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Preface

This regulatory document is part of the CNSC's environmental protection 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.

Environmental protection for nuclear facilities and activities is done in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it. The CNSC requires the environmental effects of all nuclear facilities or activities to be considered and evaluated when licensing decisions are made.

This document will be used to assess licence applications for proposed new nuclear facilities or activities, licence applications for existing facilities (renewals and amendments), new environmental risk assessments (ERAs) and updates to existing ERAs:

- all licence applications are subject to an environmental assessment (EA), commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity
- every applicant or licensee must have an ERA, commensurate with the scale and complexity of the environmental risks associated with the facility or activity; the ERA is subject to regular updates (at least every five years, and whenever significant change occurs in either the facility or activity, or in the science on which the ERA is based); the licensee's ERA forms the basis of an EA conducted by CNSC staff, either under the NSCA or under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012)
- some projects ("designated projects" as defined in section 2 of CEAA 2012 and projects proposed on federal lands as defined in section 66 of CEAA 2012) are assessed in accordance with CEAA 2012

This regulatory document describes:

- the CNSC's policy and principles for environmental protection
- for all nuclear facilities or activities, the scope of an EA and the roles and responsibilities associated with an EA
- the CNSC's requirements and guidance to applicants and licensees for developing environmental protection measures, including an ERA, for both new and existing facilities

REGDOC-2.9.1, *Environmental Policy, Assessments and Protection Measures* supersedes two regulatory documents previously published by the CNSC:

- P-223, *Protection of the Environment*
- REGDOC-2.9.1, *Environmental Protection Policies, Programs and Procedures*

REGDOC-2.9.1, *Environmental Policy, Assessments and Protection Measures* 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.

A graded approach, commensurate with risk, may be defined and used when applying the requirements and guidance contained in this regulatory document. The use of a graded approach is not a relaxation of requirements. With a graded approach, the application of requirements is commensurate with the risks and particular characteristics of the facility or activity. **Note:** For facilities or activities with no environmental interactions, the licensee's ERA is considered to be complete with the characterization and the demonstration of no interaction.

An applicant or licensee may put forward a case to demonstrate that the intent of a requirement is addressed by other means and demonstrated with supportable evidence.

Guidance contained in this document exists to inform the applicant, to elaborate further on requirements or to provide direction to licensees and applicants on how to meet requirements. It also provides more information about how CNSC staff evaluate specific problems or data during their review of licence applications. Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements.

The requirements and guidance in this document are consistent with modern national and international practices addressing issues and elements that control and enhance nuclear safety. In particular, they establish a modern, risk-informed approach to environmental protection.

Important note: Where referenced in a licence either directly or indirectly (such as through licensee-referenced documents), this document is part of the licensing basis for a regulated facility or activity.

The licensing 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.

Where this document is part of the licensing 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.

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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Environmental Policy, Assessments and Protection Measures

1. Introduction

1.1 Purpose

Environmental protection for nuclear facilities and activities is done in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it. This legislation includes provisions to ensure that licensees are meeting the CNSC's mandate to protect the environment and the health, safety and security of persons. The CNSC requires the environmental effects of all nuclear facilities or activities to be considered and evaluated when licensing decisions are made.

This regulatory document provides information to applicants and licensees on protecting the environment and the health of persons, including:

- identification of facility or activity interactions with the environment and the public
- identification and mitigation of potential environmental effects associated with these interactions
- design and implementation of effluent and emission release measures and of the environmental monitoring measures to confirm or test the predictions and the actual effects
- periodic assessments of the environmental protection measures and the licensee's performance

In particular, this regulatory document describes:

- the CNSC's policy and principles for environmental protection
- for all nuclear facilities or activities, the scope of an environmental assessment (EA) and the roles and responsibilities associated with an EA
- the CNSC's requirements and guidance to applicants and licensees for developing environmental protection measures, including an environmental risk assessment (ERA), for both new and existing facilities

1.2 Scope

This regulatory document clarifies how the CNSC undertakes an EA under the NSCA for all licence applications and, for designated projects, under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). It clarifies the CNSC's expectations of applicants and licensees and provides guidance for protecting the environment and the health of persons.

For applicants proposing facilities or activities in areas of Canada subject to land claim agreements (such as the territories and parts of Quebec and of Newfoundland and Labrador), CNSC staff will support the EA process of that land claim regime and the Commission will use the information gathered in the EA process to inform its licensing decision under the NSCA.

This document will be used to assess licence applications for proposed new nuclear facilities or activities, licence applications for existing facilities (renewals and amendments), new ERAs and updates to existing ERAs:

- all licence applications are subject to an EA, commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity

- every applicant or licensee must have an ERA, commensurate with the scale and complexity of the environmental risks associated with the facility or activity; the ERA is subject to regular updates (whenever significant change occurs in either the facility or activity, or in the science on which the ERA is based); the licensee's ERA forms the basis of an EA conducted under either the NSCA or CEAA 2012
- some projects ("designated projects" as defined in section 2 of CEAA 2012 and projects proposed on federal lands as defined in section 66 of CEAA 2012) are assessed in accordance with CEAA 2012

Notes:

- For facilities or activities with no environmental interactions, the licensee's ERA is considered to be complete with the characterization and the demonstration of no interaction.
- An EA under the NSCA is based on information that the applicant or licensee is already required to submit to the CNSC through the established licensing process; as a result, the CNSC does not expect that significant additional information will be required from applicants or licensees.

1.3 Relevant legislation

The following provisions of the NSCA and the regulations made under it are relevant to this document:

- NSCA:
  - subsection 24(4)
  - subsection 24(5)
- *General Nuclear Safety and Control Regulations*:
  - subsection 1(1)
  - paragraph 3(1)(*f*)
  - paragraphs 12(1)(*c*) and (*f*)
- *Class I Nuclear Facilities Regulations*:
  - paragraphs 3(*e*), (*g*), (*h*) and (*j*);
  - paragraphs 4(*b*), (*c*) and (*e*);
  - paragraphs 5(*b*), (*i*), (*j*) and (*k*)
  - paragraphs 6(*h*), (*i*), (*j*) and (*k*)
  - paragraphs 7(*e*), (*f*), (*g*), (*h*), (*i*) and (*k*)
  - paragraph 8(*b*)
- *Class II Nuclear Facilities and Prescribed Equipment Regulations*:
  - paragraph 3(*p*)
  - paragraphs 5(*e*), (*f*), (*h*) and (*i*)
- *Radiation Protection Regulations*:
  - paragraphs 4(*a*) and (*b*)
  - subsections 6(1) and (2)
  - subsection 13(1)
- *Nuclear Substances and Radiation Devices Regulations*:
  - paragraphs 3(1)(*b*), (*g*) and (*i*)
  - paragraph 12(1)(*k*)

- *Uranium Mines and Mills Regulations*:
    - subparagraph 3(*a*)(v)
    - subparagraphs 3(*c*)(ii), (iii), (v), (vi), (vii), (viii), (ix) and (x)
    - subparagraphs 3(*d*)(i) and (vi)

The *Canadian Environmental Assessment Act, 2012* (CEAA 2012) applies in the following instances:

- designated projects as defined in section 2 of CEAA 2012
- projects proposed to be carried out on federal lands, as defined in section 66 of CEAA 2012

The CNSC also considers pertinent legislation from other government departments, including:

- *Canadian Environmental Protection Act, 1999*
- *Species at Risk Act*
- *Migratory Birds Convention Act, 1994*
- *Fisheries Act*

The following standards from the CSA Group are relevant to this regulatory document:

- CAN/CSA ISO-14001, *Environmental Management Systems – Requirements with Guidance for Use* [1]
- CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [2]
- CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [3]
- CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [4]
- CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5]
- CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [6]

The CNSC licensing process ensures that applicable regulatory documents are considered for licensing applications. The information required to comply with those regulatory documents may contribute to meeting the requirements in this document. All regulatory documents are available on the CNSC website.

