 and #7 on the timing of key activities, the 1st paragraph refers to the possibility of submitting a 'storage with surveillance plan' as a stand alone document. If this is done, when is this plan to be submitted to the CNSC? Also: 1) The final sentence of the 1st paragraph says, "The storage with surveillance plan should outline:" This implies only limited detail is required. What level of detail is expected? 2) It's unclear what the expectations are for each of the bullet points. 3) Regarding the 5th paragraph, depending on the reactor (e.g., SMR), there may not be a need for a fuel bay. Therefore, it would not be a key activity.	As a result of the comment, the following changes were made: Bullet #1: A section was added to the document on level of detail and plan flexibility. Furthermore, there is already flexibility in the list as it is a should statement. Bullet #2: The following text was added to section 6.3, Storage with Surveillance Plan: "The storage with surveillance plan should be developed on the basis of the outcomes of the safety assessment." In addition, the graded approach should be used to determine the level of detail that is necessary for the storage with surveillance plan based on the results of the safety assessment. The information in this section is intended to align with CSA N294, *Decommissioning of facilities containing nuclear substances*, which recently underwent public consultation. The bulleted list was revised to provide additional information and context, while still aligning with CSA N294.

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			Suggested change Clarify timing expectations and that it is acceptable to provide the DDP details under a deferred dismantling strategy prior to the start of dismantling activities and *not* at the start of storage with surveillance. Also: 1) For flexibility, amend the final sentence of the opening paragraph to read, "The storage with surveillance plan could include should outline:" 2) For each of the bullet points, briefly clarify the expectations with related sub-bullets. For example, what is expected regarding the 1st bullet, "responsibilities" or the final bullet "records"? Does "quality assurance" mean "management system"? 3) Delete the references to fuel bays or insert a qualifier like " …for those facilities with fuel bays." **Impact on industry** The preparation and submission of detailed planning documents requires significant resources and has the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare detailed plans. To ensure CNSC expectations are met, the REGDOC could better describe the storage with surveillance plan sections and where the priority or focus should be. Regarding the bullet points, licensees may not be able to meet CNSC expectations/REGDOC requirements without fully understanding the expectations.	Bullet #3: As a result of this comment the sentence was revised as follows: "Stabilization activities of reactor facilities may include …"
66.	Region of Durham	6.1	Host communities should be engaged in the discussion on the preferred strategy for decommissioning. "Storage with surveillance" is not the strategy recommended by the IAEA. The impact of deferred decommissioning on the community should be a factor in this decision as they may live with the impact for decades. The rationale for this approach must take into account community impacts, costs and wellbeing.	See response to comment #2.

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			This section raises the possibility that the DDP may not be completed for decades because the storage with surveillance plan can be submitted as a stand-alone document for licensing of that stage. This "just in time approach" should not be permitted for a large nuclear generating station due to the uncertainty for the surrounding community. A DDP that outlines the overall framework and expected timing should be prepared before the storage with surveillance phase begins. Additional detail should be added to the DDP at every five-year review. The lengthy safe storage period envisioned by OPG at PNGS could mean the loss of economic benefits and revenue generating uses of this site for 30 years or more. Where deferred decommissioning is selected by a licensee (rather than prompt decommissioning), the PDP/DDP should include mitigation measures, such as compensation, for the communities for hosting nuclear waste until it can be permanently relocated.	
67.	Safety Probe International	6.1	The storage with surveillance plan should outline: • responsibilities (of who?) […] • waste management provisions • quality assurance program • qualification and training program • records keeping	The information in section 6.3, Storage with Surveillance Plan is intended to align with CSA N294, *Decommissioning of facilities containing nuclear substances*, which recently underwent public consultation. The bulleted list was revised to provide additional information and context, while still aligning with CSA N294.
68.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power,	6.2	**Issue (Major)** As with section 5.1, this section suggests a DDP for the entire site should be submitted to the CNSC for acceptance. Please see comment #14 for details on why this is a major concern to licensees. As with section 6, this REGDOC should identify that a storage with surveillance plan is required for deferred decommissioning, with a DDP required at the start of dismantling activities or for prompt decommissioning.	As a result of this comment, •the requirement was revised to: "For licensed sites with more than one facility preparing to undergo decommissioning for which the licensee is responsible, the licensee shall submit an overarching site DDP to ensure that interdependencies between the individual DDPs (planning envelopes or facilities) are taken into account." •The paragraph was revised to "For deferred decommissioning, the licensee or

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	Nuclear Waste Management Organization, Ontario Power Generation		With reference to the 5th paragraph, are facility-specific DDP's required for sites with more than one facility, while the submission of a site DDP is advised guidance (i.e. should)? Also, the list of inclusions is already provided in 6.2.1 and does not need to be duplicated in the 1st paragraph. **Suggested change** Licensees encourage the CNSC to avoid duplication of text and to clarify what is meant by a site PDP and whether it is intended to cover the facilities on site or the site itself. If it is the site itself, this should be removed from the document as the CNSC has no regulatory jurisdiction for areas outside of licensed facilities. Amend the 1st sentence of the 1st paragraph to read, "Prior to execution of decommissioning activities, the licensee shall prepare and submit a storage with surveillance plan (for deferred decommissioning) or a DDP to the CNSC for acceptance." For consistency, the CNSC should amend the 1st sentence of the 5th paragraph to read, "For sites preparing to undergo decommissioning with more than one facility, the licensee may should submit a DDP for the entire site to the CNSC for acceptance, or for each individual facility (if the facilities are to be decommissioned separately)." **Impact on industry** The wording in this section needs to be able to be applied to all facilities. While it may work for a mining site, or for a site like Chalk River National Laboratories, it will not work for a site like Bruce Power. This will cause confusion over requirements and possibly require unnecessary plans to be developed. Additional resources would also be required to produce documentation which is already covered more efficiently in the current structure (i.e., facility-only PDPs).	applicant shall detail in the DDP and supporting documents (e.g., safety assessment for decommissioning) the programs and activities that will be maintained during SWS. A graded approach should be applied, during SWS, to the level of detail in the DDP pertaining to decontamination and dismantling. Toward the end of the SWS period, the DDP and supporting documents shall be revised, detailing the decontamination, dismantling work and clean-up activities to be completed and submitted to the CNSC for acceptance."
69.	Canadian Nuclear Association,	6.2	**Issue (Major)** Similar to comment #13, clarify is sought on the line in the 3rd paragraph, which	As a result of this comment, the section was changed to: "Where decommissioning takes longer than five years, the DDP shall be reviewed and, as necessary, updated every five years, or as requested by the CNSC. The DDP

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	Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		reads, "Where the execution takes longer than five years, the DDP should be updated every five years." **Suggested change** Clarification is required since this could be interpreted that DDP work may be stopped every five years awaiting CNSC acceptance, even if there was no change. Some DDPs span a period greater than five years **Impact on industry** The preparation and submission of detailed planning documents requires significant resources and has the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare detailed plans.	should be reviewed and updated in light of incidents or events with relevant consequences for decommissioning, revised regulatory requirements, operational experience and lessons learned, and advances in decommissioning technology."
70.	Region of Durham	6.2	The only timing mentioned for submission of the DDP is "prior to executing decommissioning activities." Since the storage with surveillance plan can be submitted separately it appears that the safe storage phase is not considered to be part of decommissioning. This is not consistent with what is currently outlined in the PNGS PDP. As mentioned earlier the definition of decommissioning and the timing needs to be clear to the host community and the public in general. A five-year review cycle is supported since institutional memory related to a facility may be lost with a longer review cycle, both within the community and within the licensee's organization. We recommend that one of the planning envelopes in the decommissioning plan should outline activities that will support ongoing, meaningful community engagement including: • partnership with the host community/municipal government/indigenous community, • community awareness, well being and engagement, • sharing of information about the PDP and DDP well in advance with the host	As a result of this comment, the definition of decommissioning was revised to incorporate storage with surveillance. As all other regulatory documents, REGDOC-2.11.2 is intended to form part of the licensing basis for all CNSC licensees to who it applies. This REGDOC will be incorporated into their licence conditions handbooks (LCH). The implementation plans and timelines would be established through discussions and consultations between CNSC staff and licensees and according to the CNSC's management system process for the implementation of regulatory documents. The DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned; the final radiological, physical and chemical end-state objectives; etc. Further more, licensee are required to keep surrounding communities informed. They are subject to REGDOC-3.2.1, *Public Information and Disclosure*.

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			communities, • intergenerational knowledge transfer, • characterization of potential fiscal and socio-economic effects and environmental impacts, • development of impact mitigation strategies and • discussion about the desired end-state and use of the property, post decommissioning.	In addition, CSA N294, *Decommissioning of facilities containing nuclear substances* includes requirements on public and Indigenous communication and engagement.
71.	Region of Durham	6.2	The regulations should ensure that open dialogue among the regulator, licensee and host communities continues throughout the decommissioning process. The host community cannot avoid the decommissioning process or ask for it to occur elsewhere, so their needs and concerns must be dealt with in good faith. In this regard, the bullet on p. 11 stating that the content of the DDP should include "a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned" is insufficient. This implies that no further dialogue with the affected community is required but there is no recourse for the community if they aren't satisfied with the disposition. Even where a current nuclear operator has a strong relationship with the host communities, it cannot be assumed that this ownership arrangement or the co-operative relationship continues indefinitely. Proper community engagement, whether with municipalities or Indigenous communities, cannot be left at the discretion or good will of whoever owns the facility in future. It must be mandated to protect the host community	The DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned; the final radiological, physical and chemical end-state objectives; etc. In addition, CSA N294, *Decommissioning of facilities containing nuclear substances* includes requirements on public and Indigenous communication and engagement. During the execution of decommissioning, licensees must conduct decommissioning in accordance with the accepted DDP. Furthermore, licensees are required to keep surrounding communities informed. They are subject to REGDOC-3.2.1, *Public Information and Disclosure*.
72.	Cameco	6.2	The last paragraph in this section is confusing and should be revised to recognize situations where some "planning envelopes" at a facility may not be progressing into a DDP and will remain in a PDP stage.	As a result of this comment, the requirements was revised to: "For licensed sites with more than one facility preparing to undergo decommissioning for which the licensee is responsible, the licensee shall submit an overarching site DDP to ensure that interdependencies between the individual

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				DDPs (planning envelopes or facilities) are taken into account.”
73.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.2.1	**Issue** Licensees have several questions and suggestions to clarify the section on ‘Content of the detailed decommissioning plan.’ Specifically: 1) While the wording in this section currently aligns with that in the new revision of CSA *N294*, future revisions could misalign these two documents so it must be clear the REGDOC is setting the requirements, not the CSA standard. 2) The 2nd bullet, 5th sub-bullet, on page 11 says, “the quantities, characteristics and disposition methods of waste.” As written, this implies the CNSC approves of destructive/invasive sampling to gather characterization info. If CNSC approval is required, when and how is this approval obtained e.g. before a DDP is written or after DPP is approved? 3) The third bullet in Section 6.2.1 on page 10 implies that deferred decommissioning has been selected as the decommissioning strategy. 4) Clarity is sought regarding the 4th bullet, which says, “the final radiological, physical and chemical end state objectives.” 5) What is meant by “phased program” and “deferral periods” as listed in the 8th bullet? Where are these terms defined? 6) The 8th bullet on page 11 says, “a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned.” This would be more applicable during DDP for dismantling phase. 7) The 14th bullet on page 11 says, “a final survey program with interpretation criteria.” How are licensees to define interpretation criteria? This is related to end-state criteria but there is no guidance on how to derive. Is this following MARSSIM type of approach?	As a result of this comment, the following changes were made: Bullet #2: The DDP is required before the execution of decommissioning. Giving the varying degrees of scale, complexity, etc., associated with a facility or activity. A precise timeline for submission and approval is not provided. The IAEA recommends 2-5 years of permanent shutdown. To address this comment, the following sentence was amended: “Prior to the execution of decommissioning, the licensee shall submit a DDP to the CNSC for acceptance. For a Class I nuclear facility, the licensee should typically submit a DDP to the CNSC two to five years prior to permanent shutdown.” Bullet #3: “As applicable” was added to the bullet. Bullet #5: The bullet on deferral was changed to “the final radiological, physical and chemical end-state objectives, and interim end-state objectives, as applicable” Bullet #7: This document is completed by CSA N294, *Decommissioning of facilities containing nuclear substances* which includes an annex on surveys, including acceptance and performance criteria. This statement was deleted. See response to bullet #5. Bullet #10: The term ‘decommissioning’ was added to clarify the schedule is for decommissioning activities Bullet #11: The requested change was made. The following changes were not made: Bullet #1: Comment noted. Bullet #4: This document is completed by CSA N294, *Decommissioning of facilities containing nuclear substances* which includes and appendix on defining

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			8) The 10th bullet on page 11 says, “applicable programs” It should be applicable management system. 9) The 12th bullet on page 11 says. “conventional occupational health and safety…” It should be applicable management system. 10) The 3rd bullet and supporting sub-bullets on page 11 says, “a schedule showing...the proposed start date …anticipated completion date.” Start date” of what? “Completion date” of what? 11) The final bullet on page 11 says, “Criticality safety assessment.” This is given as a requirement even if all fissile material has been removed. Also section 6.3 does not mention a criticality safety assessment. **Suggested change** Licensees urge the CNSC to: 1) Ensure this REGDOC continues to align with *N294* Annex C. 2) As per comment #1 on timing, please provide better guidance on the CNSC approvals. 3) What about other decommissioning strategies? 4) Are end-state objectives the same as end state criteria as identified in section 8? This REGDOC does not give guidance on how to develop or who to consult to develop. 5) Define “phased program” and “deferral periods” and include in *REGDOC-3.6.* 6) Amend to require this report during the DDP for dismantling phase. 7) Clarify interpretation criteria and how it is derived. 8) Amend the 10th bullet on page 11 to read,“applicable management system	end-state objectives for decommissioning. Bullet #6: In addition to being CNSC’s expectation, this is in alignment with CSA N294. Bullet #8: This is in alignment with CSA N294. Bullet #9: This is in alignment with CSA N294.

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			programs (e.g., management system, emergency responses…" 9) Amend the 12th bullet on page 11 to "applicable management system" 10) Clarify what start and completion dates are being referenced. 11) Amend the final bullet to say, "as required"	
74.	Safety Probe International	6.2.1	A DDP for a nuclear facility with a Class I or uranium mines and mills licence shall include: • a description of, and diagram showing, the areas, components and structures to be decommissioned and grouped where appropriate into ~~logical~~ clearly defined decommissioning planning envelopes […] • the storage with surveillance stage and requirements of the: […] • inspection activities • access control […] • a human factors program that includes: […] • ergonomic issues • staff complement	The requirement is currently in alignment with N294, *Decommissioning of facilities containing nuclear substances*, which had a review in 2019. To ensure consistency, and avoid confusion between this REGDOC and CSA N294 no change made so that the list remains in alignment.

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			[…] • operational experience and lessons learned ~~from~~ applicable to the decommissioning of ~~similar~~ nuclear facilities	
75.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	6.3	**Issue (Major)** As per comments #1 and #7, this document is not clear regarding the expectations for a safety assessment for decommissioning. Is a safety assessment only required for the DDP, or is it needed for storage with surveillance as well? If the assessment is to be submitted as a stand-alone document, when specifically is it to be submitted to the CNSC? **Suggested change** Align the wording in this section with that in *N294* since this material is covered through the detailed plan. Also, provide clarity on which phases require a safety assessment so licensees can meet regulatory expectations. **Impact on industry** As written, this draft suggests a separate document needs to be part of the decommissioning approval package. If this is not the intent, further clarification is needed so licensees can meet CNSC expectations.	Decommissioning includes SWS. As a result of this comment, the definition of decommissioning has been revised to "Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination and/or dismantling of structures, systems and components, and cleanup activities) that are taken to retire a facility from service with due regard for the health and safety of people and the environment." The following text was also added to the section on detailed decommissioning plans: "For deferred decommissioning, the licensee or applicant shall detail, in the DDP and supporting documents (e.g., safety assessment for decommissioning), the activities that will be performed during the SWS period. A graded approach should be applied, during SWS, to the level of detail in the DDP pertaining to decontamination, dismantling and/or clean-up. Toward the end of the SWS period, the DDP and supporting documents shall be revised, detailing the decontamination, dismantling work and clean-up activities to be completed and submitted to the CNSC for acceptance."
76.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power,	6.3	**Issue** Licensees seek additional clarity on section 6.3. Specifically: 1) For message consistency, add "the environment" to the 1st sentence. 2) *REGDOC-3.6* defines Safety Assessment as, "An assessment of all aspects relevant to safety of the siting, design, construction, commissioning, operation or decommissioning of a nuclear facility." This focuses on safety in very general terms, however, there is mention here of safety analysis via *REGDOC-2.4.1 Deterministic Safety Analysis* which is not applicable to the definition of Safety Assessment of	As a result of this comment, all changes have been made as suggested.

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	Nuclear Waste Management Organization, Ontario Power Generation		decommissioning. 3) In the 3rd bullet in the 1st bulleted list on page 12, should "operational" be replaced with "decommissioning"? 4) In the 2nd set of bullets on page 12, the 4th and 5th bullets can be clarified. 5) It is unclear if the requirement in the final paragraph in this section applies only if the "in situ" results in a disposal site. **Suggested change** For clarity: 1) Amend the 1st sentence to read, "The licensee shall perform a safety assessment to identify hazards to workers, the environment and the public from both routine decommissioning activities and credible accidents during decommissioning." 2) Delete last sentence which on page 12 which references *REGDOC-2.4.1*. 3) Consider replacing "operational" with "decommissioning" 4) Amend the 4th and 5th bullets to read, "demonstrates ~~whether~~ an adequate defence in depth has been provided" and "demonstrates ~~whether~~ that adequate measures have been taken to prevent accident" 5) Amend the final paragraph to read, "For *in situ* decommissioning resulting in a disposal site, a long-term safety case (see section 4)… 6) shall be provided in addition to the decommissioning safety assessment"	
77.	Region of Durham	6.3	The safety assessment section is an example of planning premised on the continuation of the current (or improving) regulatory regime. It assumes that the political support and financial means necessary to support a strong safety regime will continue to be available, enabling Canada to maintain the strict regulatory structure and high	The comment is outside the scope of this document.

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			standard of oversight we have today. In the past few decades in Canada, we have seen significant shifts in political direction, a severe economic recession and related austerity measures, regulations rolled back as “red tape”, and the sale of public infrastructure. Changes like these, alone or in combination, over time, could result in a deterioration of the institutional measures, funding mechanisms and knowledge base required to complete decommissioning. Planning for a less reliable regulatory future may be warranted.	
78.	Safety Probe International	6.3	The licensee shall perform a safety assessment to identify any risks of radioactivity exposure or hazards to workers and the public from both routine decommissioning activities and credible accidents during decommissioning. […] The results of the safety assessment should be used to: […] • specify the procedures to be put in place for all operational activities significant to safety for responding to accidents or any identified risks • specify the necessary ~~competencies~~ qualifications for the staff involved in the facility or activity	As a result of this comment, •The requirement was revised to “The licensee shall perform a safety assessment to identify any radiological or non-radiological hazards to workers, the environment and the public from both routine decommissioning activities and credible accidents during decommissioning.” •The requirements was revised as requested •The term was unchanged to align with IAEA language
79.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power,	6.4	**Issue** Licensees believe this section could be clarified in the following ways: 1) The final paragraph references draft *REGDOC- 2.11.1*. As a matter of principle, draft REGDOCs should only reference other REGDOCs or standards that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and informed comments cannot be provided. 2) The document should recognize the waste management plan is higher level during	1) See response to comment 25 2) The following has been added to the section on detailed decommissioning plans “For deferred decommissioning, the licensee or applicant shall detail in the DDP and supporting documents (e.g., safety assessment for decommissioning) the programs and activities that will be maintained during SWS. A graded approach should be applied, during SWS, to the level of detail in the DDP pertaining to decontamination and dismantling. Toward the end of the SWS period, the DDP and supporting documents shall be revised, detailing the decontamination, dismantling work and clean-up activities to be completed and

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	Nuclear Waste Management Organization, Ontario Power Generation		the early stages of a facility lifecycle (PDP), becoming progressively more detailed in the DDP 3) Industry suggests more information on waste minimization could be added to section 6.4 as per *N294*. **Suggested change** For clarity, the CNSC is urged to: 1) Cite only currently published versions of REGDOCs and CSA standards. 2) Suggested adding the following to the end of the section, "In the initial phases of decommissioning planning, the waste management plan will be preliminary in nature, becoming more detailed as the facility progresses into actual decommissioning." 3) Consider adding the following text from N294, "The waste management program shall cover the following processes, as applicable: (a) characterization; (b) classification; (c) minimization; (d) segregation; (e) clearance; (f) handling; (g) volume reduction; (h) treatment; (i) packaging; (j) storage;	submitted to the CNSC for acceptance." 3) This requirement is included in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*. The requirement was changed to: "Further information on radioactive waste management and waste management programs can be found in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [6]."s
80.	Region of Durham	6.4	The decommissioning and dismantling experiences at Chalk River and Whiteshell Labs revealed undocumented waste and contamination issues such as the amount of asbestos and lead used in the older buildings on their sites. Waiting (potentially) decades to develop the waste management plan for a nuclear facility risks the loss of expertise about the facility that is available in current staff. While technology available for dismantling and packaging waste may improve over time, the best time to characterize the type and quantity of waste material that will be generated in taking the facility apart may be in the immediate future. These are matters of concern to the nearby urban community and the labour force that will be engaged in decommissioning. While the waste management plan will undoubtedly be very technical, there should be provision for making the public and host communities aware of it in plain language.	As outlined in this document, the DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned, including on the topic of waste management. This REGDOC is complemented by CSA N294, *Decommissioning of facilities containing nuclear substances*, which includes requirements for characterization surveys of the facility after shutdown. In addition, waste management requirements and guidance are outline in REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*. Furthermore, licensee are required to keep surrounding communities informed.

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			Key aspects to include could be timing of facility dismantling, volumes of material expected to be produced, planned time and location for disposition for that material.	They are subject to REGDOC-3.2.1, *Public Information and Disclosure*. No change was made as a result of this comment.
81.	Region of Durham	6.4	As noted in Attachment 1 (p.16, 21, and 22), the Region and local municipality will need to understand impacts of employee movement and the timing and volume of waste haulage on regional and local roads. The Region will need to be consulted on any airborne or waterborne emissions from the waste being generated that could affect water quality at its Lake Ontario water supply intakes. Regional and local municipal emergency responders will need to participate in planning for transfer of waste materials offsite. Managing, maintaining and moving waste on and away from that site must be done in a scientifically responsible way, but also in a socially acceptable way. Developing agreements with host communities to ensure their wellbeing during this activity should be a component of the waste management plan.	Requirements on radioactive waste management can be found in REGDOC-2.11.1, Waste Management, Volume I: *Management of Radioactive Waste*. As noted above, licensee are required to keep surrounding communities informed. They are subject to REGDOC-3.2.1, *Public Information and Disclosure*.
82.	Cameco	6.4	This section should recognize that the waste management plan is at a higher level during the early stages of a facility lifecycle (PDP) and becomes progressively more detailed in the DDP. Cameco recommends adding the following to the end of the first paragraph: “In the initial phases of decommissioning planning, the waste management plan will be preliminary in nature, becoming more detailed as the facility progresses into decommissioning activities.”	See response to comment #79.
83.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB	7	**Issue** The 2nd bullet could be clarified **Suggested change** Amend the 2nd bullet to read, “implement ~~and maintain~~ a decommissioning process ~~program and supporting programs~~, as applicable, to ensure safety”	As a result of this comment, the change was made as suggested.

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	Power, Nuclear Waste Management Organization, Ontario Power Generation			
84.	Safety Probe International	7	The licensee shall: […] • characterize and manage all remaining operational waste from the facility and all waste from decommissioning • report to the CNSC any incident involving the safety of workers , public or the environment • ensure traceability of all waste generated	This requirement is covered in regulation. However, as a result of this comment, the following references were added to the Additional information section: •REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*, Version 2 •REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills* •REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices*
85.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	7.1	**Issue** Licensees have several questions and suggestion to clarity section 7.1 such as: 1) This section should explicitly address prompt, deferred and in situ decommissioning by identifying the required decommissioning criteria for each strategy. By doing so, Section 7.1 Storage with Surveillance is not needed. 2) What about other decommissioning strategies, given that this section is focused on deferred decommissioning alone (similar to Section 6.1, etc.)? 3) Final bullets should include disposal facility as a waste path **Suggested change** Clarify by:	The general portion of section 7 applies to all decommissioning activities, regardless of the decommissioning strategy. As a result of this comment, the requirement is section 7 was changed to: "During the execution of decommissioning, the licensee shall:…" In addition, a section on *in situ* decommissioning was added.

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			1) Explicitly addressing prompt, deferred and in situ decommissioning by identifying the required decommissioning criteria for each strategy. 2) Referencing other decommissioning strategies. 3) Amending the final bullets to read, "removal of radioactive waste to an offsite licensed storage facility or disposal facility" and "removal of radioactive waste to an offsite licensed storage facility or disposal facility."	
86.	Safety Probe International	7.1	If storage with surveillance is undertaken, the licensee may perform activities to reduce risks at the facility during a period of storage with surveillance, in accordance with the licence and communication with the CNSC. These may include: […] • reduction or removal of hazardous wastes • modifying or upgrading the ventilation systems	This is in alignment with REGDOC-3.5.1, *Information Dissemination: Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills*, Version 2 however, the bullet was changed to: "The licensee shall outline in the storage with surveillance plan any activities envisioned or planned to reduce the risks at the facility or location."
87.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	8	**Issue** Licensees seek additional clarity in the following ways: 1) As per comment #1, the 2nd paragraph on page 14 says, "The licensee shall prepare and submit an end-state report to the CNSC..." but is not specific on timing. 2) What is the definition of "remaining entities" as referenced in the 5th bullet on page 14? Should clearer, alternative terminology be used? 3) Per the 8th bullet on Page 14, the licensee must "describe waste quantities and dispositions." What does this refer to? 4) The last bullet – "describe the future use of ..."- Does the term 'lands' refer to facility or site? There is no mention of release from regulatory control request to the CNSC, as depicted in Figure 1.	As a result of this comment, the following changes were made: Bullet #1: The following text was added: "The end-state report should be submitted no more than 2 years after completing the execution of decommissioning activities." Bullet #2: The term 'Entities' was replaced with 'structures, systems and components' Bullet #3: The bullet was changed to: "a summary of the waste quantities generated and managed, and disposition routes" Bullet #4: The text was changed to: "the future use of, or any restrictions on the future use of, the facility or location and remaining structures, including any institutional controls"

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			Suggested change Clarify by: 1) Being specific as to when this report is to be submitted to the CNSC. 2) Explaining what is meant by "remaining entities" or inserting an alternative phrase. 3) Further explaining the reference. 4) Saying whether the term 'lands' refer to facility or site.	
88.	Region of Durham	8	This section speaks to the licensee demonstrating that the end-state criteria specified in the DDP have been met in a way acceptable to the CNSC. The end-state also should be acceptable to the community. The public should be fully involved in developing the end-state vision and criteria for establishing that it has been achieved. As a form of community accountability, the interim end-state reports should be publicly accessible and presented, with an opportunity for local elected officials and citizens to ask questions and be responded to by the licensee. These reports would also be an opportunity as time goes on to confirm that end-state envisioned in the DDP is still viable and aligned with the shared licensee/community vision.	See response to comment #57 on public information and disclosure.
89.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management	9	**Issue (Major)** The 1st sentence says, "If institutional controls are required to be in place, the licensee shall prepare plans to address the post-decommissioning phase." As per comment #1, are these plans (including the "visual inspection plan for periodic examination of the site") to be submitted to the CNSC and if so, by when? **Suggested change** Clarify if these plans are to be submitted to the CNSC and if so, by when. **Impact on industry**	As a result of this comment, the first sentence has been amended to: "If institutional controls are required to be in place, the licensee shall prepare plans to address the post-decommissioning phase and submit them to the CNSC for review with the licence application."

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Organization, Ontario Power Generation		The preparation and submission of detailed planning documents requires significant resources and has the potential to spawn additional assessments. The more specific this REGDOC can be regarding submission timings would help licensees plan their work and assign appropriate resources and time to prepare detailed plans.	
90.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	9	**Issue** Licensees seek additional clarity in section 9 in the following ways: 1) For message consistency, add "the public" to the 2nd sentence. 2) Revise or delete bullets 2 and 3 since there are no monitoring systems that provide early warning of the release of radionuclides. Also, clarify if site boundary is the whole site or the ISD location **Suggested change** For clarity: 1) Amend the 2nd sentence to read, "The post decommissioning plans include programs for monitoring and surveillance that will be established and maintained to optimize ~~for~~ the optimization ~~of~~ safety and protection ~~and safety~~ of the public, and ~~for the protection of~~ the environment." 2) Revise or delete bullets 2 and 3. Otherwise, clarify what constitutes "active controls" and that is being actively managed.	As a result of this comment, the following changes were made: • the second sentence was changed to: "The post-decommissioning plans include programs for monitoring and surveillance that will be established and maintained to optimize safety and protection of the public and the environment." • the second bullet was changed to: "operation and maintenance of a monitoring system to detect any radionuclide release within the site boundary" • Refer to REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* regarding a description and examples of active controls.
91.	Region of Durham	9	Institutional controls (such as land use constraints, monitoring and surveillance) may continue after the end state has been achieved. During the discussion of the DDP, the host communities need to be aware of the extent and longevity of any limitations that will be imposed on the site. There must be a plan for intergenerational knowledge transfer within the general population about these limitations for example through land use planning, storytelling, historical exhibits, and school curricula. Multiple mechanisms are needed to avoid reliance on a single institutional measure that could fail or disappear.	As a result of this comment, no changes were made. As stated in Section 9 of the REGDOC, if institutional controls are required to be in place, the licensee shall prepare plans to address the post-decommissioning phase and shall submit them to the CNSC for review. The details mentioned within this comment may be addressed within the post-decommissioning phase plans that will be reviewed by the CNSC.

REGDOC-2.11.2, *Decommissioning*
REGDOC-2.11.2, *Déclassement*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
92.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	10	**Issue** Add clarity to the bulleted list by drawing points from *N294*. **Suggested change** Replace the 2nd bullet with: "- Identify contaminants, impacted and non impacted areas, and provide an estimate of the variability of contamination" Add the following two new bullets: "- Providing a complete description of the nature, extent, and variability of contamination in each area of the site/facility "- Supporting remediation activities and determine when remediation is complete"	As a result of this comment the bulleted list was revised as suggested to align with N294, *Decommissioning of facilities containing nuclear substances*.
93.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	10	**Issue** The main focus of this section should be the decommissioning phase. **Suggested change** Sections 10.1, 10.2 and 10.2.1 can be included as guidance for the other facility lifecycle phases as it does not pertain to decommissioning.	No changes were made as a result of this comment. Though it is noted that this sections focus should be on the decommissioning phase, it was decided to keep all of the survey requirements and guidance in the same section. And while not specifically performed in the decommissioning phase, pre-operational surveys, operational surveys and transition surveys are useful for establishing end-state criteria and to validate the decommissioning strategy and plan.
94.	Region of Durham	10	We support the approach proposed in this section. We suggest that pre-surveys of the surrounding area also need to include transportation routes to be used for removal of waste once the routes are established. Post-surveys also should include the	No changes were made as a result of this comment. The exact survey locations will be proposed in the survey plans that will be reviewed and approved by the

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			transportation routes used.	CNSC. CNSC staff will ensure that all pertinent locations are in the plans.
95.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	10.1	**Issue** Licensees believe: 1) The phrase 'Radionuclides and hazardous chemicals' in the 2nd sentence of the 1st paragraph is unnecessarily alarming in this context. 2) The word 'retained' in the 3rd paragraph implies it will be kept for future reference. **Suggested change** Clarify by: 1) Amending the 2nd sentence to read, "…to be measured (e.g. constituents of potential concern radionuclides and hazardous chemicals)" 2) Amending the 3rd paragraph to read, "...should be collected retained and assessed..."	As a result of this comment the text was changed as suggested.
96.	Cameco	10.1	Cameco does not believe that the term "hazardous chemicals" used in the first paragraph is appropriate and instead recommends that it should be replaced with "potential contaminants of concern" or "other parameters of interest". In the second last phrase "retained and assessed" should be replaces with "collected and assessed" because such materials will not be retained for future reference.	As the result of the comment, the following changes were made: • The first sentence has been amended to: "Prior to performing these surveys, the proponent should identify the media to be sampled (e.g., soil, sediment, surface water) and the parameters to be measured (e.g., constituents of potential concern, radionuclides and hazardous chemicals)." • The second sentence has been amended to: "Prior to commencement of a licensee's operation, samples of non-activated and non-contaminated materials should be collected, retained and assessed to determine the concentrations of naturally occurring radionuclides."
97.	Canadian	10.2	**Issue**	As a result of this comment, the sentence was added to the end of the first

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		The opening paragraph could be further clarified. **Suggested change** Add the following to the end of the 1st paragraph, "They may also include records of clean-up operations undertaken with initial and final decontamination levels achieved."	paragraph as suggested.
98.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	10.4	**Issue** Add clarity to the 1st bullet point **Suggested change** Amend the 1st bullet to read, "final radiological survey objectives and defined acceptance criteria"	As a result of this comment, the bullet was changed as suggested.
99.	Canadian Nuclear Association, Canadian	Glossary	**Issue** The Glossary requires addition clarity in the following ways:	As a result o the comment, the definition for 'decommission' was revised to: "Administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility, or location where nuclear substances

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation		1) The definition of decommissioning in the Glossary of this draft does not match the definition in *REGDOC-3.6* or align with industry's understood meaning. Rather, it refers to a broader process used to retire a facility that includes ECO processes. Also, the definition in this draft is not clear with regard to release from regulatory control. The 1st sentence says, "… the removal of some or all of the regulatory controls" while the 2nd sentence implies full release from regulatory control. 2) Add definitions for End of Commercial Operation (ECO) and End of Life (EOL) in this draft and *REGDOC-3.6*. **Suggested change** Clarify by: 1) Aligning the definition in this draft with that in *REGDOC-3.6* and *N294* and correcting any contradiction related to release from regulatory control. 2) Adding the following definitions here and in REGDOC-3.6: **End of Commercial Operation (ECO)**: The end of commercial operation of a reactor unit coincides with the reactor's final shutdown and permanent cessation of electricity production from that unit. **End of Life (EOL)**: The end of life of a licensed facility coincides with release of the facility from regulatory (CNSC) control. In accordance with CNSC *REGDOC-3.5.1*, this occurs when the licensee has successfully decommissioned the facility and restored the facility to a state in which it can be released for future use. End of life coincides with issuance of a Licence to Abandon or an exemption from licensing."	are managed, possessed or store. Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination and/or dismantling of structures, systems and components, and cleanup activities) that are taken to retire a facility from service with due regard for the health and safety of people and the environment. For disposal facilities, with the exception of ancillary facilities, the term 'closure' instead of 'decommissioning' is used." Definitions for 'End of Commercial Operation' and 'End of Life' were not included as the terms are not used in the REGDOC.
100.	Region of Durham	Glossary	The foundation for an effective REGDOC is a clear **definition** of decommissioning. The definition provided on p.18 of the draft is designed for the regulator. Describing the removal of some or all regulatory controls as a defining characteristic of decommissioning is not helpful to the average citizen.	No change made as a result of this comment. The definition of decommissioning as provided in REGDOC 3.6, *Glossary of CNSC Terminology*¸ was revised in consultation with the development of this REGDOC in order to align with both the IAEA and CSA definitions.

REGDOC-2.11.2, *Decommissioning*
REGDOC-2.11.2, *Déclassement*
Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
			The definition must be clear and understandable to the host communities and the public, as well as the regulator and licensees. Creating a shared understanding of the process and its phases is critical to building an effective partnership. Host communities need to know what is involved and required at each phase within the decommissioning process. When does it start – when the plant ceases commercial operation or later? Is the safe storage with surveillance phase part of decommissioning? When will full site restoration be achieved?	
101.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste Management Organization, Ontario Power Generation	References	Issue Additional references could be added for enhanced context. Suggested change Add the following to the Reference section: • REGDOC-2.3.3, Periodic Safety Review • REGDOC-2.6.3, Aging Management • REGDOC-2.1.1, Management System • Decommissioning of Facilities, IAEA •General Safety Requirements Part 6	No changes were made as a result of this comment. Only REGDOCs that were referenced throughout the document were included in the references list.
102.	Canadian Nuclear Association, Canadian Nuclear Laboratories, Bruce Power, Hydro-Québec, NB Power, Nuclear Waste	Additional Information	**Issue** Amend the section to include NEA reference. **Suggested change** Add: • NEA, Decommissioning Nuclear Power Plants, 2003	As a result of this comment, the NEA reference was added as suggested.

