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Decommissioning

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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*.

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.

Table of Contents

1.	Introduction.....	1
1.1	Purpose.....	1
1.2	Scope.....	1
1.3	Relevant legislation.....	1
2.	Background	2
2.1	The lifecycle approach to decommissioning.....	2
2.2	Phases of decommissioning	3
3.	Optimization and Graded Approach in Decommissioning	3
4.	Decommissioning Strategy	4
4.1	<i>In situ</i> decommissioning	5
5.	Planning for Decommissioning	6
5.1	Preliminary decommissioning plan.....	6
5.1.1	Content of the preliminary decommissioning plan	6
5.1.2	Uncertainty	8
5.2	Waste management strategy	8
6.	Preparation for Decommissioning.....	9
6.1	Detailed decommissioning plan	9
6.1.1	Content of the detailed decommissioning plan	10
6.2	Safety assessment for decommissioning.....	12
6.3	Storage with surveillance plan	13
6.4	Waste management plan	13
7.	Execution of Decommissioning	14
7.1	Storage with surveillance.....	14
7.2	Waste management	14
8.	Completion of Decommissioning	15
8.1	Post decommissioning	15
9.	Radiological and Non-Radiological Surveys.....	16
9.1	Pre-operational surveys.....	16
9.2	Operational surveys	17
9.2.1	Transition from operation to decommissioning surveys.....	17
9.3	Decommissioning surveys	17

9.4 Decommissioning end-state surveys..... 18

Glossary 19

References..... 20

Additional Information 21

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 or location 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 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 other [CNSC regulatory documents](#) and CSA standards, such as CSA N294, *Decommissioning of facilities containing nuclear substances* [1].

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. Background

2.1 The lifecycle approach to decommissioning

The CNSC requires that planning for decommissioning take place throughout the lifecycle of a nuclear facility 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 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/activity 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

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 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 (e.g., nuclear power plant or uranium mine), the same planning for decommissioning may generate plans that describe a multi-phase program addressing a variety of different facility components and/or locations, and employ a number of specialized decommissioning programs and procedures.

The licensee may consider dividing a complex facility or location 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 activity/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).

2.2 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 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

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 to years or decades for larger and more complex facilities. For some small or simple facilities 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.

3. 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 or activity.

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 or activities, 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* [2].

4. 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.

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 or location 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 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 or location, 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 or infrastructure located at the same site
- assurance that the facility or location 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
- updated schedule, cost and funding information
- operational experience and lessons learned
- revised regulatory requirements
- availability of facilities for the management of radioactive waste

If shutdown of a facility 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.

4.1 *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. 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* [3].

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 dating back to the birth of nuclear technologies in Canada for which decommissioning was not planned as part of the design.

5. 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* [5].

5.1 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 applicable regulations. 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
- updated schedule, cost and funding information
- operational experience and lessons learned
- revised regulatory requirements
- availability of facilities 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.

5.1.1 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* [6]
 - an Indigenous engagement plan as per the requirements and guidance of REGDOC-3.2.2, *Indigenous Engagement* [7]
 - 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* [5], 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.

5.1.2 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 closure occur. The PDP should be refined over time as the preparation for and the execution of decommissioning phases approach and the uncertainty decreases.

5.2 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* [8].

6. 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 permanently or ceasing to manage, possess, use or store nuclear substances. Prior to permanent shutdown of a facility 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 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.

6.1 Detailed decommissioning plan

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. 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.

If permanent shutdown takes place before a DDP has been prepared and accepted, the licensee shall prepare one as soon as possible.

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 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 or applicant 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, 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* [3].

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 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.

6.1.1 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* [5], 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.

6.2 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 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 or activity
- 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 or activity
- 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 or location, a post-closure safety case (see section 4) shall be provided, in addition to the decommissioning safety assessment.

6.3 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 or location 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 or location.

6.4 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* [8].

7. Execution of Decommissioning

During the execution of decommissioning, the licensee shall:

- conduct decommissioning in accordance with the accepted DDP and written 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 the 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.

7.1 Storage with surveillance

For deferred decommissioning, during periods of storage with surveillance, the licensee shall ensure that the facility 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, 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

7.2 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 or activity and all waste from decommissioning.

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.

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*.

8. 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 or location and remaining structures, including any institutional controls

Where decommissioning of the facility or location 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 or location, the remaining hazards, the interim end state achieved, the results of surveys, the hazards and physical condition of the facility or location, and the remaining decommissioning tasks or work packages to be completed.

8.1 Post decommissioning

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. 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 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.

If institutional controls are required, the CNSC expects the following actions to be taken by the responsible party:

- implementation of a visual inspection plan for periodic examination of the facility or location to look for signs of deterioration of the facility or location (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

9. 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 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 site/facility is sufficient to achieve the desired end state
- supporting clean-up activities and determining when clean-up is complete

9.1 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 a 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 of a nuclear 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.

9.2 Operational surveys

During operational periods, the licensee should retain records of the hazards associated with the facilities and activities, 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, 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.

9.2.1 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 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.

9.3 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.

9.4 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 or location 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 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 for the purposes of decommissioning.

Clean-up activities

The removal of contaminated soil from an area within the boundary of the facility.

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. Canadian Nuclear Safety Commission (CNSC), [REGDOC-3.5.3, Regulatory Fundamentals](#), Ottawa, 2018.
3. CNSC, draft [REGDOC-2.11.1, Waste Management, Volume III: Safety Case for the Disposal 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-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities](#), Ottawa, TBD.
6. CNSC, [REGDOC-3.2.1, Public Information and Disclosure](#), Ottawa, 2018.
7. CNSC, [REGDOC-3.2.2, Indigenous Engagement](#), Ottawa, 2019.
8. CNSC, draft [REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste](#), Ottawa, TBD.

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-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.
- IAEA, IAEA Safety Standards, Safety Guide No. WS-G-5.2, [*Safety Assessment for the Decommissioning of Facilities Using Radioactive Material*](#), Vienna, 2008.
- 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*, 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

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