1.4 CNSC contact information

The applicant or licensee should consult CNSC staff early in the planning process (before submission of a licence application) to identify the applicable regulatory documents and confirm an understanding of the licensing process.

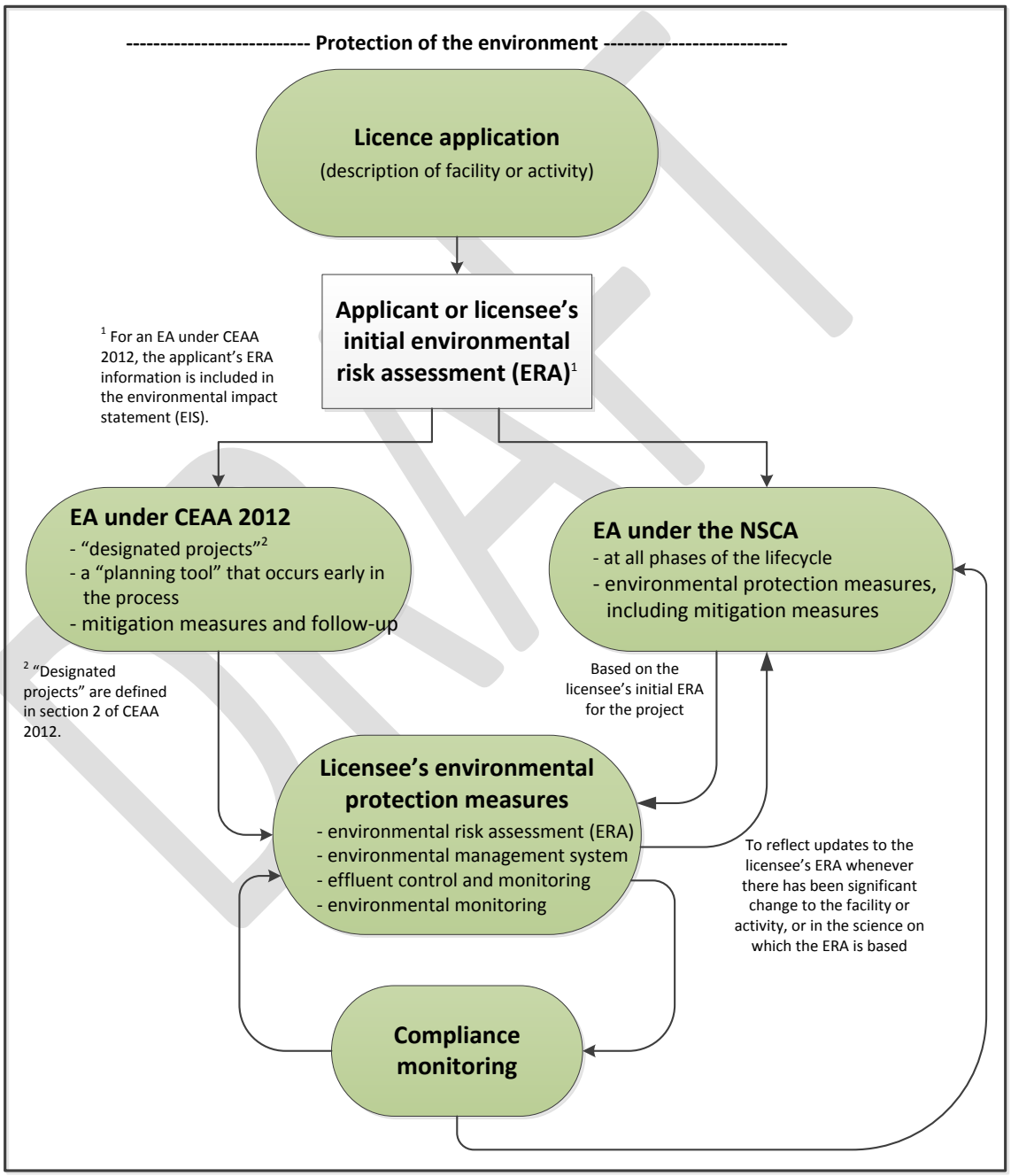
To contact the CNSC:

- Tel.: 613-995-5894 or 1-800-668-5284 (in Canada only)
- Facsimile: 613-995-5086
- Email: info@cnsc-ccsn.gc.ca

2. The CNSC's Environmental Protection Policy

Protecting the environment is part of the CNSC's mandate. The CNSC requires the environmental effects of all facilities or activities to be evaluated and considered when licensing decisions are made (see figure 1). For each licensing decision, the Commission must be satisfied that the applicant or licensee will provide adequate provision for the protection of the environment and the health and safety of persons before a licence can be granted.

Figure 1: Ensuring adequate provision for protection of the environment



2.1 The CNSC's guiding principles for protection of the environment

The CNSC regulates nuclear facilities and activities in Canada to prevent unreasonable risk to the environment and to the health and safety of persons in a manner that is consistent with Canadian environmental policies, acts and regulations and with Canada's international obligations.

The applicant or licensee shall demonstrate that:

- their provisions to protect the environment are adequate (to be demonstrated through performance assessments, monitoring or other evidence)
- their measures taken to protect the environment and the health and safety of persons:
    - are commensurate with the level of risk associated with the activity
    - recognize that uncertainty exists in science, and therefore prevent unreasonable risk
        - by keeping all releases to the environment as low as reasonably achievable (ALARA), social and economic factors being taken into account for nuclear substances [7]
        - through the application of the best available technology and techniques economically achievable (BATEA) for hazardous substances
    - are in accordance with the *Canadian Environmental Protection Act, 1999* (CEPA)
    - respect the principles of pollution prevention, precautionary principle, polluter pays, sustainable development and adaptive management
    - are in compliance with regulatory limits
    - are assessed against performance indicators and targets that are based on sound science

The following sections of this regulatory document provide information on how to meet these requirements.

2.2 Factors considered by the CNSC

The CNSC evaluates the adequacy of an applicant's or licensee's environmental protection measures for compliance with the NSCA and regulations made under the NSCA, and to applicable modern codes, standards and practices. The CNSC evaluates the environmental protection measures on a facility- or activity-specific basis commensurate with risk, taking into consideration the potential interactions between the facility or activity and the environment.

When evaluating applications for licences or making regulatory decisions, the CNSC considers the following factors:

- the relevant environmental policies, objectives, standards and guidelines
- the environmental effects that may be associated with the facility or activity
- the measures proposed or taken to mitigate the potential environmental effects of the facility or activity under normal conditions and for accidents and malfunctions
- engagement with identified Aboriginal groups whose Aboriginal or treaty rights may be affected by the proposed facility or activity
- input from interested stakeholders
- any other relevant information

The CNSC assesses proposed alternative approaches and takes into account the views and proposals of the licensee concerning their individual situations.

2.3 Other jurisdictions and federal departments

The CNSC cooperates with other jurisdictions and federal departments to protect the environment. Where appropriate, the CNSC may enter into formal arrangements to increase the effectiveness of environmental protection. For example, the CNSC holds memoranda of understanding (MOUs) with other federal departments (for example, Fisheries and Oceans Canada, Environment Canada). A complete list of MOUs is available on the CNSC's website.