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
	Management Organization, Ontario Power Generation			

Table C: Feedback on comments / Tableau C : Période des observations

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	Concerned Citizens of Renfrew County and Area	Our group believes that commenting on a CNSC REGDOC is not an appropriate means to address some very significant issues that arise in respect of decommissioning of nuclear facilities. To paraphrase some observations recently made by a colleague with a major national environmental law organization: • members of the public have a huge interest in decommissioning of nuclear reactors and other nuclear facilities; • compared to the nuclear industry, members of the public lack capacity (e.g., financial resources, technical support) to properly engage in decommissioning issues despite this huge interest; • decommissioning issues are of import for time frames ranging from decades to millennia and there will inevitably be intergenerational equity issues arising out of decisions made today; • there is a complete lack of relevant federal policies and strategies, as documented in detail by our group in environmental petitions 427 (Nuclear governance problems in Canada), 418 (Need for a national policy on decommissioning of nuclear reactors), and 411 (Policies and strategies for managing non-fuel radioactive waste); and • it would be timely and useful to have decommissioning policy issues discussed broadly in a public forum apart from the context of site specific proposals.	Comment noted. The regulatory document was not developed in response to any specific project proposals. REGDOC-2.11.2, *Decommissioning* was developed as part of CNSC's commitment to modernizing its waste management and decommissioning regulatory framework and update existing documents based on evolving international best practices, lessons learned and emerging technologies. REGDOC-2.11.2's purpose is to provide requirements and guidance regarding the planning for, preparation for, execution of, and completion of decommissioning for licensees that have decommissioning plans or strategies as a condition of their licence. The CNSC is committed to transparency and public engagement. Members of the public have participated in the development of REGDOC-2.11.2. Development of the initial draft of the regulatory document took into consideration public comments received on discussion paper DIS-16-03, *Radioactive Waste Management and Decommissioning*. The paper identified areas of improvement for the CNSC's current regulatory framework on waste management and decommissioning. A draft version of REGDOC-2.11.2 was issued for public comment from July 16, to October 16, 2019 with an additional period for feedback on comments from December 2 to 20, 2019. In addition, and in response to

			requests from stakeholders, the CNSC has arranged to hold workshops concerning the REGDOC-2.11 series of documents in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April 2020 and will outline how stakeholder comments were taken into consideration in the finalization of the document. See response to comment #2 in table C concerning participant funding. The CNSC's primary role is to regulate the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public. Natural Resources Canada (NRCan) is the federal organization that has the mandate for sustainable development and use of natural resources: energy (including nuclear), minerals and metals, earth sciences and forestry. NRCan is the lead government department responsible for developing federal nuclear energy policy, including for radioactive waste management, and decommissioning. NRCan's *Radioactive Waste Policy Framework* sets the stage for intuitional and financial arrangements to manage radioactive waste in a safe, comprehensive, and environmentally sound, integrated and cost effective measure.
2.	Concerned Citizens of Renfrew County and Area	REGDOC-2.11.2 is completely inadequate in addressing the issue of public involvement. Its guidance in this matter is essentially limited to the following statement: the licensee should consider the following, as appropriate: public and Indigenous engagement In comparison, the IAEA Decommissioning Safety Guide (SSG-47) says that: …interested parties are required to be involved in the licensing process for decommissioning, as well as in the process for termination of the authorization for decommissioning, and are required to be given an opportunity to provide comments before decisions are taken by the regulatory body and prior to the granting or termination of an authorization for decommissioning. This IAEA Safety Guide goes on to explain the public's interest in detail: Experience has shown that interested parties mainly focus their attention on the selected decommissioning strategy and its justification, the nature and extent of planned dismantling actions, the management and long term storage of radioactive waste on the site, the facility's end state, especially in the case of restricted reuse, the financial management of the decommissioning fund and the socioeconomic impacts of the decommissioning. In Canada, at present, some existing decommissioning	As stipulated in the REGDOC, the licensee must demonstrate in the decommissioning plan that the preferred decommissioning strategy will be implemented safely, and that public and Indigenous consultation will be undertaken in preparing the plan. Furthermore, a DDP must include a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned. It should be noted that the information to be included in a DDP does not constitute all of the information that a licensee would be required to submit in an application to request authorization to decommission a facility. Such an application would be subject to the CNSC licensing process which includes public hearings and the opportunity for various stakeholders to

		licences have been granted with no public input whatever. Although nuclear decommissioning activities result in significant longterm environmental impacts (both positive and negative), most are not covered by the *Impact Assessment Act*. Decommissioning strategies for two of the Government of Canada's own shutdown nuclear reactors were decided with no public input whatever, then announced, and are now being defended – at great ongoing cost to taxpayers, and with no tangible results to date. The current situation with regard to public involvement in decommissioning is untenable. The public should be consulted BEFORE the "licensee shall select a decommissioning strategy that will form the basis for the planning for decommissioning and facilitate achieving the desired end state," which is to say the public must have a say in the selection of the desired end state. The CNSC REGDOC fails to address what is arguably the most fundamental and important point made in the IAEA Safety Guide: Release from regulatory control without restrictions should be the preferred end state and ultimate objective of decommissioning.	participate. Licensees are required as part of their decommissioning strategy, PDP, and DDP, to provide the end-state objectives for the facility or location. End-states should be discussed with stakeholders to obtain their input, views, and any concerns. CNSC staff review the end-state objectives to ensure that they protect the public and the environment. Licensee will be required to inform and engaged surrounding communities. They are subject to REGDOC-3.2.1, *Public Information and Disclosure*.
3.	Concerned Citizens of Renfrew County and Area	The failure of the REGDOC to acknowledge this fundamental principle may explain why "in situ decommissioning" is being proposed as an "acceptable" strategy in certain circumstances, even though this is completely at odds with international practice. The IAEA Safety Guide says: On-site disposal of decommissioning waste is not a recommended practice in the case of decommissioning after normal operation, and is not addressed in this Safety Guide. Our group endorses the submission of Dr. J.R. Walker in its entirety. We urge the CNSC to take careful note of the concluding statement from his submission: the finalized regulatory document should not allow the use of a decommissioning strategy (in situ decommissioning) that is specifically proscribed by international standards for planned decommissioning, is fiscally unsound, and that creates an inequitable outcome for rural Canadians.	See response to Comment #3 in Table B
4.	Concerned Citizens of Renfrew County and Area	The REGDOC should acknowledge the ongoing debate regarding prompt versus deferred decommissioning. In reality, there is only one acceptable strategy – dismantling – and the question is how long to wait (if at all) before dismantling commences. As the IAEA notes, Decontamination, dismantling and other decommissioning actions may be carried out immediately following permanent shutdown or may be deferred until after a safe enclosure period. As a consequence, the time period for the conduct of decommissioning actions typically ranges from a few months for simple and small facilities undergoing immediate dismantling, to decades for large and complex facilities using the deferred dismantling strategy (for example, to allow for radioactive decay).	The CNSC does not promote or prescribe decommissioning strategies. Proponents must propose their preferred strategy as part of their decommissioning plan. Any proposed decommissioning strategy will be assessed by the CNSC to ensure the protection of health and safety of the public and the environment, and human health and safety. The CNSC requires that the selection of the decommissioning strategy be justified and that when a licensee is determining the decommissioning strategy, various factors are consider (e.g., availability of knowledgeable staff, the availability of infrastructure for radioactive waste, public and Indigenous engagement, etc.). The licensee must demonstrate in the decommissioning plan that the preferred decommissioning strategy will be implemented safely, and that public and Indigenous consultation will be undertaken in preparing the plan.

5.	Concerned Citizens of Renfrew County and Area	In general, the REGDOC should provide additional guidance on whether to carry out dismantling immediately upon closure, or after a "safe storage" period. The REGDOC should note the IAEA's preference for commencement of dismantling as soon as possible after facility closure: If the waste management infrastructure is available, including for waste disposal, then immediate dismantling is the preferred strategy. In the absence of facilities and infrastructure for processing radioactive waste, or when storage or disposal capacities are not available, the preferred decommissioning strategy could include a period of safe enclosure until the necessary waste management infrastructure is available. With regard to "safe enclosure" or "safe storage", if current knowledge suggests that well defined intermediate or interim states can be distinguished during a more complex decommissioning project (e.g. for a large power reactor), the REGDOC should provide information about what these states are and how long they may last. The REGDOC should avoid use of the confusing and inherently contradictory term of "interim end state".	See response to comment #4 in Table C.
6.	Concerned Citizens of Renfrew County and Area	Finally, the REGDOC should specify clearly what decommissioning activities – if any – can take place under an operating license, and what decommissioning activities can take place during "storage with surveillance". The REGDOC suggests that "storage with surveillance" activities may include: removal and recycling of non-contaminated or slightly-contaminated equipment (e.g., turbines, pumps and heat exchangers) This statement makes "storage with surveillance" another contradictory term (like "interim end state"). Pumps and heat exchangers may be contaminated with significant amounts of longlived radionuclides. Their removal should only be allowed after a detailed decommissioning plan has been developed and approved, so that there can be a clear pathway for management of the wastes arising. The REGDOC also proposes to allow "removal of radioactive waste to an offsite licensed storage facility" during storage with surveillance. Removal of contaminated equipment and radioactive waste should not be allowed in the absence of an approved detailed decommissioning plan.	The REGDOC outlines stabilization activities. As a result of this comment, the following statement has been added "Depending on the site-specific licence, stabilization activities may be performed under either a licence to operate or to decommission." As outlined in section 6.1, During the storage with surveillance period, the licensee may perform activities to reduce risks at the facility during a period of storage with surveillance, in accordance with the licence and consultation with the CNSC. These may include: • reduction or removal of combustibles • removal and recycling of non-contaminated or slightly-contaminated equipment • reduction or isolation of asbestos • demolition of non-nuclear facilities, provided that there are no safety impacts to the remainder of the site • removal of accumulated radioactive waste to an offsite licensed storage or disposal facility • reduction or removal of hazardous wastes Some of these activities, including removal of waste, are permitted under an

			authorization to operate based on programs that are part of a licensing basis.
7.	Northwatch	On December 2, 2019 the Canadian Nuclear Safety Commission posted a notice on their web site, indicating that they were inviting feedback on comments submitted on a draft Regulatory Document 2.11.2 until December 20th. Comments had been submitted by eight nuclear corporations (six of them submitting the same comments with different cover letters), one municipality, one individual, and one nuclear industry consultant on the draft *REGDOC-2.11.2, Decommissioning* between July 16, 2019 and October 16, 2019. As summarized in the CNSC notice, "the draft regulatory document sets out requirements and guidance regarding the planning, preparation, execution and completion of the decommissioning of Class I nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices activities licensed by the CNSC in Canada". Due to the extremely short comment period and other concurrent demands on available time and resources, Northwatch is submitting preliminary comments only at this time, with an intention to supplement this submission in the near future. We appreciate the CNSC's confirmation that they "welcome feedback on any regulatory document at any time" and so will proceed on that basis. Northwatch Feedback on Comments Submitted between July 16 and October 16, 2019 As is frequently the case with CNSC comment opportunities, the nuclear industry collaborated in preparing their comments, and several nuclear energy corporations submitted the same comments in table format, repeating them in each submission, each with a cover letter. Given this practice, Northwatch's feedback with focus on the submission of Ontario Power Generation as a proxy for the nuclear industry's coordinated lobby. **Nuclear Industry Comments** In their cover letter, OPG prefaced their table-format submission with three points which they characterized as broadly summarizing their primary comments.	Responses are provided below.
8.	Northwatch	**OPG Summary** • the REGDOC should clarify the timing of submissions and the type of documents required for submissions (a Storage with Surveillance Plan versus a Detailed Decommissioning Plan for the Storage with Surveillance Phase); **Northwatch Feedback**	Please see response to comment #8 in Table B

		• We agree that the timing, type and content of required documents should be clearly set out, as should the method of public consultation prior to their finalization, and the methods for reporting on predicted versus actual outcomes over various time frames	
9.	Northwatch	**OPG Summary** • the REGDOC should acknowledge that certain decommissioning activities can take place under an operating licence; **Northwatch Feedback** • We agree that the REGDOC should set out very clearly under which decommissioning activities – if any – can take place under an operating license, and provide clear direction on how the public and Indigenous peoples are consulted on those decommissioning activities; this is particularly important to clarify in cases where there are long license period and only preliminary decommissioning plans in place at the time of the last license review (last as in the license review previous to the decommissioning activities commencing).	Please see response to comment #8 in Table B
10.	Northwatch	**OPG Summary** • the REGDOC should have better alignment with the definitions and guidance of CSA N294; and, **Northwatch Feedback** • This is an instance where the CNSC must clarify that the CSA standards must comply with the regulatory framework, rather than the regulatory framework having to comply with industry-driven standards, such as those of the CSA	Please see response to comment #9 in Table B.
11.	Northwatch	**OPG Summary** • the REGDOC should provide decomm decommissioning strategy, and not just deferred decommissioning **Northwatch Feedback** • We agree that the REGDOC should provide additional detail for each decommissioning strategy, including more detailed criteria and conditions that must be met in selecting a decommissioning strategy	Please see response to comment #8 in Table B.

12.	Northwatch	In the following section, Northwatch provides preliminary feedback on select areas of comment provided by Ontario Power Generation. The absence of a point of feedback in this preliminary submission – or in a followup submission – does not indicate agreement with Ontario Power Generation's position or statement. Northwatch's feedback includes the following points: While we agree that there should be consistency in definitions and terminology across documents – including across CNSC regulatory documents, standards, guidelines, policies, and other regulatory tools – we disagree that the regime for nuclear regulation in Canada should be developed to conform with the CSA standards; the CSA is an industry body which develops standards and guidelines which can improve practices and performance, but it is not a regulatory agency and does not set regulation; as such the CSA should conform to the regulatory regime, rather than the reverse (OPG Comment #2)	The CNSC maintains an efficient and streamlined regulatory framework by making appropriate use of standards created by independent, third-party standard-setting organizations such as the CSA Group, the American Society of Mechanical Engineers, the International Commission on Radiological Protection and the Institute of Electrical and Electronics Engineers. Together with regulatory documents, standards provide additional clarity to licensees and applicants by explaining how to meet the requirements set out in the *Nuclear Safety Control Act* and the regulations made under it. Please see response to comment #9 in Table B.
13.	Northwatch	The progression from Preliminary Decommissioning Plan to Detailed Decommissioning Plan to execution of the decommissioning activities needs to be much more clearly set out, including in multi-unit or multi-facility sites; at present, the REGDOC is overly general, and as OPG illustrates with the comments, the industry assumptions appear to be towards full flexibility, while the CNSC's responsibility is to emphasize safety and engage with the public and Indigenous peoples to ensure that the health of workers, the community and the environment are protected (OPG Comment #7)	See response to comments #23 and #32 in Table B.
14.	Northwatch	Northwatch agrees that the Draft REGDOC lacks detail on the three identified decommissioning strategies, and that the CNSC understanding, expectations and assumptions with respect to each of these broad categories should be clearly set out in detail, with various scenarios illustrating application under different conditions / facility types; following this more detailed discussion piece being circulated by the CNSC, based on comments and feedback received, there should be a further opportunity for comment, including a workshop-style convening of interested parties (OPG Comment #9)	The document has been revised to provide more information about the possible decommissioning strategies. CNSC arranged to hold two separate workshops concerning the REGDOC-2.11 series in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April and discuss how stakeholder comments were taken into consideration. The revised draft REGDOCs and the associated detailed comments tables will be sent to all stakeholders and invitees in advance of the workshops."
15.	Northwatch	Northwatch agrees that the discussion on in situ decommissioning in the draft REGDOC is problematic, albeit perhaps for reasons and analysis that differs from that of OPG; this is another area where CNSC needs to set out their position in much greater detail, with opportunity for testing of the technical basis for the CNSC position, and an opportunity for further feedback (OPG Comment #10)	See response to comments #2 and 42 in Table B.

16.	Northwatch	Northwatch strongly disagrees with the position taken by OPG in their 11th comment, i.e. that the CNSC should " Amend the 9th bullet to read, "availability of a facility for the disposal (vs "management") of irradiated fuel"; there is no such known facility at this time and despite the CNSC and OPG's belief systems that a deep geological repository will be brought into operation within the next several decades, this is not yet certain, and even by the Nuclear Waste Management Organization (NWMO)'s 2005 "Adaptive Phased Management Plan" the decision to close the site could be centuries into the future; changing the terminology from "management" to "disposal" is ideological rather than scientific, and should be left to OPG and NWMO's promotional materials, rather than making its way into a regulatory document (OPG Comment #11)	See response to comment #43 in Table B.
17.	Northwatch	Northwatch agrees that Section 5.1 of the draft REGDOC is problematic and potentially contradictory; the section requires more detail, more explanation, and further consultation and opportunities for input after the CNSC has set out its current position in more detail (OPG Comment #14)	See response to comment #52 in Table B. See response to comment #14 in Table C.
18.	Northwatch	Northwatch agrees with the OPG comment on draft REGDOC section 5.1 that the timing of the preparation of the detailed decommissioning plan may be problematic, in that it is being done too late in the process; we agree with this assessment, and are of the view that the Preliminary Decommissioning Plans are far too vague and generalized, and that a Detailed Decommissioning Plan should be prepared much earlier that is the current practice or is set out in the draft REGDOC; the same is true of the surveys, and the (OPG Comment #19)	See response to comments #8 and 65 in Table B.
19.	Northwatch	OPG appears to accept the CNSC insertion of "in situ" decommissioning as if it was a valid approach; Northwatch does not. The comments submitted by J.R. Walker on the matter of in situ decommissioning in Section .20 of his submission are adopted by Northwatch, and are recommended to both OPG and the CNSC (OPG Comment #27).	See responses to comment #2 and #85 in Table B.
20.	Northwatch	Northwatch agrees with the OPG suggestion that "the public" be added to the second sentence of Section 9, but disagrees with the OPG suggestion that "protection" be removed in "protection of the environment" later in the same section (OPG Comment #30).	See response to comment #90 in Table B.
21.	Northwatch	Northwatch appreciates the industry's acknowledgement that they do not currently employ "monitoring systems that provide early warning of the release of radionuclides", but disagrees with the industry suggestion that the requirements for monitoring be deleted in response to this deficit; this section should be revised to make the requirements more explicit, and include specifics that the post-decommissioning monitoring regime should mirror that of the operational and decommissioning phases, and include ground and surface water monitoring, sediment, soil and air sampling, and any other relevant components of the pre-decommissioning and decommissioning period surveys; this section or a following section should also set out the requirements for contingency planning when the monitoring	See response to comment #90 in Table B.

		systems identify an outcome that was not predicted and which has the potential to be harmful to human health or the environment (OPG Comment #30).	
22.	Northwatch	Northwatch strongly disagrees with the position being taken by the nuclear industry that Sections 10.1, 10.2 and 10.2.1 – which outline requirements for radiological and nonradiological surveys – do not pertain to decommissioning; this position is consistent with OPG's refusal to make groundwater monitoring information from the Pickering site available to the Northwatch and Lake Ontario Waterkeeper, but is unacceptable. Having comprehensive surveys of radiological and non-radiological hazards is fundamental to understanding site conditions and so developing, adjusting and implementing a decommissioning plan/strategy (OPG Comment #32).	See response to comment #93 in Table B.
23.	Northwatch	The industry comments that they find "the phrase 'Radionuclides and hazardous chemicals' in the 2nd sentence of the 1st paragraph is unnecessarily alarming in this context", and suggests replacing it with "constituents of potential concern"; alarming to who? This particular comment suggests that either a) the industry was really struggling to find things to say, or b) those preparing the comments were completely out of their depth. Realistically, any reader of this REGDOC is almost certainly going to have an awareness that radiological and chemical hazards are key concerns, and are more likely to be alarmed at the absence of that terminology than by its presence (OPG Comment #33).	See response to comment #95 in Table B.
24.	Northwatch	**Conclusions** Thank you for consideration of these preliminary comments. As noted above, the CNSC draft Regulatory Document is in need of considerable revision. Our recommendation is that the CNSC issue a document setting out their disposition of comments and feedback on those comments as an interim next step, followed by a series of subject papers pertaining to various aspects of the this regulatory area, and that these be examined in workshop format by a range of interestholders. Only after more development and engagement should the CNSC move to preparing a second draft regulatory document, which should then be the subject of a second consultation period. Again, it is our intention to prepare and submit more detailed comments than was possible during this very short feedback period	Comment noted. See response to comment #14 in Table C.
25.	Canadian Environmental Law Association	CELA writes in response to the CNSC's consultation on Reg Doc 2.11.2, Decommissioning. While we have reviewed the comments provided to date, we are not submitting comments on the comments. Instead of commenting on the comments, we write to suggest that the question of how to approach decommissioning of nuclear facilities in Canada requires a thorough examination in a public policy proceeding that the Commission should establish under its broad powers as set out below. We are familiar with similar proceedings established by the Ontario Energy Board on matters of	All comments submitted related to the 2.11.1 REGDOCs were dispositioned and sent to all stakeholders who submitted comments during the public consultation phase (including feedback on comments). Public consultations resulted in changes to the REGDOCs as identified in this disposition table. The revised draft documents will be submitted in April to the Commission at a public meeting. The draft documents are

		policy. This can include funding participants to prepare reports; the Commission establishing a panel to hold public roundtables on particular issues relevant to overall decommissioning policy; that panel attending host communities to hear residents' views in public venues; and attending in-person themed hearings or meetings on the policy questions held by the relevant advisory, standing or other committee to be established by the Commission, followed by a draft report and public comments on same. The rationale for the suggestion that the Commission establish a policy proceeding on the topic of decommissioning is as follows: • There is clearly no current venue for the very significant issues arising in respect of decommissioning to be examined and debated by the public; • There is a huge public interest in this topic; • There is a lack of policy direction and no regulatory framework for decommissioning planning at the moment; • There is a lack of capacity of the public to properly engage despite their huge interest (compared to industry, for example); • The ramifications of these questions are of future import for time frames ranging from decades to millennia; and • The approaches to decommissioning will inevitably result in intergenerational equity issues arising out of the decisions made today. In our experience it is often useful to hold these kinds of proceedings apart from the context of site-specific proposals.	included in this stakeholder package. In response to requests from industry and civil society stakeholders, the CNSC arranged to hold two separate workshops concerning the REGDOC-2.11 series of documents in February 2020. The workshops will provide clarity on the final draft documents that will be submitted to the Commission for approval in April and discuss how stakeholder comments were taken into consideration. Draft REGDOCs and the associated detailed comments tables will be sent to all stakeholders and invitees in advance of the workshops. The CNSC's Participant Funding Program (PFP) provides reasonable funding support to eligible recipients to more meaningfully participate in and bring value-added information to the Commission. An application to decommission a Class I nuclear facility or uranium mine or mill would be subject to the CNSC licensing process which includes public hearings and the opportunity for various stakeholders to participate. Commission proceedings and processes are outside the scope of this REGDOC. Natural Resources Canada is the lead government department responsible for developing and implementing federal nuclear energy policy across the nuclear supply chain – from uranium mining to the final disposition of waste. CNSC, as the nuclear regulator, does not determine Canada's radioactive waste policy.
26.	Canadian Environmental Law Association	We reference the authority of the Commission to take this approach based on section 21 of the Nuclear Safety and Control Act wherein the Commission is empowered to, among other things: (b) establish and maintain programs to provide the Commission with scientific, technical and other advice and information; (b.1) establish and maintain a participant funding program to facilitate the participation of the public in proceedings under this Act;	See response to comment #25 in Table C.

		(c) establish and fix the terms of reference of, advisory, standing and other committees; (e) disseminate objective scientific, technical and regulatory information to the public concerning the activities of the Commission and the effects, on the environment or on the health or safety of persons, of the development, production or use of nuclear energy or the production, possession or use of a nuclear substance, prescribed equipment or prescribed information. We urge you to seriously consider this proposal and look forward to your response in this respect.	
27.	F. R. Greening	Please accept this email as an intervention concerning the CNSC's REGDOC-2.11.2, entitled *Decommissioning*, issued July 2019. I wish to thank the CNSC for providing an opportunity for interested parties to contribute to the debate on the vitally important issue of nuclear power plant, (NPP), decommissioning. Having reviewed the 20 or so pages of text that constitute the issues addressed by REGDOC-2.11.2, my first reaction is that the document as it now stands is of little practical value to a reactor owner/operator wishing to decommission a nuclear facility, largely because of its non-prescriptive approach. Nevertheless, in looking at the interventions that have already been submitted to the CNSC with regard to REGDOC-2.11.2, it appears that there are *three* approaches to NPP decommissioning that need to be considered: (i) Immediate dismantling of the facility (ii) Delayed or deferred dismantling of the facility for periods up to 50 years (iii) Entombment of the facility Generally speaking, option (i) is favored by environmentalists, while options (ii) and (iii) are favored by NPP owner/operators. However, it is worth noting that the International Atomic Energy Agency, the IAEA, has tacitly rejected option (iii), facility entombment, as a viable approach to decommissioning. Thus, in the IAEA document entitled: *Decommissioning of Facilities*, General Safety Requirements Part 6, GSR Part 6, issued in 2014, we read: *Entombment, in which all or part of the facility is encased in a structurally long-lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g., following a severe accident).* The rationale behind this opinion from the IAEA will not be discussed in this intervention. Therefore, we shall restrict our evaluation of decommissioning strategies to the relative *pros and cons* of options (i)	Comment noted.

		and (ii): immediate dismantling and delayed dismantling, respectively.	
28.	F. R. Greening	**1a. Immediate Dismantling, Pros:** The main positive attribute of Immediate Dismantling of an NPP as a decommissioning strategy is that it fast-tracks the removal/disposal of something that has served its design purpose and is no longer capable of further safe, reliable operation. In this "no longer of any use" state, a shutdown nuclear facility is universally regarded as an eyesore – a structure that despoils a potentially pleasant landscape, and therefore something that should be removed as quickly and as efficiently as possible. In this regard, most people consider a shutdown nuclear reactor as something akin to an old car that sits abandoned on a downtown lot. And to continue this analogy, environmentalists dream of this old car being towed away to a scrap yard with a minimum of fuss, and the lot converted into a park or children's playground – the ideal *green field* final state for a former nuclear site. **1b. Immediate Dismantling, Cons:** A preference for, and the positive picture painted by many environmentalists of the immediate dismantlement of an NPP needs to be tempered by the fact that the radiation fields emanating from a nuclear reactor are at their *maximum* immediately after reactor shutdown; the good news being that these fields decay at a predictable rate thereafter. Thus, delayed dismantlement is a simple way to reduce reactor shutdown radiation fields to more acceptable levels and thereby reduce the radiation exposure of workers assigned to tasks requiring close proximity to a reactor's core, where the fields are very, and frequently unacceptably high. It is tempting to estimate the radiation doses expected for workers involved in a CANDU *decommissioning* by referring to the known doses for workers involved in reactor *refurbishments* such as those that have been successfully carried out on Units 1 & 2 at Bruce A. However, the dismantlement of a CANDU reactor involves cutting up *reactor core components* that are much more radioactive than the pressure tubes, calandria tubes and feeder pipes that constitute the main radioactive wastes associated with CANDU refurbishments. Thus, the radiation field emanating from removed pressure tubes is about 800 rem/hr – which, in the absence of shielding, will give a lethal dose to an exposed individual in less than 5 minutes; by comparison, the radiation fields coming off reactor core components such as the thermal shield, calandria shell and dump tank are 260,000 rem/hr, 49,000 rem/hr and 12,000 rem/hr, respectively. These are truly dangerous radiation fields that are lethal in less than 1 minute of exposure and are impractical	Comment noted.

		to shield! The predicted radioactivity of such CANDU core components is described in detail in OPG's *Preliminary Nuclear Decommissioning Cost Study*, issued in 1981 For the present discussion, Co-60 is the most important radionuclide since it is the principal gamma-emitter in the decommissioning waste for a mature reactor, at least for the first 50 years or so after reactor shutdown. Thus, in Table 5-4 of OPG's 1981 report we find estimates of the Pickering A shutdown activity of Co-60 in components of interest as follows: Pressure Tubes = 3,300 TBq Calandria Tubes = 1,200 TBq End Fittings = 19,000 TBq This gives the total Co-60 activity of Pickering A's *refurbishment waste* at shutdown of 23,500 TBq. By comparison, OPG's 2016 prediction of the Co-60 shutdown activity of Pickering A, (See *Preliminary Decommissioning Plan – Pickering Generating Stations A & B*), is 75,000 TBq, or about 3 times the refurbishment waste activity. Fortunately, Table 5-4 of OPG's 1981 *Decommissioning Cost Study* also provides estimates of the Pickering A shutdown activity of Co-60 for the major core components as follows: Calandria Shell = 37,000 TBq Thermal Shield = 19,000 TBq Calandria Tube-sheet = 8,500 TBq Containment Shell = 4,100 TBq Adjuster Rod Guide Tube = 520 TBq Shutoff Rod Guide Tubes = 410 TBq Moderator Dump Tank = 3000 TBq This gives a total Co-60 activity of Pickering A's *decommissioning waste* of 72,530 TBq, or about 3 times the refurbishment waste activity of 23,500 TBq noted above. As described below, these activities, and the associated doses to decommissioning workers, may be significantly reduced by allowing time for radioactive decay.	
29.	F. R. Greening	**2a. Deferred Dismantling, Pros:** The main reason to defer the decommissioning of a CANDU reactor is to allow the shutdown activity to	Comment noted.

		decay to acceptable levels. As previously noted, Co-60, with a half-life of 5.27 years, is the main activity responsible for over 90% of the reactor's radiation field at shutdown. For this reason, decay periods measured in tens of years are required to achieve significant reductions in the radiation fields, as shown in Table 1 below. **Table 1: Decay of Cobalt-60 as a Function of Time** Decay Period (Years After Shutdown): 0 / 10 / 20 / 30 / 40 / 50 Decay Factor: 1 / 0.269 / 0.072 / 0.019 / 0.0052 / 0.0014 From Table 1 we see that a decay of 50 years reduces a Co-60 radiation field to a mere 0.14 % of its shutdown activity. Such a means of dose reduction is in line with the ALARA (As Low As Reasonably Achievable), principle of radiation protection by reducing a worker's dose commitment from decommissioning activities to an acceptable level. **2b. Deferred Dismantling, Cons:** The main disadvantage of deferring the dismantlement of an NPP, apart from the public's perception of a problem left unresolved, is that the facility has to be monitored on a 24-hour/7-days-a-week basis for an extended period of time – potentially up to 50 years. However, this monitoring, and the associated staffing of the facility, will be far less than the staffing that would be required for a normally operating facility.	
30.	F. R. Greening	**Discussion:** So far in this intervention the radio-activation of an NPP's physical structure has been considered as the only radiological factor of concern in the dismantlement of the facility. However, in the case of Pickering NGS, and to a lesser extent Bruce NGS, tritium that has escaped from containment and entered the local aquifer is a very significant issue that must be dispositioned, especially if the ultimate goal of the decommissioning is to return these facilities to a green-field state. For this reason, we shall review what is known about the extent of this tritium escape problem with particular focus on Pickering	Comment noted.

Table 1 (within comment above):

Decay Period	(Years After Shutdown)					
	0	10	20	30	40	50
Decay Factor	1	0.269	0.072	0.019	0.0052	0.0014

NGS.

The main source of tritium in a CANDU reactor is the moderator system which typically contains about 300,000 kilograms of heavy water, or D_2O. Virgin D_2O contains no tritium, but tritium (as DTO) builds up in a moderator during reactor operation at an initial rate of about 2 Ci/kg per year; with a combination of decay and de-tritiation, an "equilibrium" state is attained whereby the reactor operates with about 10 Ci of tritium per kilogram of D_2O. Thus, a mature CANDU moderator contains 10 (Ci/kg) × 300,000 (kg) of tritium, which equals 3 million Curies or 1.11×10^{17} Bq of tritium.

In the early years of operation of the CANDU Units at Pickering and Bruce, heavy water leaks and spills were quite common, resulting in the following average leakage rates:

PNGS 'A' heavy water leakage rate (1978 estimate): 3.3 ± 0.2 kg/hour
PNGS 'A' heavy water spillage rate (1978 estimate): 8.5 ± 1.2 kg/hour

Total: 11.8 kg/hour

Total per year: 11.8 ´ 24 ´ 365 = 103,368 kg

Bruce 'A' moderator heavy water leakage (1982): 0.48 kg/hr = 16,800 kg/year
Bruce 'A' PHTS (IX and filter room) leakage (1982): 0.50 kg/hr = 17,500 kg/year

However, during this period, most of the heavy water that leaked or was spilt was recovered. Thus, for PNGS 'A' Units, in comparison to the data given above, only 11,000 kg of heavy water per year was actually lost, about 50% via airborne and 50% by waterborne emissions. Similarly (in 1979), the Bruce 'A' heavy water loss was estimated to be 0.735 kg/hour per Unit. Thus, the total heavy water loss for four Bruce 'A' Units in 1979, (again about 50% via airborne and 50% by waterborne emissions), was equal to 0.735 ´ 4 ´ 24 ´ 365, or 25,754 kg/year.

Station condition records for the first decade of operation of Units at Pickering and Bruce show that accidental spills and unexpected leaks were quickly dealt with and contained. Furthermore, there is no evidence from that time period of any chronic escape of tritiated water from containment. However, in 1997, for the very first time, OPG acknowledged the presence of tritium in Pickering A groundwater samples. The samples in question were collected in monitoring wells and groundwater tubes located adjacent to the Heavy Water Upgrader Plant and the Auxiliary Irradiated Fuel Bay. In addition, in the year 2000, very high levels of tritium were observed to be leaking into the site groundwater via the Unit 1 moderator pit.

		Between the years 2000 and 2005, highly elevated levels of tritium were identified in groundwater samples collected at various locations, both at PNGS A and at PNGS B. The samples listed below revealed just how serious groundwater contamination was at that time: • PNGS A Unit1 moderator purification room pit had tritium concentrations up to 1.04×10^{10} Bq/L • PNGS A & B foundation drain sumps had tritium concentrations up to 1.3×10^{5} Bq/L • PNGS A reactor auxiliary bay sumps had tritium concentrations up to 1.9×10^{8} Bq/L • PNGS B reactor auxiliary bay sumps had tritium concentrations up to 8.0×10^{6} Bq/L • PNGS B irradiated fuel bay ground-tubes had tritium concentrations up to 4.0×10^{6} Bq/L It is important to note that several of these samples show Pickering groundwater with contamination levels that are well above the CNSC limit of 3×10^{6} Bq/L for tritium in non-potable water, (See Footnote 1). Indeed, tritium concentration contour maps of the Pickering site measured between 2000 and 2003 show an area centered on Unit 1, Unit 2 and the Vacuum Building with a groundwater tritium concentration over 32,000,000 Bq/liter. More recent data on Pickering groundwater samples show that Unit 1 foundation drains continue to exhibit very high levels of tritium, with concentrations as high as 1.19×10^{9} Bq/L measured as recently as the first quarter of 2018. Other Pickering site locations tend to show somewhat lower tritium activities but many sampling locations, (for example the Irradiated Fuel Bay between Units 2 and 3 and Monitoring Wells, (MWs), Nos 235-30, 239-30 and 273-20), have consistently exhibited tritium concentrations above the CNSC limit of 3×10^{6} Bq/L over the past ten years. So, we need to ask: what is the impact of these elevated levels of tritium in Pickering's groundwater on the decommissioning of this site? OPG's position on this was made quite clear in its 2016 Report P-PLAN-00960-00001 entitled *Preliminary Decommissioning Plan – Pickering Generating Stations A & B*, where we read: *Localized areas of slightly elevated tritium concentrations are present in the groundwater located within the protected area of the Pickering site. The sources of these historical releases were identified by previous assessments and subsequently eliminated through procedural and/or operational changes, with steps taken to mitigate the risk of future releases. Previous Environmental Assessments (EAs) indicate that tritium concentrations are not migrating off-site and that no effects result from the tritium in groundwater on biota are likely. The groundwater monitoring program will continue to track, monitor,*	

and report on the groundwater quality on site.

Furthermore, at the CNSC Licence Renewal Hearing for OPG's Pickering Nuclear Generating Station, held on April 4th 2018, the Commission concluded:

Tritium in groundwater is mainly localized within the station's Protected Area. The foundation drains act as hydraulic sinks that capture most of the tritium plumes in the groundwater. The groundwater monitoring program results confirmed the site perimeter concentrations remain low, indicating no off-site impacts.

Thus, we have statements by OPG and the CNSC that make two significant claims:

(i) OPG considers Pickering groundwater samples to exhibit only "*slightly elevated tritium concentrations*", even though many samples have consistently exhibited tritium concentrations well above the CNSC limit of 3×10^6 Bq/L over the past ten years.

(ii) Tritium in Pickering groundwater is "*not migrating off-site*" because "*the foundation drains act as hydraulic sinks that capture most of the tritium plumes in the groundwater.*"

However, in stark contradiction to claim (ii), we are also told in OPG's *Preliminary Decommissioning Plan – Pickering Generating Stations A & B*, that:

After the PNGS A and B Units are shut down and all the sources of tritium leakage have been terminated, significant decreases in overall groundwater tritium concentrations can be expected to occur over the course of the 30-year Safe Storage period due to dispersion and radioactive decay over time. As such, tritium concentrations will naturally decrease to levels that would meet the release criteria for the site.

Thus, when it comes to decommissioning, in spite of it being captured in a "*hydraulic sink*", OPG believes that Pickering's groundwater tritium activity will "*significantly decrease*" due to "*dispersion and radioactive decay over time*". The amount of radioactive decay of tritium may be precisely determined from its half-life of 12.3 years, as shown in Table 2, below.

Table 2: Decay of Tritium as a Function of Time

	(Years After Shutdown)

Decay Period	0	10	20	30	40	50
Decay Factor	1	0.569	0.324	0.184	0.105	0.0598

From Table 2, we see that for a decay of 30 years, the tritium activity will be 18.4% of its value at shutdown. Thus, for example, an initial tritium activity of 32×10^6 Bq/L will have decayed in 30 years to 5.9×10^6 Bq/L, which is still well above the CNSC limit of 3×10^6 Bq/L for tritium in non-potable water.

And I would ask OPG to explain by what mechanism the tritium currently "*captured*" beneath the Pickering facility will be "*dispersed*", especially in view of OPG's and the CNSC's claim that "*Environmental Assessments indicate that tritium is not migrating off-site*".

Tritium in Groundwater: The Source Term for Pickering NGS

As we have seen, very high levels of tritium are known to be present in the groundwater located beneath the foundations of Pickering NGS. However, in order to quantify the impact of this radioactive contamination on the decommissioning of this facility we need a precise estimate of the tritium in groundwater source term. Unfortunately, detailed records of when, where, and how much tritium has leaked into Pickering's foundation drains since the commissioning of this facility in the early 1970s, (Pickering A), and early 1980s, (Pickering B), have not been published by OPG – quite often because such data were not always collected. Thus, some tritiated heavy water leaks at Pickering NGS were first "discovered" at some point in time that was evidently long *after* the leak began. Indeed, many heavy water leaks in CANDU reactors are initially too small to detect – typically less than 1 gram/hr – but increase with time until they eventually become detectable.