2.4 Public and Aboriginal engagement

Participation opportunities for the public and for Aboriginal groups are an important component of the CNSC's licensing process. CNSC determines the appropriate level of participation opportunities on a case-by-case basis. The criteria include:

- interests of the public and Aboriginal groups
- the complexity of the facility or activity and its potential interactions with the environment and the public
- additional factors such as other jurisdictional mandates or type of decision

For further information on the CNSC's expectations of licensees for public and Aboriginal engagement, refer to:

- RD/GD-99.3, *Public Information and Disclosure* [8]
- REGDOC-3.2.2, *Aboriginal Engagement* [9]

Notes:

- The CNSC ensures that all of its licensing decisions uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights pursuant to section 35 of the *Constitution Act, 1982* (see the CNSC's *Codification of Current Practice: CNSC's Commitment to Aboriginal Consultation* [10]).
- The CNSC makes a separate determination of appropriate Aboriginal consultation activities with identified Aboriginal groups for each application. These activities may be in addition to the EA public participation opportunities. The CNSC works with the licensee on identifying Aboriginal groups to be engaged and consulted during each review.

3. Environmental Assessments

The CNSC requires that the environmental effects of all nuclear facilities or activities be considered and evaluated when licensing decisions are made. All licence applications are subject to an environmental assessment (EA), commensurate with the scale and complexity of the environmental risks associated with the facility or activity.

EAs are carried out either under the *Canadian Environmental Assessment Act, 2012* (an "EA under CEAA 2012") or under the *Nuclear Safety and Control Act* (an "EA under the NSCA"). Early in the process, CNSC staff determine which EA applies by reviewing the information provided by the applicant or licensee in their application and supporting documentation.

For applicants proposing facilities or activities in areas of Canada subject to land claim agreements (such as the territories and parts of Quebec and of Newfoundland and Labrador), CNSC staff will support the EA process of that land claim regime and the Commission will use the information gathered in the EA process to inform its licensing decision under the NSCA. Under CEAA 2012, the application may be subject to a federal, provincial and/or territorial decision.

The applicant or licensee is required to perform an ERA for the facility or activity, commensurate with the scale and complexity of the environmental risks associated with the facility or activity. The applicant or licensee's ERA forms the basis for both an EA under the CEAA 2012 and an EA under the NSCA. CNSC staff use the information available in the ERA to assess the environmental effects of the facility or activity.

3.1 Environmental assessments under CEAA 2012

The requirements of CEAA 2012 must be met in the following circumstances:

- designated projects as defined in section 2 of CEAA 2012 and outlined in the associated *Regulations Designating Physical Activities* are subject to an EA under CEAA 2012
- for physical activities proposed to be carried out on federal lands as defined in section 66 of CEAA 2012, the applicant is required to comply with section 67 of CEAA 2012 (to determine if the completion of a proposed activity will result in significant adverse environmental effects)

An EA under CEAA 2012 is carried out early in the licensing process (at the beginning of the lifecycle of the project) and serves as a planning tool. It may include follow-up monitoring. The process for an EA under CEAA 2012 is described in appendix A.

Notes:

- CEAA 2012 requirements, if any, are identified early in the process. Applicants will be aware if their project or activity requires an EA under CEAA 2012.
- Following an EA under CEAA 2012, successful applicants may be licensed by the CNSC for the facility or activity. All licensed facilities and activities are subject to an ongoing EA under the NSCA, with requirements for environmental protection measures including monitoring and where the licensee's ERA is subject to regular updates (as described in section 4).

3.2 Environmental assessments under the NSCA

The CNSC assesses the potential environmental effects and health effects for all licence applications. An EA under the NSCA is a review by CNSC staff of information used to support the Commission's determination on whether the applicant or licensee will make adequate provision for the protection of the environment and the health of persons while carrying on a licensed activity. This assessment is commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity.

An EA under the NSCA is carried out at every phase of the lifecycle of the facility or activity.

3.2.1 Overview of the process for an environmental assessment under the NSCA

An EA under the NSCA is primarily based on information that the applicant or licensee is required to submit to the CNSC through the established licensing process, such as the licence application and its supporting documentation, and information on their environmental protection measures. An EA under the NSCA may also be supported by additional information from research, the CNSC's independent environmental monitoring program (IEMP), the CNSC's compliance verification activities, and Aboriginal and public input. No decision is made on the EA itself, as the information is intended to inform and support the Commission's regulatory decision.

The applicant or licensee is required to perform an ERA, commensurate with the scale and complexity of the environmental risks associated with the facility or activity. The applicant or licensee's ERA forms the basis of an EA under the NSCA. CNSC staff use the information in the applicant or licensee's ERA to assess the environmental effects of the facility or activity.

The CNSC's process for an EA under the NSCA ensures applicants or licensees can facilitate the identification of Aboriginal and public concerns or opinions early in the licensing process, by conducting participation opportunities (in addition to CNSC's regular public outreach and Aboriginal consultation activities) in advance of documenting the EA findings and presenting them to the Commission in a hearing.

3.2.2 Roles and responsibilities for an environmental assessment under the NSCA

Applicant or licensee's role and responsibilities

The applicant or licensee's participation in the CNSC's process for an EA under the NSCA occurs at the following stages:

- **Pre-application consultation:**
  To ensure the applicant or licensee understands all appropriate EA requirements, they are encouraged to seek CNSC guidance at the earliest possible stage of planning before submitting a licence application.
- **Environmental protection measures:**
  For every facility or activity, the applicant or licensee is required to submit information on their environmental protection measures (including an ERA) commensurate with the scale and complexity of the environmental risks associated with the facility or activity; for additional information, refer to section 4. The applicant or licensee should complete the ERA and develop their environmental protection measures prior to submitting the licence application or other official notification. The set of environmental protection measures is an important component of the licence application.

- **Licence application:**
  CNSC staff use the information in the licence application and supporting documentation to conduct an EA under the NSCA. The licence application must contain sufficient information to meet regulatory requirements and demonstrate that the applicant or licensee will make adequate provision for the protection of the environment. During the CNSC's review of the licence application, the applicant or licensee is responsible for addressing all issues identified by the CNSC.
- **Public participation:**
  The applicant or licensee has the opportunity to provide responses to questions or concerns raised during public participation. This opportunity may be at a Commission hearing.

Role of the applicant or licensee's environmental risk assessment in an environmental assessment under the NSCA

The applicant or licensee's ERA supports environmental protection throughout the regulatory lifecycle of a facility or activity. The licensing basis with respect to environmental protection is the performance and effects predictions associated with the ERA, which establishes the environmental bounds within which the facility or activity is licensed to operate.

The ERA is revised and updated periodically. Revisions to the ERA are informed by the accumulated site knowledge derived from operational experience, monitoring, special investigations, the incorporation of advances in scientific knowledge and, if available, Aboriginal traditional knowledge. As a result, the initial ERA evolves through the life of the facility, remaining current and becoming increasingly more site-specific. The evolution of the ERA through accumulated monitoring data and new scientific knowledge means the licensee can assess the significance of deviations from predictions of environmental performance.

This approach promotes informed adaptive management and assists the licensee in identifying significant deviations, in implementing relevant environmental protection measures (including mitigation measures).

For information on the requirements and guidance for performing an ERA, refer to section 4.

The CNSC's role and responsibilities for an environmental assessment under the NSCA

Upon receipt of a licence application, CNSC staff complete an EA determination to establish which type of EA applies to the facility or activity, prior to any licensing action. All licensing actions being considered by the CNSC undergo an EA under the NSCA unless it is determined that the proposed licensing action requires an EA under CEAA 2012. The EA report may be completed at the later stages of the licensing process.

Note: If an EA under CEAA 2012 is required, an NSCA EA report will not be developed in addition to the CEAA 2012 EA report.

The CNSC's process for an EA under the NSCA includes:

- pre-application consultation
- a technical review of the licensee's submission
- documenting the EA findings
- determining and organizing opportunities for public and Aboriginal participation
- presenting the EA information to the Commission to support a licensing decision

Pre-application consultation

Pre-application consultation with the CNSC is recommended. Applicants may begin to determine the feasibility of a facility or activity well before submitting a licence application. The CNSC provides potential licensees with:

- the legislative and regulatory requirements and the policy context
- the expected scope and identification of any technical support studies required
- information on the CNSC's licensing process, including the EA under the NSCA
- information requirements for a complete licence application

The CNSC can provide guidance, as appropriate or upon request. The EA information required by CNSC staff is based on the information that is required in the licence application to meet the requirements of the NSCA and the regulations made under it.

Technical review of the licensee's submissions

CNSC staff perform a technical review of the licence application and supporting documentation, including the applicant's ERA. The scope of the technical review varies, depending on the complexity of the facility or activity, the anticipated interactions with the environment and the type of regulatory decision being sought.

Documenting the EA findings

CNSC staff document the EA findings and present them to the Commission for consideration in the licensing decision. The information includes CNSC staff's determination of whether the licensee will make adequate provision for the protection of the environment and the health of persons.

Documents being presented to the Commission for a licensing decision are made available to the public on request. Aboriginal groups and the public are provided an opportunity to review the information and to provide their comments at a public hearing.

If warranted by the level of complexity or by Aboriginal and public interest in the facility or activity, CNSC staff may prepare an EA report, documenting the findings to an appropriate level of detail.

An EA report describes aspects of the full assessment of information required under the NSCA and regulations made under the NSCA and, in particular, covers those elements of the facility or activity that are deemed to be of Aboriginal, public or regulatory interest. If an EA report is prepared, it will be made available to the public on request.

Determining and organizing opportunities for public and Aboriginal participation

CNSC staff may organize an external review of the EA report. An EA under the NSCA allows for consultation on a case-by-case basis with the public and Aboriginal groups on the EA report before the report is finalized and presented to the Commission. Where identified Aboriginal groups were sent a formal notice or where stakeholders and members of the public have responded to the notice of participation opportunities, the CNSC sends the relevant documents to those groups and informs them of the timelines and the process to submit comments.

Presenting the EA information to the Commission to support a licensing decision

The Commission considers the licence application in a public hearing. During the hearing, the Commission may accept written or oral interventions. In advance of the hearing, the CNSC posts a notice on the CNSC website and to the CNSC subscription list, advertises in local media and sends a formal notice to identified Aboriginal groups and to participants in any facility- or activity-specific consultation activities.

Following the hearing, the Commission makes its decision. The Commission Secretariat issues the *Record of Proceedings, Including Reasons for Decision*. This record is posted on the CNSC website. A copy of the decision report is sent to the Aboriginal groups that participated in the review, and is available on request for other Aboriginal groups and members of the public.

4. Environmental Protection Measures

Environmental protection measures identify, control and (where necessary) monitor releases of nuclear and hazardous substances from facilities or as the result of the licensee's activities and their effects on the environment to protect the environment and the health of persons. Environmental protection measures are an important component of the overall requirement for licensees to make adequate provision for protection of the environment and the health of persons.

Note: Environmental protection measures may also be referred to as environmental protection programs. Applicants and licensees are not required to update their management system or other documents to reflect the term "environmental protection measures", but they must meet the requirements listed in this section.

The CNSC's environmental protection safety and control area (SCA) covers measures that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities.

The applicant's or licensee's ERA and environmental protection measures should address all aspects of the CNSC's environmental protection SCA that are relevant to the facility or activity. The necessary measures for environmental protection are determined on a facility- or activity-specific basis, taking into consideration:

- the specific requirements of the NSCA and the regulations made under it
- the CNSC's policy and guiding principles (described in section 2)
- the complexity of the facility or activity and its potential interactions with the environment
- applicable CNSC regulatory documents
- applicable CSA, national and international standards

Not every facility or activity is required to have every environmental protection measure described in this section. The applicant or licensee may address certain requirements by demonstrating that a particular measure is not necessary or applicable to that facility or activity. The scope and complexity within each measure should be commensurate with the nature and scale of the interactions with the environment that may result from the facility or activity.

4.1 Environmental risk assessment

An ERA is a systematic process that evaluates the likelihood that adverse effects may occur or are occurring as a result of physical disturbances (stressors) or releases of nuclear or hazardous substances, and the severity or significance of those adverse effects. An ERA is a practice or methodology that provides science-based information to support decision-making and to prioritize the implementation of mitigation measures.

The applicant or licensee's ERA forms the basis of an EA conducted under CEAA 2012 and under the NSCA by providing the information that is assessed by CNSC staff. The ERA:

- identifies facility- or activity-specific characteristics and site-specific environmental characteristics
- identifies interactions between them
- assesses the likelihood and significance of these interactions and the resulting potential effects on the environment and the public

The ERA and its associated performance predictions serve as the basis for control and monitoring of releases, environmental monitoring, and any supplementary studies. All of these measures are interrelated and managed within the environmental management system (EMS).

The initial ERA for a facility or activity is based on best estimates of the facility- or activity-specific characteristics and on predictions of contaminant releases, transport and bioavailability. The initial ERA should provide sufficient actual baseline information (measured before the start of any activity and measured at control sites for valued ecosystem components) to detect any effects of the facility or activity on the receiving environment, with a statistically defensible level of confidence.

The ERA uses facility- or activity-specific estimates (mean and upper bound) of physical disturbances and chemical releases (both nuclear and hazardous substances) to predict:

- the source terms of gaseous and liquid discharges
- the transport of nuclear and hazardous substances through the environment
- public exposure and dose
- exposure and effects on biota
- changes in habitat and effects on species that rely on that habitat

Based on these predictions, the licensing basis sets the boundary conditions for acceptable environmental performance for the facility or activity, and establishes the basis for the CNSC's compliance program for that facility or activity.

The applicant or licensee incorporates the results of the initial ERA into their EMS, including the effluent and environmental monitoring measures. The predictions for physical disturbances and releases, and the associated environmental behavior and potential effects, are measured and tested using site-specific monitoring.

Requirements

The licensee shall identify the potential effects of the facility or activity on the environment and on members of the public and document these potential effects in an ERA.

The ERA shall be completed in a systematic, scientifically defensible manner that identifies, quantifies and characterizes the risk posed by releases of nuclear and hazardous substances and physical disturbances (stressors) on all biota (human and non-human).

For Class I facilities and uranium mines and mills, the licensee shall conduct an ERA in accordance with CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5].

For Class II facilities and other facilities or activities operating under the authority of the *Nuclear Substances and Radiation Devices Regulations*, the licensee shall use the ERA process described in CSA N288.6 [5] in a graded approach as appropriate to their circumstances. For many of these facilities, a simple screening assessment (as described in CSA N288.6) is adequate.

The licensee shall ensure that the ERA includes, as applicable to the facility or activity, both an ecological risk assessment (EcoRA) for the environment and a human health risk assessment (HHRA) for members of the public residing in the local and regional study areas.

Facilities and activities with no environmental interactions are not required to move any further through the ERA process. This exercise demonstrates that a formal systematic process was applied to identify whether the facility or activity had the potential to affect the environment and that, on this basis, no further assessment activities are required. In other words, for facilities or activities with no environmental interactions, the licensee's ERA is considered to be complete with the characterization and the demonstration of no interaction.

Guidance

Early consultation with CNSC staff is encouraged for facilities that are not specifically addressed by CSA N288.6 [5] (such as hospitals). CNSC staff can provide facility- or activity-specific guidance to assist licensees with this process.

The ERA is a risk management tool and should be initiated during the design phase of a facility or activity. Potential points of interaction with the environment and the public should be identified wherever reasonably achievable through the adoption of:

- engineering designs
- pollution prevention technologies and techniques
- administrative procedures to eliminate or reduce the extent of interaction with the environment
- application of the precautionary principle

4.1.1 Design of the facility or activity

Requirements

The applicant or licensee shall demonstrate that the facility or activity has been designed with mitigation measures (engineering and administrative) to prevent or minimize areas of interaction with the environment as identified by the assessment of the effects (through the ERA).