Nevertheless, some *average* leak rate data have been published in documents such as the annual COG *D_2O Management Reports* that allow an estimate to be made of the current source term for tritium in Pickering's groundwater. These reports show that Pickering's D_2O loss rate for the mature station has typically been about 0.8 kg/hour/Unit. It is also known that the main sources of D_2O escape are moderator purification and heat exchanger maintenance, especially during spent moderator resin and drum handling. These activities result in an average loss rate of "*high-Curie*" D_2O of about 0.4 kg/hour/Unit for which we estimate an average tritium concentration of 0.5 Ci/kg. In addition, we shall assume about half of this D_2O, or 0.2 kg/hour/Unit has entered the groundwater beneath Pickering,

		which is equivalent to 1750 kg/year/Unit. Starting with these assumptions, the Pickering tritium in groundwater source term, S_{GW}(Bq), may be determined using the following equation and parameter values: $S_{GW}(Bq) = R(kg/year) \times C(Ci/kg) \times N(Units) \times T(years) \times D(decay\ factor) \times 3.7 \times 10^{10}\ (Bq/Ci)$ Where, R is the rate of ingress of D_2O into Pickering groundwater = 1750 kg/year/Unit C is the average Curie content of the D_2O = 0.5 Ci/kg N is the number of operating Units = 2 PNGS A + 4 PNGS B = 6 Units T is the effective operating time for each Unit = 30 years D is an average decay factor for tritium taken as a decay of 15 years = 0.43 Hence, $S_{GW}(Bq) = 1750\ (kg/year/Unit) \times 0.5\ (Ci/kg) \times 6\ (Units) \times 30\ (years) \times 0.43 \times 3.7 \times 10^{10}\ (Bq/Ci)$ $S_{GW}(Bq) = 2.5 \times 10^{15}$ Bq Furthermore, if we assume the contaminated groundwater occupies a volume equal to the Pickering A & B site area of (750 × 200) m^2 extending to a depth of 2 meters, we have an effective average tritium in groundwater concentration of 8.3×10^6 Bq/L; this is well within the range of tritium concentrations measured in monitoring wells at Pickering, as previously discussed. To provide some perspective on these tritium amounts and concentrations it is useful to consider some comparative data: Tritium inventory accumulated at Pickering NGS site at shutdown = 7.0×10^{17} Bq Tritium source term for Pickering groundwater = 2.5×10^{15} Bq = 0.36% of the station inventory Tritium average concentration in Pickering groundwater = 8.3×10^6 Bq/L	

Tritium inventory in OPG's proposed DGR = 1.5×10^{14} Bq

Tritium average concentration in DGR waste = 1.5×10^{6} Bq/L

Tritium inventory in CNL's proposed NSDF = 8.9×10^{14} Bq

Tritium average concentration in NSDF waste = 1.0×10^{6} Bq/L

These data show that Pickering groundwater is contaminated with tritium to a level that is significantly *higher* than the Low and Intermediate Level wastes slated for disposal in a DGR or NSDF facility.

Interestingly, however, OPG *does* address the issue of the disposal of contaminated soil at Pickering NGS in its 2016 *Preliminary Decommissioning Plan* report, where we read:

The longer half-life radionuclides that are typically found during decommissioning are Co-60, Cs-137 and Sr-90. This contamination is likely to be found in soil relatively close (within a few meters) to the underside of the structure or components from which the leakage occurred. Remediation would likely entail excavation of the affected soil, with off-site disposal of the soil as radioactive waste. A preliminary estimate has been made, which indicates six affected locations with an affected soil volume of 6,730 m^3 that will have to be excavated and disposed.

Clearly, OPG's "plan" does *not even mention* tritium as a contaminant of concern in Pickering's near-surface soil; but I would argue that this tritium contamination must be properly dealt with during the decommissioning of this facility simply on the basis of its high specific activity in the site's foundation drains. It also follows that the amount of soil requiring excavation and disposal will be orders of magnitude greater that the 6,730 m^3 estimated by OPG. Indeed, if tritium contamination of the Pickering site is taken seriously, it could well prove to be a proverbial "show stopper" because of the sheer volume of contaminated material involved and the cost entailed in its removal, shipping and emplacement in an appropriate disposal facility.

Footnote 1:

As first pointed out by W. Ruland in his October 2019 report for *Lake Ontario Waterkeepers*, the CNSC limit of 3×10^{6} Bq/L for tritium in non-potable water appears to have no scientific basis, and is much higher than the US NRC Regulatory Limit of 37,000 Bq/L for the release of tritium to groundwater. In addition, a large nuclear power station such as Pickering, Bruce and Darlington, is restricted in its tritium contaminated liquid effluent discharges to its DRL limited concentration of about 0.5×10^{6} Bq/L,

		or 6 times *lower* than the CNSC's "*non-potable water*" discharge limit of 3×10^6 Bq/L. The CNSC needs to explain these anomalies.	
31.	F. R. Greening	**Conclusions:** (i) Deferred or delayed dismantling of the Pickering, Bruce and Darlington NPPs is the *only* viable option for the safe, ALARA decommissioning of these facilities. (ii) The high levels of tritium in groundwater currently located beneath the foundations of Pickering NGS pose a serious waste disposal problem that threatens the economic viability of the decommissioning of this site and could potentially prevent it from ever being returned to a true *green field* state. *For which of you, desiring to build a tower, does not first sit down and count the cost, whether he has enough to complete it?*	Comment noted.

Table D: targeted consultation with Class II licensees / Tableau D: Consultation ciblée avec les détenteurs de permis de catégorie II

	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse la CCSN
No comments received			

Table E: Letters sent to the Hon. Seamus O'Regan, Minister of Natural Resources / Tableau E: Lettres envoyées à l'Honorable Seamus O'Regan, Ministre des Ressources Naturelles

1.	Barry Stemshorn Honorary Senior Fellow University of Ottawa	The nuclear industry and the Canadian Nuclear Safety Commission (CNSC) are proposing to use legacy nuclear reactor sites for on-site disposal of nuclear wastes. Approving nuclear plants as waste sites would appear to ignore Canada's responsibilities as a signatory to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management that requires Canada to pay "due regard to internationally endorsed criteria and standards". CNSC's draft "regulatory document" on decommissioning proposes on-site disposal of decommissioning wastes at nuclear reactor sites in violation of the IAEA's safety standards on decommissioning. <u>I therefore urge you to halt this proposal</u>. I also encourage you (Minister of Natural Resources) to develop and ensure the implementation of	See response to comments #1, 2, 3 and 4 in Table B. Natural Resources Canada is the lead government department responsibly for developing and implementing federal nuclear energy policy across the nuclear supply chain – from uranium mining to the final disposition of waste. The CNSC, as the nuclear regulator, does not determine Canada's radioactive waste, including decommissioning, policy. REGDOC-2.11, *Framework for Radioactive Waste Management and*

		nuclear waste policies in the best interests of Canadians and in accordance with IAEA international standards. This is a government responsibility and should not be delegated to an "independent" nuclear industry regulator described as "benign" and captive to industry interests. We need sound policies and a robust regulatory regime to deal with our toxic nuclear waste legacy. These policies must respect the rights of Indigenous peoples, incorporate the best-available scientific information, ensure responsible governance and uphold and respect Canada's international obligations.	*Decommissioning in Canada* provides information on the framework for radioactive waste management and decommissioning in Canada. It describes the philosophy underlying the CNSC's approach to regulating the management of radioactive waste and the decommissioning of facilities, and explains the principles taken into account in CNSC regulatory decisions. REGDOC-2.11 expresses Canada's international obligation to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
2.	Sunil Nijhawan, Ph.D, P.Eng	I am writing you (Prime Minster Trudeau/Minister O'Regan) to bring to your attention plans by the CNSC, an agency under your watch, to allow in-situ burial of nuclear facilities as opposed to the normal and sane international practice of their total removal in what we call Decommissioning. This plan is unfathomably irresponsible and against our current and future national interest. Imagine burying or even leaving patients where they die - a morbid example but nonetheless no more horrific than littering the country with dangerous and unpredictable nuclear reactor morgues. This is contrary to what we promised when we started building civilian reactors and related nuclear sites ~50 years ago. We were going to 'decommission' them and return the sites to green spaces and actually set aside money for it. The sneaky proposal now by the CNSC is to declare the practice of on-site burials they currently propose for 3 smaller reactors into an acceptable practice and to turn nuclear stations into nuclear waste sites. Imagine a 4 sq km of nuclear morgue in the middle of metro Toronto as the Pickering site will soon be just outside Scarborough where a million people live. Then imagine it staying there decaying and hurting this nation for the next million years because neither the CNSC, nor the associated companied will survive more than a couple of decades. Our generation has no right to allow such decisions, no matter which corrupt or incompetent person in authority or company it is convenient to or benefits now. Also imagine the response your US state and federal counterparts will have when they discover that the common waters of the lakes we share are going to see abandoned nuclear sites on our sides of the lakeshores. The shame the outcry will cause can be avoided by your timely intervention. You must support only responsible behaviour by our federal agencies, no matter how they sugarcoat their irresponsible decisions such as this one. I would like you to intervene and have your staff re-examine the planned audacity of the Canadian Nuclear Safety Commission (CNSC) to totally ignore international guidelines and practices and contemplate supporting such a policy in interest solely of the multinational consortia that it now blatantly keeps foremost and serves first in its decisions and policy making. As a nuclear engineer all I	See response to comments #1, 2, 3 and 4 in Table B. Furthermore, this REGDOC is complement by other CNSC regulatory documents, such as REGDOC-2.11, *Framework for Radioactive Waste Management and Decommissioning in Canada.* REGDOC 2.11 provides principles the CNSC considers when making regulatory decisions about the management of radioactive waste, such as: • The predicted impacts on the health and safety of persons and the environment from the management of radioactive waste are no greater than the impacts that are permissible in Canada at the time of the regulatory decision. • The measures needed to prevent unreasonable risk to present and future generations from the hazards of radioactive waste are developed, funded and implemented as soon as reasonably practicable. • The trans-border effects on the health and safety of persons and the environment that could result from the management of radioactive waste in Canada are not greater than the effects experienced in Canada REGDOC-2.11 expresses Canada's international obligation to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

		can say is- in words of Greta Thunberg a now famous environmental activist - HOW DARE YOU?	

Table F: Workshop with industry and civil society organizations / Tableau F: Atelier avec l'industrie et avec des organisations de société civile

	Organization / Organisation	Section	Comment / Commentaire	CNSC Response / Réponse la CCSN
1.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**General**	**MAJOR** Industry has concerns regarding overarching PDPs/DDPs for a site with multiple facilities. **Suggested change** Licensees believe that interdependencies between planning envelopes or facilities, location or site, can be included as required content for the facility PDPs/DDPs, thus avoiding the production of a separate document with repeat content being produced for CNSC review/approval. **Impact on industry** Recognizing the interdependencies in this REGDC would avoid duplicate efforts and ensure consistency.	This is in alignment with IAEA GSR Part 6, *Decommissioning of Facilities* that indicates that a site strategy be developed for sites with more than one facility.
2.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**2.2, 4 and 6.1**	**MAJOR** Industry has concerns with the timing of decommissioning activities as discussed in various sections. For instance: 1) The discussion of Class I and Class II licensee decommissioning strategies in Section 4 does not give consideration to sites like CNL. 2) Not all facilities end decommissioning activities "with the release of the facility or location from CNSC regulatory control" (e.g., Elliot Lake) as indicated in the final bullet of section 2.2. 3) Most significantly, section 6.1 says a DDP should be submitted two to five years prior to **permanent shutdown**. This timing is impractical. The process for producing a DDP makes it unlikely that one could be submitted prior to shutdown. Surveys (typically done after shutdown) and end-state condition assessments are required to inform the safety assessment. In turn, the safety assessment is required to support the development of the decommissioning plan, maintenance plans, risk identification and mitigation, etc. However, in response to the Region of Durham (item 15 in the CNSC disposition table) CNSC staff indicates that, "As outlined in Section 6, the CNSC expects the detailed decommissioning plan , storage with surveillance plan, safety	1. A new sentence was added to the section to address the comment. 2. Change made to state "…in the future, or if…". 3. The text was changed to "prior to the execution of decommissioning." The second paragraph was removed.

			assessment and waste management plan during the preparation for decommissioning phases (i.e. prior to the execution of decommissioning phase) [emphasis added]. Also, section 2.2 of the REGDOC says, "Execution of decommissioning begins when decommissioning activities commence, which may include decontamination…" Thus, the DDP should be produced before execution, not prior to shutdown. In addition, for deferred decommissioning, the first two paragraphs say a DDP is to be produced that documents activities during the SWS period. Section 6.3 identifies that a storage with surveillance plan can be submitted in addition to a DDP (or as part of the DDP). In either case, a DDP is required for deferred decommissioning, which may be no more detailed than a PDP with a very detailed SWS plan. Given this, industry should be given the option to continue to produce a PDP with an SWS plan for deferred decommissioning as the information submitted to the regulator will be the same. **Suggested change** To ensure the timing in the REGDOC is practical and its applicability to legacy sites is clear, licensees urge the CNSC to: 1) Clarify in the 1st paragraph of section 4 that legacy sites are not subject to the timing constraints. 2) Amend the final bullet in 2.2 to read, "Decommissioning ends with the release of the facility or location from CNSC regulatory control, even if the CNSC subsequently authorizes the site for any other licensed activity in the future or If unrestricted release cannot be achieved, institutional controls are required to be in place." 3) Revise the 1st paragraph and delete the 2nd paragraph in section 6.1 to read, "Prior to the execution of decommissioning, the licensee shall submit a DDP to the CNSC for acceptance. Since work plans are defined from the safety assessment and then developed into the DDP, For licensees of a Class I nuclear facility, the licensee should typically submit a DDP to the CNSC two to five years prior to starting decommissioning activities ~~permanent shutdown~~. The DDP shall … a licence authorizing decommissioning. If permanent shutdown takes place before a DDP has been prepared and accepted, the licensee shall prepare one as soon as possible." **Impact on industry** The timing in this REGDOC is impractical and does not always reflect what will actually happen leading up to permanent shutdown. Unclear direction makes it difficult to comply.	

3.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**1.2. 2.1 and 2.2**	**MAJOR** The document does not reflect the difference in complexity between mines and mills in comparison to power plants in the Scope and many of its sections. Nor is its expectations always clear for Class II licensees or licensees with unique organizational/ownership structures. For instance, the draft cites numerous activities that licensee are required to perform prior to the shutdown of a facility (e.g. maintaining the financial guarantee, development of the decommissioning strategy and a PDP). However, there are organizational realities (such as the Bruce Power lease from Ontario Power Generation) in which the owner of a facility is required to meet the decommissioning obligations. This is not clearly reflected in this document. Also, are the following passages only linked to the licensed areas, or is it broader: ●"For licensed sites with more than one facility or location for which the licensee is responsible, the licensee shall submit an overarching PDP to ensure that interdependencies between planning envelopes or facilities, locations or sites are taken into account." ●"For licensed sites with more than one facility preparing to undergo decommissioning for which the licensee is responsible, the licensee shall submit an overarching site DDP to ensure that interdependencies between the individual DDPs (planning envelopes or facilities) are taken into account. " **Su** Amend the Scope to include the following, "<u>Where the licensee is not the owner of the facility, the obligations contained within this REGDOC remain with the owner, who may request support of the licensee to discharge the obligations</u>." Also, clarify: ●What lifecycle Class II licensees are subject to in section 2.1 ●In the last paragraph of section 2.2. whether larger, more complex licensees are required to have separate decommissioning plans for the Class II licences they hold (e.g., the Class II licence that Bruce Power has yet to integrate into its PROL). ●Whether section 2.2 should say decommissioning 'stages' rather than 'phases' to avoid the potential to confuse phases of decommissioning with lifecycle phases.**ggested change** **Impact on industry** While the Bruce Power-OPG lease is somewhat unique at the moment, it may not always be. For regulatory clarity, it is important that decommissioning obligations are fully	No change made, the requirements of this REGDOC are for the licensee, irrespective of the owner of the facility. 1. No change made. The applicable lifecycle stages for Class II licensees are described below this list. 2. The last paragraph of section 2.2 refers to the need to have a licence to decommission prior to conducting decommissioning activities. It does not refer to preliminary decommissioning plans. No change made. 4. The use of "phase" aligns with both CSA and IAEA GSR Part 6, *Decommissioning of Facilities*.

			understood. While this is clear in current Power Reactor Operation Licenses, it is not in this draft REGDOC, which will be a document referenced often in future years by all stakeholders interested in decommissioning obligations. The inclusion of a brief, clarifying line in the Scope would easily remedy this.	
4.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**5.1 and 5.1.1**	**MAJOR** Industry is concerned with the language related to cost and financial guarantees as per section 5.1.1 and item 52 in the CNSC comment disposition table regarding implied acceptance of the cost estimates. The PDPs currently contain a summary of the cost estimate and separate standalone detailed cost estimates are provided to the CNSC staff. Section 5.1.1 identifies the cost estimate and financial guarantee can be a standalone document, which brings concern the stand-alone cost estimates will require acceptance by CNSC staff. It is the accountability of the Commission to accept the financial guarantee and associated cost estimate. Also, this section could better align with the language in *N294.* **Suggested change** For clarity, the CNSC is urged to: 1)Clarify acceptance of the PDP is for compliance to the REGDOC 2.11.2. Amend the 1st sentence in 5.1.1 to align with *N294* so it reads, "A PDP for a nuclear facility with a Class I or uranium mines and mills licence may ~~shall~~ include:, as applicable **Impact on industry** Layers of acceptance when accountability for acceptance of the financial guarantee is at the Commission may be a barrier to financial guarantee renewal.	No change made. The CNSC reviews PDPs and financial guarantees as part of the conditions of a licence.
5.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**General**	**MAJOR** Industry has concerns regarding overarching PDPs/DDPs for a site with multiple facilities. **Suggested change** Licensees believe that interdependencies between planning envelopes or facilities, location or site, can be included as required content for the facility PDPs/DDPs, thus avoiding the production of a separate document with repeat content being produced for CNSC review/approval. **Impact on industry** Recognizing the interdependencies in this REGDC would avoid duplicate efforts and ensure consistency.	This is in alignment with IAEA GSR Part 6, *Decommissioning of Facilities* that indicates that a site strategy be developed for sites with more than one facility.

6.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**4.1 and 5.2**	**MAJOR** This REGDOC continues to cite draft documents**.** It is confusing to suggest that licensees comply with REGDOCs that are still in draft form and potentially subject to change. These include *REGDOC 3.3.1, Financial Guarantees for decommissioning of nuclear facilities and termination of licensed activities* and *REGDOC 2.11.1, Vol. III, Safety Case for Long-Term Radioactive Waste Management.* **Suggested change** References to draft REGDOCs should be removed. REGDOCs should only be cross-referenced in interdependent documents after they have been presented to the Commission and approved for publication. **Impact on industry** Draft guidance is subject to change. The path to (e.g., timing of) compliance is therefore unclear.	The following draft REGDOCs will be presented to the Commission as a package to complete the CNSC's regulatory framework related to waste management: ● 1.2.1, *Guidance on Deep Geological Repository Site Characterization* ● 2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* ● 2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2* ● 2.11.2, *Decommissioning* ● 3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*
7.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**6.1.1**	**MAJOR** The current document does not align with *CSA N294*. **Suggested change** Add "<u>The detail and complexity of the DDP shall be commensurate with the facility being decommissioned</u>" as the first sentence of this section. **Impact on industry** Creates uncertainty for licensees.	No change made. A section on graded approach was added to the REGDOC, making the quoted sentence redundant.
8.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-	**6.2**	**MAJOR** Safety assessment for DDP is not the same as the safety assessment for the SWS **Suggested change** Provide clarification on the safety assessment requirements for the SWS stage. **Impact on industry** Uncertainty on how to satisfy safety requirements for the SWS.	Section 8.3 outlines guidance of what should be included in the storage with surveillance plan. As stated in Section 8.3, Storage with surveillance plan, the storage with surveillance plan should be developed on the basis of the outcomes of the safety assessment. Finally, Section 8.2, Safety assessment for decommissioning, outlines the requirements of what the safety assessment shall ensure.

	Québec, Kinetrics, NB Power, NWMO, OPG, Orano			
9.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**6.4**	**MAJOR** The last paragraph references *REGDOC 2.11.1 Volume I* and not *Volume II*. **Suggested change** Add reference to *REGDOC 2.11.1, Volume II* to this section. **Impact on industry** Omission creates uncertainty for mines and mills.	The change was implemented as suggested.
10.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**7**	**MAJOR** Licensees believe section 7 requires the following edits: 1) In the 1st bullet, the reference to decommissioning in accordance with 'written procedures' is inconsistent with Section 6. This could be interpreted as CNSC approval being required for licensees' procedures. 2) Regarding the 4th bullet, surveillance and maintenance plans for all SSC is not required and should focus on SSC important to safety. 3) **Suggested change** Amend: 1) The 1st bullet to read, "conduct decommissioning in accordance with the accepted DDP and written programs ~~procedures~~" 2) The 4th bullet to clarify that only SSCs important to safety require surveillance and maintenance plans by saying, "…surveillance and maintenance plans for these ~~the~~ SSCs." 3) **Impact on industry** Without these minor edits, there would be an increased regulatory burden if licensee procedures are subject to CNSC approval and surveillance and maintenance plans are	1. Text revised to say "…with the DDP and associated procedures" 2. Change made as suggested.

			required for SSCs not important to safety.	
11.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**8.1**	**MAJOR** Licensees have the following concerns with section 8: 1) In the 2nd full sentence on page 16, the term "assign" in "…institutional controls by may assign that responsibility…" does not include transfers. 2) The actions in the bulleted list may not apply to all properties in institutional control. Mines and mills in institutional control do not rely on active controls to prevent unrestricted access. **Suggested change** The CNSC is urged to: 1) Replace the term "assign" with "<u>assign or transfer, as the case may be</u>" or "<u>assign or transfer, as applicable</u>" Amend the sentence before the bullets with "<u>As applicable,"</u> **Impact on industry** For mines and mills, institutional control involves a transfer and not an assignment. This process must be included in the REGDOC in order for section 8.1 to apply to institutional control for mines and mills. As written, the REGDOC creates uncertainty for mines and mills in which access to sites in institutional control is not restricted.	The following sentence was added to the end of Section 8: "Decommissioning ends with the release of the facility or location from CNSC regulatory control, even if the CNSC subsequently authorizes the site for any other licensed activity in the future. If unrestricted release cannot be achieved, institutional controls are required to be in place and the facility or location may need to remain under CNSC oversight." Section 8.1 was re-titled to "Institutional control" The sentence was revised to: "The licensee is responsible for implementing and maintaining the post-decommissioning plans and institutional controls unless that responsibility was transferred to a third party with their agreement and the Commission's approval."
12.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**3**	Licensees believe references to relevant CSA and IAEA documents, in addition to *REGDOC 3.5.3, Regulatory Fundamentals*, are needed to help readers truly grasp the concept of a graded approach. **Suggested change** Add references to section 4.1.2 of *CSA N286-12, Management System for Nuclear Facilities*, the *N286* Commentary and *IAEA GS-G-3.5, Annex I.* Also reference *N294, Decommissioning of Nuclear Facilities*, which asks for compliance to *N286* to ensure quality assurance linkages.	Comment noted, some of the suggested references have been added to the document
13.	Bruce Power, BWXT, Cameco, CNA,	**6**	The content for the permanent shutdown plan or stabilization activity plan has not been outlined/identified. **Suggested change** It's likely this will not be two documents, but a combined stabilization activity plan from	There is no requirement in the REGDOC to have separate documents. No change made.

	CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano		operation to a stable state for decommissioning.	
14.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**6.1**	The 4th paragraph uses the acronym SWS without introducing it first. **Suggested change** As it has not been used previously, recommend spelling it out in full for clarity.	This was removed in editing.
15.	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**Glossary**	Definitions are inconsistent with those in *REGDOC-3.6, Glossary of CNSC terminology*. **Suggested change** There may be a need to provide more fulsome definitions in the current REGDOC, but they should align with those in REGDOC-3.6, Glossary.	The REGDOC 3.6, *Glossary of CNSC Terminology* is outside the scope of this document but CNSC staff will consider your comments as part of the next revision of the Glossary. This will be done after the suite of five REGDOCs is published in order to incorporate the changes in definitions that were included in those documents. Please note that we are always seeking greater alignment with IAEA definitions but the scope of workshop does not include comments on the glossary or other CNSC REGDOCs as well.

16.	Region of Durham		Based on the CNSC responses to Durham Region's submission on the decommissioning REGDOC, it is not clear whether the CNSC sees our participation in this process as valuable. The responses to the points we raised appear to be recitations of what is in the REGDOC, the very items we were saying don't meet our needs. Many of the responses suggest our comments are out of scope, with the implication that the broadening the scope of the REGDOG is not up for discussion. The basic question for us is whether the CNSC sees itself having a role in outlining best practices for a licensee in working with their host community on a lengthy decommissioning process. The REGDOC says there must be engagement with the public and Indigenous groups and communities. It does not indicate what constitutes timely or adequate engagement. The REGDOC on Public Information and Disclosure is also not very informative in this regard. It is very challenging and time consuming for our staff to read and digest these highly technical documents and convey our concerns within your framework. You will note that we only commented on the decommissioning draft REGDOC as it seemed most germane to our interests though we did read the others. We are the host community to two of Canada's nuclear plants and thus have definite interests in how decommissioning will be carried out, how used fuel and waste will be managed, and so on. If our input and perspective is not pertinent or useful to you, then we won't dedicate the resources to participate. If some other format or avenue to gather our input would be more useful, we would be happy to discuss it. We find the current process to be very industry-oriented and rather impenetrable. It seems to be set up to serve experts rather than the public or communities. We look forward to hearing from you soon so that we can make a decision about the value of participating in the 3 hour webinar on March 26.	The CNSC's public consultation process on its draft regulatory documents is targeted towards industry, civil society organizations (CSOs) and members of the public and Indigenous communities that would be impacted by the implementation of the regulatory document. CNSC staff read and take into careful consideration each comment that is submitted on its draft regulatory documents. Each comment is dispositioned in writing and made publicly available to further ensure that the process of developing regulatory documents remains transparent. To ensure CSOs, members of the public and Indigenous communities are increasingly engaged and informed about CNSC regulatory activities, the CNSC hosted a workshop on the draft suite of waste regulatory documents (including this REGDOC) that was held on April 23, 2020. Specifically with response to the comments on the scope of REGDOC-2.11.2, this document is not intended to detail of the information that a licensee would be required to submit as part of the licence application. A separate document, REGDOC 1.1.4, Licence Application Guide to Decommission a Reactor, is being drafted to capture this information and will undergo public consultation in the future. As outlined in REGDOC-2.11.2, the CNSC requires that planning for decommissioning take place throughout the lifecycle of a facility as it is important to ensure early engagement with surrounding communities on proposed decommissioning plans. Section 6, Decommissioning Strategy, states that the licensee should consider public and Indigenous engagement when determining the appropriate decommissioning strategy. Section 7.1.1, Content of the preliminary decommissioning plan, states that a preliminary decommissioning plan shall contain a public consultation plan, including a public information program and avenues for public participation as per the requirements and guidance of REGDOC-3.2.1, *Public Information and Disclosure.* Section 8.1.1, Content of the detailed decommissioning plan, states that a detailed decommissioning plan shall include a summary report of any public and Indigenous consultations undertaken in preparing the detailed decommissioning plan, including issues raised and how they were considered and dispositioned.

				This draft REGDOC is complemented by CSA N294, *Decommissioning of facilities containing nuclear substances*. CSA N294 includes requirements and guidance on public and Indigenous communication and engagement as well as guidance for communication with stakeholders for complex sites. CSA N294 also requires that the decommissioning strategy consider political, social and economic impacts. The CNSC is currently developing REGDOC-1.1.4, L*icence Application Guide to Decommissioning Reactor Facilities*, which will further outline public and Indigenous engagement requirements and guidance regarding decommissioning.
17.	Concerned Citizens of Renfrew County and Area		Q #1. The Preface of the July 2019 version of the REGDOC had language that helped clarify the facilities and activities to which it app is not clearly stated?	Section 1.2, Scope, states that the document applies to Class I and Class II nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices licensees that are required to have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their licence. The scope of this REGDOC was not limited following public consultation, it was actually expanded to include Class II nuclear facilities, as well as to all nuclear substances and radiation devices that are required to have decommissioning strategies or plans, and not just waste nuclear substance licensees.
18.	Concerned Citizens of Renfrew County and Area		Q #2. With regard to section 1.1, “Purpose”, it should be noted that the CNSC has put forward multiple definitions of “decommissioning” that do not contain consistent language: ● CNSC Glossary: “Those actions taken to retire a licensed facility permanently from service and render it to a predetermined end-state condition.” ● July 2019 version of REGDOC: the administrative and technical actions taken to retire a facility from service or to cease licensed activities, and which allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, possessed or stored. ● February 2020 version of REGDOC: the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, used, possessed or stored. Why does the definition in the CNSC Glossary not conform to that in the REGDOC? Why is “location” included as well as “facility” in the REGDOC definition? What “locations” that are not “facilities” require decommissioning?	The intent of including an updated definition for decommissioning in the draft regulatory document was to solicit comments on it. If the Commission accepts this draft regulatory document, the definition for decommissioning in this regulatory document will supersede the definition for decommissioning contained in REGDOC-3.6, *Glossary of CNSC terminology*. On the next revision to REGDOC-3.6, the definition for decommissioning will then be updated to align with the definition in this REGDOC. The definition for “decommissioning” was amended between the July 2019 version and the February 2020 version of the document to address comments that were received during public consultation. “Nuclear facility” is a term used to encompass a specific set of facilities including, but not limited to, nuclear fission or fusion reactors, particle accelerators, uranium or thorium mines and mills, etc., for which the definition is found within REGDOC-3.6. This term does not encompass all licensed sites that will require decommissioning actions. To ensure that this

				draft regulatory document was not limited in scope, CNSC staff used the terms facilities, locations and sites in the draft regulatory document to fully encompass all situations, and to ensure that no licensee would be excluded based solely on terminology used.
19.	Concerned Citizens of Renfrew County and Area		Q #3. A great deal of text has been removed from section 1.1, "Purpose", including the following: "The CNSC reviews every licence application to verify that licensees have made adequate provisions for decommissioning, such that workers, the public and the environment are protected. All licensees for regulated facilities or activities are required to ensure that they effectively decommission all licenced locations as appropriate. Particular decommissioning plans and strategies are evaluated through the licensing process and included as part of the licensing basis." This text includes an implied commitment of the CNSC to protect workers, the public and the environment. This is important to ordinary citizens. It has been replaced by a statement that "Decommissioning actions… are taken… with due regard for the health and safety of people and the environment." This statement is an assumption – one that may or may not be true depending on how decommissioning actions are taken. Here it is stated as fact. This change to the "Purpose" was not requested by any of the reviewers. Who asked for this change? Why was it made? Does the CNSC no longer consider that a purpose of the REGDOC is to verify that licensees' decommissioning provisions are adequate to protect workers, the public and the environment? How will it be clarified that review of decommissioning plans by the regulator is essential to protect public health and the environment?	During the public consultation phase of the development of this REGDOC, many comments were received on the scope of the document. To address these comments, CNSC staff conducted a holistic review of the purpose, scope and background of this document to ensure that each section contained the appropriate information. The sentence referenced is regarding CNSC staff review of licence applications. It was removed as the purpose of this document is not a licence application guide. A separate document, REGDOC 1.1.4, *Licence Application Guide to Decommission a Reactor*, is being drafted to capture this information and will undergo public consultation in the future. As well, the requirement to protect workers, members of the public and the environment is embedded within the CNSC's regulations. This draft regulatory document continues to provide requirements and guidance to protect workers, the public and the environment.
20.	Concerned Citizens of Renfrew County and Area		Q #4. At the end of the first paragraph in section 1.2 ("Scope") the phrase "under continuous management and regulatory oversight" has been removed. What was the reason for its removal?	During the public consultation phase of the development of this REGDOC, many comments were received on the scope of the document. To address these comments, CNSC staff conducted a holistic review of the purpose, scope and background of this document to ensure that each section contained the appropriate information. This document also underwent editing to ensure that consistent and plain language was used throughout the document. The addition of "continuous management and regulatory oversight" did not provide information regarding the scope of the document, nor did it provide clarification, and was therefore not appropriate for this section.

21.	Concerned Citizens of Renfrew County and Area		Q #5. The July 2019 version of section 1.2 stated "This regulatory document is not intended… for planning for the remediation of legacy sites for which decommissioning was not planned." The February 2020 version changes this to "This regulatory document is not intended…for the remediation of sites or locations contaminated by residual radioactive material arising from past activities that were never subject to regulatory control or subject to regulatory control before the *Nuclear Safety and Control Act* (NSCA) and its associated regulations came into force." Although the language in both versions lacks clarity, both suggest that the REGDOC does apply to remediation of sites contaminated <u>after</u> the *Act* came into force. However, a statement in the July 2019 version that the REGDOC "may be used as guidance for scoping the regulatory oversight of remediation activities" no longer appears in the February 2020 version. Removal of this statement creates doubt as to whether the REGDOC is intended to apply to remediation. The definition of "remediation" in the REGDOC is similar to that in the IAEA Glossary: "Any measures that may be carried out to reduce the radiation exposure due to existing contamination of land areas through actions applied to the contamination itself (the source) or to the exposure pathways to humans." The IAEA adds, "Decommissioning can entail activities that are similar to remediation (also an authorized process), such as removal of contaminated soil from an area within the authorized boundary of a facility, but in this case, such removals are normally referred to as clean-up activities and are typically performed under the authorization for decommissioning." What is the intent of the new language? If contaminated land areas are within the boundary of a currently licensed facility, are they subject to the "clean-up" provisions of the REGDOC, regardless of when the contamination occurred? Does this REGDOC have provisions related specifically to remediation, as opposed to clean-up? If not, does the REGDOC have any relevance to remediation of contaminated sites, regardless of when contamination occurred? Do <u>any</u> provisions of the *Act* and its regulations pertain to remediation of radioactively contaminated sites?	CNSC staff amended this section of the draft regulatory document to ensure that the language used was consistent to that of GSR Part 6, *Decommissioning of Facilities*. This draft regulatory document does not address the remediation of areas such as historic mines that were never subject to regulatory control or were not subject to regulatory control before the relevant Act and its associated regulations came into force. Contaminated lands that were subject to regulatory control (*Atomic Energy Control Act*) would still be subject to the provisions of this REGDOC. The draft regulatory document does state this may be used as guidance for the remediation of these. Historic properties that were not subject to regulatory control are regulated with site-specific remediation objectives set through regulatory approvals that are open for public consultation through the Commission's public proceedings..
22.	Concerned Citizens of Renfrew County and		Q #6. Language referring to "waste nuclear substance licensees" has been removed from section 1.2, "Scope". Several matters should be clarified. Do all waste nuclear substance licensees "have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their licence?" If so, why was reference to this class of	Section 1.2, Scope, states that the document applies to Class I and Class II nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices licensees that are required to have decommissioning plans or strategies as a result of a regulatory requirement or a condition of their

	Area		licensees removed? If not, how is it determined which waste nuclear substance licensees are required to have decommissioning plans or strategies?	licence. The scope of this regulatory document was not limited following public consultation, it was actually expanded to include Class II nuclear facilities, as well as to all nuclear substances and radiation devices that are required to have decommissioning strategies or plans, and not just waste nuclear substance licensees. The licence condition to maintain decommissioning plans is a standard licence condition for waste nuclear substance licences.
23.	Concerned Citizens of Renfrew County and Area		Q #7. In section 4 ("Decommissioning Strategy") the nuclear industry requested removal of the first sentence (but not the second sentence) in the following paragraph (detailed comments table B #40): "The licensee shall justify the selected strategy and should conduct a comparison of alternative decommissioning strategies. The evaluation method used to select the decommissioning strategy should ensure that the relative advantages and disadvantages of the remaining strategies can be objectively compared in a systematic and traceable fashion." The CNSC response was to remove the entire paragraph. No rationale or explanation was provided. The International Atomic Energy Agency, General Safety Requirements Part 6, "*Decommissioning of Facilities*," requires that the selected decommissioning strategy be justified: "Requirement 8: Selecting a decommissioning strategy 5.1. The preferred decommissioning strategy shall be immediate dismantling. However, there may be situations in which immediate dismantling is not a practicable strategy when all relevant factors are considered. 5.2. The selection of a decommissioning strategy shall be justified by the licensee…" What is the CNSC's rationale for removing language requiring the licensee to justify the selection of a decommissioning strategy? Will the international requirement to do this be ignored?	The second sentence in question, "The evaluation method used to select the decommissioning strategy should ensure that the relative advantages and disadvantages of the remaining strategies can be objectively compared in a systematic and traceable fashion." was not removed following public consultation and remains in Section 6, Decommissioning Strategy. The requirement to justify the selected strategy was removed from this section as it was a repetition of a requirement already captured as part of the preliminary decommissioning plan. Section 7.1.1, Content of the preliminary decommissioning plan, states that a PDP shall include the decommissioning strategy including: the final end-state objective and the rationale for the decommissioning strategy selected, interim end states, periods of storage with surveillance and any institutional controls; as well as the assessment of alternative strategies.
24.	Concerned Citizens of Renfrew County and Area		Q #8. The July 2019 version, section 4 ("Decommissioning Strategy") of the draft REGDOC stated "The following decommissioning strategies should be considered individually or in combination:" immediate (prompt) decommissioning, deferred decommissioning, and *in situ* decommissioning. The February 2020 version retains this language. The REGDOC considers *in situ* decommissioning to be a strategy that "should be considered."	Following the public consultation phase of the development of this draft regulatory document from December 2-20, 2019, 30 comments were received. These comments are found in Table C of the disposition table "Feedback on comments". Section 6.1, *In situ* decommissioning, contains pertinent information and requirements on when in situ may be considered as a decommissioning

			Reviewers commented extensively on this matter (see detailed comments table B 1, 2, 3, 4, 5, 6, 7, 87, 34, 42, 44, 48, 53, 76. 85; table C 3, 15, 19). Most of these comments either rejected this strategy outright, or called for further clarification. In addition, over 100 comments were submitted to cnsc.consultation.ccsn@canada.ca prior to the deadline of December 20th, stating that "On-site Disposal of Nuclear Reactors Is Not Acceptable." These comments reveal substantial public concern about on-site disposal of nuclear reactors. By scrolling over the pdf version of the "detailed comments table" for the *Decommissioning* REGDOC one can read the title REGDOC_2_11_2_Detailed_comments_table_(closed_October_16_2019). Yet the consultation period lasted until December 20, 2019. Hence, these public comments have never been acknowledged by CNSC staff, and no explanations have been provided for why they were not accepted. It is extremely important that there be additional discussion on this matter. The International Atomic Energy Agency released an Integrated Regulatory Review Service report following a September 2019 peer review of Canada's nuclear safety framework. It states: "CNSC should consider revising its current and planned requirements in the area of decommissioning to align with the IAEA guidance that entombment is not considered an acceptable strategy for planned decommissioning of existing NPPs and future nuclear facilities." The International Atomic Energy Agency, General Safety Requirements Part 6, "*Decommissioning of Facilities*," "establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future." It states that for nuclear power plants and other nuclear facilities, entombment (also known as *in situ* decommissioning): "Entombment, in which all or part of the facility is encased in a structurally long lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g. following a severe accident)." Before including this clear statement in GSR Part 6 (in 2014), the IAEA gave	strategy. Specifically, Section 6.1 states that "*In situ* decommissioning may be considered a solution only under exceptional circumstances (e.g., following a severe accident) or for legacy sites". New text was added to this section to address the feedback received from the recent IRRS mission, in particular, the following sentences: "In situ decommissioning shall not be considered a reasonable option for planned decommissioning of existing nuclear power plants, or for future nuclear facilities and situations where removal is possible and practicable." Together with the existing text, this aligns with IAEA guidance, while taking the Canadian context into consideration. All information contained in the draft regulatory document surrounding in situ decommissioning should be read in its entirety so that a sentence is not read out of context. The CNSC does not promote or prescribe decommissioning strategies. Proponents must propose their preferred strategy as part of their decommissioning plan. Any proposed decommissioning strategy will be assessed by the CNSC to ensure the protection of the health and safety of the public and the environment. The CNSC requires that the selection of the decommissioning strategy be justified and that, when a licensee is determining the decommissioning strategy, various factors be considered (e.g., potential worker and public radiological doses, conventional safety, the availability of infrastructure for radioactive waste, public and Indigenous engagement, etc.). If *in situ* confinement is used as a decommissioning strategy and results in a waste disposal facility, the CNSC requires that all regulatory requirements for that type of facility be met and that safety be demonstrated via a science-based safety case and post closure safety assessment, as outlined in draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Disposal of Radioactive Waste*, Version 2.