The applicant or licensee shall demonstrate that best practices are applied with respect to the design of the facility or activity, and that pollution control and abatement technologies and techniques are applied respecting the principles of pollution prevention (ALARA and BATEA).

The applicant or licensee shall demonstrate that all reasonable precautions have been taken to prevent or mitigate physical disturbances and releases of nuclear or hazardous substances, and also to prevent or minimize any effects associated with those disturbances and releases. As interactions with the environment and the potential effects are identified, the licensee shall determine whether modifications to the design or activity could eliminate or mitigate the effect.

The applicant or licensee shall demonstrate that applying mitigation measures to any residual physical disturbances or releases will protect the environment or the health of persons.

Guidance

The applicant or licensee should identify the performance and design characteristics (with respect to environmental protection) of the top-performing similar facilities or activities. Where applicable, the licensee should incorporate these performance and design characteristics into their own design and procedures.

After completing the design for the facility or activity, the licensee should characterize the likelihood and severity of the residual interactions with the environment and the associated

potential effects through an ERA, to determine whether the design demonstrates adequate precautions to protect the environment and the health of persons.

4.1.2 Complexity of the environmental risk assessment

Requirements

The applicant or licensee shall identify facility characteristics and activities that may interact with the environment during any phase of the facility or activity's lifecycle (for example, site preparation, construction, operation and decommissioning).

This characterization shall include descriptions of facility- or activity-specific performance with respect to:

- physical disturbances (for example, footprint for surface structures, below-grade structures, diversions or flow alterations of surface or groundwater)
- emissions released to the environment
- effluents released to the environment

The facility or activity characterization shall be of sufficient detail to determine the expected mean and upper bound of the facility- or activity-specific performance with respect to those physical disturbances, emissions and effluents.

The applicant or licensee shall develop a characterization of the baseline environment (that is, the environment before any development of the activity or facility has started) for any portion of the environment where the site characterization indicates potential for interaction.

The applicant or licensee shall use the facility- or activity-specific characterization and the local environmental baseline characterization to identify the potential interactions between the facility or activity and the surrounding environment, and between the environment and the facility or activity. Note that these identified interactions will become the focus of further stages within the ERA.

The applicant or licensee shall use the potential environmental interactions to support their justification as to the level of complexity for the ERA in accordance with CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5].

Guidance

For information on completing a characterization of the baseline environment, see appendix B.

ERAs may be completed in a tiered manner reflecting the complexity of the disturbances and releases associated with the facility or activity and with the complexity or sensitivity of the surrounding environment. This tiered approach allows the rapid completion of simple screening risk assessments for those facilities or activities with little or no interaction with the receiving environment or the public but also allows for progressively more complex quantitative assessments for facilities or activities when warranted by the severity and the spatial and temporal extent of potential effects.

All ERAs (screening, preliminary quantitative and detailed quantitative) should start with the characterization of the facility or activity and the nature of the surrounding local and regional study areas (ecological and public). For additional information and guidance on the most-

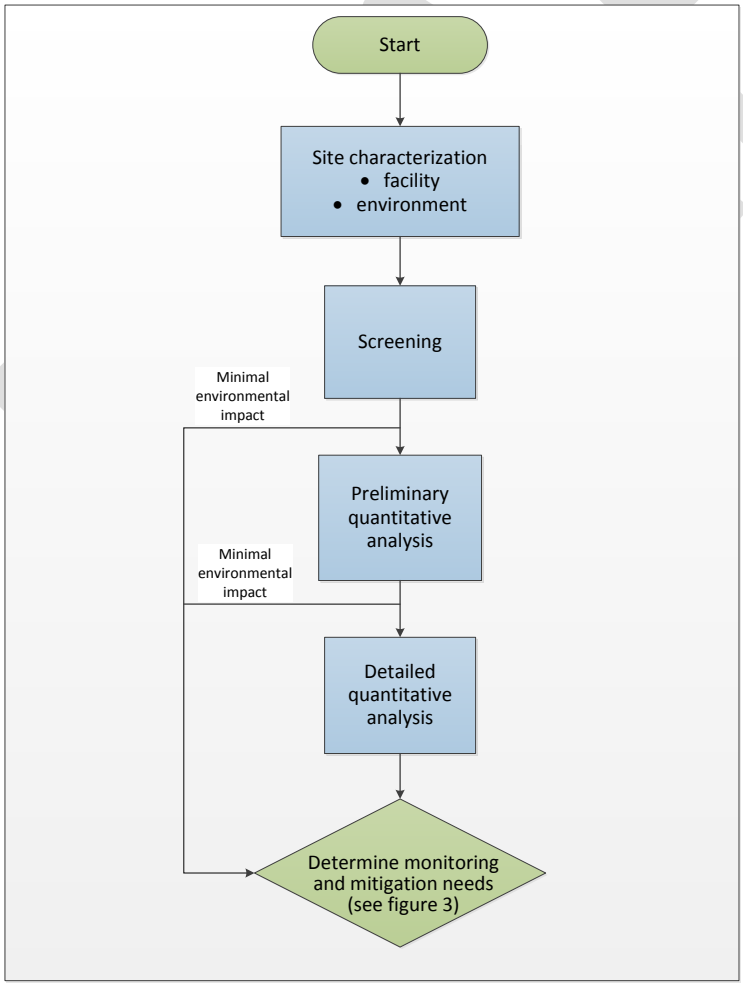
common elements to be considered for characterization of the baseline and the types of environmental effects that may need to be addressed, see appendices B and C.

The applicant or licensee should support the environmental site characterization with tables, maps and figures to provide an appropriate understanding of facility (or activity) and local environmental characteristics. The applicant or licensee should develop a table of core facility or activity characteristics for each licensing stage, and of the portions of the environment that have been considered for potential interaction with the facility or activity (for additional information, see appendices C and D).

For facilities and activities with interactions related to a few minor disturbances or releases (such as low-level releases below or near environmental quality guidelines), the applicant or licensee may complete a simple hazard quotient screening assessment.

For facilities or activities with multiple waste sources and streams, consisting of complex mixtures of nuclear and hazardous substances with increased potential for environmental effects, detailed quantitative risk assessments may be required. The tiered options within ERAs are shown in figure 2 (which is based on CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5]).

Figure 2: Tiered options for environmental risk assessments



Updating the environmental risk assessment

The licensee shall update the ERA at a frequency specified by the Commission, or in accordance with CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5]; taking into consideration:

- whether there has been:
  - a significant change in the facility or activity (such as modification, expansion or refurbishment)
  - a significant change in the science on which the ERA is based
- any transition to a new phase in the lifecycle (such as transitioning to licence to operate, decommission or abandon) where the new licensing phase was not previously captured in the ERA

The ERA shall be updated by adding accumulated site knowledge derived from:

- operational experience (for example, performance of mitigation measures such as effluent control systems)
- results of the monitoring
- supplementary studies
- incorporation of recent developments in scientific knowledge

The updated ERA shall be used to assess the environmental performance of the facility or activity relative to the level of environmental effects identified in the licensing basis. The ERA shall also be used to predict continued future performance and associated environmental effects of the facility or activity.

The licensee shall assess the adequacy of the effluent monitoring and environmental monitoring for:

- assessing the performance of the facility or activity relative to the predictions of the previous ERA
- assessing the future performance of the facility or activity relative to predictions of the newly updated ERA

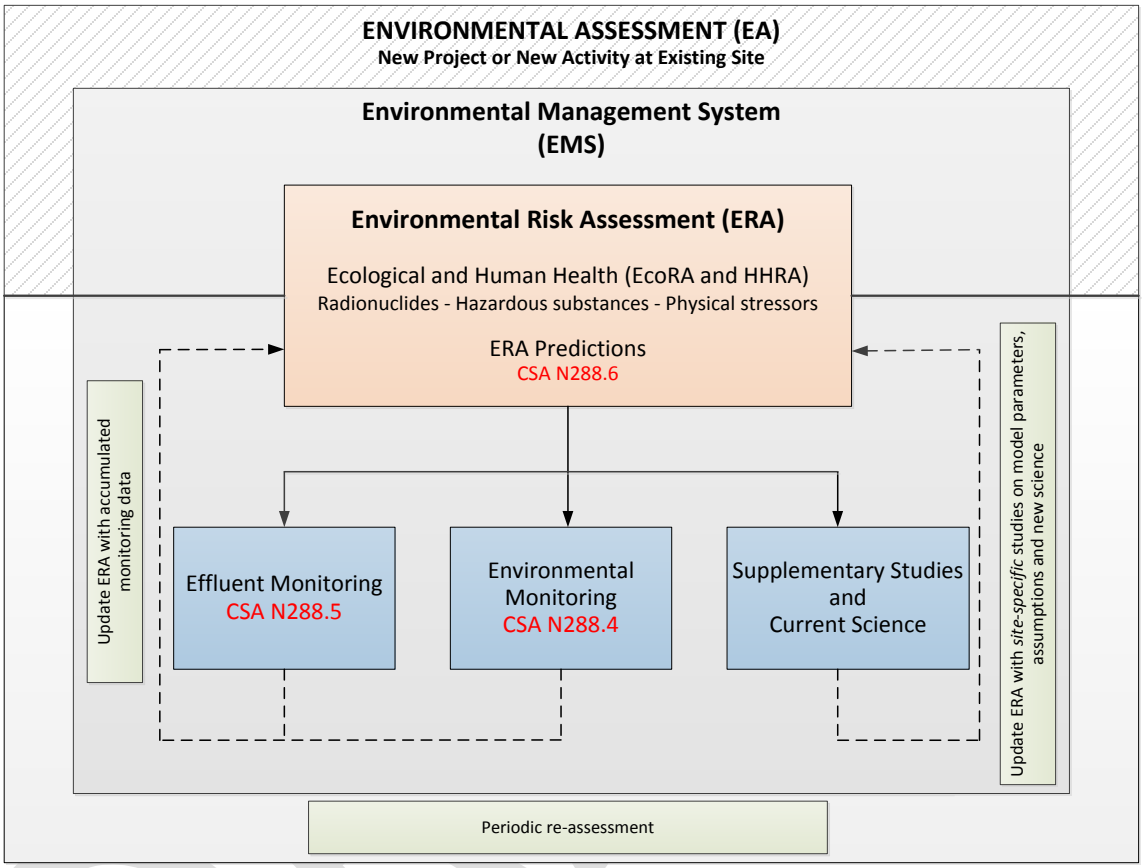
The licensee shall submit the updated ERA and the adequacy assessment of the associated monitoring to the CNSC for technical review.

If the updated ERA indicates that the nature, extent and significance of environmental effects is greater than identified in the licensing basis, the licensee shall implement adaptive management. The licensee shall undertake investigations to identify the significance and cause(s) of the deviation and propose mitigation measures where necessary. The licensee shall identify any changes needed to the effluent and emissions monitoring measures.

Guidance

Figure 3 shows the cyclical nature of the ERA and links to the effluent monitoring and environmental monitoring.

Figure 3: Links between effluent monitoring, environmental monitoring and the ERA



4.2 Effluent and emissions control and monitoring

Controls on environmental releases are established to provide protection to the environment and to respect the principles of sustainable development, pollution prevention and continuous improvement.

Requirements

The preventive and control measures shall be based on the potential risks to the environment that the facility or activity may pose.

The effluent and emissions control and monitoring shall:

- identify and document the infrastructure and activities (such as pipelines or storage) with the potential for significant accidental release to the environment of nuclear and hazardous substances and the barriers (such as primary and secondary containment, and liners) to prevent releases

- identify and document the points of release to the environment and the preventive control measures and equipment necessary to regulate and control the release of these nuclear and hazardous substances in the authorized manner
- measure, document and report the quality and quantity of releases to the environment
- verify the nature and quantity of releases against compliance criteria (such as limits and action levels) and the predictions of releases used as input parameters for the site-specific ERA (that is, the licensing basis)
- implement mitigation measures to further control releases when the monitoring results identify deviations from the expected performance

4.2.1 Control of environmental releases

The effluent and emissions preventive and control measures are established on the basis of best industry practice, incorporating the application of BATEA and ALARA assessments and the results of an ERA.

Guidance

A licensee's effluent and emissions control should address the following:

- technology:
  - design and maintain engineered barriers between key waste streams and sources of nuclear and hazardous substances (for example, double-lined piping, secondary containment and sumps, waste rock pads and pond liners), with maintenance programs to ensure the integrity of these barriers
  - wastewater treatment systems (for example, precipitation and settling systems, ion-exchange columns, evaporators and membrane separation systems such as reverse osmosis) that minimize the contaminants released to surface waters from liquid effluent streams with maintenance programs to ensure the availability and performance of these systems
  - air pollution control technology systems (for example, HEPA filters, baghouse filters, wet/dry scrubbers, absorption/adsorption systems) that minimize air pollutants released to the environment via air emissions through stacks or as fugitive emissions from the facilities with maintenance programs to ensure the availability and performance of these systems

- techniques:
  - BATEA assessments (optimization-focused); that is, the application of pollution prevention performance standards, design objectives and best practices to minimize or eliminate the release of nuclear or hazardous substances to the environment:
    - both operational and managerial practices that can influence the quality of releases to the environment (for example, upstream and downstream process optimization, adequate training of staff and effective overall management of the operation)
    - application and continual review of action levels as indicators of a potential loss of control of the site-specific environmental protection measures, to ensure the process is operating within its approved design specification and normal operating conditions

  - ALARA assessments (minimization-focused); that is, the application of radiation protection principles to effectively minimize human and environmental exposure to nuclear substances

- processes and procedures for ensuring effective management of the effluent and emission control systems (for example, maintenance of treatment systems, timely replacement of filters, calibration of monitoring equipment and procedures detailing appropriate responses to action level exceedances) within the EMS

4.2.2 Monitoring of releases to the environment

As described in CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [4], the ERA provides the technical foundation and structure for identifying the need for, and details of, the effluent and emissions monitoring. The site-specific effluent and emissions monitoring is designed using the characterization of the locations, the anticipated volume, chemistry and flow rate of releases, and the proposed maximum quantities and concentrations of nuclear and hazardous substances (including their physical, chemical and radiological characteristics).

For facilities and activities with no significant measurable releases to the environment, effluent and emissions monitoring is not required. In such cases, the licensee should demonstrate (through engineering or scientific methods and an EMS) that appropriate barriers and practices are in place, and are monitored and maintained to prevent releases to the environment.

For facilities and activities with releases at quantities too low or too difficult to measure, the licensee may justify the replacement of effluent and emissions monitoring with modelling of releases based on known engineering principles of site-specific process chemistry.

Requirements

For Class I nuclear facilities and uranium mines and mills, the effluent and emissions monitoring shall address the requirements in CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [4] or an equivalent standard, as appropriate.

For Class II facilities and other facilities or activities operating under the authority of the *Nuclear Substances and Radiation Devices Regulations*, the licensee shall use the process described in CSA N288.5 [4] in a graded approach as appropriate to their circumstances.