			entombment serious consideration as a possible decommissioning strategy. In December 2005 it published IAEA-TECDOC-1478, *Selection of decommissioning strategies: Issues and factors: Report by an expert group*." That group's report did consider entombment as among three possible decommissioning strategies, similar to the draft REGDOC. But the report included cautionary language: "Entombment requires a robust regulatory/legal framework. The lack of international experience on entombment and its regulatory complexity may make this strategy the least desirable… The following actions may be considered in the case of entombment: • The activity concentration of long-lived alpha radionuclides needs to be considered with regards to the suitability of such waste to be disposed in a near surface configuration. • Public consultation in order to obtain acceptance for a waste repository." There is no evidence that the CNSC considered such matters before including entombment as a viable decommissioning strategy in REGDOC-2.11.2. Entombment ("*in situ* decommissioning") first appeared in the Canadian Standards Association Nuclear Standard N294 ("*Decommissioning of facilities containing nuclear substances"*) in July 2009, was "reaffirmed" twice, and now appears in REGDOC-2.11.2. It must be stressed that i*n situ* decommissioning is not a decommissioning strategy, but a means of creating a radioactive waste repository. Relevant requirements for radioactive waste storage and disposal are contained in other REGDOCs and should not be duplicated in REGDOC-2.11.2. However, a new section 4.1 ("*In situ* decommissioning") has now been included in the February 2020 version of the REGDOC. It contains new and ambiguous language that could be interpreted as promoting the consideration of *in situ* decommissioning as a strategy for "future nuclear facilities": *"In situ* decommissioning shall not be considered a reasonable decommissioning option for planned decommissioning of existing nuclear power plants, or for future nuclear facilities and situations where removal is possible and	

			practicable." This statement could be interpreted to mean that *in situ* decommissioning is a reasonable option for new facilities - such as small modular reactors - if their removal is not possible and practicable. Allowing small modular reactors to be abandoned in place would significant reduce their life cycle costs, but would also be highly controversial, as demonstrated by the comments submitted (but never acknowledged) on REGDOC-2.11.2. Why is the CNSC promoting use of a decommissioning strategy that is specifically proscribed by international standards? Who requested the addition of new language on *in situ* decommissioning of "future nuclear facilities"? Why is this language so ambiguously worded? Is it intended to allow, or prohibit, *in situ* decommissioning of future nuclear facilities? How will this be clarified?	
25.	Concerned Citizens of Renfrew County and Area		Q #9. Section 4 includes the statement "When determining the appropriate decommissioning strategy, the licensee should consider the following, as appropriate," following by a bulleted list of considerations. Two items in the list contained in the July 2019 draft REGDOC have been removed: ● the availability of a fuel disposal facility if applicable; and ● other political, social and economic considerations. No request was made to remove the bullet referring to the availability of a fuel disposal facility, so it is unclear why this was done. While this now appears as a consideration in a second bulleted list ("The decommissioning strategy should be reviewed and updated in light of the following,") it is relevant to both lists. With regard to the item, "other political, social and economic considerations," the nuclear industry commented (table B, #40) that this is "broad and open to variations in interpretation. It should be removed." The CNSC removed the bullet without responding to this comment. Consideration of the items in the bulleted list is not framed as a requirement ("When determining the appropriate decommissioning strategy, the licensee should consider the following, as appropriate"). The two deleted items are significant considerations. Why were they removed?	CNSC staff consider "fuel disposal facilities" to be a type of waste management facility, which is captured under bullet 13 of the list as follows: "availability of waste management facilities, locations or sites". The bullet in question was therefore removed to avoid duplication and to provide clarity that a fuel disposal facility is a waste management facility. CSA N294, *Decommissioning of facilities containing nuclear substances* complements draft REGDOC-2.11.2. CSA N294 contains the clause to consider political, social and economic considerations when determining the decommissioning strategy. CNSC staff removed the clause from the draft REGDOC as these factors are outside the mandate of the CNSC.
26.	Concerned Citizens of Renfrew		Q #10. The July 2019 version of the REGDOC, Section 5, "Planning for Decommissioning" stated:	The term disposition is defined in CSA N292.0, *General principles for the management of radioactive waste and irradiated fuel*, as: "consignment of, or arrangements for the consignment of, radioactive waste for some

	County and Area		The licensee shall prepare a waste management strategy that identifies the categories and estimated quantities of all waste streams that will be generated during decommissioning, and the planned disposition path in compliance with the applicable clauses of draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [6]. A similar version of this requirement (modified to allow the waste management strategy to be incorporated within the Preliminary Decommissioning Plan (PDP) rather than submitted as a "stand-alone document") is in the February 2020 draft REGDOC (section 5.2, "Waste management strategy"). A concern is that introduction of term "planned disposition path" creates regulatory uncertainty. No language or requirements pertaining to a "disposition path" for radioactive waste can be found in draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*. "Disposition" is not defined in the CNSC Glossary. What is meant by "disposition" -- is it disposal, or something else? What are the regulatory expectations for the long-term management of decommissioning wastes?	specified (interim or final) destination. For example, for the purpose of processing, disposal or storage". CSA N292.0 complements draft REGDOC-2.11.2. Requirements and guidance regarding the management of radioactive waste are set out in draft REGDOC-2.11.1, Volume I: *Management of Radioactive Waste*, as well as the CSA Group standards that complement it.
27.	Concerned Citizens of Renfrew County and Area		Q #11. Section 5.1.1 ("Content of the preliminary decommissioning plan") required "the identification of any features of the surrounding natural and social environment that could be significantly affected by the decommissioning process." Why was this requirement removed? Who asked for its removal? (Note: this is <u>not</u> the same as providing "details regarding the surrounding environment" in the "description of the location of the facility".	During public consultation, reviewers requested that the content of a preliminary decommissioning plan list in draft REGDOC-2.11.2 be consistent with the information contained in CSA N294, *Decommissioning of Facilities Containing Nuclear Substances* (which had undergone public consultation in 2019). As a result, CNSC staff aligned the list, which caused the removal of this bullet point. CNSC staff understand the need for the comprehensive and detailed lists to be aligned to assist licensees in the development of their preliminary decommissioning plans. In addition, the content of the detailed decommissioning plan list of draft REGDOC-2.11.2 includes the following line item: "a characterization of potential environmental effects and the measures that will be employed to mitigate and monitor the effects."
28.	Concerned Citizens of Renfrew County and Area		Q #12. Section 6.2 ("Detailed Decommissioning Plan") (DDP) states that "A DDP for a nuclear facility with a Class I or uranium mines and mills licence shall include, as applicable… a waste management plan." In section 6.4 ("Waste management plan"), the requirement for the plan be prepared "prior to decommissioning" has been removed. Why was this change made?	The requirement to prepare a waste management plan prior to decommissioning remains in the draft regulatory document. The first clause of section 8.4, Waste management plan, states that the licensee shall prepare a waste management plan, which is in Section 8, Preparation for Decommissioning, and so the plan inherently is required to be submitted and approved prior to the execution of decommissioning actions, i.e., the removed wording was redundant.

29.	Concerned Citizens of Renfrew County and Area		Q #13. In the July 2019 version of the REGDOC, Section 7 ("Execution of Decommissioning") stated that the "the licensee shall… ● consider the waste hierarchy, including preventing generation, reducing volume and radioactivity content, reusing and recycling materials and components, and disposing of the waste; ● characterize and manage all remaining operational waste from the facility and all waste from decommissioning; and ● ensure traceability of all waste generated." These are clearly important requirements. Why have they been removed? Who asked for their removal?	The clauses in question were not removed from the draft regulatory document, they were however all moved to more appropriate sections to improve clarity. The first bullet was moved to section 8.4, waste management plan, and reads as follows: "The licensee shall prepare a waste management plan that considers the waste hierarchy, including preventing generation, reducing volume and radioactivity, reusing and recycling materials and components, and disposing of the waste." The second bullet was moved to section 9.2, waste management, and reads as follows: "The licensee shall characterize and manage all remaining operational waste from the facility or activity and all waste from decommissioning." The third bullet was also moved to section 9.2, waste management, and reads as follows: "The licensee shall ensure the traceability and maintain up-to-date records of the waste generated and managed in the facility or transferred to another facility or waste organization, specifying its quantities, characteristics and destination."
30.	Concerned Citizens of Renfrew County and Area		Q #14. Section 7.1 ("Storage with surveillance") includes the statement that "During the storage with surveillance period, the licensee may perform activities to reduce risks at the facility, in accordance with the licence and consultation with the CNSC. These may include… removal and recycling of non-contaminated or slightly contaminated equipment." The term "slightly contaminated equipment" lacks clarity and precision. The July 2019 version of the REGDOC contained examples ("turbines, pumps and heat exchangers") that appear to be major reactor components. These examples were removed from the February 2020 version. What is the meaning of "slightly contaminated equipment"? Why were the examples removed? Can a precise definition of levels of different radionuclides in "slightly contaminated equipment" be provided? What levels of activation products would be found in slightly contaminated equipment"? If this term cannot be precisely defined, why should there be provision to allow its removal during "storage with surveillance"? How would the provisions of the Detailed Decommissioning Plan (including "a description of… the nature and source of potential significant risks to workers, the public and the environment (including estimates of doses)") be applied to removal of "slightly	Preparatory actions for decommissioning (including storage with surveillance) can include decontamination, and work of removal and/or dismantling of unnecessary structures, systems and components, providing these activities are within a licensees licensing basis. These activities may be done under a CNSC licence for operation depending on the licence requirements, programs and procedures. What activities may be done would be limited to those activities covered by the existing licensing basis. This is in alignment with SSG-47, *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities*. In accordance with a licensees waste management program, a licensee must characterize and manage all waste arising from operational and preparatory decommissioning activities. Requirements for safe waste management practices are found in REGDOC 2.11.1 Volume I. REGDOC 2.11.1 Volume I states that licensees should optimize the clearance of materials and locations from CNSC regulatory control. Exemption quantities, conditional clearance levels and unconditional clearance levels can be found in the *Nuclear Substances and Radiation Devices Regulations.*

			contaminated equipment"?	
31.	Concerned Citizens of Renfrew County and Area		Q #15. In section 8 ("Completion of Decommissioning"), changes have been made to the required contents of the end-state report. These include: ● Change of the requirement to "describe waste quantities and dispositions" to "a summary of the waste quantities generated and managed, and disposition routes." ● Addition of "an inventory of nuclear substances that will remain on site." The latter change was not requested by reviewers during the public comment period. It appears to be one among a number of changes that were made by the CNSC to facilitate *in situ* decommissioning and abandonment of waste on existing nuclear sites. Making such changes to the REDGOC without affording an opportunity for public review and comment violates principles of accountability and transparency. Why were these changes made? Who requested them? Will the Commission require additional opportunities for public review and submission of comments on REGDOC-2.11.2 before making a decision on its approval? Will the approval process be done in public, with consideration of public comments?	The additional language added to the first bullet in question adds additional direction and clarity to the licensees and does not change the intent behind the clause. The addition of the second bullet in question is not to solely accomodate in situ decommissioning but to capture all situations that could arise at the completion of decommissioning stage. This could include in situ decommissioning that would result in a waste disposal site, as well as mine and mill tailing sites but also addresses the need to ensure that no radioactive material above exemption or clearance levels will remain on site for those properties that will be released unconditionally from CNSC oversight. Minimal changes were made to this draft regulatory document following consultation. The workshops held between CNSC staff and industry and CNSC staff and CSOs were intended to provide the opportunity for industry and the public to comment on these changes.
32.	Concerned Citizens of Renfrew County and Area		Q #16. In section 8.1 ("Post decommissioning"), new language has been inserted stating: "The licensee is responsible for implementing and maintaining the post-decommissioning plans and institutional controls but may assign that responsibility to a third party with their agreement and the Commission's acceptance." Who requested the addition of this language? Why is this not reflected in the detailed comments table? How would the Commission decide if a third party is qualified to maintain institutional controls?	CNSC staff amended this clause to improve clarity and accuracy. A licensee cannot assign their responsibilities to a third-party without the acceptance of the Commission. The original wording of the clause in question would give the impression that a licensee could assign their responsibilities to a third party without the Commission's acceptance, and without agreement from the third party, which is not accurate.
33.	Concerned Citizens of Renfrew County and Area		Q #17. Section 10 ("Radiological and Hazardous Surveys") requires the licensee to "perform radiological and non-radiological surveys throughout the various phases in the lifecycle." In the July 2019 version of the REGDOC, the first suggested survey objective was "identifying potential radiation risks for workers, the public and the environment associated with specific decommissioning activities"	The intent of the clause in question was expanded to include radiological and non-radiological risks, which is why the specific reference to "radiation" was removed. However, CNSC staff understand that this may cause confusion and so have amended the bullet as follows to add additional clarity: "identifying potential radiological and non-radiological risks for workers, the public and the environment associated with specific decommissioning activities."

			In the February 2020 version of the REGDOC the word "radiation" has been removed. None of the survey objectives in the new version of the REGDOC specifically mention survey of radiation risks to workers or the public. Who asked for this change? Does the CNSC recognize the importance of surveying radiation risks to workers and the public during decommissioning activities? Will language referring to survey of radiation risks be restored in the REGDOC?	The word "radiological" is not included, as the surveys should include both radiological and non-radiological aspects.
34.	Saskatchewan Environmental Society		REG DOC 2-11-2 Decommissioning, paragraph 8: This includes defining "future use of, or any restrictions on the future use of, the facility or location…". Shouldn't this include a requirement that the responsible party define how compliance with such restrictions will be assured over the extended post-decommissioning period. Is it reasonable to assume that present administrative systems will continue *ad infinitum ?*	Section 10, Completion of Decommissioning, of draft REGDOC-2.11.2 contains requirements and guidance regarding the post-decommissioning phase, including institutional controls for the site. Further information regarding institutional controls can be found in draft REGDOC-2.11.1, REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* and REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste*, Version 2,
35.	Ralliement contre la pollution radioactive		How do the REGDOC guarantee that SMR will not be situ decommissioned, leaving dangerous wastes in remote regions? Why the REGDOC does not support the inherited responsibility of the Canadian government to completely dismantle old nuclear reactors without making entombment regardless of whether the complete decommissioning has been planned. This would align with the IAEA guidance that entombment is not considered an acceptable strategy for planned decommissioning of existing NPPs and future nuclear facilities. Could you request the waste owners evaluate the cost over a long time period of the temporary storage in engineered waste packages? It would then be possible to compare these costs to a medium depth management facility for intermediate level waste and a high level radioactive waste management facility.	See response to comment #23 in Table F. The acceptability of storage and/or disposal facilities for the management of radioactive waste is outside the scope of this REGDOC. The CNSC does not promote or prescribe waste disposition paths. Any proposed waste management storage or disposal facilities and activities will be assessed by the CNSC to ensure the protection of the health and safety of the public and the environment. For a waste management facility, the regulations require applicants to submit comprehensive information on their programs (e.g , safety analysis, fitness for service, etc) the design and components of the proposed facility, the manner in which the facility is expected to operate, facility operating manuals and procedures, and any potential impacts on the site or surrounding environment. Applicants are required to identify the manner by which the facility may fail to operate correctly, predict the potential consequences of such a failure and establish specific engineering measures to mitigate the consequences to acceptable levels. CNSC staff review all submissions to determine if the proposed waste management safety and control measures described in the application and the documents that support the application are adequate and meet the

				applicable requirements.

Canada's Nuclear Regulator

Financial Guarantees

Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

REGDOC-3.3.1

May 2020

DRAFT

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities
Regulatory document REGDOC-3.3.1

Cat. No. XXXXX
ISBN XXXXX

Également publié en français sous le titre : ***Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées***

Document availability

This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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Publishing history
[Month year]   Version X.0

Preface

This regulatory document is part of the CNSC's financial guarantees series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*, sets out requirements and guidance for applicants and licensees regarding the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the Canadian Nuclear Safety Commission.

REGDOC-3.3.1 provides information on financial guarantees used to ensure a licensee will have sufficient funds to decommission a licensed location and dispose of any associated nuclear substances. The document is intended to form part of the licensing basis for a regulated facility or activity within the scope of the document. It is intended for inclusion in licences as either part of the conditions and safety and control measures in a licence, or as part of the safety and control measures to be described in a licence application and the documents needed to support that application.

This document supersedes G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*, published in June 2000. For information on the implementation of regulatory documents in the licensing basis and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

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Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

1. Introduction

1.1 Purpose

Financial guarantees for decommissioning of nuclear facilities and termination of licensed activities are implemented in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under the NSCA.

Applicants and licensees are required to make adequate provision for the safe decommissioning of existing or proposed new nuclear facilities by ensuring that sufficient financial resources are available to fund all approved decommissioning activities should the licensee not be able to fulfill its obligations. Operationally, the Commission may also require that financial resources be available for termination of licensed activities other than for decommissioning of nuclear facilities.

This document provides requirements and guidance to applicants and licensees regarding the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the Canadian Nuclear Safety Commission (CNSC).

1.2 Scope

This document presents information for those who have incurred, or expect to incur, obligations with respect to the decommissioning of nuclear facilities or the termination of activities licensed by the CNSC.

Part I of this document pertains to financial guarantees for decommissioning of nuclear facilities or activities for Class IA and IB licences issued in accordance with the *Class I Nuclear Facilities Regulations*, uranium mines and mills licences and waste nuclear substances licences.

Part II of this document pertains to financial guarantees for the termination of licensed activities, such as for nuclear substances and radiation devices, prescribed equipment, and Class II facilities.

1.3 Relevant legislation

The provisions of the *Nuclear Safety and Control Act* and regulations that are relevant to this regulatory document include:

- *Nuclear Safety and Control Act*, subsection 24(5)
- *General Nuclear Safety and Control Regulations*, paragraph 3(1)(l)
- *General Nuclear Safety and Control Regulations*, subparagraph 29(1)(j)(i) to 29(1)(j)(x)
- *General Nuclear Safety and Control Regulations* subsection 29(2)

2. Background

The CNSC's mandate is to regulate the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public.

The CNSC defines decommissioning as the administrative and technical decommissioning actions taken to allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, possessed or stored. Decommissioning actions are the procedures, processes and work activities that lead to the release of a facility or location from regulatory control, with or without restrictions on its future use (for example, decontamination and/or dismantling of structures, systems and components).

Financial guarantees are a tangible commitment by a licence applicant or a licensee that there will be sufficient resources to safely terminate licensed activities. A financial guarantee does not relieve applicants or licensees from complying with regulatory requirements for decommissioning of nuclear facilities or termination of licensed activities – the financial guarantee ensures that there are funds available to the CNSC if applicants or licensees are unable to carry out safe decommissioning or termination of activities.

Financial obligations are intended to ensure:

- funding is available to make adequate provision for the health and safety of current and future generations
- the applicants and licensees establish adequate funds to pay for the decommissioning and termination of their licensed activities

Financial guarantees must be sufficient to cover the cost of decommissioning of nuclear facilities or termination of licensed activities authorized by the current licence.

The types of instruments for financial guarantees can vary. The applicants and the licensees should select an instrument that suits the scope and the timeframe of their decommissioning plan.

The requirements and guidance for decommissioning planning are provided in REGDOC-2.11.2, *Decommissioning* [1] and CSA standard N294-19, *Decommissioning of Facilities Containing Nuclear Substances* [2].

A graded approach may be applied by the CNSC when assessing the financial guarantees. The assessment could take into consideration the facility lifecycle stage, the type and complexity of the activity, and the level of detail provided in the decommissioning plan, which should be consistent with the magnitude of risk arising from the facility's decommissioning.

3. Acceptance Criteria for Financial Guarantees

The following are the CNSC's general expectations for criteria of liquidity, certainty of value, adequacy of value and continuity. An applicant or licensee may propose alternative approaches to meet the intent of the acceptance criteria for financial guarantees. In all cases the financial guarantees must be accepted by the Commission or, where a designated officer has issued a licence, by the designated officer.

3.1 Liquidity

The proposed financial guarantee must be such that the only requirement to draw upon the instrument is a formal request or demand by the Commission or a person authorized by the Commission, and such that payout for decommissioning purposes is not prevented, unduly delayed, or compromised for any reason. .

3.2 Certainty of value

Applicants or licensees must select funding or security instruments or arrangements which provide full assurance of their value.

3.3 Adequacy of value

The value of the financial guarantees for nuclear facilities must be linked to the cost estimate associated with the most up to date decommissioning plan for nuclear facilities or activities authorized under Class I, uranium mines and mills and waste nuclear substances licences.

Financial guarantees for other licensed activities, addressed in Part II of this document, must be linked to their licence for nuclear substances and radiation devices, prescribed equipment, and Class II facilities.

3.4 Continuity

The financial guarantees required for decommissioning and termination of licenced activities must be maintained on a continuing basis. This may require periodic renewals, revisions or replacements of securities provided or issued for fixed terms. In order to ensure continuity of coverage, financial guarantees must include provisions for advance notice to the CNSC of termination or the intent to not renew. See section 5 for additional information.

4. Acceptable Financial Guarantee Instruments

The following sections provide examples of acceptable financial guarantee instruments. In all cases the financial guarantee instruments must be accepted by the Commission or, where a designated officer has issued a licence, by the designated officer.

4.1 Cash funds

Cash funds include cash as well as other equivalent securities such as certified cheques, bearer bonds and guaranteed investment certificates.

These instruments can provide certainty and adequacy of value, ease of liquidity, and continuity. Such instruments provide maximum protection against the risk of default.

Any cash collateral or direct funding should be made into an account which is controlled by the federal government (either the CNSC or the Receiver General for Canada) or by a Canadian chartered bank listed in Schedule I or II of the *Bank Act*.

4.2 Investment funds

Investment funds are financial instruments that are publicly traded or can be easily liquidated if required.

Funds earmarked for financial guarantees purposes may be invested in an investment portfolio in order to earn interest income to help to cover the costs of decommissioning.

When investment funds are used, there are several economic estimates that must be made including the rate of inflation over time, and the estimated rate of return of the portfolio. Information on planned disbursements should be included in order for the CNSC to review the financial guarantee to ensure it is sufficient to cover costs of decommissioning.

4.3 Letters of credit

A letter of credit is an agreement between a licensee or applicant and a financial institution.

A letter of credit can provide for specific sums of money to be paid on demand to designated parties or their agents should a triggering event occur, such as a licensee defaulting on its obligation to decommission. Letters of credit can provide certainty of value, can be easily liquidated, and may be rewritten or revised as the required amount of security changes. Appendix A provides an example of a letter of credit.

Letters of credit should be issued by a Canadian chartered bank listed in Schedule I or II of the *Bank Act*.

4.4 Surety bonds

Surety bonds include bid bonds, performance bonds, labour and material payment bonds and maintenance bonds. Surety bonds are widely used in the construction industry.

Variations of these bond types may be appropriate as primary security, or to complement other instruments.

For example, under the terms of a performance bond agreement, a surety company could commit to responsibility for all claims and expenses for decommissioning up to a specified limit. Another form of financial guarantee will be required where the estimated cost of the decommissioning exceeds the value of the surety bond.

Surety bonds should name the CNSC as a beneficiary and the insurance or bonding agents should be Canadian companies subject to Canadian regulatory oversight.

4.5 Insurance

Insurance policies may be acceptable financial guarantee instruments provided the insurance policy is developed and accepted by the CNSC. Insurance policies should name the CNSC as a beneficiary, and the insurance agents should be Canadian companies subject to Canadian regulatory oversight.

4.6 Expressed commitments from Canadian government entities

Expressed commitments from a Canadian federal, provincial or territorial government, may be an acceptable financial guarantee instrument to cover all aspects of decommissioning a facility or site for which the government has assumed liability.

Expressed commitments from a Canadian provincial or territorial government are restricted to guarantees over which the federal government has rights of offset with respect to transfer payments as a method to enforce the guarantee if it becomes necessary.

Universities and hospitals may also use expressed commitments as a financial guarantee instrument. In such a case, universities and hospitals must maintain a letter of commitment acknowledging the responsibility and liability for the decommissioning of the site. The letter of commitment must be signed by a person of authority at the institution[1].

Institutions that operate research reactors, such as SLOWPOKE reactors, should maintain sufficient financial guarantees in a form other than expressed commitments to bring the facility to a safe state, including removal of fuel and radioactive and hazardous materials from the site. The remaining cost for completing the decommissioning of the facility may be covered by a letter of commitment acknowledging the responsibility and liability of decommissioning. The letter of commitment must be signed by a person of authority at the institution.

4.7 Other types of instruments

Other types of financial guarantee instruments may be considered by the Commission as part of the licensing or renewal process. In all cases, the financial guarantee instrument must satisfy the general acceptance criteria listed in section 3. Since parent company guarantees and pledges of assets do not satisfy the acceptance criteria listed in section 3, they are not considered acceptable financial guarantee instruments.

5. Administration of Financial Guarantees

Financial guarantees are administered by clearly defined and legally enforceable arrangements acceptable to the CNSC. These arrangements must be structured to ensure that the financial guarantee provided by the applicant or the licensee includes the terms outlined in the following subsections:

5.1 Access to funds upon demand

The CNSC must be assured that it can, upon demand, access or direct adequate funds if a licensee is not available to fulfill its obligations for decommissioning. The funds must be structured such that the instrument can be drawn upon only with the prior acceptance of the CNSC and that such pay-out is not prevented, delayed or compromised, and must be structured such that the instrument can provide full assurance of value.

In cases, such as for uranium mines in the province of Saskatchewan, where the province has a legislative framework in place, the financial guarantee may be payable to a provincial entity

[1] Examples of a person of authority include the president or chief financial officer of the organization.

which is qualified to conduct the decommissioning of the mine, if this arrangement is approved by the Commission.

5.2 The provincial entity is also responsible for the following institutional control program as legislated by the province. Separation of financial guarantee from licensee's other assets

The financial guarantee arrangements must be structured to ensure that the funds provided by the applicant or licensee to guarantee funding for an approved decommissioning plan are separated from its other assets. This might require the inclusion of terms restricting access to, or use of, monies realized from the funds.

Withdrawals from a fund, or access to monies realized from other security vehicles must only be permitted for approved purposes; in particular, to pay for approved decommissioning activities, or to refund excess monies to the licensee.

5.3 Maintenance on a continuous basis

Financial guarantee instruments must be automatically renewed and must include provisions for advance notice to the CNSC of termination or the intent to not renew.

Financial guarantee instruments should be open-ended, or, if written for a specified term, must be renewed automatically unless 30 days or more prior to the renewal date the issuer notifies the CNSC (as the beneficiary) and the licensee of any intention not to renew.

5.4 Replacement of financial guarantee

If the licensee fails to provide a replacement acceptable to the CNSC within 10 days after receipt of notification of cancellation, the terms of arrangement should further provide that the full face value of the instrument may automatically be paid into an account which is controlled by the federal government (either the CNSC or the Receiver General for Canada) or by a Canadian chartered bank listed in Schedule I or II of the *Bank Act* prior to expiration, without proof of forfeiture required. The value of the instrument must be payable, for purposes of funding decommissioning or termination of activities.

5.5 Signing officers

Applicants or licensees must provide, and continually update as required, a list of signing officers who have the requisite corporate or governmental authority to bind the corporation or the government as applicable.

6. Reporting requirements

Licensees are required to report annually on the status and the validity of their financial guarantee. Licensees must indicate if their financial guarantee remains valid, in effect and sufficient to meet decommissioning needs according to the current decommissioning plan associated with the cost estimate used to establish the amount of the financial guarantee [3] [4].

The expectations for reporting on financial guarantees are specified in the licence conditions handbook and in REGDOC 3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills* [3], and REGDOC 3.1.3, *Reporting Requirements for*

Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices [4].

Part I: Financial Guarantees for the Decommissioning of Nuclear Facilities and Activities

7. Introduction

7.1 Scope

Part I of this document provides information to applicants and licensees with regard to the CNSC's requirements and guidance for establishing financial guarantees for decommissioning of licensed facilities and activities for Class IA and IB licences issued in accordance with the *Class I Nuclear Facilities Regulations*, and uranium mine and mill licences, and waste nuclear substances licences.

7.2 Background

The *Nuclear Safety and Control Act* (NSCA) and associated regulations require applicants and licensees to make adequate provision for the safe operation and decommissioning of existing or proposed operations.

In addition, a licence may contain conditions requiring licensees to have acceptable decommissioning plans in place, and an acceptable financial guarantee that must remain valid, in effect and sufficient to meet decommissioning needs according to the most up-to-date decommissioning plan.

8. Planning for Decommissioning

Planning for the decommissioning of a facility or activity is an integral part of the lifecycle planning. The lifecycle stages of a facility include siting, construction (including design), operation and decommissioning. Planning for decommissioning is an ongoing process and should be considered at each lifecycle stage of the facility.

Requirements and guidance for decommissioning planning for CNSC-regulated activities and facilities are provided in REGDOC-2.11.2, *Decommissioning* [1], and CSA standard N294-19, *Decommissioning of facilities containing nuclear substances* [2]. Decommissioning plans can vary in complexity and detail in accordance with specific circumstances but must be sufficiently detailed to enable credible estimates of the amount of financial guarantees.

9. Cost Estimates for Decommissioning

The cost estimate for decommissioning should be based on the most up-to-date decommissioning plan and should reflect the assumed decommissioning strategy and end state of the facility or activity.

The decommissioning cost estimates may vary depending on the stage in the lifecycle. In the case of estimates undertaken at the conceptual design stage of a project, the purpose is to:

- enable designers and client organizations to establish overall project costs
- inform the long-term financing process to provide for future funds when a facility will be decommissioned

Later, when the decommissioning project planning has advanced as a facility or activity nears the end of its period of operation, the cost estimate forms part of the basis for the detailed decommissioning planning.

Various approaches to determine the level of cost estimate accuracy exist. Organizations such as the Association for Advancement of Cost Engineering (AACE International) have guidelines for estimating cost for different industries. Guidance establishing the cost estimate level of accuracy is provided in appendix B.

10. Requirements for Costs to Be Included

Cost estimates must include all decommissioning activities from operations, during shutdown to the final release from regulatory control. The cost estimate for decommissioning must address the cost of the following principal activities, if applicable:

- preparation for final shutdown
- facility shutdown activities
- additional activities for safe enclosure (if applicable)
- decontamination and dismantling activities
- waste processing and storage, including used fuel
- project management, engineering and site support
- site clean-up, landscaping and restoration (if required)
- long-term management, including disposal of radioactive waste and used fuel (if applicable)
- long-term monitoring and maintenance of the site and institutional control (if applicable)
- miscellaneous expenditures

The applicant or licensee must estimate the cost for all activities included in their decommissioning plan.

11. Cost Categories

Four cost categories should be defined for each principal activity:

- labour cost: payments to employees including social and health benefits
- investment cost: capital/equipment/material cost
- expenses: consumables, taxes, insurance, etc.
- contingencies: a specific provision for unforeseeable elements of cost within the defined project scope

The applicant or the licensee should reflect local construction rates for labour, and provide conservative estimates for materials, equipment and administrative expenses.

An example of standardized definitions for cost categories for all major activities is presented in appendix C.

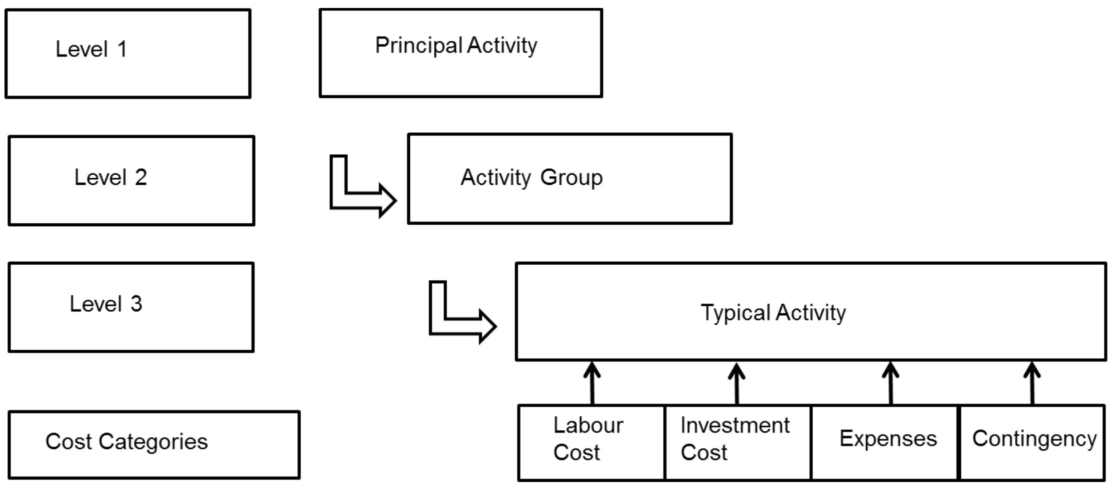
12. Presentation of Cost Estimate

When developing a decommissioning cost estimate, consideration should be given to the presentation of cost estimate. The method most widely used as a platform for presenting the cost estimation for establishing the funding for decommissioning is the work breakdown structure (WBS).

The WBS elements are arranged in a hierarchal format. The first level identifies the principal activities of the decommissioning project as listed in section 10 of this document. The second level presents the cost of activity groupings under which project costs would be gathered. The first and second levels are usually aggregations of the typical activities identified in the third level. The cost associated with each activity could be subdivided according to the four cost categories shown in figure 1.

An example of the hierarchal cost structure used by the International Structure for Decommissioning Costing (ISDC) is presented in figure 1 [5].

Figure 1: Hierarchal cost structure as per International Structure for Decommissioning Costing [5]



Subsequent levels to the cost structure could be added in order to distinguish costs related to specific parts of the facility or specific periods of decommissioning project. The ISDC summary of cost item hierarchy is presented in appendix D. The detailed itemization presented in the appendix provides general guidance on cost to be included in the estimate. The applicants and licensees should ensure that costs for all activities described in the decommissioning plan are reflected.

The approaches to cost estimation vary depending on the primary objective of the cost estimate, the facility lifecycle stage and the advancement of decommissioning planning. A brief description and comparison of those estimating methods is provided in table 1 in appendix E.

13. Elements of Cost Estimates

When developing a decommissioning cost estimate, the four basic elements to a cost estimate should be considered: basis of estimate, structure of estimate (work breakdown structure [WBS]), schedule and uncertainty analysis. These four elements are described in detail in the following sections.

13.1 Basis of estimate

The basis of estimate (BOE) is the foundation upon which the cost estimate is developed. A BOE should fully reflect the current decommissioning plan prepared in accordance with REGDOC-2.11.2, *Decommissioning* [1]. The BOE should be based on the following:

- assumptions and exclusions
- boundary conditions and limitations – legal and technical (e.g., regulatory framework)
- decommissioning strategy description
- end state of the facility
- stakeholder, public and indigenous input/concerns
- facility description and site characterization (radiological/hazardous material inventory)
- waste management (packaging, storage, transportation, and disposal)
- used fuel management (activities included in a decommissioning project)
- sources of data used (actual field data vs. estimating judgment)
- cost estimating methodology used (e.g., bottom-up)
- basis for determining contingency, estimating uncertainty and risk
- discussion of techniques and technology to be used
- schedule analysis
- uncertainty analysis

The cost estimate for decommissioning should provide that, if impacts of proposed operations are difficult or impossible to estimate with precision, a credible worst-case scenario must be used. The cost estimate should not assume drawdown of nuclear substances or hazardous waste during operations. A "decommissioning tomorrow approach" must be applied, assuming that the facility is shutting down overnight, and the cost estimate must be based on the state of the facility and inventories at the time of shutdown. A credit for salvage of materials or equipment is not allowed. For the purpose of the cost estimate, they must be considered as waste.

The cost estimate for decommissioning must cover the entire decommissioning project, including, as applicable, the need for post-closure licensing, monitoring, surveillance and maintenance, and institutional control.

13.2 Structure of estimate

The WBS is used to categorize cost elements and work activities into logical groupings that have a direct or indirect relationship to each other and to determine how they affect the overall cost of the project. To that end, the work scope cost elements are broken down into activity-dependent, period-dependent, and collateral costs as defined in the following paragraphs.

13.2.1 Activity-dependent costs

Activity-dependent costs are costs associated directly with performing decommissioning activities. Examples of such activities include decontamination; removal of equipment; demolition of buildings; and waste packaging, shipping and disposal. These activities lend themselves to the use of unit cost and work productivity factors (or work difficulty factors) applied against the facility, activity and structure's inventories to develop the decommissioning cost and schedule.

13.2.2 Period-dependent costs

Period-dependent costs include those activities associated primarily with the project duration: engineering, project management, dismantling management, licensing, health and safety, security, energy and quality assurance. These are primarily management staffing level costs, developed by estimating the manpower loading and associated overhead costs based on the scope of work to be accomplished during individual phases within each period of the project.

13.3 Collateral and special item costs

In addition to activity and period-dependent costs, there are costs for special items, such as for procurement of construction or dismantling equipment, site preparation, insurance, property taxes, health physics supplies, liquid radioactive waste processing and independent verification surveys. Such items do not fall in either of the other categories.

13.3.1 Contingency

Contingency is a work scope element of cost and it should be applied to the base cost to account for unforeseen elements of cost that are likely to occur. Because of the unique nature of this element of cost, the application of contingency is further described in section 13.5 of this document.

13.4 Schedule

The project schedule is an integral part of a cost estimate.

The preparation of a schedule is a well-developed process for which proven software programs are available.

The breakdown by project phase ties together all related activities in a chronological sequence to better define the work scope and schedule. The schedule's work breakdown structure should be the same as the cost estimate work breakdown structure.

Activity sequencing requires the determination and documentation of the relationship between activities. Work process flow charts should be used to structure the relationship between activities.

At the early stages of decommissioning planning and cost estimation, a less detailed schedule summarizing the principal activities may be provided, and a more detailed schedule should be provided later based on the detailed decommissioning planning.

13.5 Uncertainty analysis

The BOE should fully define the boundaries of the decommissioning project scope and set out the basis for estimating the base cost and the associated uncertainties.

Contingencies are defined as unforeseeable elements of cost **within** the defined project scope.

The base cost is first calculated on the basis of standard conditions where activities are performed within the defined project scope, without delays, interruptions, inclement weather, tool or equipment breakdown, labour strikes, waste shipment problems, disposal facility waste acceptance criteria changes, or changes in the anticipated shutdown conditions.

The following three approaches for applying contingency could be used:

- for the entire decommissioning project
- for groups of decommissioning activities
- for individual decommissioning activities

Applicants or licensees should add contingencies to the base cost as a specific provision for any unforeseeable elements of cost within the defined project scope that may occur. Applicants or licensees must provide a justification of the contingencies applied to the cost estimates and link them to the cost estimate category. Contingencies are an integral part of the cost estimate.

14. Development of the Financial Guarantee

Cost estimates are first prepared in current dollars assuming that the decommissioning will be executed at the time the cost is estimated. However, the time required to fully decommission can vary widely and has a significant impact on the calculation of the cost of decommissioning. Various factors must therefore be outlined in the estimate of the financial guarantee requirement:

Inflation rate: The forecasted percentage increase in the price of goods and services annually. The rate of inflation used should be from a reasonable and credible source, such as from the Bank of Canada. Applicants or licensees must factor in inflation to ensure that there are sufficient funds reserved even when price increases are factored in.

Discount rate (or expected rate of return on investment): In cases where the funds are invested, the expected rate of return that will be earned by the funds over time must be estimated. This expected rate of return should be supported by assumptions such as historical performance of the fund over time, the risk of the portfolio etc.

Another element that is important when performing this calculation is an estimate of when various elements of the work will be performed. Disbursements or planned spending must be factored in.

Starting with current value of the money, then applying the inflation rate and the discount rate, results in the net present value of funds required to be invested today, to ensure there are sufficient funds available for decommissioning in the future.

14.1 Constant dollars

Liabilities for decommissioning activities are reported in the present value of the underlying obligation, thereby expressing estimates in constant dollars to reflect changes in underlying funding obligations over time.

14.2 Cash flow and planned disbursements

A schedule of cash flow and planned disbursements for decommissioning must also be submitted in order to calculate the net present value of decommissioning requirements

14.3 Net present value

The net present value presents the current dollar value of estimated future cash expenditures. It depends on the timing of decommissioning activities and expected expenditure profile.

In order to determine how much money is required today to pay for future liability, economic assumptions with respect to inflation and interest rate must be considered. Applicants and licensees must indicate the inflation rate and interest or discount rate used in calculations and justify the validity of the selected rates and assumptions.

As stated above, many decommissioning activities take place over a number of years, so it is important to ensure there are sufficient funds available today to cover costs that will be incurred years into the future.

15. Review of Financial Guarantees

Applicants or licensees must ensure that the financial guarantee remains valid, in effect and sufficient to meet decommissioning needs according to the most up-to-date decommissioning plan. Therefore, licensees must revise their financial guarantee at a minimum every five years or earlier when requested by the Commission. Applicants or licensees may request a review of their financial guarantees by the CNSC at any time.

Applicants or licensees must submit the updated financial guarantee for review by CNSC staff and acceptance by the Commission.

Part II: Financial Guarantees for Termination of Licensed Activities

16. Introduction

16.1 Scope

Part II of this document applies to holders of nuclear substances and radiation devices, prescribed equipment, and Class II facilities licensees. These licensees must ensure that they are financially responsible for the termination of the activities authorized by their licence. The CNSC has developed an insurance-based financial guarantee program to ensure that the Crown is not held financially responsible in the situation where a licensee has failed to properly terminate licensed activities.

17. Financial Guarantee Program

Under the insurance-based program, the CNSC is the insured party and the beneficiary. Licensees that participate in this program contribute to the cost of the insurance policy, in proportion to their liability. Liability is calculated on the basis of a formula that prescribes an estimated liability for each unit of prescribed equipment and sealed source as well as a room or laboratory where open source material is used.

Additional information on financial guarantees for nuclear substances and radiation devices and prescribed equipment and Class II facilities can be found on the CNSC website.

18. Alternatives to Financial Guarantee Program

The financial guarantee program is flexible in situations where a licensee's activities do not meet the prescribed formula. In these situations a licensee has the option to propose its own financial guarantee for review and acceptance by the Commission following the established principles of section 3 and 4 of this document.

19. Review of Financial Guarantees

Financial guarantees for licences are assessed annually by the CNSC staff or when required by the Commission, to ensure that coverage is sufficient for the licensed activities.

Appendix A: Example of Letter of Credit

The following provides an example of letter of credit[2]. This template may be used by licence applicants or licensees when submitting a letter of credit to the CNSC.

1. The undersigned, hereinafter called the Guarantor , irrevocably guarantees to pay to the Beneficiary, an amount not exceeding xxx Canadian dollars including interest, costs and accessories, upon receipt of a written demand by the Beneficiary certifying that the Applicant has failed to fulfil its obligations with respect to decommissioning resulting from, or under the *Nuclear Safety and Control Act*, its regulations, or licence no. xxx.

2. This Guarantee is effective from its issuance and must terminate and automatically expire on the expiry date.

3. Upon expiry of this Guarantee, by payment in favour of the Beneficiary or by lapse of time, the Beneficiary must return to the Guarantor the original of the Guarantee, bearing clear mention of its cancellation.

4. This Guarantee must be deemed to be automatically extended without amendment for a further one (1) year period from the present or any future expiration date hereof, unless at least thirty (30) days prior to the present or any future expiration date, the bank notifies you, the Beneficiary, in writing by courier or registered mail, that the bank elect not to consider this Guarantee to be renewable for any additional period. If the Applicant fails to provide a replacement financial guarantee acceptable to the Beneficiary within ten (10) days after receipt of the said notification, the full face value of this Guarantee, less any partial drawings made hereunder, must be paid to the Beneficiary, or to a trustee acceptable to the Beneficiary, prior to the expiration date, with no proof of forfeiture required.

5. Partial draws by the Beneficiary are permitted hereunder. The amount of the partial draw shall be paid by the Guarantor to the Beneficiary, and the full face value of this Guarantee (i.e.: the Guarantor’s maximum liability under this Guarantee) shall be automatically reduced by the amount of any partial drawings made hereunder.

6. Any demand for payment must be signed by a person authorized to act on the behalf of the Beneficiary

7. The Guarantor will honour the demand of the Beneficiary without enquiring whether the Beneficiary has the right as between itself and the Applicant to make such demand and without acknowledging any claim of the Applicant.

8. The Guarantor’s liability under this Guarantee must in no event exceed the sum mentioned in paragraph 1 herein, and such liability must terminate if a demand for payment made strictly in accordance with the requirements of these presents has not been received at the above branch no later than on the expiry date.

9. This Guarantee is not assignable.

[2] Note: This is an example only and not the form of any specific financial institution. In any specific case additional or varied clauses may be used or required.

10. This Guarantee is governed by the laws of xxx, and the Courts of that province must have exclusive jurisdiction on all matters relating to this Guarantee and all recourses resulting therefrom.

11. This Guarantee sets forth in its entirety all of the obligations of the Guarantor and these obligations cannot be modified, interpreted or increased by any document or agreement mentioned herein, and any reference to any such document or agreement must not be construed as incorporating same to this Guarantee.

Appendix B: Cost Estimate Grades and Classification

A universally accepted standard for developing decommissioning cost estimates has not been established. However, organizations such as the Association for the Advancement of Cost Engineering (AACE International) have developed guidelines for estimation cost for different industries.

General

AACE International and the Construction Industry Institute have established guidelines and procedures for estimating costs. These guidelines rank cost estimates as Grades A, B, or C, depending on their level of accuracy.

Grade C (accuracy of ±25% to 30%)

Grade C cost estimates are known as order-of-magnitude cost estimates. They are performed quickly by using shortcut techniques such as

a) escalating and/or scaling up from previous estimates
b) cost curves
c) preliminary process design and equipment sizing without plot plans or major equipment quotations

It is likely that the overall scope of the project has not been defined.

Grade B (accuracy of ±15% to 20%)

Grade B cost estimates are known as budgetary cost estimates. They can be developed when the scope of the project has been defined but the detailed planning has not been performed. For large projects, they can be developed as soon as the preliminary process flow diagrams, preliminary plot plans, and equipment sizing have been completed. On smaller projects, estimates are developed when approximately 10% of the engineering is completed.

Grade A (accuracy of ±10%)

Grade A cost estimates are known as definitive cost estimates. They can be developed when the scope of the project is well defined and the detailed planning is prepared. For large projects, a Grade A estimate are prepared when the engineering flow diagrams, facility plans, and equipment lists are completed, and design has progressed to the stage required for the bidding process. For small projects, more engineering detail is necessary, and 30% to 50% of the engineering might be required to be completed.

Cost estimate classes

AACE International describes a classification system for cost estimates in the process industry (see table 1). In general, the accuracy of the cost estimate increases as the level of project definition increases. Decommissioning cost estimates prepared for the PDP are typically prepared as Class 4 study-type cost estimates. For additional information refer to the AACE International's *Required Skills and Knowledge of Cost Engineering* [6].

Table 1: AACE International cost estimate classification for process industries [6]

Estimate class	Level of definition, % of complete definition	End usage (typical purpose of estimate)	Methodology (typical estimating method)	Expected accuracy (typical variation in low and high ranges), %	Preparation effort (typical degree of effort relative to lowest cost index of 1)
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	Low: -20% to -50% High: +30% to +100%	1
Class 4	1% to 15%	Study of feasibility	Equipment factored or parametric models	Low: -15% to -30% High: +20% to +50%	2-4
Class 3	10% to 40%	Budget, authorization of control	Semi-detailed unit costs with assembly level line items	Low: -10% to -20% High: +10% to +30%	3-10
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	Low: -5% to -15% High: +5% to +20%	4-20
Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	Low: -3% to -10% High: +3% to +15%	5-100

Appendix C: Standardized Definitions for Cost Categories

This appendix provides information on standardised definitions for cost categories for all major activities. These definitions have been developed by the International Structure for Decommissioning Costing (ISDC) [5].

For each cost item, four cost categories have been defined:

1. labour costs
2. investment costs (capital, equipment and material costs)
3. expenses
4. contingency

1. Labour costs

Labour costs are defined as costs calculated on the basis of the workload for a particular cost item and the labour cost unit rate, including:

- salaries
- contributions to social security and health insurance
- company contributions to pension scheme and fringe benefits
- overheads

2. Investment costs (capital, equipment and material costs)

Investment costs are defined as costs for:

- equipment
- machinery

3. Expenses

Expenses are defined as costs for consumer items or expendable items, or as costs for other expenditures related to decommissioning cost items where applicable, such as:

- consumables
- spare parts
- protective clothing
- travel expenses
- legal expenses
- taxes
- value added tax
- insurance
- consultants costs
- quality assurance costs
- rents
- office material
- heating costs
- water costs

- electricity costs
- computer costs
- telephone/fax costs
- cleaning
- interest
- public relation
- licences/patents
- decommissioning authorisation
- income from asset recovery ("negative expenses")

4. Contingency

Contingency, added to individual cost items of the standardised listing, is a specific provision for unforeseeable elements of costs within the defined project scope. Any impacts on cost outside of the scope of the decommissioning project are not considered.

Appendix D: International Structure for Decommissioning Costing Cost Item Hierarchy

This appendix provides information from the International Structure for Decommissioning Costing (ISDC) [5]. The ISDC was developed as a presentation platform for standardized listing of costs within the scope of decommissioning planning. Note that cost estimation for decommissioning of nuclear facilities can vary widely in format, content and practice.

ISDC Summary of cost item hierarchy

Principle activity 01: Pre-decommissioning actions

- 01.0100 Decommissioning planning
  - 01.0101 *Strategic planning*
  - 01.0102 *Preliminary planning*
  - 01.0103 *Final planning*
- 01.0200 Facility characterisation
  - 01.0201 *Detailed facility characterisation.*
  - 01.0202 *Hazardous-material surveys and analyses*
  - 01.0203 *Establishing a facility inventory database*
- 01.0300 Safety, security and environmental studies
  - 01.0301 *Decommissioning safety analysis*
  - 01.0302 *Environmental impact assessment*
  - 01.0303 *Safety, security and emergency planning for site operations*
- 01.0400 Waste management planning
  - 01.0401 *Establish waste management criteria*
  - 01.0402 *Develop a waste management plan*
- 01.0500 Authorisation
  - 01.0501 *License applications and license approvals*
  - 01.0502 *Stakeholder involvement*
- 01.0600 Preparing management group and contracting
  - 01.0601 *Management team activities*
  - 01.0602 *Contracting activities*

Principle activity 02: Facility shutdown activities

- 02.0100 Plant shutdown and inspection
  - 02.0101 *Termination of operation, plant stabilisation, isolation and inspection*
  - 02.0102 *Defueling and transfer of fuel to spent-fuel storage*
  - 02.0103 *Cooling down of spent fuel*
  - 02.0104 *Management of fuel, fissile and other nuclear materials*
  - 02.0105 *Isolation of power equipment*
  - 02.0106 *Facility reuse*
- 02.0200 Drainage and drying of systems
  - 02.0201 *Drainage and drying of closed systems not in operation*
  - 02.0202 *Drainage of spent-fuel pool and other open systems not in operation*
  - 02.0203 *Removal of sludge and products from open systems*
  - 02.0204 *Drainage of special process fluids*
- 02.0300 Decontamination of closed systems for dose reduction
  - 02.0301 *Decontamination of process installations using operational procedures*
  - 02.0302 *Decontamination of process installations using additional procedures*

02.0400 Radiological inventory characterisation to support detailed planning
- 02.0401 *Radiological inventory characterisation*
- 02.0402 *Underground water monitoring*

02.0500 Removal of system fluids, operational waste and redundant material
- 02.0501 *Removal of combustible material*
- 02.0502 *Removal of system fluids (water, oils, etc.)*
- 02.0503 *Removal of special system fluids*
- 02.0504 *Removal of waste from decontamination*
- 02.0505 *Removal of spent resins*
- 02.0506 *Removal of specific operational waste from fuel cycle facilities*
- 02.0507 *Removal of other waste from facility operations*
- 02.0508 *Removal of redundant equipment and materials*

Principle activity 03: Additional activities for safe enclosure

03.0100 Preparation for safe enclosure
- 03.0101 *Decontamination of selected components and areas to facilitate safe enclosure*
- 03.0102 *Zoning for long-term storage*
- 03.0103 *Removal of inventory not suitable for safe enclosure*
- 03.0104 *Dismantling and transfer of contaminated equipment and material to containment structure for long-term storage*
- 03.0105 *Radiological inventory characterisation for safe enclosure*

03.0200 Site boundary reconfiguration, isolating and securing structures
- 03.0201 *Modification of auxiliary systems*
- 03.0202 *Site boundary reconfiguration*
- 03.0203 *Construction of temporary enclosures, stores, structural enhancements, etc.*
- 03.0204 *Stabilisation of radioactive and hazardous waste pending remediation*
- 03.0205 *Facility controlled area hardening, isolation for safe enclosure*

03.0300 Facility entombment
- 03.0301 *Facility entombment as end state of decommissioning strategy*
- 03.0302 *Institutional control and monitoring of the entombment end state*

Principle activity 04: Dismantling activities within the controlled area

04.0100 Procurement of equipment for decontamination and dismantling
- 04.0101 *Procurement of general site-dismantling equipment*
- 04.0102 *Procurement of equipment for decontamination of personnel and tools*
- 04.0103 *Procurement of special tools for dismantling the reactor systems*
- 04.0104 *Procurement of special tools for dismantling in fuel cycle facilities*
- 04.0105 *Procurement of special tools for dismantling other components or structures*

04.0200 Preparations and support for dismantling
- 04.0201 *Reconfiguration of existing services, facilities and site to support dismantling*
- 04.0202 Pr*eparation of infrastructure and logistics for dismantling*
- 04.0203 *Ongoing radiological characterisation during dismantling*

04.0300 Pre-dismantling decontamination
- 04.0301 *Drainage of remaining systems*
- 04.0302 *Removal of sludge and products from remaining systems*
- 04.0303 *Decontamination of remaining systems*
- 04.0304 *Decontamination of areas in buildings*

04.0400 Removal of materials requiring specific procedures
- 04.0401 *Removal of thermal insulation*
- 04.0402 *Removal of asbestos*
- 04.0403 *Removal of other hazardous materials*

04.0500 Dismantling of main process systems, structures and components
- 04.0501 *Dismantling of reactor internals*
- 04.0502 *Dismantling of reactor vessel and core components*
- 04.0503 *Dismantling of other primary loop components*
- 04.0504 *Dismantling of main process systems in fuel cycle facilities*
- 04.0505 *Dismantling of main process systems in other nuclear facilities*
- 04.0506 *Dismantling of external thermal/biological shields*

04.0600 Dismantling of other systems and components
- 04.0601 *Dismantling of auxiliary systems*
- 04.0602 *Dismantling of remaining components*

04.0700 Removal of contamination from building structures
- 04.0701 *Removal of embedded elements in buildings*
- 04.0702 *Removal of contaminated structures*
- 04.0703 *Decontamination of buildings*

04.0800 Removal of contamination from areas outside buildings
- 04.0801 *Removal of underground contaminated pipes and structures*
- 04.0802 *Removal of contaminated soil and other contaminated items*

04.0900 Final radioactivity survey for release of buildings
- 04.0901 *Final radioactivity survey of buildings*
- 04.0902 *Declassification of buildings*

Principle activity 05: Waste processing, storage and disposal

05.0100 Waste management system
- 05.0101 *Establishing the waste management system*
- 05.0102 *Reconstruction of existing facilities for decommissioning waste management system*
- 05.0103 *Procurement of additional equipment for management of historical/legacy waste*
- 05.0104 *Maintenance, surveillance and operational support for waste management system*
- 05.0105 *Demobilisation/decommissioning of waste management system*

05.0200 Management of historical/legacy high-level waste
- 05.0201 *Characterisation*
- 05.0202 *Retrieval and processing*
- 05.0203 *Final conditioning*
- 05.0204 *Storage*
- 05.0205 *Transport*
- 05.0206 *Disposal*
- 05.0207 *Containers*

05.0300 Management of historical/legacy intermediate-level waste
- 05.0301 *Characterisation*
- 05.0302 *Retrieval and processing*
- 05.0303 *Final conditioning*
- 05.0304 *Storage*
- 05.0305 *Transport*
- 05.0306 *Disposal*
- 05.0307 *Containers*

05.0400 Management of historical/legacy low-level waste
- 05.0401 *Characterisation*
- 05.0402 *Retrieval and treatment*
- 05.0403 *Final conditioning*
- 05.0404 *Storage*
- 05.0405 *Transport*
- 05.0406 *Disposal*
- 05.0407 *Containers*

05.0500 Management of historical/legacy very low-level waste
- 05.0501 *Characterisation*
- 05.0502 *Retrieval, treatment and packaging*
- 05.0503 *Transport*
- 05.0504 *Disposal*

05.0600 Management of historical/legacy exempt waste and materials
- 05.0601 *Retrieval, treatment and packaging*
- 05.0602 *Clearance measurement of exempt waste and materials*
- 05.0603 *Transport of hazardous waste*
- 05.0604 *Disposal of hazardous waste at dedicated waste dumps*
- 05.0605 *Transport of conventional waste and materials*
- 05.0606 *Disposal of conventional waste at conventional waste dumps*

05.0700 Management of decommissioning high-level waste
- 05.0701 *Characterisation*
- 05.0702 *Processing*
- 05.0703 *Final conditioning*
- 05.0704 *Storage*
- 05.0705 *Transport*
- 05.0706 *Disposal*
- 05.0707 *Containers*

05.0800 Management of decommissioning intermediate-level waste
- 05.0801 *Characterisation*
- 05.0802 *Processing*
- 05.0803 *Final conditioning*
- 05.0804 *Storage*
- 05.0805 *Transport*
- 05.0806 *Disposal*
- 05.0807 *Containers*

05.0900 Management of decommissioning low-level waste
- 05.0901 *Characterisation*
- 05.0902 *Processing*
- 05.0903 *Final conditioning*
- 05.0904 *Storage*
- 05.0905 *Transport*
- 05.0906 *Disposal*
- 05.0907 *Containers*

05.1000 Management of decommissioning very low-level waste
- 05.1001 *Characterisation*
- 05.1002 *Treatment and packaging*
- 05.1003 *Transport*
- 05.1004 *Disposal*

05.1100 Management of decommissioning very short-lived waste
05.1101 *Characterisation*
05.1102 *Treatment, storage, handling and packaging*
05.1103 *Final management of decommissioning very short-lived waste*
05.1200 Management of decommissioning exempt waste and materials
05.1201 *Treatment and packaging*
05.1202 *Clearance measurement of exempt waste and materials*
05.1203 *Transport of hazardous waste*
05.1204 *Disposal of hazardous waste at dedicated waste dumps*
05.1205 *Transport of conventional waste and materials*
05.1206 *Disposal of conventional waste at conventional waste dumps*
05.1300 Management of decommissioning waste and materials generated outside controlled areas
05.1301 *Recycling of concrete*
05.1302 *Treatment and packaging of hazardous waste*
05.1303 *Treatment and recycling of other materials.*
05.1304 *Transport of hazardous waste*
05.1305 *Disposal of hazardous waste at dedicated waste dumps*
05.1306 *Transport of conventional waste and materials*
05.1307 *Disposal of conventional waste at conventional waste dumps*

Principle activity 06: Site infrastructure and operation

06.0100 Site security and surveillance
06.0101 *Procurement of general security equipment*
06.0102 *Operation and maintenance of automated access control systems, monitoring systems and alarms*
06.0103 *Security fencing and protection of remaining entrances against trespassing*
06.0104 *Deployment of guards/security forces*
06.0200 Site operation and maintenance
06.0201 *Inspection and maintenance of buildings and systems*
06.0202 *Site upkeep activities*
06.0300 Operation of support systems
06.0301 *Electricity supply systems*
06.0302 *Ventilation systems*
06.0303 *Heating, steam and lighting systems*
06.0304 *Water supply systems*
06.0305 *Sewage/waste water systems*
06.0306 *Compressed air/nitrogen systems*
06.0307 *Other systems*
06.0400 Radiation and environmental safety monitoring
06.0401 *Procurement and maintenance of equipment for radiation protection and environmental monitoring.*
06.0402 *Radiation protection and monitoring.*
06.0403 *Environmental protection and radiation environmental monitoring*

Principle activity 07: Conventional dismantling, demolition and site restoration

07.0100 Procurement of equipment for conventional dismantling and demolition
07.0101 *Procurement of equipment for conventional dismantling and demolition*

07.0200 Dismantling of systems and building components outside the controlled area
07.0201 *Electricity generating system*
07.0202 *Cooling system components*
07.0203 *Other auxiliary systems*
07.0300 Demolition of buildings and structures
07.0301 *Demolition of buildings and structures from the formerly controlled area*
07.0302 *Demolition of buildings and structures outside the controlled area*
07.0303 *Dismantling of the stack*
07.0400 Final cleanup, landscaping and refurbishment
07.0401 *Earthworks, landworks*
07.0402 *Landscaping and other site finishing activities*
07.0403 *Refurbishment of buildings*
07.0500 Final radioactivity survey of site
07.0501 *Final survey*
07.0502 *Independent verification of the final survey*
07.0600 Perpetuity funding/surveillance for limited or restricted release of property
07.0601 *Routine maintenance*
07.0602 *Surveillance and monitoring*

Principle activity 08: Project management, engineering and support

08.0100 Mobilisation and preparatory work
08.0101 *Mobilisation of personnel*
08.0102 *Establishment of general supporting infrastructure for decommissioning project*
08.0200 Project management
08.0201 *Core management group*
08.0202 *Project implementation planning, detailed ongoing planning*
08.0203 *Scheduling and cost control*
08.0204 *Safety and environmental analysis, ongoing studies*
08.0205 *Quality assurance and quality surveillance*
08.0206 *General administration and accounting*
08.0207 *Public relations and stakeholders involvement*
08.0300 Support services
08.0301 *Engineering support*
08.0302 *Information system and computer support*
08.0303 *Waste management support*
08.0304 *Decommissioning support including chemistry, decontamination*
08.0305 *Personnel management and training*
08.0306 *Documentation and records control*
08.0307 *Procurement, warehousing, and materials handling*
08.0308 *Housing, office equipment, support services*
08.0400 Health and safety
08.0401 *Health physics*
08.0402 *Industrial safety*
08.0500 Demobilisation
08.0501 *Demobilisation of project infrastructure for decommissioning*
08.0502 *Demobilisation of personnel*
08.0600 Mobilisation and preparatory work by contractors (if needed)
08.0601 *Mobilisation of personnel*
08.0602 *Establishment of general supporting infrastructure for decommissioning project*

08.0700 Project management by contractors (if needed)
08.0701 *Core management group*
08.0702 *Project implementation planning, detailed ongoing planning*
08.0703 *Scheduling and cost control*
08.0704 *Safety and environmental analysis, ongoing studies*
08.0705 *Quality assurance and quality surveillance*
08.0706 *General administration and accounting*
08.0707 *Public relations and stakeholder involvement*
08.0800 Support services by contractors (if needed)
08.0801 *Engineering support*
08.0802 *Information system and computer support*
08.0803 *Waste management support*
08.0804 *Decommissioning support including chemistry, decontamination.*
08.0805 *Personnel management and training*
08.0806 *Documentation and records control*
08.0807 *Procurement, warehousing, and materials handling*
08.0808 *Housing, office equipment, support services*
08.0900 Health and safety by contractors (if needed)
08.0901 *Health physics*
08.0902 *Industrial safety*
08.1000 Demobilisation by contractors (if needed)
08.1001 *Demobilisation of project infrastructure for decommissioning.*
08.1002 *Demobilisation of personnel*

Principle activity 09: Research and development
09.0100 Research and development of equipment, techniques and procedures
09.0101 *Equipment, techniques and procedures for characterisation*
09.0102 Equipment, techniques and procedures for decontamination
09.0103 *Equipment, techniques and procedures for dismantling*
09.0104 *Equipment, techniques and procedures for waste management*
09.0105 *Other research and development activities*
09.0200 Simulation of complicated works
09.0201 *Physical mock-ups and training*
09.0202 *Test or demonstration programmes*
09.0203 *Computer simulations, visualisations and 3D modelling*
09.0204 *Other activities*

Principle activity 10: Fuel and nuclear material
10.0100 Removal of fuel or nuclear material from facility to be decommissioned
10.0101 *Transfer of fuel or nuclear material to external storage or to treatment facilities*
10.0102 *Transfer of fuel or nuclear material to dedicated buffer storage*
10.0200 Dedicated buffer storage for fuel and/or nuclear material
10.0201 *Construction of buffer storage*
10.0202 *Operation of buffer storage*
10.0203 *Transfer of fuel and/or nuclear material away from the buffer storage*
10.0300 Decommissioning of buffer storage
10.0301 *Decommissioning of buffer storage*
10.0302 *Management of waste*

Principle activity 11: Miscellaneous expenditures

- 11.0100 Owner costs
  - 11.0101 *Implementation of transition plans*
  - 11.0102 *External projects to be performed as a consequence of decommissioning*
  - 11.0103 *Payments (fees) to authorities*
  - 11.0104 *Specific external services and payments*
- 11.0200 Taxes
  - 11.0201 *Value added taxes*
  - 11.0202 *Local, community, federal taxes*
  - 11.0203 *Environmental taxes*
  - 11.0204 *Taxes on industrial activities*
  - 11.0205 *Other taxes*
- 11.0300 Insurances
  - 11.0301 *Nuclear related insurances*
  - 11.0302 *Other insurances*

Appendix E: Approaches to Cost Estimation

The Nuclear Energy Agency document *The Practice of Cost Estimation for Decommissioning of Nuclear Facilities* provides a comparative overview of the cost estimation methods and their advantages and disadvantages [7]. It is summarized in the following table.

Table 1: Estimating method comparison [8]

Estimating Method	Description	Advantages	Disadvantages
Bottom-up	In this building blocks technique, a work statement and set of drawings or specifications are used to extract material quantities required for executing each discrete task performed in accomplishing a given activity. From these quantities, direct labour, equipment and overhead costs can be derived.	Most accurate as it accounts for site-specific radiological and physical inventory. Relies on unit cost factors (UCFs).	Requires detailed description of inventory and site specific labour, material and equipment costs for the UCFs.
Specific analogy	Specific analogies depend upon the known cost of an item used in prior estimates as the basis for the cost of a similar item in a new estimate. Adjustments are made to known costs to account for differences in relative complexities of performance, design and operational characteristics.	Accurate if prior estimates are appropriately adjusted for size differences, inflation and regional differences in labour materials and equipment.	Adjustments as noted may require detailed documentation and introduce approximations that reduce accuracy.
Parametric	Parametric estimating requires historical databases on similar systems or subsystems. Statistical analysis is performed on the data to find correlations between cost drivers and other system parameters, such as design or performance. The analysis produces cost equations or cost estimating relationships that may be used individually or grouped into more complex models.	Suitable for use for large sites where detailed inventory is not readily available. Suited for Order of Magnitude estimates.	Approximations based on areas or volumes introduce additional inaccuracies. There is no way to track actual inventory. Not suited for project planning of work activities.

Estimating Method	Description	Advantages	Disadvantages
Cost review and update	An estimate may be constructed by examining previous estimates of the same or similar projects for internal logic, completeness of scope, assumptions and estimating methodology.	Suitable for large sites where detailed inventory is not available. Suited for update of previous estimates, or order of magnitude estimates.	There is no way to track actual inventory. Generally not suited for project planning of work activities.
Expert opinion	An expert opinion technique may be used when other techniques or data are not available. Several specialists may be consulted iteratively until a consensus cost estimate is established.	An expert opinion technique may be used when other techniques or data are not available. Several specialists may be consulted iteratively until a consensus cost estimate is established.	Expert opinion may not be specific to the work activities. May not reflect the radiological limitations of the decommissioning project.

Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

References

1. CNSC, REGDOC-2.11.2, *Decommissioning*. Ottawa, TBD.

2. CSA Group, N294, *Decommissioning of Facilities Containing Nuclear Substances*. Toronto, 2019.

3. CNSC, REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*. Ottawa, 2018.

4. REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices*. Ottawa, 2020.

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6. AACE International, *Skills and knowledge of cost engineering*, 6th edition. USA, 2015.

7. Nuclear Energy Agency (NEA) Organization for Economic Co-Operation and Development (OECD), *The Practice of Cost Estimation for Decommissioning of Nuclear Facilities*. France, 2015.

Additional Information

The following documents provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- CNSC, REGDOC-3.1.1, *Reporting Requirements: Reporting Requirements for Nuclear Power Plants*, version 2. Ottawa, 2016.

CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

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2.11 Waste management
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L'organisme de réglementation nucléaire du Canada

Garanties financières

Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées

REGDOC-3.3.1

Mai 2020

ÉBAUCHE

Commission canadienne de sûreté nucléaire
Canadian Nuclear Safety Commission

Canada

Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées
Document d'application de la réglementation REGDOC-3.3.1

N[o] de cat. XXXXX
ISBN XXXXX

Also available in English under the title: Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

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Historique de publication
[Mois Année]   Version X.0

Préface

Ce document d'application de la réglementation fait partie de la série de documents d'application de la réglementation de la CCSN intitulée Garanties financières. La liste complète des séries figure à la fin de ce document et elle peut être consultée à partir du site Web de la CCSN.

Le REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées*, énonce les exigences et l'orientation à l'intention des demandeurs et des titulaires de permis concernant l'établissement et le maintien de financement pour le déclassement des installations et la cessation des activités autorisées par la Commission canadienne de sûreté nucléaire.

Le REGDOC-3.3.1 fournit de l'information sur les garanties financières utilisées pour s'assurer que le titulaire de permis disposera de fonds suffisants pour déclasser un emplacement autorisé et pour éliminer toutes les substances nucléaires connexes. Le document se veut un élément du fondement d'autorisation d'une installation ou d'une activité réglementée visée par le présent document. Il sera intégré soit aux conditions et aux mesures de sûreté et de réglementation d'un permis, soit aux mesures de sûreté et de réglementation devant être décrites dans la demande de permis et les documents soumis à l'appui de cette demande.

Le REGDOC-3.3.1 remplace le document G-206, *Les garanties financières pour le déclassement des activités autorisées*, publié en juin 2000. Pour en savoir plus sur la mise en œuvre des documents d'application de la réglementation qui font partie du fondement d'autorisation et sur l'approche graduelle, consultez le REGDOC-3.5.3, *Principes fondamentaux de réglementation*.

Le terme « doit » est employé pour exprimer une exigence à laquelle le titulaire ou le demandeur de permis doit se conformer; le terme « devrait » dénote une orientation ou une mesure conseillée; le terme « pourrait » exprime une option ou une mesure conseillée ou acceptable dans les limites de ce document d'application de la réglementation; et le terme « peut » exprime une possibilité ou une capacité.

Aucune information contenue dans le présent document ne doit être interprétée comme libérant le titulaire de permis de toute autre exigence pertinente. Le titulaire de permis a la responsabilité de prendre connaissance de tous les règlements et de toutes les conditions de permis applicables et d'y adhérer.

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Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées

1. Introduction

1.1 Objet

Les garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées sont mises en œuvre conformément à la *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et aux règlements pris en vertu de la LSRN.

Les demandeurs et les titulaires de permis doivent prendre les mesures adéquates pour le déclassement sécuritaire d'installations nucléaires existantes ou nouvelles proposées en s'assurant que les ressources financières disponibles suffisent à financer l'ensemble des activités de déclassement approuvées au cas où le titulaire ne serait pas en mesure de s'acquitter de ses obligations. Sur le plan opérationnel, la Commission peut également exiger que les ressources financières soient disponibles pour mettre fin aux activités autorisées autres que le déclassement des installations nucléaires.

Le présent document énonce les exigences et l'orientation à l'intention des demandeurs et des titulaires de permis concernant l'établissement et le maintien d'un financement pour le déclassement des installations et la cessation des activités autorisées par la Commission canadienne de sûreté nucléaire (CCSN).

1.2 Portée

Le présent document contient des renseignements à l'intention de ceux et celles qui ont contracté, ou prévoient contracter, des obligations relatives au déclassement d'installations nucléaires ou à la cessation d'activités autorisées par la CCSN.

La partie I du présent document porte sur les garanties financières pour le déclassement des installations ou des activités nucléaires visées par des permis de catégorie IA et IB délivrés en vertu du *Règlement sur les installations nucléaires de catégorie I*, des permis de mines et usines de concentration d'uranium et des permis de déchets de substances nucléaires.

La partie II du présent document porte sur les garanties financières pour la cessation des activités autorisées, comme celles visant les substances nucléaires et les appareils à rayonnement, l'équipement réglementé et les installations de catégorie II.

1.3 Législation pertinente

Les dispositions de la *Loi sur la sûreté et la réglementation nucléaires* et des règlements connexes qui s'appliquent au présent document sont les suivantes :

- *Loi sur la sûreté et la réglementation nucléaires*, paragraphe 24(5)
- *Règlement général sur la sûreté et la réglementation nucléaires*, alinéa 3(1)l)
- *Règlement général sur la sûreté et la réglementation nucléaires*, sous-alinéas 29(1)j)(i) à 29(1)j)(x)
- *Règlement général sur la sûreté et la réglementation nucléaires*, paragraphe 29(2)

2. Contexte

La CCSN a pour mandat de réglementer l'utilisation de l'énergie et des matières nucléaires afin de préserver la sûreté, la santé et la sécurité, de protéger l'environnement, de respecter les engagements internationaux du Canada à l'égard de l'utilisation pacifique de l'énergie nucléaire, et d'informer objectivement le public sur les plans scientifique ou technique ou en ce qui concerne la réglementation du domaine de l'énergie nucléaire.

La CCSN définit le déclassement comme les mesures administratives et techniques prises pour lever certains ou l'ensemble des contrôles réglementaires visant une installation ou un site où l'on gère, possède ou stocke des substances nucléaires. Ces mesures englobent les procédures, les processus et les activités opérationnelles conduisant à la levée du contrôle réglementaire pour l'installation ou le site, avec ou sans restrictions quant à son utilisation future (p. ex. décontamination ou démantèlement des structures, systèmes et composants).

Les garanties financières représentent la volonté concrète du demandeur ou du titulaire de permis de faire en sorte que des ressources financières suffisantes soient disponibles pour cesser les activités autorisées en toute sûreté. Une garantie financière ne dispense pas les demandeurs ou les titulaires de permis de se conformer aux exigences réglementaires relatives au déclassement des installations nucléaires ou à la cessation des activités autorisées – la garantie financière garantit que la CCSN dispose de fonds lorsque les demandeurs ou les titulaires de permis ne sont pas en mesure de procéder au déclassement sûr ou à la cessation sûre des activités.

Ces obligations financières visent à assurer que :

- des fonds sont disponibles pour prendre des mesures adéquates afin d'assurer la santé et la sécurité des générations actuelles et futures
- les demandeurs et les titulaires de permis établissent des fonds suffisants pour payer le déclassement et la cessation de leurs activités autorisées

Les garanties financières doivent être suffisantes pour couvrir le coût du déclassement des installations nucléaires ou de la cessation des activités autorisées par le permis actuel.

Les types d'instruments de garantie financière peuvent varier. Les demandeurs et les titulaires de permis devraient choisir un instrument qui convient à la portée et au calendrier de leur plan de déclassement.

Les exigences et l'orientation relatives à la planification du déclassement sont énoncées dans le REGDOC-2.11.2, *Déclassement* [1], et la norme N294-19 du Groupe CSA, *Déclassement des installations contenant des substances nucléaires* [2].

Une approche graduelle peut être appliquée par la CCSN au moment d'évaluer les garanties financières. L'évaluation pourrait prendre en compte l'étape du cycle de vie de l'installation, le type et la complexité de l'activité, et le niveau de détail fourni dans le plan de déclassement, lequel devrait correspondre à l'ampleur du risque associé au déclassement de l'installation.

3. Critères d'acceptation des garanties financières

Voici les attentes générales de la CCSN relativement aux critères généraux de liquidité, de valeur garantie, de valeur adéquate et de continuité. Le demandeur ou le titulaire de permis peut proposer des méthodes de rechange en vue de respecter l'intention des critères d'acceptation pour les garanties financières. Dans tous les cas, les garanties financières doivent être acceptées par la Commission ou, lorsqu'un fonctionnaire désigné a délivré un permis, par le fonctionnaire désigné.