The licensee shall provide justification to support whether effluent and emissions monitoring is required, or if changes to existing monitoring and control procedures are appropriate. The licensee's justification shall address:

- characteristics of the nuclear facility or licensed activity
- releases (emissions and effluent) from the nuclear facility or licensed activity
- nuclear or hazardous substances contained in the effluents
- characteristics of the receiving environment

The effluent and emissions monitoring shall be designed and implemented:

- to demonstrate that releases are within the limits defined in the licence and the licensing basis
- to demonstrate that controlled releases to water frequented by fish are not acutely toxic

- to include action levels or other performance indicators and corresponding actions to be implemented to provide early indication of a potential loss of control or deviation from predicted performance with respect to concentration and loadings
- to support and assess the adequacy of any adaptive management measures

For facilities subject to the *Uranium Mines and Mills Regulations*, the licensee shall develop environmental action levels for the release of nuclear and hazardous substances to the environment. Note that, under the *Uranium Mines and Mills Regulations*, a facility-specific code of practice, which includes the environmental action levels, is required.

For effluents released to water frequented by fish, the effluent and emissions monitoring and control shall include fish toxicity testing. The method and frequency of testing shall be established within the environmental monitoring and control measures, including the action to be implemented as a result of a test failure such as:

- testing of a submitted duplicate sample
- resampling and toxicity testing
- implementation of toxicity identification and evaluation (TIE) testing procedures
- if necessary, implementation of corrective actions

Guidance

The effluent and emissions monitoring should:

- include the objectives and criteria for establishing the monitoring
- include sampling and analytical procedures that are designed to provide data suitable for the intended purpose of the monitoring; the sampling and analytical procedures should contain or reference all of the procedures and information necessary to support and implement the monitoring
- state the requirements for data analysis and interpretation
- identify appropriate quality assurance and quality control (QA/QC) for all aspects of the monitoring
- include any required reporting, periodic reviews, annual assessments and audits
- be formally managed within the EMS
- be performed by qualified personnel; the applicant or licensee should define the qualification and training requirements for each person performing an effluent and emissions monitoring activity

The applicant or licensee should describe the arrangements that have been made for monitoring all significant radiation sources during the proposed licensed activity. The information should justify the adequacy of the provisions for monitoring to cover operational states, design-basis accidents, beyond-design-basis accidents and, where appropriate, severe accidents.

The radiation protection program should also address the requirements and expectations in the following documents:

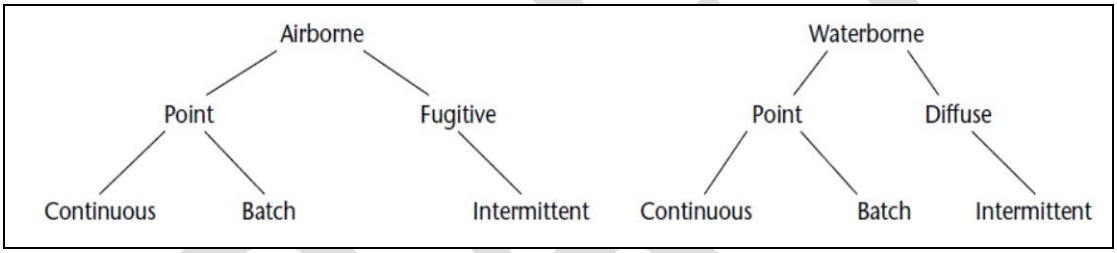
- G-129, *Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"* [7]
- CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [2]

For all facilities not subject to the *Uranium Mines and Mills Regulations*, the licensee should develop environmental action levels for the release of nuclear and hazardous substances to the environment.

The licensee should incorporate acute toxicity testing of effluent using Environment Canada's *Reference method EPS 1/RM/13 Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout (Reference Method EPS 1/RM/13)* [11] or any other test method accepted through the licensing process.

The measurement and evaluation of environmental releases are key to verifying the efficacy of preventive and control measures. The overall process should include feedback mechanisms (both periodic and continual) to assess and implement actions to achieve performance targets. Monitoring should be conducted on a temporal scale relevant to the nature and complexity of the release (such as intermittent, continuous or batch), and should use a standard sampling methodology (or a non-standard methodology approved by CNSC staff) that is appropriate for the type of release (see figure 4).

Figure 4: Types of releases that may be associated with a nuclear facility or activity that can influence sampling methodology and frequency (CSA N288.5 [4])



Effluent and emission monitoring addresses both the nature and quantities of releases of nuclear and hazardous substances (including wastes). Performance indicators for operational control, such as action levels, should be established to serve as early indicators of potential loss of control or deviation from expected quality or quantity of releases. Performance indicators should be designed to initiate investigation of abnormal situations and, if necessary, result in corrective measures. Measurement and evaluation should be coordinated to permit timely corrective action.

Under the *Radiation Protection Regulations*, licensees are required to develop action levels for releases of nuclear substances. These action levels should be integrated into the effluent and emission monitoring. Reaching an action level should initiate specific documented actions to investigate potential deviations in release quality or quantity and, if necessary, result in corrective action.

Under the *Uranium Mines and Mills Regulations*, licensees are required to develop environmental action levels within the facility's code of practice. This code necessitates the development of environmental action levels for releases of nuclear and hazardous substances. The CNSC recommends that the licensee use the ERA to identify substances requiring an action level.

For other facilities, licensees should consider the development of similar environmental performance indicators for inclusion in their effluent and emission monitoring for the most significant contaminants associated with their releases as indicated by the site-specific ERA.

Useful generic guidance on the principles underlying action levels are provided in G-218, *Preparing Codes of Practice to Control Radiation Doses at Uranium Mines and Mills* [12] and G-228, *Developing and Using Action Levels* [13]. These principles, along with ALARA as outlined in G-129, *Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable (ALARA)"* [7], should be applied to develop action levels related to nuclear and hazardous substances.

4.3 Environmental monitoring

Environmental monitoring consists of a risk-informed set of integrated and documented activities to sample, measure, analyze, interpret and report one or all of:

- the concentration of nuclear and hazardous substances in environmental media to assess one or all of:
    - the background concentration or activity level of nuclear and hazardous substances in the local or regional study area
    - the transport of nuclear and hazardous substances released from the facility or activity through the environment
    - the exposure of receptors to those substances
    - the potential effects on human health, safety and the environment
- the effect, or lack of effect, on biological organisms or communities if such potential is predicted by the ERA or required by legislation
- the intensity of physical stressors and their potential effect on human health and the environment
- the physical, chemical and biological parameters of the environment normally considered in the design of the environmental monitoring necessary to support the interpretation of the results; some examples are supportive data for transport (such as wind velocity) or toxicity assessment (such as organic carbon or hardness)

Requirements

The licensee shall use the ERA to identify the need for and complexity of the environmental monitoring. The licensee shall provide justification to support whether environmental monitoring is required, or if changes to existing monitoring and control procedures are appropriate. In the justification, the licensee shall address:

- characteristics of the licensed activity or facility
- characteristics of the surrounding environment
- nuclear and hazardous substances and physical stressors
- receptors that can be affected
- spatial extent of potential exposures
- severity, probability, and spatial and temporal extent of any potential biological effects

The licensee shall ensure that the environmental monitoring measures, plans and data provide sufficient information to assess exposure or potential effects on human health and the environment due to releases or physical perturbations resulting from the facility or activity.

For Class I nuclear facilities and uranium mines and mills, the licensee shall ensure that the environmental monitoring addresses CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [3].

For Class II facilities and other facilities or activities operating under the authority of the *Nuclear Substances and Radiation Devices Regulations*, the licensee shall use the process described in CSA N288.4 [3] in a graded approach, as appropriate to their circumstances.

The licensee shall ensure that the results of the environmental monitoring are used to confirm that the effects on the environment are within the licensing basis and adequate provisions are in place to protect the environment.