3.1 Liquidité

La garantie financière proposée doit faire en sorte que la seule exigence pour avoir accès à l'instrument est une demande officielle de la Commission ou d'une personne autorisée par la Commission, et que les paiements faits à des fins de déclassement ne puissent être empêchés, indûment retardés ou compromis pour quelque raison que ce soit.

3.2 Valeur garantie

Les demandeurs ou les titulaires de permis doivent choisir des moyens de financement, des instruments ou des arrangements financiers dont la valeur est entièrement assurée.

3.3 Valeur adéquate

La valeur des garanties financières doit être liée à l'estimé des coûts associée au plan de déclassement le plus récent pour les installations ou les activités nucléaires autorisées aux termes des permis de catégorie I, de mines et d'usines de concentration d'uranium et de déchets de substances nucléaires.

Les garanties financières pour les autres activités autorisées, abordées à la Partie II du présent document, doivent être liées à leur permis pour les substances nucléaires, l'équipement réglementé ou les installations de catégorie II.

3.4 Continuité

Les garanties financières requises pour le déclassement et la cessation des activités autorisées doivent être maintenues en permanence, ce qui pourrait exiger le renouvellement, la révision ou le remplacement périodique des titres financiers fournis ou à échéance fixe. Afin d'assurer la continuité de la couverture, les garanties financières doivent comprendre des dispositions permettant de donner un préavis de résiliation à la CCSN ou de faire connaître l'intention de ne pas renouveler. Voir la section 5 pour de plus amples renseignements.

4. Instruments de garantie financière acceptables

Les sections suivantes donnent des exemples d'instruments de garantie financière acceptables. Dans tous les cas, ces instruments doivent être acceptés par la Commission ou, lorsqu'un fonctionnaire désigné a délivré un permis, par le fonctionnaire désigné.

4.1 Fonds en espèces

Les fonds en espèces comprennent les espèces proprement dites, de même que les titres équivalents, comme les chèques certifiés, les obligations au porteur et les certificats de placement garanti.

Ces instruments offrent la possibilité de garantir la valeur et la suffisance des fonds, présentent une bonne liquidité et assurent la continuité. Ces instruments offrent une protection maximale contre le risque de défaut.

Toute garantie en espèces ou tout financement direct doit être versé dans un compte contrôlé par le gouvernement fédéral (la CCSN ou le receveur général du Canada) ou par une banque à charte canadienne figurant aux annexes I ou II de la *Loi sur les banques*.

4.2 Fonds de placement

Les fonds de placement sont des instruments financiers qui sont cotés en bourse ou qui peuvent être facilement liquidés au besoin.

Les fonds pourraient être investis dans un portefeuille de placements afin d'obtenir un revenu d'intérêt pour aider à couvrir les coûts du déclassement.

Si l'on utilise des fonds de placement, plusieurs paramètres économiques doivent être estimés, y compris le taux d'inflation au fil du temps, le taux de rendement estimatif du portefeuille et l'information sur les dépenses prévues, afin que la CCSN puisse examiner la garantie financière pour s'assurer qu'elle est suffisante pour couvrir les coûts du déclassement.

4.3 Lettres de crédit

Les lettres de crédit sont des ententes entre les demandeurs ou les titulaires de permis et une institution financière.

Une lettre de crédit peut prévoir le versement de sommes d'argent précises sur demande à des parties désignées ou à leurs mandataires en cas d'événement déclencheur, comme le défaut d'un titulaire de permis de respecter ses obligations de déclassement. La lettre de crédit permet de garantir la valeur des fonds, présente une bonne liquidité et peut être reformulée ou révisée lorsque le montant de la garantie change. Plusieurs titulaires de permis l'ont utilisée comme mécanisme de garantie financière. Un exemple de lettre de crédit figure à l'annexe A.

Les lettres de crédit doivent être émises par une banque à charte canadienne figurant à l'annexe I ou II de la *Loi sur les banques*.

4.4 Cautionnements

Les cautionnements comprennent les cautionnements de soumission, les cautionnements d'exécution, les cautionnements de paiement de la main-d'œuvre et des matériaux et les cautionnements d'entretien. Les cautionnements sont largement utilisés dans l'industrie de la construction.

Des variantes de ces types de cautionnements pourraient être appropriées à titre de garantie principale ou pour compléter d'autres instruments.

Par exemple, aux termes d'une convention de cautionnement d'exécution, une société de cautionnement pourrait s'engager à assumer la responsabilité de toutes les demandes de règlement et de tous les frais de déclassement, jusqu'à concurrence d'une limite déterminée. Une autre forme de garantie financière sera exigée si le coût estimatif du déclassement dépasse la valeur du cautionnement.

Le cautionnement doit désigner la CCSN comme bénéficiaire et les agents d'assurance ou de cautionnement doivent être des sociétés canadiennes assujetties aux organismes de réglementation canadiens.

4.5 Assurances

Les polices d'assurance peuvent être des instruments de garantie financière acceptables à condition qu'une police d'assurance soit élaborée et acceptée par la CCSN. Les polices d'assurance doivent désigner la CCSN comme bénéficiaire, et les agents d'assurance doivent être des sociétés canadiennes assujetties aux organismes de réglementation canadiens.

4.6 Engagements exprimés par des entités gouvernementales

Les engagements exprimés par un gouvernement fédéral, provincial ou territorial du Canada pourraient constituer un instrument de garantie financière acceptable pour couvrir tous les aspects du déclassement d'une installation ou d'un site pour lequel le gouvernement a assumé la responsabilité.

Les engagements exprimés par un gouvernement provincial ou territorial du Canada se limitent aux garanties sur lesquelles le gouvernement fédéral a des droits de compensation à l'égard des paiements de transfert comme moyen d'appliquer la garantie, le cas échéant.

Les universités et les hôpitaux peuvent également utiliser des engagements exprimés comme instrument de garantie financière. Dans de tels cas, les universités et les hôpitaux doivent maintenir une lettre d'engagement reconnaissant la responsabilité et l'obligation de déclasser leurs sites. La lettre d'engagement doit être signée par une personne autorisée de l'établissement[1].

Les établissements qui exploitent des réacteurs de recherche, comme les réacteurs SLOWPOKE, doivent maintenir une garantie financière suffisante sous une forme autre qu'un engagement exprimé pour placer l'installation dans un état sûr, y compris l'enlèvement du combustible et des matières radioactives et dangereuses du site. Le reste des coûts de déclassement de l'installation pourrait être couvert par une lettre d'engagement reconnaissant la responsabilité et l'obligation de déclassement. La lettre d'engagement doit être signée par une personne autorisée de l'établissement.

4.7 Autres types d'instruments

La Commission pourrait envisager d'autres types d'instruments de garantie financière dans le cadre du processus d'autorisation ou de renouvellement. Dans tous les cas, l'instrument de garantie financière doit satisfaire aux critères d'acceptation énumérés à la section 3. Étant donné que les garanties et les mises en gage d'actifs des sociétés mères ne satisfont pas aux critères d'acceptation énumérés à la section 3, ils ne sont pas considérés comme des instruments de garantie financière acceptables.

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1 Le président ou dirigeant principal des finances de l'organisation sont des exemples de personnes autorisées.

5. Administration des garanties financières

Les garanties financières sont administrées au moyen d'arrangements clairement définis et ayant force exécutoire que la CCSN juge acceptables. Ces arrangements doivent être structurés de telle sorte que la garantie financière fournie par le demandeur ou le titulaire de permis comporte les modalités énoncées dans les sous-sections qui suivent.

5.1 Accès aux fonds sur demande

La CCSN doit avoir la garantie qu'elle peut, sur demande, accéder aux fonds requis, ou transférer les fonds en question, si un titulaire de permis est incapable de s'acquitter de ses obligations en matière de déclassement. Les fonds doivent être structurés de manière à ce que l'instrument ne puisse être utilisé qu'avec l'approbation préalable de la CCSN et qu'un tel paiement ne soit pas empêché, retardé ou compromis, et ils doivent également être structurés de manière à ce que l'instrument puisse fournir une assurance complète de la valeur.

Dans les cas où la province a en place un cadre législatif, comme pour les mines d'uranium de la province de Saskatchewan, la garantie financière peut être payable à l'entité provinciale compétente pour réaliser le déclassement de la mine après acceptation de cet arrangement par la Commission.

L'entité provinciale est également responsable du programme de contrôle institutionnel qui s'ensuit, tel qu'imposé par la loi de la province.

5.2 Séparation de la garantie financière et des autres éléments d'actif du titulaire de permis

Ces dispositions doivent être structurées de manière à garantir que les fonds fournis par le demandeur ou le titulaire de permis pour garantir le financement d'un plan de déclassement approuvé soient séparés de ses autres actifs. Cela pourrait nécessiter l'inclusion de modalités restreignant l'accès aux sommes générées à partir du fonds, ou l'utilisation de ces sommes.

Les retraits d'un fonds ou l'accès à des fonds provenant d'autres instruments de garantie ne doivent être autorisés qu'à des fins approuvées, en particulier pour payer les activités de déclassement approuvées ou pour rembourser au titulaire de permis les sommes excédentaires.

5.3 Maintien sur une base continue

Les instruments de garantie financière doivent être renouvelés automatiquement et comprendre des dispositions permettant de donner un préavis de résiliation à la CCSN ou de faire connaître l'intention de ne pas les renouveler.

Les instruments de garantie financière devraient être laissés ouverts. Si l'échéance est spécifiée, elle doit être automatiquement renouvelée sauf si, au moins 30 jours avant la date de renouvellement, l'émetteur informe la CCSN (bénéficiaire) et le titulaire de permis de toute intention de ne pas la renouveler.

5.4 Remplacement de la garantie financière

Si le titulaire de permis omet de fournir un remplacement acceptable pour la CCSN dans les 10 jours suivant la réception de l'avis d'annulation, les modalités de l'entente devraient prévoir que la pleine valeur nominale de l'instrument pourrait être automatiquement versée dans un compte contrôlé par le gouvernement fédéral (la CCSN ou le Receveur général du Canada) ou par une banque canadienne figurant aux annexes I ou II de la *Loi sur les banques*, et ce, avant son expiration, sans avoir à fournir de preuve de déchéance. La valeur de l'instrument est payable aux fins du financement du déclassement ou de la cessation des activités.

5.5 Signataires autorisés

Les demandeurs ou les titulaires de permis doivent fournir et mettre à jour continuellement, au besoin, une liste des signataires autorisés qui ont le pouvoir de lier la société ou le gouvernement, selon le cas.

6. Exigences en matière de rapports

Les titulaires de permis sont tenus de présenter un rapport annuel sur l'état et la validité de leur garantie financière. Les titulaires de permis doivent indiquer si leur garantie financière demeure valide, en vigueur et suffisante pour répondre aux besoins de déclassement selon le plan de déclassement actuel associé à l'estimation des coûts utilisée pour établir le montant de la garantie financière [3] [4].

Les attentes en matière de rapports sur les garanties financières sont précisées dans le manuel des conditions de permis et les documents REGDOC-3.1.2, *Exigences relatives à la production de rapports, tome I : Installations nucléaires de catégorie I non productrices de puissance et mines et usines de concentration d'uranium* [3], et REGDOC-3.1.3, *Exigences relatives à la production de rapports pour les pour les titulaires de permis de déchets de substances nucléaires, les installations nucléaires de catégorie II et les utilisateurs d'équipement réglementé, de substances nucléaires et d'appareils à rayonnement* [4].

Partie I : Garanties financières pour le déclassement des installations et activités nucléaires

7. Introduction

7.1 Portée

La partie I du présent document fournit des renseignements aux demandeurs et aux titulaires de permis sur les exigences et l'orientation de la CCSN concernant l'établissement de garanties financières pour le déclassement des installations et des activités visées par des permis de catégorie IA et IB délivrés en vertu du *Règlement sur les installations nucléaires de catégorie I*, des permis de mines et d'usines de concentration d'uranium et des permis de déchets de substances nucléaires.

7.2 Contexte

La *Loi sur la sûreté et la réglementation nucléaires* (LSRN) et ses règlements d'application exigent que les demandeurs et les titulaires de permis prennent les mesures voulues pour assurer l'exploitation et le déclassement sûrs des activités existantes ou proposées.

En outre, un permis peut prévoir des conditions selon lesquelles les titulaires de permis doivent avoir en place des plans de déclassement acceptables et une garantie financière acceptable qui doit demeurer valide, en vigueur et suffisante pour répondre aux besoins de déclassement selon le plan de déclassement le plus récent.

8. Planification du déclassement

La planification du déclassement d'une installation ou d'une activité fait partie intégrante de la planification du cycle de vie. Les étapes du cycle de vie d'une installation comprennent le choix de l'emplacement, la construction (notamment la conception), l'exploitation et le déclassement. La planification du déclassement est un processus continu qui devrait être envisagé à chaque étape du cycle de vie de l'installation.

Les exigences et l'orientation relatives à la planification du déclassement des activités et des installations réglementées par la CCSN sont énoncées dans le REGDOC-2.11.2, *Déclassement* [1], et la norme du Groupe CSA N294-19, *Déclassement des installations contenant des substances nucléaires* [2]. Les plans de déclassement peuvent varier en complexité et en détail selon les circonstances, mais ils doivent être suffisamment détaillés pour permettre des estimations crédibles du montant des garanties financières.

9. Estimations des coûts de déclassement

L'estimation des coûts de déclassement devrait être fondée sur le plan de déclassement le plus récent et tenir compte de la stratégie de déclassement et de l'état final présumés de l'installation ou de l'activité.

Les estimations des coûts de déclassement pourraient varier selon l'étape du cycle de vie. Dans le cas d'estimations effectuées à l'étape de la conception d'un projet, l'objectif est le suivant :

- permettre aux concepteurs et aux organisations clientes d'établir les coûts globaux du projet;
- éclairer le processus de financement à long terme afin de prévoir les fonds futurs lorsqu'une installation sera déclassée.

Plus tard, lorsque la planification du projet de déclassement parvient à une étape plus avancée, alors que l'installation ou l'activité approche la fin de sa période d'exploitation, l'estimation des coûts devient partie intégrante du fondement de la planification détaillée du déclassement.

Il existe différentes approches pour déterminer le niveau de précision de l'estimation des coûts. Des organisations comme l'Association for Advancement of Cost Engineering (AACE International) se sont dotées de lignes directrices relatives à l'estimation des coûts pour différentes industries [6]. L'orientation sur l'établissement de la catégorie d'estimation des coûts figure à l'annexe B.

10. Exigences relatives aux coûts à inclure

Les estimations des coûts doivent comprendre toutes les activités de déclassement pendant l'exploitation, la période d'arrêt et jusqu'à la libération définitive du contrôle réglementaire. L'estimation des coûts de déclassement doit couvrir le coût des activités principales suivantes, le cas échéant :

- la préparation en vue de l'arrêt définitif
- les activités d'arrêt de l'installation
- les activités supplémentaires pour assurer le confinement sûr (le cas échéant)
- les activités de décontamination et de démantèlement
- le traitement et le stockage des déchets, y compris le combustible usé
- la gestion de projet, l'ingénierie et le soutien sur le site
- l'assainissement, l'aménagement paysager et la remise en état du site (au besoin)
- la gestion à long terme, y compris le stockage définitif, des déchets radioactifs et du combustible usé (le cas échéant)
- la surveillance et l'entretien à long terme du site et le contrôle institutionnel (le cas échéant)
- les dépenses diverses

Le demandeur ou le titulaire de permis doit estimer le coût de toutes les activités comprises dans son plan de déclassement.

11. Catégories de coûts

Quatre catégories de coûts devraient être définies pour chaque activité principale :

- le coût de la main-d'œuvre : paiements aux employés, y compris les avantages sociaux et de santé
- le coût des investissements : coût d'immobilisation, d'équipement et de matériel
- les dépenses : consommables, taxes, assurances, etc.
- les imprévus : disposition particulière pour les éléments de coût imprévisibles dans le cadre de la portée définie du projet

Le demandeur ou le titulaire de permis devrait tenir compte des tarifs de construction locaux pour la main-d'œuvre et fournir des estimations prudentes pour les matériaux, l'équipement et les frais administratifs.

Un exemple de définitions normalisées des catégories de coûts pour toutes les principales activités figure à l'annexe C.

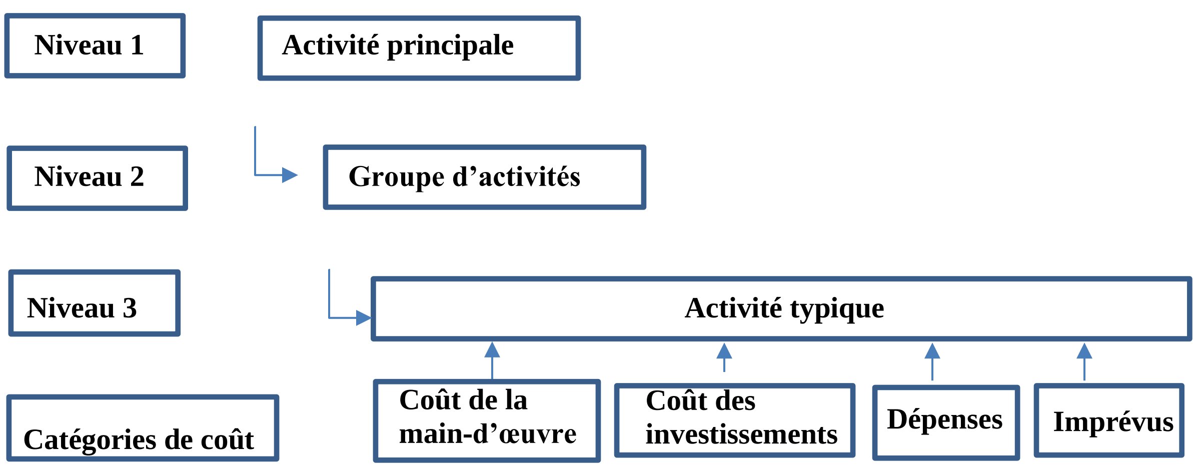
12. Présentation de l'estimation des coûts

Lors de l'élaboration d'une estimation des coûts de déclassement, on devrait tenir compte de la présentation de l'estimation des coûts. La méthode la plus largement utilisée pour la présentation de l'estimation des coûts en vue de financer le déclassement est la structure de répartition du travail (SRT).

Les éléments de la SRT sont organisés selon un format hiérarchique. Le premier niveau de la SRT établit les principales activités du projet de déclassement énumérées à la section 10. Le deuxième niveau présente le coût des groupes d'activités du projet. Le premier et le deuxième niveau sont habituellement des regroupements des activités typiques identifiées au troisième niveau. Les coûts associés à chaque activité pourraient être subdivisés selon les quatre catégories de coûts décrites à la figure 1.

La figure 1 présente un exemple de la structure hiérarchique des coûts utilisée par l'International Structure for Decommissioning Costing – ISDC (structure internationale d'établissement des coûts de déclassement) [5].

Figure 1 : Structure hiérarchique des coûts selon l'International Structure for Decommissioning Costing [5]



Des niveaux subséquents à la structure de coûts pourraient être ajoutés afin de distinguer les coûts liés à des parties particulières de l'installation ou à des périodes particulières du projet de déclassement. Le sommaire de la hiérarchie des éléments de coûts de l'ISDC est présenté à l'annexe D. La ventilation présentée dans cette annexe donne des indications générales sur les coûts à inclure dans l'estimation. Les demandeurs et les titulaires de permis devraient s'assurer que les coûts de toutes les activités décrites dans le plan de déclassement sont pris en compte.

Les méthodes d'estimation des coûts varient selon l'objectif principal de l'estimation des coûts, l'étape du cycle de vie de l'installation et l'avancement de la planification du déclassement. Le tableau 1 de l'annexe E présente une brève description et une comparaison de ces méthodes d'estimation.

13. Éléments d'une estimation des coûts

Lors de l'élaboration d'une estimation des coûts de déclassement, on devrait tenir compte des quatre éléments de base d'une estimation des coûts : le fondement de l'estimation, la structure de l'estimation (SRT), le calendrier et l'analyse des incertitudes. Ces quatre éléments sont décrits en détail dans les sections suivantes.

13.1 Fondement de l'estimation

Le fondement de l'estimation (FdE) est la base sur laquelle l'estimation des coûts est fondée. Un FdE devrait refléter pleinement le plan de déclassement préparé conformément au REGDOC-2.11.2 [1]. Le FdE devrait reposer sur les éléments suivants :

- des hypothèses et exclusions
- des conditions limites et contraintes – juridiques et techniques (p. ex. cadre de réglementation)
- une description de la stratégie de déclassement
- l'état final de l'installation
- des commentaires et préoccupations des parties intéressées, du public et des Autochtones
- une description de l'installation et caractérisation du site (inventaire des matières radiologiques et dangereuses)
- la gestion des déchets (emballage, stockage, transport et évacuation)
- la gestion du combustible usé (activités incluses dans un projet de déclassement)
- les sources de données utilisées (données réelles obtenues sur le terrain par rapport au jugement d'estimation)
- la méthode d'estimation des coûts utilisée (telle que la méthode ascendante)
- un fondement de la détermination des imprévus, et de l'estimation des incertitudes et du risque
- une description des techniques et de la technologie qui seront utilisées
- une analyse des calendriers
- une analyse des incertitudes

L'estimation des coûts de déclassement doit tenir compte du pire scénario crédible, s'il est difficile ou impossible d'estimer avec précision les impacts des opérations proposées. L'estimation des coûts ne devrait pas partir du principe que les substances nucléaires ou les déchets dangereux seront retirés du site pendant l'exploitation. Une « approche de déclassement demain » doit être adoptée, en supposant que l'installation ferme du jour au lendemain, et l'estimation des coûts doit être fondée sur l'état de l'installation et les inventaires au moment de la fermeture. Il n'est pas permis de prévoir un crédit pour la récupération des matériaux ou de l'équipement. Aux fins de l'estimation des coûts, ils doivent être considérés comme des déchets.

L’estimation des coûts de déclassement doit couvrir l’ensemble du projet de déclassement, y compris, le cas échéant, l’obtention d’un permis post-fermeture, les activités de suivi, de surveillance et d’entretien, ainsi que le contrôle institutionnel.

13.2 Structure de l’estimation

La SRT sert à catégoriser les éléments de coût et les activités de travail en groupes logiques qui ont une relation directe ou indirecte les uns avec les autres et à déterminer comment elles influent sur le coût global du projet. À cette fin, les éléments de coût pour l’étendue du projet sont répartis en coûts dépendants de l’activité, en coûts dépendants de la période et en coûts collatéraux, qui sont expliqués dans les paragraphes suivants.

13.2.1 Coûts dépendants de l’activité

Les coûts dépendants de l’activité sont les coûts directement liés à l’exécution des activités de déclassement. La décontamination, le retrait de l’équipement, la démolition de bâtiments, ainsi que l’emballage, l’expédition et l’évacuation des déchets sont des exemples de ces activités. Ces activités se prêtent à l’utilisation de facteurs de coût unitaire et de productivité du travail (ou facteurs de difficulté au travail) appliqués aux inventaires de l’installation, de l’activité et de la structure pour établir le coût et le calendrier du déclassement.

13.2.2 Coûts dépendants de la période

Les coûts dépendants de la période comprennent les activités associées principalement à la durée du projet, à savoir : ingénierie, gestion de projet, gestion du démantèlement, autorisation, santé et sécurité, sûreté, énergie et assurance de la qualité. Il s’agit principalement des coûts de dotation en personnel de gestion, établis en estimant la charge de main-d’œuvre et les frais généraux connexes en fonction de l’étendue des travaux à accomplir au cours des différentes phases de chacune des périodes du projet.

13.3 Coûts collatéraux et des éléments spéciaux

Outre les coûts liés à l’activité et à la période, il faut prévoir des coûts pour des éléments spéciaux, tels que l’achat de matériel de construction ou de démantèlement, la préparation du site, les assurances, les impôts fonciers, les fournitures de radioprotection, le traitement des déchets radioactifs liquides et les enquêtes indépendantes de vérification. Ces éléments n’entrent dans aucune des deux autres catégories.

13.3.1 Imprévus

Les imprévus constituent un élément de coût couvrant l’étendue des travaux et devraient être appliqués au coût de base pour tenir compte des éléments de coût imprévus qui sont susceptibles de survenir. En raison de la nature unique de cet élément de coût, l’application de la disposition pour imprévus est décrite plus en détail à la section 13.5 du présent document.

13.4 Calendrier

Le calendrier du projet fait partie intégrante de l’estimation des coûts.

La préparation d’un calendrier est un processus bien développé pour lequel des logiciels éprouvés sont disponibles.

La ventilation par phase du projet relie toutes les activités connexes dans un ordre chronologique afin de mieux définir la portée et le calendrier des travaux. La SRT établie pour le calendrier devrait être identique à la SRT établie pour l'estimation des coûts.

L'enchaînement des activités exige la détermination et la documentation de la relation entre les activités. On devrait utiliser les organigrammes des flux de travaux pour structurer les relations entre les activités.

Aux premières étapes de la planification du déclassement et de l'estimation des coûts, un calendrier moins détaillé résumant les principales activités peut être fourni. Un calendrier plus détaillé devrait être fourni plus tard en fonction de la planification détaillée du déclassement.

13.5 Analyse des incertitudes

Le FdE devrait définir entièrement les limites de la portée du projet de déclassement et établir le fondement pour estimer le coût de base et les incertitudes connexes.

Les imprévus sont définis comme des éléments de coût imprévisibles **qui relèvent** de la portée définie du projet.

Le coût de base est d'abord calculé selon des conditions standard, soit lorsque les activités sont exécutées dans le cadre du projet défini, sans retard, interruptions, intempéries, défaillances d'outils ou d'équipement, grèves de personnel, problèmes de transfert des déchets, changements aux critères d'acceptation des déchets des installations d'élimination ou changements aux conditions de fermeture prévues.

Les trois approches suivantes pour l'application de mesures en cas d'imprévus pourraient être utilisées :

- approche couvrant l'ensemble du projet de déclassement
- approche couvrant les groupes d'activités de déclassement
- approche couvrant des activités de déclassement individuelles

Les demandeurs ou les titulaires de permis devraient ajouter au coût de base les imprévus à titre de disposition particulière pour tout élément de coût imprévisible dans le cadre de la portée définie du projet qui peut survenir. Les demandeurs ou les titulaires de permis doivent justifier les imprévus appliqués aux estimations de coûts et les relier à la catégorie d'estimation des coûts. Les imprévus font partie intégrante de l'estimation des coûts.

14. Élaboration de la garantie financière

On prépare d'abord les estimations des coûts en dollars courants, avec l'hypothèse que le déclassement sera exécuté au moment de l'estimation des coûts. Toutefois, le temps requis pour le déclassement complet peut varier considérablement et a une incidence importante sur le calcul du coût du déclassement. Différents facteurs doivent donc être pris en compte dans l'estimation de la garantie financière exigée.

Taux d'inflation : le pourcentage prévu d'augmentation annuelle du prix des biens et services. Le taux d'inflation utilisé devrait provenir d'une source raisonnable et crédible, comme la Banque du Canada. Les demandeurs ou les titulaires de permis doivent tenir compte de l'inflation pour s'assurer qu'il y a suffisamment de fonds réservés, même en tenant compte des augmentations de prix.

Taux d'actualisation (ou taux de rendement prévu du capital investi) : dans les cas où les fonds sont investis, leur taux de rendement prévu au fil du temps doit être estimé. Ce taux de rendement prévu doit être étayé par des hypothèses telles que le rendement historique du fonds par le passé, le risque du portefeuille, etc.

Un autre élément important pour effectuer ce calcul est l'estimation du moment où les divers éléments du travail seront effectués. Les prélèvements ou la planification des dépenses doivent être pris en compte et décrits dans les calculs fournis à la CCSN afin d'assurer des fonds suffisants à long terme.

En tenant compte de la valeur actuelle de l'argent, en appliquant le taux d'inflation et le taux d'actualisation, on obtient la valeur actualisée nette des fonds qui doivent être investis aujourd'hui, afin de s'assurer qu'il y aura suffisamment de fonds disponibles pour le déclassement dans l'avenir.

14.1 Dollars constants

Les responsabilités relatives aux activités de déclassement sont présentées en valeur actuelle de l'obligation sous-jacente, ce qui permet d'exprimer les estimations en dollars constants pour tenir compte de l'évolution des obligations de financement sous-jacentes au fil du temps.

14.2 Flux de trésorerie et décaissements prévus

Un calendrier des flux de trésorerie et des décaissements prévus pour le déclassement doit également être soumis pour examen afin que l'on puisse calculer la valeur actualisée nette des besoins de déclassement.

14.3 Valeur actualisée nette

La valeur actualisée nette présente les estimations actualisées en fonction du calendrier des dépenses, d'après les prévisions économiques. Elle dépend du calendrier des activités de déclassement et du profil des dépenses prévues.

Afin de déterminer combien d'argent est nécessaire aujourd'hui pour payer leur responsabilité future, il faut tenir compte des hypothèses économiques relatives à l'inflation et au taux d'intérêt. Les demandeurs et les titulaires de permis doivent indiquer le taux d'inflation et le taux d'intérêt ou d'actualisation utilisés dans les calculs et justifier la validité de ces taux et des hypothèses formulées.

Comme il est indiqué ci-dessus, de nombreuses activités de déclassement s'échelonnent sur plusieurs années. Il est donc important de veiller à ce que des fonds suffisants soient disponibles aujourd'hui pour couvrir les coûts qui seront engagés plus tard.

15. Examen des garanties financières

Les demandeurs ou les titulaires de permis doivent s'assurer que la garantie financière demeure valide, en vigueur et suffisante pour répondre aux besoins de déclassement selon le plan de déclassement le plus récent. Par conséquent, les titulaires de permis doivent réviser leur garantie financière au moins tous les cinq ans ou plus tôt si la Commission le leur demande. Les demandeurs ou les titulaires de permis peuvent demander en tout temps à la CCSN d'examiner leurs garanties financières.

Les demandeurs ou les titulaires de permis doivent soumettre la garantie financière actualisée au personnel de la CCSN pour examen et acceptation par la Commission.

Partie II : Garanties financières pour la cessation des activités autorisées

16. Introduction

16.1 Portée

La partie II du présent document s'applique aux titulaires de permis de substances nucléaires et d'appareils à rayonnement, d'équipement réglementé et d'installations de catégorie II. Ces titulaires de permis doivent s'assurer qu'ils sont financièrement responsables de la cessation des activités autorisées par leur permis. La CCSN a élaboré un programme de garantie financière fondé sur des assurances afin que l'État ne soit pas tenu responsable financièrement dans les cas où un titulaire de permis n'a pas cessé de façon appropriée ses activités autorisées.

17. Programme de garantie financière

En vertu d'un programme fondé sur l'assurance, la CCSN est la partie assurée et les bénéficiaires (titulaires de permis) qui participent à ce programme contribuent au coût de la police, proportionnellement à leur responsabilité. La responsabilité est calculée selon une formule qui prescrit une responsabilité estimative pour chaque source scellée et unité d'équipement réglementé et pour les locaux ou les laboratoires où des matières contenant des sources ouvertes sont utilisées.

Des renseignements supplémentaires sur les garanties financières pour les substances nucléaires et les appareils à rayonnement, ainsi que pour l'équipement réglementé et les installations de catégorie II se trouvent sur le site Web de la CCSN.

18. Solutions de rechange au programme de garantie financière

Le programme de garantie financière est souple dans les situations où les activités d'un titulaire de permis ne respectent pas la formule prescrite. Dans ces situations, le titulaire de permis a la possibilité de présenter sa propre garantie financière acceptable pour la Commission, conformément aux principes énoncés aux sections 3 et 4 du présent document.

19. Examen des garanties financières

Les garanties financières pour les permis sont évaluées chaque année par la CCSN ou à la demande de la Commission afin de s'assurer que la couverture est suffisante pour les activités autorisées.

Annexe A Exemple de lettre de crédit

Voici un exemple de lettre de crédit[2]. Les demandeurs ou les titulaires de permis peuvent utiliser ce modèle lorsqu'ils soumettent une lettre de crédit à la CCSN.

1. Le soussigné, ci-après le Garant, garantit irrévocablement le versement au Bénéficiaire d'une somme n'excédant pas xxx dollars canadiens, y compris les intérêts, les coûts et les frais accessoires, à la réception d'une demande écrite du Bénéficiaire attestant que le Demandeur a manqué à ses obligations en matière de déclassement découlant de la *Loi sur la sûreté et la réglementation nucléaires*, de ses règlements d'application ou du permis n° xxx.

2. La présente garantie entre en vigueur dès son émission et prend fin et vient à échéance automatiquement au plus tard à sa date d'expiration.

3. À l'échéance de la présente garantie, à la suite du paiement au Bénéficiaire ou par absence d'opposition, le Bénéficiaire doit retourner au Garant le document original de garantie portant une mention claire de son annulation.

4. La présente garantie est réputée être automatiquement prolongée sans modification pour une autre période d'un (1) an à compter de la présente date d'expiration ou toute date d'expiration future, sauf si au moins trente (30) jours avant la présente date d'expiration ou toute date d'expiration future nous vous avisons, le Bénéficiaire, par écrit, par messagerie ou courrier recommandé, que nous avons choisi de ne pas considérer cette garantie comme étant renouvelable pour toute période supplémentaire. Si le Demandeur ne fournit pas une garantie financière de remplacement acceptable pour le Bénéficiaire dans les dix (10) jours suivant la réception de ladite notification, la valeur nominale totale de cette garantie, moins tout retrait partiel effectué en vertu des présentes, doit être versée au Bénéficiaire, ou à un fiduciaire acceptable pour le Bénéficiaire, avant la date d'expiration, sans qu'aucune preuve de déchéance ne soit requise.

5. Les retraits partiels effectués par le Bénéficiaire sont autorisés en vertu des présentes. Le montant du retrait partiel est payé par le Garant au Bénéficiaire, et la valeur nominale totale de la présente garantie (c'est-à-dire la responsabilité maximale du Garant au titre de la présente garantie) est automatiquement réduite du montant de tout retrait partiel effectué en vertu des présentes.

6. Toute demande de paiement doit porter la signature du Bénéficiaire ou d'une personne réputée le représenter.

7. Le Garant honorera la demande du Bénéficiaire sans demander si le Bénéficiaire et le Demandeur se sont entendus sur la présentation d'une telle demande et sans reconnaître quelque revendication que ce soit de la part du Demandeur.

8. La responsabilité du Garant en vertu de la présente garantie ne saurait en aucun cas excéder la somme mentionnée au premier paragraphe 1 des présentes, et cette responsabilité prend fin si une demande de paiement faite en stricte conformité avec les exigences des présentes n'a pas été reçue à la succursale ci-dessus au plus tard à la date d'expiration.

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[2] Remarque : Il s'agit d'un exemple seulement et non du modèle utilisé par une institution financière particulière. Dans tous les cas particuliers, des clauses supplémentaires ou modifiées pourraient être utilisées ou exigées.

9. La présente garantie n’est pas cessible.

10. La présente garantie est régie par les lois de xxx, et les tribunaux de cette province ont compétence exclusive sur toutes les questions relatives à la présente garantie et à tous les recours qui en découlent.

11. La présente garantie énonce dans son intégralité toutes les obligations du Garant et ces obligations ne peuvent être modifiées, interprétées ou augmentées par un document ou une entente mentionné aux présentes, et toute référence à un tel document ou entente ne doit pas être interprétée comme incorporant ledit document à la présente garantie.

Annexe B Estimations des coûts – Catégories et classification

Il n'existe pas de norme universellement acceptée pour estimer les coûts du déclassement. Toutefois, des organisations comme l'AACE International ont élaboré des lignes directrices pour l'estimation des coûts pour différentes industries [6].

Généralités
AACE International et le Construction Industry Institute ont établi des lignes directrices et des procédures pour l'estimation des coûts [6]. Ces lignes directrices classent les estimations de coûts dans les catégories A, B ou C, en fonction de leur niveau d'exactitude.

Catégorie C (précision de ± 25 % à 30 %)
Les estimations des coûts de catégorie C sont connues sous le nom d'estimations des coûts par ordre de grandeur. Elles sont réalisées rapidement en utilisant des techniques de raccourcis, notamment :

a) l'utilisation de facteur d'indexion et/ou la mise à l'échelle par rapport aux estimations précédentes
b) les courbes de coûts
c) la conception préliminaire des procédés et la mise en dimension de l'équipement sans plans du terrain ni devis pour l'équipement majeur

Il est probable que la portée globale du projet n'a pas été définie.

Catégorie B (précision de ± 15 % à 20 %)
Les estimations de coût de catégorie B sont connues sous le nom d'estimations budgétaires. Elles peuvent être élaborées lorsque la portée du projet a été définie, mais que la planification détaillée n'a pas été effectuée. Pour les grands projets, elles peuvent être élaborées dès que les diagrammes préliminaires des processus, les plans préliminaires du terrain et la mise en dimension de l'équipement ont été complétés. Dans le cas des petits projets, des estimations sont établies lorsqu'environ 10 % du volet ingénierie est terminé.

Catégorie A (précision de ± 10 %)
Les estimations de coût de catégorie A sont appelées « estimations de coût définitives ». Elles peuvent être élaborées lorsque la portée du projet est bien définie et que la planification détaillée est préparée. Pour les grands projets, une estimation de catégorie A est préparée lorsque les organigrammes techniques, les plans des installations et les listes d'équipement sont terminés et que la conception a atteint le stade requis pour le processus de soumission. Pour les petits projets, plus de détails techniques sont nécessaires, et de 30 % à 50 % du volet ingénierie pourrait devoir être terminé.

Classes d'estimations des coûts
AACE International décrit un système de classification pour les estimations de coûts dans l'industrie des procédés (voir le tableau 1). En général, l'estimation des coûts se précise à mesure que le projet est de mieux en mieux défini. Les estimations des coûts de déclassement préparées pour le PPD sont habituellement des estimations de coûts de type étude de classe 4. Pour de plus amples renseignements, veuillez consulter le document d'AACE International intitulé *Required Skills and Knowledge of Cost Engineering*.

Tableau 1 : Classification AACE International des estimations de coûts pour les l'industrie des procédés [6]

Classe d'estimation	Niveau de définition, % de la définition complète	Utilisation finale (but usuel de l'estimation)	Méthode (méthode usuelle d'estimation)	Exactitude attendue (variation usuelle dans les fourchettes basse et haute), %	Effort de préparation (degré d'effort usuel par rapport à l'indice de coût le plus bas, soit 1)
Classe 5	de 0 % à 2 %	Examen préalable du concept	Capacité pondérée, modèles paramétriques, jugement ou analogie	Faible : -20 % à -50 % Élevée : +30 % à +100 %	1
Classe 4	de 1 % à 15 %	Étude de faisabilité	Prise en compte de l'équipement ou des modèles paramétriques	Faible : -15 % à -30 % Élevée : +20 % à +50 %	2-4
Classe 3	de 10 % à 40 %	Budget, autorisation de contrôle	Coûts unitaires semi-détaillés avec ventilation au niveau de l'assemblage	Faible : -10 % à -20 % Élevée : +10 % à +30 %	3-10
Classe 2	de 30 % à 70 %	Contrôle ou soumission/ appel d'offres	Coût unitaire détaillé avec avant-métré détaillé forcé	Faible : -5 % à -15 % Élevée : +5 % à +20 %	4-20
Classe 1	de 50 % à 100 %	Vérification de l'estimation ou de l'offre/la soumission	Coût unitaire détaillé avec avant-métré détaillé	Faible : -3 % à -10 % Élevée : +3 % à +15 %	5-100

Annexe C Définitions normalisées des catégories de coûts

La présente annexe fournit des informations sur les définitions normalisées des catégories de coûts pour toutes les principales activités. Ces définitions ont été élaborées par l'International Structure for Decommissioning Costing – ISDC (structure internationale d'établissement des coûts de déclassement) [5].

Pour chaque élément de coût, quatre catégories de coûts ont été définies :

1. les coûts de la main-d'œuvre
2. les coûts d'investissement (immobilisations, équipement et matériel)
3. les dépenses
4. les imprévus

1. Coûts de la main-d'œuvre

Les coûts de la main-d'œuvre sont définis comme des coûts calculés en fonction de la charge de travail pour un élément de coût particulier et du taux unitaire des coûts de la main-d'œuvre, y compris :

- les salaires
- les cotisations à la sécurité sociale et à l'assurance maladie
- les cotisations de l'entreprise au régime de retraite et les avantages sociaux
- les frais généraux

2. Coûts d'investissement (coûts d'immobilisation, en équipement et en matériel)

Les coûts d'investissement couvrent les éléments suivants :

- l'équipement
- les machines

3. Dépenses

Les dépenses sont définies comme les coûts des biens de consommation ou des biens non durables, ou comme les coûts d'autres dépenses liées aux éléments de coûts du déclassement, le cas échéant, notamment :

- articles de consommation
- pièces de rechange
- vêtements de protection
- frais de déplacement
- frais d'avocat
- impôts
- taxe sur la valeur ajoutée
- assurance
- frais de consultants
- coûts de l'assurance de la qualité
- loyers
- matériel de bureau

- frais de chauffage
- coûts de l’eau
- coûts de l’électricité
- coûts informatiques
- frais de téléphonie/télécopie
- nettoyage
- intérêts
- relations publiques
- permis/brevets
- autorisation de déclassement
- revenus provenant du recouvrement d’actifs (« charges négatives »)

4. Imprévus

Les imprévus, ajoutés aux éléments de coûts individuels de la liste normalisée, constituent une disposition particulière pour les éléments de coûts imprévisibles dans le cadre du projet défini. Les répercussions sur les coûts qui ne font pas partie de la portée du projet de déclassement ne sont pas prises en compte.

Annexe D Structure internationale d'établissement des coûts de déclassement Hiérarchie des éléments de coûts

La présente annexe fournit des renseignements tirés de l'International Structure for Decommissioning Costing – ISDC (structure internationale d'établissement des coûts de déclassement) [5]. L'ISDC a été conçue comme plateforme pour la présentation d'une liste normalisée des coûts dans le cadre de la planification du déclassement. Il est à noter que l'estimation des coûts de déclassement des installations nucléaires peut varier considérablement en termes de format, de contenu et de pratique.

Résumé de la hiérarchie des éléments de coûts de l'ISDC

Activité principale 01 : Mesures préalables au déclassement

- 01.0100 Planification du déclassement
  - 01.0101 *Planification stratégique*
  - 01.0102 *Planification préliminaire*
  - 01.0103 *Planification finale*
- 01.0200 Caractérisation de l'installation
  - 01.0201 *Caractérisation détaillée de l'installation*
  - 01.0202 *Études et analyses des matières dangereuses*
  - 01.0203 *Établissement d'une base de données d'inventaire de l'installation*
- 01.0300 Études sur la sécurité, la sûreté et l'environnement
  - 01.0301 *Analyse de la sûreté du déclassement*
  - 01.0302 *Étude d'impact sur l'environnement*
  - 01.0303 *Sûreté, sécurité et planification des mesures d'urgence pour l'exploitation du site*
- 01.0400 Planification de la gestion des déchets
  - 01.0401 *Établissement de critères de gestion des déchets*
  - 01.0402 *Élaboration d'un plan de gestion des déchets*
- 01.0500 Autorisation
  - 01.0501 *Demandes de permis et approbations des permis*
  - 01.0502 *Participation des parties intéressées*
- 01.0600 Préparation du groupe de gestion et passation de marchés
  - 01.0601 *Activités de l'équipe de gestion*
  - 01.0602 *Activités de passation de marchés*

Activité principale 02 : Activités d'arrêt de l'installation

- 02.0100 Fermeture et inspection de l'installation
  - 02.0101 *Cessation de l'exploitation, stabilisation de l'installation, isolement et inspection*
  - 02.0102 *Déchargement du combustible et transfert du combustible au stockage du combustible usé*
  - 02.0103 *Refroidissement du combustible usé*
  - 02.0104 *Gestion du combustible, des matières fissiles et autres matières nucléaires*
  - 02.0105 *Isolement de l'équipement électrique*
  - 02.0106 *Réutilisation de l'installation*
- 02.0200 Drainage et séchage des systèmes
  - 02.0201 *Drainage et séchage des systèmes fermés non exploités*
  - 02.0202 *Drainage de la piscine de combustible usé et des autres systèmes ouverts non exploités*
  - 02.0203 *Retrait des boues et des produits des systèmes ouverts*
  - 02.0204 *Drainage des fluides de procédé spéciaux*

02.0300 Décontamination des systèmes fermés pour la réduction des doses
02.0301 *Décontamination des installations de traitement à l'aide de procédures opérationnelles*
02.0302 *Décontamination des installations de traitement à l'aide de procédures supplémentaires*
02.0400 Caractérisation de l'inventaire radiologique à l'appui de la planification détaillée
02.0401 *Caractérisation de l'inventaire radiologique*
02.0402 *Surveillance des eaux souterraines*
02.0500 Enlèvement des fluides de systèmes, des déchets d'exploitation et des matériaux redondants
02.0501 *Enlèvement des matériaux combustibles*
02.0502 *Enlèvement des fluides de systèmes (eau, huiles, etc.)*
02.0503 *Enlèvement des fluides spéciaux de systèmes*
02.0504 *Enlèvement des déchets de décontamination*
02.0505 *Enlèvement des résines usées*
02.0506 *Enlèvement des déchets d'exploitation des installations du cycle du combustible*
02.0507 *Enlèvement des autres déchets provenant de l'exploitation de l'installation*
02.0508 *Enlèvement de l'équipement et du matériel redondants*

Activité principale 03 : Activités supplémentaires pour un confinement sûr
03.0100 Préparation en vue d'un confinement sûr
03.0101 *Décontamination des composants et des zones sélectionnés pour faciliter le confinement sûr*
03.0102 *Zonage pour le stockage à long terme*
03.0103 *Enlèvement de l'inventaire ne se prêtant pas à un confinement sûr*
03.0104 *Démantèlement et transfert de l'équipement et du matériel contaminés à la structure de confinement pour le stockage à long terme*
03.0105 *Caractérisation de l'inventaire radiologique pour un confinement sûr*
03.0200 Reconfiguration des limites du site, isolement et sécurisation des structures
03.0201 *Modification des systèmes auxiliaires*
03.0202 *Reconfiguration des limites du site*
03.0203 *Construction d'enclos temporaires, d'entrepôts, d'améliorations structurales, etc.*
03.0204 *Stabilisation des déchets radioactifs et dangereux en attendant leur assainissement*
03.0205 *Durcissement des zones contrôlées de l'installation, isolement pour un confinement sûr*
03.0300 Mise au tombeau de l'installation
03.0301 *Enfouissement de l'installation comme état final de la stratégie de déclassement*
03.0302 *Contrôle institutionnel et surveillance de l'état final de la mise au tombeau*

Activité principale 04 : Activités de démantèlement dans la zone contrôlée
04.0100 Achat d'équipement de décontamination et de démantèlement
04.0101 *Achat d'équipement général de démantèlement de site*
04.0102 *Acquisition d'équipement pour la décontamination du personnel et des outils*
04.0103 *Acquisition d'outils spéciaux pour le démantèlement des systèmes du réacteur*
04.0104 *Acquisition d'outils spéciaux pour le démantèlement des installations du cycle du combustible*
04.0105 *Acquisition d'outils spéciaux pour le démantèlement d'autres composants ou structures*

04.0200 Préparatifs et appui au démantèlement

04.0201 *Reconfiguration des services, des installations et du site existants pour soutenir le démantèlement*

04.0202 *Préparation de l'infrastructure et de la logistique pour le démantèlement*

04.0203 *Caractérisation radiologique continue pendant le démantèlement*

04.0300 Décontamination préalable au démantèlement

04.0301 *Drainage des systèmes restants*

04.0302 *Enlèvement des boues et des produits des systèmes restants*

04.0303 *Décontamination des systèmes restants*

04.0304 *Décontamination de zones dans les bâtiments*

04.0400 Enlèvement des matériaux nécessitant des procédures particulières

04.0401 *Enlèvement de l'isolant thermique*

04.0402 *Enlèvement de l'amiante*

04.0403 *Enlèvement des autres matières dangereuses*

04.0500 Démantèlement des principaux systèmes, structures et composants fonctionnels

04.0501 *Démantèlement des parties internes du réacteur*

04.0502 *Démantèlement de la cuve et des composants du cœur du réacteur*

04.0503 *Démantèlement des autres composants du circuit primaire*

04.0504 *Démantèlement des principaux systèmes fonctionnels dans les installations du cycle du combustible*

04.0505 *Démantèlement des principaux systèmes fonctionnels dans d'autres installations nucléaires*

04.0506 *Démantèlement des boucliers thermiques/biologiques externes*

04.0600 Démantèlement des autres systèmes et composants

04.0601 *Démantèlement des systèmes auxiliaires*

04.0602 *Démantèlement des composants restants*

04.0700 Élimination de la contamination des structures du bâtiment

04.0701 *Enlèvement d'éléments encastrés dans les bâtiments*

04.0702 *Enlèvement des structures contaminées*

04.0703 *Décontamination des bâtiments*

04.0800 Élimination de la contamination à l'extérieur des bâtiments

04.0801 *Enlèvement des conduites et des structures souterraines contaminées*

04.0802 *Enlèvement du sol contaminé et des autres articles contaminés*

04.0900 Relevé radiologique final pour la libération des bâtiments

04.0901 *Relevé radiologique final des bâtiments*

04.0902 *Déclassement des bâtiments*

Activité principale 05 : Traitement, stockage et évacuation des déchets

05.0100 Système de gestion des déchets

05.0101 *Mise en place du système de gestion des déchets*

05.0102 *Reconstruction des installations existantes pour le déclassement du système de gestion des déchets*

05.0103 *Acquisition d'équipement supplémentaire pour la gestion des déchets historiques et hérités*

05.0104 *Entretien, surveillance et soutien opérationnel du système de gestion des déchets*

05.0105 *Démobilisation/déclassement du système de gestion des déchets*

05.0200 Gestion des déchets historiques et hérités de haute activité

05.0201 *Caractérisation*

05.0202 *Récupération et traitement*

05.0203 *Conditionnement final*

05.0204 *Stockage*

05.0205 *Transport*
05.0206 *Stockage définitif*
05.0207 *Conteneurs*
05.0300 Gestion des déchets historiques et hérités de moyenne activité
05.0301 *Caractérisation*
05.0302 *Récupération et traitement*
05.0303 *Conditionnement final*
05.0304 *Stockage*
05.0305 *Transport*
05.0306 *Stockage définitif*
05.0307 *Conteneurs*
05.0400 Gestion des déchets historiques et hérités de faible activité
05.0401 *Caractérisation*
05.0402 *Récupération et traitement*
05.0403 *Conditionnement final*
05.0404 *Stockage*
05.0405 *Transport*
05.0406 *Stockage définitif*
05.0407 *Conteneurs*
05.0500 Gestion des déchets historiques et hérités de très faible activité
05.0501 *Caractérisation*
05.0502 *Récupération, traitement et emballage*
05.0503 *Transport*
05.0504 *Évacuation*
05.0600 Gestion des déchets et des matériaux historiques/hérités exemptés
05.0601 *Récupération, traitement et emballage*
05.0602 *Mesure du dégagement des déchets et des matériaux exemptés*
05.0603 *Transport de déchets dangereux*
05.0604 *Élimination des déchets dangereux dans des décharges spécialisées*
05.0605 *Transport de déchets et de matériaux non nucléaires*
05.0606 *Élimination des déchets non nucléaires dans des décharges non nucléaires*
05.0700 Gestion du déclassement des déchets de haute activité
05.0701 *Caractérisation*
05.0702 *Traitement*
05.0703 *Conditionnement final*
05.0704 *Stockage*
05.0705 *Transport*
05.0706 *Stockage définitif*
05.0707 *Conteneurs*
05.0800 Gestion du déclassement des déchets de moyenne activité
05.0801 *Caractérisation*
05.0802 *Traitement*
05.0803 *Conditionnement final*
05.0804 *Stockage*
05.0805 *Transport*
05.0806 *Stockage définitif*
05.0807 *Conteneurs*
05.0900 Gestion du déclassement des déchets de faible activité
05.0901 *Caractérisation*
05.0902 *Traitement*
05.0903 *Conditionnement final*

05.0904 *Stockage*
05.0905 *Transport*
05.0906 *Stockage définitif*
05.0907 *Conteneurs*
05.1000 Gestion du déclassement des déchets de très faible activité
05.1001 *Caractérisation*
05.1002 *Traitement et emballage*
05.1003 *Transport*
05.1004 *Évacuation*
05.1100 Gestion du déclassement des déchets de très courte période radioactive
05.1101 *Caractérisation*
05.1102 *Traitement, stockage, manutention et emballage*
05.1103 *Gestion finale du déclassement des déchets de très courte période*
05.1200 Gestion du déclassement des déchets et des matériaux exemptés
05.1201 *Traitement et emballage*
05.1202 *Mesure de libération des déchets et des matériaux exemptés*
05.1203 *Transport de déchets dangereux*
05.1204 *Élimination des déchets dangereux dans des décharges spécialisées*
05.1205 *Transport de déchets et de matériaux non nucléaires*
05.1206 *Élimination des déchets non nucléaires dans des décharges non nucléaires*
05.1300 Gestion du déclassement des déchets et des matériaux produits en dehors des zones contrôlées
05.1301 *Recyclage du béton*
05.1302 *Traitement et emballage des déchets dangereux*
05.1303 *Traitement et recyclage des autres matériaux*
05.1304 *Transport des déchets dangereux*
05.1305 *Élimination des déchets dangereux dans des décharges spécialisées*
05.1306 *Transport de déchets et matériaux non nucléaires*
05.1307 *Élimination des déchets non nucléaires dans des décharges non nucléaires*

Activité principale 06 : Infrastructure et exploitation du site

06.0100 Sécurité et surveillance du site
06.0101 *Achat d'équipement de sécurité générale*
06.0102 *Exploitation et entretien de systèmes automatisés de contrôle d'accès, de systèmes de surveillance et d'alarmes*
06.0103 *Clôtures de sécurité et protection des entrées restantes contre les intrusions*
06.0104 *Déploiement de gardes et de forces de sécurité*
06.0200 Exploitation et entretien du site
06.0201 *Inspection et entretien des bâtiments et des systèmes*
06.0202 *Activités d'entretien du site*
06.0300 Fonctionnement des systèmes de soutien
06.0301 *Systèmes d'alimentation en électricité*
06.0302 *Systèmes de ventilation*
06.0303 *Systèmes de chauffage, de vapeur et d'éclairage*
06.0304 *Systèmes d'approvisionnement en eau*
06.0305 *Systèmes d'égouts/eaux usées*
06.0306 *Systèmes d'air comprimé/azote*
06.0307 *Autres systèmes*
06.0400 Surveillance de la sécurité radiologique et environnementale
06.0401 *Achat et entretien d'équipement de radioprotection et de surveillance de l'environnement*

06.0402 *Radioprotection et surveillance*
06.0403 *Protection de l'environnement et surveillance radiologique de l'environnement*

Activité principale 07 : Démantèlement, démolition et remise en état de sites non nucléaires

07.0100 Acquisition d'équipement pour le démantèlement et la démolition de nature non nucléaire
07.0101 *Acquisition d'équipement pour le démantèlement et la démolition de nature non nucléaire*
07.0200 Démantèlement des systèmes et des composants du bâtiment en dehors de la zone contrôlée
07.0201 *Système de production d'électricité*
07.0202 *Composants du système de refroidissement*
07.0203 *Autres systèmes auxiliaires*
07.0300 Démolition de bâtiments et de structures
07.0301 *Démolition de bâtiments et de structures de l'ancienne zone contrôlée*
07.0302 *Démolition de bâtiments et de structures en dehors de la zone contrôlée*
07.0303 *Démantèlement de la cheminée*
07.0400 Nettoyage final, aménagement paysager et rénovation
07.0401 *Travaux de terrassement*
07.0402 *Aménagement paysager et autres activités de finition du site*
07.0403 *Rénovation de bâtiments*
07.0500 Relevé radiologique final du site
07.0501 *Relevé final*
07.0502 *Vérification indépendante du relevé final*
07.0600 Financement/surveillance à perpétuité pour la libération limitée ou restreinte de la propriété
07.0601 *Entretien courant*
07.0602 *Surveillance et contrôle*

Activité principale 08 : Gestion de projet, ingénierie et soutien

08.0100 Mobilisation et travaux préparatoires
08.0101 *Mobilisation du personnel*
08.0102 *Mise en place d'une infrastructure générale de soutien pour le projet de déclassement*
08.0200 Gestion de projet
08.0201 *Groupe de gestion de base*
08.0202 *Planification de la mise en œuvre du projet, planification détaillée et continue*
08.0203 *Planification et contrôle des coûts*
08.0204 *Analyse de la sécurité et de l'environnement, études continues*
08.0205 *Assurance et surveillance de la qualité*
08.0206 *Administration générale et comptabilité*
08.0207 *Relations publiques et participation des parties intéressées*
08.0300 Services de soutien
08.0301 *Soutien technique*
08.0302 *Système d'information et soutien informatique*
08.0303 *Appui à la gestion des déchets*
08.0304 *Soutien au déclassement, y compris la chimie et la décontamination*
08.0305 *Gestion et formation du personnel*
08.0306 *Contrôle de la documentation et des dossiers*
08.0307 *Approvisionnement, entreposage et manutention*
08.0308 *Logement, équipement de bureau, services de soutien*

08.0400 Santé et sécurité
- 08.0401 *Radioprotection*
- 08.0402 *Sécurité industrielle*

08.0500 Démobilisation
- 08.0501 *Démobilisation de l'infrastructure du projet pour le déclassement*
- 08.0502 *Démobilisation du personnel*

08.0600 Mobilisation et travaux préparatoires des entrepreneurs (si nécessaire)
- 08.0601 *Mobilisation du personnel*
- 08.0602 *Mise en place d'une infrastructure générale de soutien pour le projet de déclassement*

08.0700 Gestion de projet par des entrepreneurs (si nécessaire)
- 08.0701 *Groupe de gestion de base*
- 08.0702 *Planification de la mise en œuvre du projet, planification détaillée et continue*
- 08.0703 *Planification et contrôle des coûts*
- 08.0704 *Analyse de la sécurité et de l'environnement, études continues*
- 08.0705 *Assurance et surveillance de la qualité*
- 08.0706 *Administration générale et comptabilité*
- 08.0707 *Relations publiques et participation des parties intéressées*

08.0800 Services de soutien par des entrepreneurs (au besoin)
- 08.0801 *Soutien technique*
- 08.0802 *Système d'information et support informatique*
- 08.0803 *Appui à la gestion des déchets*
- 08.0804 *Soutien au déclassement, y compris la chimie et la décontamination*
- 08.0805 *Gestion du personnel et formation*
- 08.0806 *Contrôle de la documentation et des dossiers*
- 08.0807 *Approvisionnement, entreposage et manutention*
- 08.0808 *Logement, équipement de bureau, services de soutien*

08.0900 Santé et sécurité des entrepreneurs (au besoin)
- 08.0901 *Radioprotection*
- 08.0902 *Sécurité industrielle*

08.1000 Démobilisation par les entrepreneurs (si nécessaire)
- 08.1001 *Démobilisation de l'infrastructure du projet pour le déclassement*
- 08.1002 *Démobilisation du personnel*

Activité principale 09 : Recherche et développement

09.0100 Recherche et développement pour l'équipement, les techniques et les procédures
- 09.0101 *Équipement, techniques et procédures de caractérisation*
- 09.0102 *Équipement, techniques et procédures de décontamination*
- 09.0103 *Équipement, techniques et procédures de démantèlement*
- 09.0104 *Équipement, techniques et procédures de gestion des déchets*
- 09.0105 *Autres activités de recherche et développement*

09.0200 Simulation de travaux complexes
- 09.0201 *Maquettes physiques et formation*
- 09.0202 *Programmes d'essai ou de démonstration*
- 09.0203 *Simulations informatiques, visualisations et modélisation 3D*
- 09.0204 *Autres activités*

Activité principale 10 : Combustible et matières nucléaires

10.0100 Enlèvement du combustible ou des matières nucléaires de l'installation devant être déclassée

10.0101 *Transfert de combustible ou de matières nucléaires vers des installations de stockage externe ou de traitement*
10.0102 *Transfert de combustible ou de matières nucléaires vers une installation de stockage tampon spécialisé*
10.0200 Stockage tampon dédié pour le combustible et/ou les matières nucléaires
10.0201 *Construction d'une installation de stockage tampon*
10.0202 *Fonctionnement de l'installation de stockage tampon*
10.0203 *Transfert de combustible et/ou de matières nucléaires hors du stockage tampon*
10.0300 Déclassement de l'installation de stockage tampon
10.0301 *Déclassement de l'installation de stockage tampon*
10.0302 *Gestion des déchets*

Activité principale 11 : Dépenses diverses
11.0100 Coûts du propriétaire
11.0101 *Mise en œuvre des plans de transition*
11.0102 *Projets externes à réaliser à la suite du déclassement*
11.0103 *Paiements (droits) aux autorités*
11.0104 *Services et paiements externes particuliers*
11.0200 Impôts et taxes
11.0201 *Taxes sur la valeur ajoutée*
11.0202 *Impôts locaux, communautaires et fédéraux*
11.0203 *Taxes environnementales*
11.0204 *Impôts sur les activités industrielles*
11.0205 *Autres taxes*
11.0300 Assurances
11.0301 *Assurances liées au nucléaire*
11.0302 *Autres assurances*

Annexe E Approches en matière d’estimation des coûts

Dans le document The Practice of Cost Estimation for Decommissioning of Nuclear Facilities, l’Agence pour l’énergie nucléaire donne un aperçu comparatif des méthodes d’estimation des coûts et de leurs avantages et inconvénients [7]. Il est résumé dans le tableau suivant.

Tableau 1 : Comparaison des méthodes d’estimation [6]

Méthode d’estimation	Description	Avantages	Inconvénients
Méthode ascendante	Dans cette méthode consistant en blocs de construction, un énoncé de travail et un ensemble de dessins ou de spécifications sont utilisés pour estimer les quantités de matériaux nécessaires à l’exécution de chaque tâche distincte effectuée lors de l’exécution d’une activité donnée. À partir de ces quantités, on peut calculer les coûts directs de main-d’œuvre, d’équipement et de frais généraux.	Méthode la plus précise, car elle tient compte de l’inventaire radiologique et physique propre au site. S’appuie sur les facteurs de coût unitaire (FCU).	Nécessite une description détaillée de l’inventaire et des coûts de main-d’œuvre, de matériel et d’équipement propres au site pour les FCU.
Analogie particulière	Les analogies particulières dépendent du coût connu d’un élément utilisé dans les estimations antérieures comme base pour le coût d’un élément similaire dans une nouvelle estimation. Des ajustements sont apportés aux coûts connus pour tenir compte des différences dans la complexité relative du rendement, la conception et les caractéristiques opérationnelles.	Méthode précise si les estimations antérieures sont correctement ajustées pour tenir compte des différences de taille, de l’inflation et des différences régionales dans la main-d’œuvre, les matériaux et l’équipement.	Les ajustements indiqués pourraient nécessiter une documentation détaillée et introduire des approximations qui réduisent l’exactitude.
Méthode paramétrique	L’estimation paramétrique nécessite des bases de données historiques sur des systèmes ou sous-systèmes similaires. Ces données font l’objet d’une analyse statistique afin de trouver des corrélations entre les	Convient aux grands sites où l’inventaire détaillé n’est pas facilement disponible. Convient aux estimations de l’ordre de grandeur.	Les approximations basées sur les superficies ou les volumes introduisent des inexactitudes supplémentaires. Il n’y a aucun moyen de suivre l’inventaire réel. Ne

Méthode d'estimation	Description	Avantages	Inconvénients
	inducteurs de coûts et d'autres paramètres du système, tels que la conception ou le rendement. L'analyse fournit des équations de coûts ou des relations d'estimation des coûts qui pourraient être utilisées individuellement ou regroupées dans des modèles plus complexes.		convient pas à la planification des activités de travail d'un projet.
Examen et mise à jour des coûts	Il est possible de procéder à une estimation en examinant les estimations antérieures des mêmes projets ou de projets semblables pour en vérifier la logique interne, l'exhaustivité de la portée, les hypothèses et la méthode d'estimation.	Convient aux grands sites où l'inventaire détaillé n'est pas disponible. Convient à la mise à jour d'estimations antérieures ou pour les estimations de l'ordre de grandeur.	Il n'y a aucun moyen de suivre l'inventaire réel. En général, ne convient pas à la planification des activités de travail d'un projet.
Avis d'expert	Il est possible de recourir à des avis d'experts lorsque d'autres techniques ou données ne sont pas disponibles. Plusieurs spécialistes pourraient être consultés itérativement jusqu'à ce qu'une estimation consensuelle des coûts soit établie.	Il est possible de recourir à des avis d'experts lorsque d'autres techniques ou données ne sont pas disponibles. Plusieurs spécialistes pourraient être consultés itérativement jusqu'à ce qu'une estimation consensuelle des coûts soit établie.	L'avis d'experts pourrait ne pas s'appliquer expressément aux activités de travail. Il pourrait ne pas refléter les limites radiologiques du projet.

Glossaire

Les définitions des termes utilisés dans le présent document figurent dans le REGDOC-3.6, *Glossaire de la CCSN*, qui comprend des termes et des définitions tirés de la *Loi sur la sûreté et la réglementation nucléaires*, de ses règlements d'application ainsi que des documents d'application de la réglementation et d'autres publications de la CCSN. Le REGDOC-3.6 est fourni à titre de référence et pour information**.**

Références

La CCSN pourrait inclure des références à des documents sur les pratiques exemplaires et les normes, comme celles publiées par le Groupe CSA. Avec la permission du Groupe CSA, qui en est l'éditeur, toutes les normes de la CSA associées au nucléaire peuvent être consultées gratuitement à partir de la page Web de la CCSN « Comment obtenir un accès gratuit à l'ensemble des normes de la CSA associées au nucléaire ».

1. Commission canadienne de sûreté nucléaire (CCSN). Document d'application de la réglementation REGDOC-2.11.2, *Déclassement*. Ottawa, 2019.

2. Groupe CSA. Norme N294, *Déclassement des installations contenant des substances nucléaires*, Toronto. 2019.

3. CCSN. REGDOC-3.1.2, *Exigences relatives à la production de rapports, tome 1 : Installations nucléaires de catégorie I non productrices de puissance et mines et usines de concentration d'uranium*. Ottawa, 2018.

4. CCSN. REGDOC-3.1.3, *Exigences relatives à la production de rapports pour les titulaires de permis de déchets de substances nucléaires, les installations nucléaires de catégorie II et les utilisateurs d'équipement réglementé, de substances nucléaires et d'appareils à rayonnement*. Ottawa. 2020.

5. Agence pour l'énergie nucléaire (AEN). Organisation de coopération et de développement économiques (OCDE), *International Structure for Decommissioning Costing (ISDC) of Nuclear Installations*. France, 2012.

6. AACE International. *Skills and knowledge of cost engineering, 6th edition*. États-Unis, 2015.

7. AEN/OCDE. *The Practice of Cost Estimation for Decommissioning of Nuclear Facilities*, France, 2015.

Renseignements supplémentaires

Les documents suivants fournissent des renseignements supplémentaires qui pourraient être pertinents et faciliter la compréhension des exigences et de l'orientation fournis dans le présent document d'application de la réglementation :

- CCSN. REGDOC-3.1.1, *Rapports à soumettre par les exploitants de centrales nucléaires*. Ottawa, 2016.

Séries de documents d'application de la réglementation de la CCSN

Les installations et activités du secteur nucléaire du Canada sont réglementées par la CCSN. En plus de la *Loi sur la sûreté et la réglementation nucléaires* et de ses règlements d'application, il pourrait y avoir des exigences en matière de conformité à d'autres outils de réglementation, comme les documents d'application de la réglementation ou les normes.

Les documents d'application de la réglementation préparés par la CCSN sont classés en fonction des catégories et des séries suivantes :

1.0 Installations et activités réglementées

Séries
- 1.1 Installations dotées de réacteurs
- 1.2 Installations de catégorie IB
- 1.3 Mines et usines de concentration d'uranium
- 1.4 Installations de catégorie II
- 1.5 Homologation d'équipement réglementé
- 1.6 Substances nucléaires et appareils à rayonnement

2.0 Domaines de sûreté et de réglementation

Séries
- 2.1 Système de gestion
- 2.2 Gestion de la performance humaine
- 2.3 Conduite de l'exploitation
- 2.4 Analyse de la sûreté
- 2.5 Conception matérielle
- 2.6 Aptitude fonctionnelle
- 2.7 Radioprotection
- 2.8 Santé et sécurité classiques
- 2.9 Protection de l'environnement
- 2.10 Gestion des urgences et protection-incendie
- 2.11 Gestion des déchets
- 2.12 Sécurité
- 2.13 Garanties et non-prolifération
- 2.14 Emballage et transport

3.0 Autres domaines de réglementation

Séries
- 3.1 Exigences relatives à la production de rapports
- 3.2 Mobilisation du public et des Autochtones
- 3.3 Garanties financières
- 3.4 Séances de la Commission
- 3.5 Processus et pratiques de la CCSN
- 3.6 Glossaire de la CCSN

Remarque : Les séries de documents d'application de la réglementation pourraient être modifiées périodiquement par la CCSN. Chaque série susmentionnée peut comprendre plusieurs documents d'application de la réglementation. Pour obtenir la plus récente liste de documents d'application de la réglementation, veuillez consulter le site Web de la CCSN.

Consultation Report: REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*

Rapport de consultation: REGDOC-3.3.1, *Garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées*

Introduction

REGDOC-3.3.1 provides requirements and guidance to applicants and licensees regarding the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the CNSC.

If approved by the Commission, it will supersede G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*.

Consultation process

CNSC staff have extensively engaged with stakeholders on the waste management and decommissioning framework.

On July 26, 2019, a draft version of REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* was issued for public consultation until September 24, 2019.

During the consultation period, the CNSC received 33 comments from 7 respondents: Bruce Power, Canadian Nuclear Association (CNA), Canadian Nuclear Laboratories (CNL), New Brunswick Power (NB Power), Nordion, Ontario Power Generation (OPG) and Saskatchewan Environmental Society.

Consultation submissions were posted for feedback on comments from November 6 to 26, 2019. No new comments were received.

Introduction

Le REGDOC-3.3.1 énonce les exigences et l’orientation à l’intention des demandeurs et des titulaires de permis concernant l’établissement et le maintien du financement pour le déclassement des installations et la cessation des activités autorisées par la Commission canadienne de sûreté nucléaire (CCSN).

S’il est approuvé par la Commission, ce REGDOC remplacera le document G-206, *Les garanties financières pour le déclassement des activités autorisées*.

Processus de consultation

Le personnel de la CCSN a mené de vastes consultations auprès des parties intéressées sur le cadre de déclassement et de gestion des déchets.

Le 26 juillet 2019, la version provisoire du REGDOC-3.3.1, *Les garanties financières pour le déclassement des installations nucléaires et la cessation des activités autorisées* a été publié aux fins de consultation publique jusqu’au 24 septembre 2019.

Pendant cette période, la CCSN a reçu 33 commentaires provenant de sept répondants : Bruce Power, l’Association nucléaire canadienne (ANC), les Laboratoires Nucléaires Canadiens (LNC), Énergie du Nouveau-Brunswick (Énergie NB), Nordion, Ontario Power Generation (OPG) et la Saskatchewan Environmental Society.

Les commentaires ont été affichés aux fins de

Civil society organizations (CSOs) and industry requested workshops to discuss REGDOCs from the waste management and decommissioning series, including this one.

CNSC staff held a workshop with industry on February 5, 2020 and a webinar with CSOs on February 26. Due to technical difficulties, a second webinar with members of the public and CSOs was held April 23rd, 2020. The purpose of the webinars was to explain the changes made to the document following public consultation and to discuss outstanding issues and how comments were dispositioned.

The following organizations participated for the February 5 workshop with industry:

- Bruce Power
- BWX Technologies
- Cameco
- CNA
- CNL
- CANDU Owners Group
- Hydro-Québec
- Kinetrics
- New Brunswick Power
- Nuclear Waste Management Organization
- OPG
- Orano

The following commenters participated in the CSO webinar, either in person or through written submissions:

- Algonquin Eco Watch
- Canadian Environmental Law Association
- Concerned Citizens of Renfrew
- Dr. Frank Greening
- Dr. Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Regional Municipality of Durham
- Concerned Citizens of Renfrew County

rétroaction du 6 au 26 novembre 2019. La CCSN n’a reçu aucun autre commentaire.

Des organisations de la société civile (OSC) et l’industrie ont demandé des ateliers pour discuter des REGDOC faisant partie de la série sur la gestion des déchets et le déclassement, y compris ce REGDOC.

Le personnel de la CCSN a tenu un atelier avec l’industrie le 5 février 2020 et un webinaire avec les OSC le 26 février. En raison de difficultés techniques, le second webinaire avec les membres du public et les OSC a eu lieu le 23 avril 2020. Ces webinaires avaient pour objectif d’expliquer les modifications apportées au document à la suite de la consultation publique et de discuter des questions en suspens et de la manière dont les commentaires ont été pris en compte.

Les entités suivantes ont participé à l’atelier du 5 février avec l’industrie :

- Bruce Power
- BWX Technologies
- Cameco
- ANC
- LNC
- Groupe des propriétaires de CANDU
- Hydro-Québec
- Kinetrics
- Énergie du Nouveau-Brunswick
- Société de gestion des déchets nucléaires
- OPG
- Orano

Les commentateurs suivants ont participé, en personne ou par le biais d’un mémoire, au webinaire organisé pour les OSC :

- Algonquin Eco Watch
- Association canadienne du droit de l’environnement
- Concerned Citizens of Renfrew
- Frank Greening

and Area

- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

The full responses to stakeholder feedback on individual REGODCs, including comments received during public consultation or in advance of the workshops, can be found in the associated detailed comments table included as part of the Commission Member Document package.

- Sandy Greer
- Northwatch
- Dodie LeGassick
- Michael Stephens
- Municipalité régionale de Durham
- Concerned Citizens of Renfrew County and Area
- Gordon Edwards
- Saskatchewan Environmental Society
- Ralliement contre la pollution radioactive

Les réponses complètes aux commentaires des parties intéressées sur les différents REGDOC, y compris les commentaires reçus lors de la consultation publique ou avant les ateliers, se trouvent dans le tableau connexe des commentaires détaillés qui fait partie de la trousse de documents remise aux commissaires.

Key comments

The following summarizes the key comments received during the consultation period and provides the CNSC's responses:

Principaux commentaires

Les principaux commentaires reçus lors de la période de consultation sont résumés ci-après et accompagnés des réponses de la CCSN.

Comment 1:

CSOs raised concerns on the perceived lack of financial guarantees (funding) for long-term monitoring of waste facilities.

Commentaire 1

Les OSC ont soulevé des préoccupations à l'égard du manque perçu de garanties financières (fonds) pour la surveillance à long terme des installations de déchets.

CNSC staff response:

No change were made to the REGDOC. The financial guarantees are established to ensure that money is available for the decommissioning of the facilities as per the preliminary decommissioning plan. This plan is updated every five years. The CNSC requires that the costs of long-term monitoring and maintenance of the site and institutional control be included in the cost estimates for decommissioning.

Réponse du personnel de la CCSN

Aucune modification n'a été apportée au REGDOC. Les garanties financières sont établies dans le but de s'assurer que l'argent est disponible pour le déclassement des installations, conformément au plan préliminaire de déclassement. Ce plan est mis à jour tous les cinq ans. La CCSN exige que les coûts de la surveillance et de l'entretien à long terme du site ainsi que des contrôles institutionnels soient inclus dans l'estimation

The cost estimates for long-term management are based on predicted conditions in the future. Therefore it is required to include contingencies to cover to for future unforeseeable elements.

Comment 2:

CSOs did not agree on allowing expressed commitments by Canadian federal, provincial or territorial governments to cover financial guarantees for certain facilities or activities.

CNSC staff response:

No changes were made to the REGDOC. Expressed commitments from a Canadian government may be acceptable only in specific cases, for example, legacy sites and past activities of Crown Corporations for the decommissioning of which the government takes responsibility.

As stated in section 4 of the REGDOC, in all cases the financial guarantee instruments are subject to financial and legal review by the CNSC and must be accepted by the Commission.

Comment 3:

Industry questioned CNSC's decision to changing guidance statements from G-206, Financial Guarantees for the Decommissioning of Licensed Activities into mandatory requirements in REGDOC 3.3.1.

CNSC staff response:

No changes were made to the REGDOC since

des coûts de déclassement.

L'estimation des coûts pour la gestion à long terme est basée sur les conditions prévues dans le futur. Par conséquent, les garanties doivent inclure des fonds de prévoyance pour couvrir les éléments futurs imprévisibles.

Commentaire 2

Les OSC n'étaient pas d'accord avec l'idée que les gouvernements fédéral, provinciaux ou territoriaux canadiens s'engagent expressément à couvrir les garanties financières pour certaines installations ou activités.

Réponse du personnel de la CCSN

Aucune modification n'a été apportée au REGDOC. Les engagements exprimés par un gouvernement canadien peuvent être acceptables dans des cas bien précis seulement, par exemple, pour les sites hérités et les activités passées des sociétés d'État dont le gouvernement assume la responsabilité du déclassement.

Comme il est indiqué à la section 4 du REGDOC, dans tous les cas, les instruments de garantie financière font l'objet d'un examen financier et juridique par la CCSN et doivent être acceptés par la Commission.

Commentaire 3

L'industrie a remis en question la décision de la CCSN de transposer l'orientation énoncée dans le document G-206, *Les garanties financières pour le déclassement des activités autorisées*, en exigences obligatoires dans le REGDOC-3.3.1.

Réponse du personnel de la CCSN

Aucune modification n'a été apportée au

the changes proposed in this REGDOC reflect the regulatory experience acquired since the publication of G-206, as well as international best practices.

The changes from guidance to requirement for the mentioned section will not have an impact on licensees since the financial guarantees that have been approved by the Commission already meet those requirements.

Comment 4:

Industry requested clarification about reviewing and reporting requirements for financial guarantees.

CNSC staff response:

The REGDOC was revised. Section 6 *Reporting requirements* of document was revised for clarity and precision.

Comment 5:

Industry noted a lack of clarity and precision throughout the REGDOC.

CNSC staff response:

The REGDOC was reviewed. The language was revised throughout the document for clarity and precision.

Concluding remarks

This project has undergone extensive stakeholder consultations. CNSC staff have listened to concerns and the document has been modified, as appropriate.

REGDOC puisque les changements proposés dans ce REGDOC reflètent l'expérience en matière de réglementation acquise depuis la publication du document G-206, ainsi que les meilleures pratiques internationales.

L'orientation transposée en exigences dans la section mentionnée n'aura pas d'incidence sur les titulaires de permis, puisque les garanties financières qui ont été approuvées par la Commission répondent déjà à ces exigences.

Commentaire 4

L'industrie a demandé des précisions à l'égard des exigences en matière d'examen et de rapport pour les garanties financières.

Réponse du personnel de la CCSN

Le REGDOC a été révisé. La section 6 *Exigences en matière de rapports* du document a été révisée à des fins de clarté et de précision.

Commentaire 5

L'industrie a relevé un manque de clarté et de précision dans l'ensemble du document.

Réponse du personnel de la CCSN

Le REGDOC a été révisé. Le libellé a été modifié dans le document à des fins de clarté et de précision.

Mot de la fin

Ce projet a fait l'objet de vastes consultations auprès des parties intéressées. Le personnel de la CCSN a entendu les préoccupations et a modifié le document, au besoin.

NOTE: Draft REGDOC-3.3.1 has gone through an iterative consultation process with stakeholders involving three distinct phases and three separate draft versions of the document being created. Therefore changes noted in Tables A and B reflect document modifications that were used for further stakeholder comments in Table C. As a result, only the changes noted in the final table (Table C) are reflected in the final draft version of the document submitted to the Commission for approval.

Comments received:

- Table A: public consultation period (July 26, 2019 to September 24, 2019): 33 comments from number of (6) reviewers
- Table B: feedback on comments period (November 6 to November 26, 2019): No comments were received
- Table C: workshop with industry and civil society organizations on February 5, 2020 and April 23, 2020: 9 comments received

Commentaires reçus :

- Tableau A : période de consultation publique (du 26 juillet au 24 septembre 2019) :33 commentaires reçus de nombre (6) examinateurs
- Tableau B : période des observations (du 6 novembre au 26 novembre 2019) : aucun commentaire reçu
- Tableau C: atelier avec l'industrie et avec des organisations de société civile du 5 février 2020 et du 23 avril 2020 : 9 commentaires reçus

Table A: Public consultation period / Tableau A : Période de consultation publique

#	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse de la CCSN
1.	**General**	Canadian Nuclear Association (CAN),	**Industry Issue** • The CNA and its members appreciate the CNSC's desire to provide early drafts; however, this draft contains numerous typos, unclear language and formatting issues which make reviewing the document more challenging. Requirements and guidance are more easily understood if they are written in clear, concise language. • As pointed out in our reviews of other draft RegDocs, the CNA is very concerned with the ongoing tendency of the CNSC to convert guidance into new requirements by the use the term "must". While there maybe occasions when it is appropriate to change guidance into a requirement, the intent and rationale should be clearly stated not included as part of a blanket update. Changes from guidance to requirement have a significant impact on industry and industry would like to understand the rationale for such changes. • In reviewing this draft, CNA members noted a number of occasions where terms were either undefined or misaligned with definitions in other regulatory documents or CSA nuclear standards. This creates the potential for confusion and misinterpretation and the CNA encourages the CNSC to ensure definitions align with REGDOC 3.6. Glossary of CNSC Terminology.	Comment noted. The document was revised for clarity and precision and terminology reviewed. The changes proposed in this REGDOC reflect the regulatory experience acquired since the publication of G-206, as well as international best practices. The document was revised for clarity and precision and terminology was reviewed. REGDOC 3.6. Glossary of CNSC Terminology will be updated with any new definitions once the REGDOC is published

#	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse de la CCSN
2.	**General**	Ontario Power Generation (OPG),	• There is a need to provide for consistency between various CNSC reporting documents, especially with respect to definitions (example REGDOC-3.6, Glossary of CNSC Terminology and all other related REGDOCs.) • Please review all conversions of previous guidance to new requirements to ensure they are justified and not just blanket changes done as part of the CNSC's document framework project.	Comment noted. The document was revised for clarity and precision and terminology was reviewed. REGDOC 3.6. Glossary of CNSC Terminology will be updated with any new definitions once the REGDOC is published. The changes proposed in this REGDOC reflect the regulatory experience acquired since the publication of G-206, as well as international best practices.
3.	**General**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The CNSC is using the creation of a draft REGDOC to convert effective guidance into new requirements. For instance, Section 3 of this draft includes "must" requirements for each of the sections on Liquidity, Certainty of value, Adequacy of value and Continuity that are currently "should" guidance statements in *G-206.* Licensees appreciate that changing guidance to a requirement may be appropriate in select instances. If it truly tightens a gap to nuclear safety, industry will not only support such a move, it will ensure it becomes a priority in the field. These conversions should be the exception, not the rule. **Suggested Change** Review all conversions of previous guidance to new requirements to ensure they are justified and not just blanket changes done as part of the CNSC's document framework project. Maintain the proper guidance from *G-206*, by amending the following passages from Section 3: • 3.1. "The proposed financial guarantee should ~~must~~ be such that the instrument can be drawn upon only with the prior acceptance of the CNSC …" • 3.2 "Licensees should ~~must~~ elect funding or security instruments or arrangements which provide full assurance of their value." • 3.3 "The value of the financial guarantees for nuclear facilities should ~~must~~ be linked to the cost estimate associated with the most up to date decommissioning plan. **MAJOR Impact on Industry** REGODOC changes are not theoretical or academic exercises for licensees. Every new requirement carries a real-life cost, either in hard resources or time. The cumulative impact of ever-increasing requirements means licensees' ability to	The changes proposed in this REGDOC reflect the regulatory experience acquired since the publication of G-206, as well as international best practices. The changes from guidance to requirement for the mentioned section will not have an impact on licensees since the financial guarantees that have been approved by the Commission already meet those requirements. Paragraph 3(1)(l) of the *General Nuclear Safety and Control Regulations* requires that a licence application contain a description of any proposed financial guarantee relating to the activity to be licensed. Subsection 24(5) of the *Nuclear Safety and Control Act* states that "A licence may contain any term of condition that the Commission considers necessary for the purpose of the Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission." Licence condition requires licensees to maintain a financial guarantee (FG) for decommissioning that is acceptable to the Commission. The FG shall remain valid and in effect and adequate to fund the activities described in the preliminary decommissioning plan. Based on the Act and its Regulations, CNSC staff consider that to be acceptable to the Commission, the FG must meet the acceptance criteria as listed in Section 3 of REGDOC-3.3.1.

#	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse de la CCSN
			prioritize their work and distribute their limited resources in areas that truly impact operational nuclear safety is progressively limited	
4.	**General**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Licensees appreciate the CNSC's desire to provide early drafts to industry, but feel more time could have been spent improving the editorial quality of this document, which contains a significant number of typos, unclear language and formatting issues. While industry understands these will be corrected before publication, this draft would have been easier to review if an editorial check had been done ahead of its release. **Suggested Change** Licensees urge the CNSC to review the draft for clarity of language, spelling and formatting and would be pleased to review it again ahead of publication. **MAJOR Impact on Industry** Requirements and guidance are more easily understood if they are written in clear, concise language.	The document was revised for clarity and precision and terminology was reviewed.
5.	**General**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Reviewers found several terms that were either undefined or misaligned with definitions in other regulatory documents or CSA nuclear standards. For example: 1. In Section 2, the CNSC definition of "decommissioning" is not clear with regard to release from regulatory control. The first sentence within the definition states, "the removal of some or all of the regulatory controls," while the second sentence implies full release from regulatory control. 2. "Intergenerational equity" is referenced in the 3rd paragraph on Page 2, but not defined. 3. "Securities" is referenced in the 2nd second section 3.4, but not defined. 4. In Section 13.1, "drawdown" and "uncertainty analysis" are referenced, but not defined. Also, there is some ambiguity between period dependent costs and "collateral and special item costs." 5. In Section 13.2.1, the terms "structure" and "inventories" are referenced, but not defined. 6. In section 16. 1, the "Crown" is referenced, but not defined. **Suggested Change**	The definition of decommissioning used in section 2 comes from the IAEA General Safety Standards Part 6 Decommissioning of Facilities. As a result of this comment, the document was revised for clarity and precision. "Intergenerational equity" referenced in the 3rd paragraph on Page 2 has been removed Comment noted. The terminology was reviewed. REGDOC 3.6. Glossary of CNSC Terminology will be updated with any new definitions once the REGDOC is published.

#	Section	Organization / Organisation	Comment / Commentaire	CNSC Response / Réponse de la CCSN
			Ensure definitions for each of the examples are provided in this document and included in *REGDOC-3.6, Glossary of CNSC Terminology* and all other related REGDOCs. **MAJOR Impact on Industry** Undefined terms -- or definitions that vary across REGDOCs and are not included in *REGDOC3.6* -- increase the risk of licensees misunderstanding requirements. Having clear, consistent definitions applied across the entire CNSC framework and catalogued in its Glossary promotes better compliance.	
6.	**1.1**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** This section does not acknowledge the current state of the facility/financial guarantee and the evolution throughout the lifecycle of the facility. Not all proposed facilities would be captured in the initial (construction) financial guarantee if they were planned to be constructed near the end of the facility life. **Suggested Change** Amend the 1st sentence of the 2nd paragraph to read, "Applicants and licensees are required to make adequate provision for the safe decommissioning of existing or ~~proposed~~ nuclear facilities by ensuring that sufficient financial resources are available to fund all approved decommissioning activities should the licensee not be able to fulfill its obligations." **MAJOR Impact on Industry** As written, this would require additional financial assurance than is currently the practice for uranium mines and mill licensees.	As a result of this comment, the document was revised for clarity and precision. Section 1.1. 2nd paragraph was revised: Applicants and licensees are required to make adequate provision for the safe decommissioning of existing or proposed new nuclear facilities that will be constructed in the 5-year financial guarantees period by ensuring that sufficient financial resources are available to fund all approved decommissioning activities should the licensee is not able to fulfill its obligations. The requirement to provide an adequate FG for decommissioning applies to the existing and new build facilities.
7.	**2, 3.1, 5.1, 5.3, 5.4**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** In each of these sections, the document does not recognize that assurances are given to provinces in some jurisdictions and not the CNSC. In those instance, it is the province that has funds available to it. **Suggested Change**	The CNSC must be assured that it or its agents can, upon demand, access or direct adequate funds if a licensee is not available to fulfil its obligations for decommissioning. The provinces can be named beneficiary to the financial guarantees ONLY with the Commission's prior acceptance.

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			• In Section 2, amend the 3rd paragraph to read, "…the financial guarantee ensures that there are funds available to the beneficiary ~~CNSC~~ …" • Add the following as a subsection: **X.X.X Beneficiary** An appropriate beneficiary should be named in the financial guarantee document. The beneficiary may be the CNSC, or where an understanding exists, may be an alternative government body with jurisdiction over the decommissioning activities of the nuclear facility. • In Section 3.1, amend the 1st sentence to read, "…prior acceptance of the beneficiary ~~CNSC~~…" • In Section 5.1, amend the 2nd sentence to read, "…prior acceptance of the beneficiary ~~CNSC~~…" • In Section 5.3, amend the 2nd paragraph to read, "…the issuer notifies the ~~CNSC (as the~~ beneficiary~~)~~ • In Section 5.4, amend the 1st sentence to read "…controlled by the provincial or federal government …" **Clarification**	
8.	**2.**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The use of the phrase, "the polluter pays" in the 4th paragraph, could be perceived as inflammatory and not necessary to inform readers about the background of financial guarantees. Without context, some may seize upon the phrase "polluters" to improperly drive a narrative. **Suggested Change** Amend the 4th paragraph to read, "~~Sustainable assurance of safety is guided by the two key principles of decommissioning: "the polluter pays" and "the intergenerational equity" principles. These principles raise specific financial obligations for decommissioning. These f~~Financial obligations are intended to ensure: **Clarification**	As a result of this comment, the document was revised for clarity and precision. References to "polluter pays" and "intergenerational equity" was deleted.
9.	**2**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New	**Industry Issue** The final paragraph cites draft *REGDOC-2.11.2* and CSA standard *N294*, which is being amended at the time of this review. As a matter of principle, draft REGDOCs should only reference other REGDOCs or standards that are currently published and not out for review. Otherwise, approved requirements may not be fully understood and informed comments cannot be provided.	Only REGDOCs that are already published or will be published at the same time as this REGDOC will be referenced in the published version.

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		Brunswick Power (NBPower), Bruce Power	**Suggested Change** Cite only currently published versions of REGDOCs and CSA standards. **Clarification**	
10.	**3**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The language used to describe the designated officer is unclear. **Suggested Change** Amend the 1st sentence to read, “The Commission, or ~~where a licence is used by~~ a designated officer, ~~the designated officer~~ will determine …” **Clarification**	No change was made as a result of this comment. The Commission can delegate authority to a designated officer to issue licences and make decisions for those licences under Nuclear Safety and Control Act, Section 37 (2) (c) (d) Designated Officers
11.	**3.2**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Applicants are not mentioned alongside licensees in this section. **Suggested Change** Wherever “licensees” are referenced, “applicants” should be as well for consistency. **Clarification**	As a result of this comment, the document was revised for clarity and precision: Wherever “licensees” are referenced, “applicants” was added for consistency.
12.	**3.4, 5.3**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** With regard to the “advance notice” referenced in the 3rd sentence, to whom must this “advance notice” be given? Is such notice given to the CNSC? **Suggested Change** Please clarify to whom advance notice is to be given. **Clarification**	As a result of this comment, the document was revised for clarity and precision: CNSC needs to be advised in advance of termination or intent to not renew.
13.	**4**	Nordion	**Industry Issue** • The draft REGDOC-3.3.1 sets out “Acceptable Financial Guarantee Instruments” in Section 4. In the past, the CNSC has rejected some of these instruments as being acceptable. Given that the CNSC now has more experience with these instruments and they are now documented in the	No change was made as a result of this comment. Section 4 provides examples of acceptable financial guarantee instruments and states that in all cases these instruments are subject of legal and financial review by CNSC. In order to be accepted, each proposed financial instrument must meet the

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			REGDOC, the CNSC should be prepared to accept the indicated financial guarantee instruments if they meet the other requirements of the REGDOC.	acceptance criteria as provided in section 3 and the terms for financial guarantees administration in section 5.
14.	**4.6**	Saskatchewan Environmental Society	**Industry Issues** I also raise a question about the statement in Section 4.6 that "Expressed commitments from a Canadian federal, provincial or territorial government may be acceptable financial guarantee instruments if used to cover all otherwise underfunded aspects of decommissioning". The wording continues, "Expressed commitments from a Canadian provincial government are restricted to guarantees over which the federal government has rights of offset with respect to transfer payments as a method to enforce the guarantee." There seems to be too much vagueness here. For example, if a province's entitlement to transfer payments changes (i.e. a have-not province becomes a have province), the federal government loses its ability to enforce the guarantee. Moreover, it is not unknown for governments to back away from previously expressed "commitments", so it is unclear how we can be sure that such commitments will be honoured. All of which leads me to the conclusion that we must be very careful not to allow "financial guarantees" to becomes a substitute for very thorough remediation before a site is considered to be decommissioned. Sites that will require on-going care and restrictions for hundreds or thousands of years are not truly decommissioned.	No change was made as a result of this comment. Expressed commitments from a Canadian government may be acceptable only in specific cases, for example, legacy sites and past activities of Crown Corporations for the decommissioning of which the government takes responsibility. As stated in section 4, in all cases the financial guarantee instruments are subject to financial and legal review by the CNSC and must be accepted by the Commission.
15.	**6**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Annual status reports are not completed now by some licensees. Any proposed change to a facility requires discussion on the implications of the financial guarantee under the licence conditions handbook (LCH) change request process and when no change is proposed, no status report is necessary. Licensees who currently provide annual updates to the CNSC as per their LCH have significant concerns with the unnecessary inclusion of the phrase "according to the most up-to-date decommissioning plan" in the 2nd sentence. It is not practical or reasonable to expect the associated cost estimates be updated on an annual basis with all the required review and approval due diligence from licensees and governments. Please see comments on section 13.1 for related concerns.	Section 6 refers to the annual compliance reporting and not to a requirement for updating the financial guarantees every year. This section does not require the licensees to do anything further than the current annual compliance reporting as per the reporting requirements for their facilities set in the REGDOCs and the licence condition handbook. As a result of this comment the text in section 6 was revised to: Licensees must indicate if their financial guarantee remains valid, in effect and sufficient to meet decommissioning needs according to the current decommissioning plan associated with the cost estimate used to establish the amount of the financial guarantee.

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			Suggested Change Delete section 6. Otherwise, align it with the LCH's of those licensees who are required to file updates by amending it to read, "Certain licensees are required by their licence conditions handbooks to report annually on the status and the validity of their financial guarantee. These licensees must indicate if their financial guarantee remains valid, in effect and sufficient to meet decommissioning needs ~~according to the most up-to-date decommissioning plan [3] [4].~~ ~~For certain licensees, additional requirements for reporting on financial guarantees may be specified in the licence conditions handbook~~." **MAJOR Impact on Industry** This section imposes a new annual report on some licensees and -- without further clarification -- could significantly increase the resource burden on other licensees with no corresponding improvement to nuclear safety. Before publication of this REGDOC, the CNSC is strongly encouraged to discuss this issue further with industry to ensure all requirements and their impacts are fully understood.	
16.	**6**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The financial guarantee review reporting requirements, as stated in sections 15 and 19, are not referenced in this section on reporting requirements. **Suggested Change** If section 6 is retained, reference the financial guarantee review reporting requirements from sections 15 and 19. **Clarification**	No change was made as a result of this comment. Sections 15 and 19 refer to the update and review of the financial guarantees (FGs) and not to the annual reporting requirements as stated in section 6. Section 15 applies to Part I of this REGDOC addressing the requirements for FGs for nuclear facilities and activities. Part II applies only to the termination of licensed activities for nuclear substance and class II licences.
17.	**8**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New	**Industry Issue** This section contains redundant information that is discussed in proposed *REGDOC-2.11-2*. The scope of this document should be kept to discussion on the cost estimation process and financial guarantees. **Suggested Change** Remove the section.	Section 8 states the importance of timely and proper decommissioning planning which provides basis for the financial guarantees and makes a reference to the requirements for planning for decommissioning set in REGDOC-2.11.2.

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		Brunswick Power (NBPower), Bruce Power	**Clarification**	
18.	**8**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Clarity can be added to the lifecycles stages of a facility. **Suggested Change** Amend the 2nd sentence of the 1st paragraph to read, “The lifecycle stages of a facility include: siting; design and construction; ~~commissioning;~~ operation and maintenance; ~~final shutdown~~; decommissioning.” **Clarification**	As a result of this comment, the document was revised for clarity and precision: 2nd sentence of the 1st paragraph was amended: <u>The lifecycle stages of a facility include: siting; construction (including design); operation and decommissioning. Planning for decommissioning is an ongoing process and should be considered at each lifecycle stage of the facility.</u>
19.	**9**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** It is unclear how Appendix B would be applied for determining contingencies in cost estimates. Recommended contingencies provide for Grade A, B and C estimates in the first part of the Appendix. In Table 1 of Appendix B, a column is provided with ‘Expected Accuracy’ **Suggested Change** Confirm if this is intended to also be considered when selecting an appropriate contingency. Also, clarify which type of classification (grades vs classes) would be better suited for decommissioning cost estimates for nuclear power plants. **Clarification**	No change was made as a result of this comment. Appendix B is provided as a guidance and gives as an example of the guidance developed by the Association for the Advancement of Cost Engineering (AACE International). It will be up to the licensees to define the type and level of uncertainty to include depending on the advancement of their planning for decommissioning and the complexity of the cost estimation.
20.	**10**	Saskatchewan Environmental Society	**Industry Issue** It is reassuring to see (Section 10) that “costs to be included”include “long-term monitoring and maintenance of the site and institutional control (if applicable)”. What is problematic is the concept of “long-term”. In dealing with old uranium mining areas – and doubtless with other radioactively contaminated sites – we are talking about time frames of centuries and millennia. As an example, a current request to remove a Beaverlodge property from CNSC licensing includes a requirement to replace a mine-opening cover in 1200 years. There are also requirements to conduct monitoring activities every 75 years (with no end-date). In this particular case, an attempt has been made to project inflation rates and expected rate of return on investments based on recent short-term experience, leading to what look like extremely unreliable conclusions.	No change was made as a result of this comment. The financial guarantees are established to ensure that money is available for the decommissioning of the facilities as per the PDP and updated every five years. The schedule for decommissioning is a key element of the BOE and usually extends to the foreseeable future. Limited number of CNSC regulated facilities, mainly former uranium mines and tailings may be transferred to institutional control. Therefore, CNSC require that the “costs of long-term monitoring and maintenance of the site and institutional control to be included in the cost estimates. The cost estimates for long-term management are based on predicted conditions in the future. Therefore it is required to include contingencies to cover future unforeseeable elements.

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21.	**10**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** With regard to radioactive waste and used fuel, what is the difference between long-term management (as referenced in the eighth bullet) and storage and disposal (as referenced in the fifth bullet)? **Suggested Change** Please clarify. **Clarification**	As a result of this comment, the document was revised for clarity and precision: Section 10 was revised; The cost estimate for decommissioning must address the cost of the following principal activities, if applicable: • preparation for final shutdown • facility shutdown activities • additional activities for safe enclosure (if applicable) • decontamination and dismantling activities • waste processing and storage, including used fuel • project management, engineering and site support • site clean-up, landscaping and restoration (if required) • disposal of radioactive waste and used fuel (if applicable) • long-term monitoring and maintenance of the site and institutional control (if applicable) • miscellaneous expenditures
22.	**11**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** In the last paragraph on Page 11, the reference to "reasonably conservative" is subjective, not defined and not necessary to convey the point being made. **Suggested Change** Amend to read, "The applicant or the licensee should reflect local construction rates for labour, ~~reasonably~~ conservative estimates for materials, equipment and administrative expenses." **Clarification**	As a result of this comment, the document was revised for clarity and precision: the sentence was revised: The applicant or the licensee should reflect local construction rates for labour, ~~reasonably~~ conservative estimates for materials, equipment and administrative expenses."
23.	**12**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The 3rd sentence in the 2nd paragraph references "major cost groupings" in terms of the second level of a hierarchal cost structure, but such groupings are referred to as "activity groups" in terms of the example hierarchal cost structure presented in Figure 1. **Suggested Change** For the sake of consistency, such groupings should be referred to as either "major cost groupings" or "activity groups" throughout the REGDOC. **Clarification**	As a result of this comment, the document was revised for clarity and precision: the 2nd sentence corrected to revised "The second level presents activity groupings under which project costs would be gathered".
24.	**13.1**	Ontario Power Generation (OPG),	**Industry Issue**	The BOE should be provided in the most up-to-date decommissioning plan.

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		Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	Some of the bullets listed in this section are redundant as they are requirement of a decommissioning strategy (i.e. PDP or DDP) described in *REGDOC-2.11.2*. The 13th bullet, "description of computer codes or calculation methodology employed" is onerous and not needed since proper QA programs are already in place. **Suggested Change** Amend to read, <u>"The basis of estimate (BOE) is the foundation upon which the cost estimate is developed. For nuclear facilities, the BOE comprises the decommissioning strategies within the PDP and DDP prepared in accordance with *REGDOC-2.11.2*. Additional BOE information should be included in the cost estimate such as:</u> • <u>assumptions and exclusions, including the reference year and the currency used</u> • <u>boundary conditions and limitations – legal and technical (e.g., regulatory framework)</u> • <u>sources of data used (actual field data vs. estimating judgment)</u> • <u>cost estimating methodology used; e.g., bottom-up</u> • <u>the basis for determining contingency, estimating uncertainty and risk</u> • <u>schedule analysis</u> • <u>uncertainty analysis"</u> Remove remaining bullets. **Clarification** A well-documented BOE should fully reflect the current decommissioning plan for the facility. The BOE should provide a detailed description of the decommissioning project including:	As a result of this comment, the document was revised for clarity and precision. The 1st paragraph of Section 13.1 was revised: The basis of estimate (BOE) is the foundation upon which the cost estimate is developed. The BOE should fully reflect the current decommissioning plan for the facility prepared in accordance with REGDOC-2.11.2. In addition, the bullet "description of computer codes or calculation methodology employed" was deleted.
25.	**13.1**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Industry believes the 2nd paragraph in this section adds more confusion than clarity and is not required. Specifically, licensees have significant concerns with the phrase 'worst-case scenario or "decommissioning tomorrow approach" in the 1st sentence of the 2nd paragraph. This is not defined and could be inappropriately interpreted by some to require the highest cost estimate.	This comment takes the paragraph out of context, the paragraph states that "if impacts of proposed operations are difficult or impossible to estimate with precision, the worst-case scenario or "decommissioning tomorrow approach" must be used. The "decommissioning tomorrow approach " means that a drawdown of nuclear substances or hazardous waste during operation is not assumed. It must be assumed that the shutdown is occurring overnight. Therefore, the cost estimation must be

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			The last sentence in the 2nd paragraph reads, "A credit for salvage of materials or equipment is not allowed. For the purpose of the cost estimate, they must be considered waste." However, Appendix C, item 3, expenses, states, "income from asset recovery ("negative expenses") is included." **Suggested Change** Delete the 2nd paragraph. This section is meant to provide BOE guidance, which is sufficiently offered by the revised bullet list as per comment #19 and the final paragraph in the section. As currently written, the 2nd paragraph adds more confusion than clarity. It does not define: 'worst-case scenario'; 'asset recovery'; or 'salvage.' Perhaps there is a subtlety between salvage of material and asset recovery? It's also unclear if the salvage of materials or equipment can be considered as part of the "uncertainty analysis." **Clarification**	based on the facility and inventories state at the time of shut down. Appendix C is provided as an example of standardized definitions for cost categories used by the International Structure of Decommissioning Costing (ISDC). The licenses could estimate the potential income from the asset recovery but its cost should not be included in the amount of the financial guarantees.
26.	**13.4**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** In terms of the "summary-level schedule" referenced in the last paragraph, to whom would this be provided? Would it be provided to the CNSC? **Suggested Change** Please clarify. **Clarification**	As a result of this comment, the document was revised for clarity and precision. Section 13.4 was amended: <u>At the early stages of decommissioning planning and cost estimation, a less detailed schedule summarizing the principal activities may be provided and a more detailed schedule should be provided later based on the detailed decommissioning planning.</u> The schedule is one of the four basic elements of the cost estimation and should be provided as part of the cost estimation.
27.	**13.5**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New	**Industry Issue** In terms of the 3rd sentence in the 4th paragraph on Page 12, why are contingencies "expected to be spent during the realization of the decommissioning project"? **Suggested Change**	As a result of this comment, the document was revised as suggested.

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		Brunswick Power (NBPower), Bruce Power	Amend the last sentence of the 4th paragraph to read, "Contingencies are an integral part of the cost estimate ~~and are expected to be spent during the realization of the decommissioning project~~." **Clarification**	
28.	**13.5**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Licensees have clarity and compliance concerns with the phrase, "Unforeseeable elements outside the defined project scope." **Suggested Change** Remove the reference to "outside the project scope" in this section and throughout the document. **MAJOR Impact on Industry** "Unforeseeable elements outside the defined project scope" is ambiguous terminology and would be difficult, if not impossible, for licensees and applicants to fully account for in a financial guarantee.	As a result of this comment, the document was revised for clarity and precision. Section 13.5 was amended. Information on the out-of scope uncertainty was removed.
29.	**14**	Saskatchewan Environmental Society	**Industry Issue** So while the statement in Section 14 of the REG DOC that "Licencees must factor in inflation to ensure that there are sufficient funds reserved even when consideration for price increases is factored in", and that "In cases where funds are invested, the expected rate of return that will be earned by the funds over time must be estimated" are appropriate, it is inconceivable that such estimates for a period of 1000 years – or even 75 years – can be considered meaningful. In fact, there is sufficient uncertainty about the economic and regulatory future (as noted in Section 13.5) that any projections of societal capacity for very long-term monitoring and maintenance must be regarded as very dubious.	No change was made as a result of this comment. The financial guarantees are established to ensure that money is available for the decommissioning of the facilities as per the PDP and updated every five years. The schedule for decommissioning is a key element of the BOE and usually extends to the foreseeable future. Limited number of CNSC regulated facilities, mainly former uranium mines and tailings need to be transferred to institutional control. Therefore, CNSC require that the "costs of long-term monitoring and maintenance of the site and institutional control to be included in the cost estimates. The cost estimates for long-term management are based on predicted conditions in the future. Therefore it is required to include contingencies to cover to for future unforeseeable elements.
30.	**14. 14.1**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN),	**Industry Issue** The terms "current value" and "constant dollars" are used interchangeably in this section. "Constant dollars" is the better term as per most cost estimating terminology.	Terminology constant dollar and present value was reviewed.

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		Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Suggested Change** For clarity and consistency, just use "constant dollars." **Clarification**	
31.	**15**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The wording in this section should reflect the fact that the financial guarantee **requirement** needs to be reviewed every five years, presented to the CNSC, etc., not just the financial guarantee. **Suggested Change** Revise accordingly. **Clarification**	No change was made as a result of this comment. All licensees are required to maintain a financial guarantee. It is the financial guarantee itself that needs to be reviewed, not the requirement for one. The CNSC review of licensee's financial guarantees every five years includes both the review of cost estimation for decommissioning and the financial instrument.
32.	**Appendix B**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** Which type of classification (grades vs classes) would be better suited for decommissioning cost estimates for NPPs? Also for Table 1, the expected accuracy column for class 4 should be aligned with latest AACE reference document. **Suggested Change** Please clarify the classification and ensure alignment regarding Table 1. **Clarification**	Appendix B is provided as a guidance. CNSC does not prescribe the type of uncertainty classification to be used. It is up to the licensees/applicants to analyse the uncertainties and justify the consignees based on the complexity of their operations and planning for decommissioning. As a result of this comment, the document was revised for clarity and precision: Table 1 class 4 corrected to align with latest AACE reference document.
33.	**Appendix C**	Ontario Power Generation (OPG), Canadian Nuclear Association (CAN), Canadian Nuclear Laboratories (CNL), Nordion, New Brunswick Power (NBPower), Bruce Power	**Industry Issue** The preamble includes "materials" as part of investment costs. Section 3 speaks to "consumables" and spare parts as part of the expenses category. **Suggested Change** Please clarify **Clarification**	No change was made as a result of this comment. Consumables are materials that are used in a production process although, unlike direct materials, they do not form part of the direct cost and are included as expenses. For example in construction, brisk, wood, cement, etc. are materials while consumables would be glue, nails, tape.

Table B: Feedback on comments period / Tableau B: Période des observations

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No comments received.				

Table C: Workshop with industry and civil society organizations / Tableau C: Atelier avec l'industrie et avec des organisations de société civile

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1.	General	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**MAJOR** This REGDDOC continues to refer to the 'licensee' and 'applicant' throughout the document, but does not clearly recognize there is an important difference between 'owner' and 'licensee.' Decommissioning and financial guarantee is the responsibility of the owner (not the licensee). In most cases, they are one and the same. However, in some instances (such as the Bruce Power lease with Ontario Power Generation), the licensee is not the owner. **Suggested change:** As per industry's suggestions with other, interdependent REGDOCs, this document needs to replace "licensee" with "owner" in most cases throughout the document. Alternatively, a clarifying paragraph should be added at the beginning of the document which clearly addresses the situation. **Impact on industry:** As issues related to financial guarantees and decommissioning draw increased political and public scrutiny, it's imperative that all readers of this REGDOC understand the relationships, commercial agreements and regulatory obligations between "owners" and "licensees."	REGDOC-3.3.1 does not address specific arrangements between the licensees. The NSCA applies to licensees and applicants. The Commission includes conditions on the licence requiring the CNSC licensees or applicants for a new licence to establish a financial guarantee for decommissioning. Specific relationships between "owners" and licensees are arranged through additional agreements. The ultimate responsibility for complying with the requirements of the Act, Regulations and Licence conditions remains with the licence holder.
2.	General	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power,	**MAJOR** While Industry is grateful for the opportunity to review and offer feedback on draft REGDOCs, we are concerned that this document may be in draft form and subject to change. **Suggested change:**	Based on comments received from public consultation, CNSC staff reviewed and revised the purpose and scope of the document.

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		NWMO, OPG, Orano	We know that the CNSC will address the editorial issues. What is concerning is the incompleteness of the scope (e.g., referenced legislation in Section 1.3). **Impact on industry:** The document is incomplete and may be subject to change.	
3.	2, 3.4, 4 & 5	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**MAJOR** Section describes CNSC as the beneficiary of the guarantee when applicable provincial or other jurisdictional legislation may also require a guarantee from an applicant or licensee provided that an understanding or arrangement exists between the jurisdiction that requires the financial guarantee and the CNSC. **Suggested change:** Replace ‘funds available to the CNSC’ with ‘funds available to the beneficiary’. **Impact on industry:** Some licensees could not comply.	The CNSC must be assured that it can, upon demand, access or direct adequate funds if a licensee is not available to fulfill its obligations for decommissioning. The funds must be structured such that the instrument can be drawn upon only with the prior acceptance of the CNSC and that such pay-out is not prevented, delayed or compromised, and must be structured such that the instrument can provide full assurance of value. Section 5.1, 2nd paragraph was revised for clarity and precision: “In cases, such as for uranium mines in the province of Saskatchewan, where the province has a legislative framework in place, the financial guarantee may be payable to a provincial entity which is qualified to conduct the decommissioning of the mine following the acceptance of this arrangement by the Commission. The provincial entity is also responsible for the following institutional control program as legislated by the province.”
4.	4.6	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	**MAJOR** A letter from the Crown can be used to address all associated costs of decommissioning. **Suggested change:** Edit “…if used to cover all otherwise unfunded aspects… **Impact on industry:** A letter from the Crown can be used to cover all aspects of decommissioning a facility or site for which the federal government has assumed liability.	As a result of this comment, the document was revised for clarity and precision. Section 4.6, 1st paragraph was revised to: “Expressed commitments from a Canadian federal, provincial or territorial government, may be an acceptable financial guarantee instrument to cover all aspects of decommissioning a facility or site for which the government has assumed liability.”
5.	2 & 8	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	Section 2 last paragraph and section 8 1st paragraph, refer to facility lifecycle as “stages” rather than phases **Suggested change:** Request that they use the same description as applied in the CSA standards – “life-cycle phases”.	No change to the REGDOC. This terminology is aligned with the terminology used in CSA N294, *Decommissioning of facilities containing nuclear substances*”, stages of the facility lifecycle and phases of decommissioning.

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6.	3.3	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	Last sentence - clarity is required as to what it's meant to imply – "Financial guarantees for other licensed activity must be linked to their license." **Suggested change:** What does "Financial guarantees for other licensed activity must be linked to their license" mean?	As a result of this comment, the document was revised for clarity and precision. Section 3.3 was revised to : "The value of the financial guarantees for nuclear facilities must be linked to the cost estimate associated with the most up to date decommissioning plan for nuclear facilities or activities authorized under Class I, uranium mines and mills and waste nuclear substances licences." Financial guarantees for other licensed activities, addressed in Part II of this document, must be linked to their licence for nuclear substances and radiation devices, prescribed equipment, and Class II facilities.
7.	6	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	Section 6 does not acknowledge that it might not be the licensee that holds the liability for the financial guarantee (e.g., government agency, lease arrangement). **Suggested change:** Provide clarifying text.	The reporting requirements indicated in Section 6, are based on the conditions included on the licence and expectations for complying with those conditions. The expectations for reporting on financial guarantees are specified in the licence conditions handbook and in REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills*, and REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices*.
8.	13.1	Bruce Power, BWXT, Cameco, CNA, CNL, CANDU Owners Group, Hydro-Québec, Kinetrics, NB Power, NWMO, OPG, Orano	G-206 qualified "worst-case" with "credible worst-case". **Suggested change:** Replace "worst-case" with "credible worst-case" as qualifying "worst-case" provides more certainty.	The text was changed to: "credible worst-case scenario". The cost estimate for decommissioning should provide that, if impacts of proposed operations are difficult or impossible to estimate with precision, a credible worst-case scenario must be used.
9.		Saskatchewan Environmental Society	REG DOC 3-3-1 Financial Guarantees, paragraph 14: In estimating future costs, reference is made to projecting future inflation and discount rates. In post-decommissioning of mine/mill sites we are dealing with monitoring and maintenance costs that extend many thousands of years into the future. Isn't it unrealistic to assume that projections of inflation and discount rates over such a time period can be based on the experience of the past few years? Even suggesting that estimates could be adjusted when major economic changes occur would not solve the problem, as such changes could well happen after the original proponent had handed over responsibility to an institutional control agency and adjustment of the financial guarantee would be impossible.	REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities* applies to a large variety of licensees regulated by the CNSC. The CNSC requires that the established financial guarantees reflect the complexity, risk level and timeframe of the licensed activities. In the case of uranium mines, the majority of the established financial guarantees cover for the decommissioning of the mines/mills until they reach a state allowing for their release from CNSC regulatory

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				control and transferred to the provincial institutional control program. The cost of the institutional control program is only a portion of the FG and is expected to decrease overtime when the required long-term monitoring and maintenance activities decrease. The proposed institutional control program and the projected cost should meet applicable provincial regulations and is reviewed by the Province.