Guidance

Environmental monitoring should:

- include the objectives and criteria for establishing the environmental monitoring
- include sampling and analytical procedures that are designed to provide data suitable for the intended purpose of the monitoring; the sampling and analytical procedures should contain or reference all of the procedures and information necessary to support and implement the monitoring
- include either predetermined performance indicators based on environmental quality criteria, or site-specific performance indicators derived from the ERA
- state the requirements for data analysis and interpretation
- identify QA/QC for all aspects of the monitoring
- include any required reporting, periodic reviews, annual assessments and audits
- be formally managed within the EMS
- be performed by qualified personnel; the applicant or licensee should define the qualification and training requirements for each person performing an environmental monitoring activity

The results of the environmental monitoring should:

- be used to validate the predictions related to transport of nuclear and hazardous substances through the environment and the magnitude and extent of any effects predicted in the site-specific ERA to determine whether the facility continues to operate within its approved environmental performance (licensing basis)
- be periodically reviewed (in conjunction with the periodic revision and update of the ERA) as to its adequacy for testing the environmental predictions that form the licensing basis
- be modified as necessary to support and assess the adequacy of any adaptive management measures

All licensees should review, and apply as appropriate, CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [3]. Although this standard was developed for Class I facilities and uranium mines and mills, the methodology and general principles can be applied to all facilities and activities regulated by the CNSC.

Monitoring for the presence of stressors (physical stressors or nuclear and hazardous substances) in the environment is sometimes more practical than monitoring the release at the source. The

practice of monitoring ambient air quality is common for atmospheric emissions, especially fugitive or diffuse emissions (such as radon from ore pads).

Environmental monitoring may involve three basic types of monitoring objectives (see CSA N288.4 [3]):

- pathways monitoring
- biological effects monitoring
- supplementary studies

Pathways monitoring is the most common form of monitoring. It involves sampling and analyzing abiotic and biotic media that lie along the pathways connecting a source (that is, a release from a facility or activity) to a receptor (such as non-human biota or the public) to determine the concentration or level of a contaminant or physical stressor in that medium. This data, combined with environmental transfer parameters that describe the movement of contaminants or physical stressors through the environment, may be used to assess the exposure of the receptor. Some examples of the most common sampling media are:

- components such as air, water, soil and sediment
- vegetation consumed by herbivorous receptors
- tissues of prey animals consumed by carnivorous receptors
- foodstuffs consumed by humans

Such environmental monitoring is only necessary for those facilities where the releases have the potential to be measurable within the environment. The monitoring details, with respect to the analytes being measured (physical stressors, nuclear and hazardous substances) and the media to be sampled (air, water, and so on), are dependent on the scale and complexity of the risks associated with the facility or activity.

Biological effects monitoring is used to detect actual measurable biological responses of organisms to exposure to the stressor. For regulatory purposes, responses at the individual, population or community level of biological organization are considered to be more relevant as indicators of ecological effects. Some examples of biological effects monitoring that may be required depending on the risk posed by the facility are benthos and fish.

Supplementary studies may be conducted to achieve specific well-defined objectives such as:

- providing the data required to reduce uncertainty and confounding factors in the ERA
- increasing knowledge of the behavior of contaminants and physical stressors in the environment (for example, refining environmental transfer parameters)
- investigating monitoring results that indicate potential deviation from the transport or effects predictions in the ERA or the licensing basis

Note: Even if the site-specific ERA indicates little potential for measurable levels of stressors or effects in the environment, consideration should be given to the benefit of confirmatory monitoring (surveillance monitoring of no measurable effect). The licensee should specifically consider confirmatory monitoring for potable water sources and country foods, and to demonstrate that public doses are less than or equal to predictions made during an EA or ERA (see CSA N288.4 [3]).

For additional information on environmental monitoring, see CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [3].

4.4 Public dose

Radiological releases to the environment are controlled and monitored by the effluent and emissions control and monitoring and the environmental monitoring. Results of these monitoring and control activities are used to determine dose to members of the public.

A human health risk assessment (HHRA) is completed as a sub-element of the ERA for both nuclear and hazardous substances.

Requirements

The *Radiation Protection Regulations* require licensees to implement a radiation protection program for protection of the public. The focus for radiation protection within the environmental protection framework is on radiological protection of the environment and the public.

The *Radiation Protection Regulations* define prescribed dose limits for workers and members of the public, and require doses to be monitored by direct measurement or by estimation of the quantities and concentrations of any nuclear substance released as a result of a licensed activity.

Guidance

The development of a radiation protection program should be based on a sound policy, strategy and method for radiation protection and the achievement of ALARA, while taking into consideration the pathways and critical groups identified in the derived release limits (DRL) document (CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [2]).

The licensee should design the radiation protection program commensurate with the radiological hazards associated with the licensed activities, based on an ERA, and including radiation exposure and dose assessments.

4.5 Groundwater protection and monitoring

Groundwater protection is a specialized element of the overall environmental protection measures. As groundwater flow and associated contaminant transport can be more difficult to detect and delineate than that of surface water, specific requirements and guidance are provided here.

4.5.1 Groundwater protection

Groundwater protection is an inter-related system of initiatives, processes and activities that serve the following purposes:

- prevent, stop or minimize qualitative, physical and chemical changes to groundwater and any end use of groundwater
- prevent, stop or minimize releases of nuclear and hazardous substances to groundwater
- contain, stop, minimize and remediate the adverse effects of any unauthorized releases to groundwater or changes to groundwater flow and properties or any end use of groundwater that do occur

Requirements

Where the criteria outlined in CSA N288.7, *Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills* [6] are met, the licensee shall establish groundwater protection in accordance with CSA 288.7 [6].

The licensee shall develop groundwater protection measures using a site-specific graded approach where the level of complexity is commensurate with the risk and with site-specific conditions.

Groundwater protection shall contain the following measures, initiatives and processes:

- development of a conceptual site model (CSM) to describe the current knowledge of the site hydrology, geology, and hydrogeology; the groundwater flow and contaminant transport; the groundwater vulnerability; and the release mechanisms and pathways
    - a CSM is site-specific
    - a CSM could be a simple 1-D or 2-D graphical illustration of the interaction of the relevant components, or a complex 3-D visualization of the relevant components (including flow and contaminant migration rates) quantified through 1-D, 2-D or 3-D analytical or numerical modeling of the groundwater flow, source release and contaminant transport process
    - some or all of the information required to develop a CSM should have already been obtained in the site characterization or ERA; the licensee may provide cross-references to this information
- release source characterization that identifies past, present and potential contaminant sources
- determination of the protection objectives and strategies in accordance with the groundwater vulnerability and end-use of the site at different phases of the lifecycle, and all relevant federal, provincial, territorial and municipal regulations, policies, objectives, standards and guidelines
- measures and processes to prevent, stop or minimize:
    - changes to groundwater quantity and quality (such as groundwater table elevations, flow direction and flow rates, interaction with surface water bodies, temperature and pH)
    - releases of contaminants into groundwater
- if they do occur, investigation and remediation of unauthorized releases of contaminants or changes to groundwater flow and properties

Note: If a licensee is proposing to discharge effluents to groundwater, the licensee shall justify and demonstrate that there is no alternative. The CNSC does not typically authorize discharges of effluents to groundwater.

4.5.2 Groundwater monitoring

Groundwater monitoring serves to confirm that groundwater is protected by:

- providing baseline data on the groundwater quantity and quality
- sampling, measuring, analyzing and interpreting groundwater quantity and quality
- verifying predictions of environmental effects
- confirming compliance with licence requirements and conditions

- confirming that unauthorized changes and releases to groundwater are not occurring and, if they do occur, to determine why, when, where and how the releases are migrating
- providing warning or detection of compromised facility integrity or containment structures
- identifying risks to groundwater as a potential resource
- identifying risks from contaminated groundwater to receptors
- evaluating the effectiveness of mitigation and remediation measures

Guidance

The design for monitoring groundwater should include:

- a CSM that identifies sources, groundwater end-use and groundwater vulnerability for the site for all phases of the facility's lifecycle
- a network for monitoring wells
- groundwater performance indicators
- a sample data management, documentation and reporting plan
- an audit and review plan
- a QA/QC plan

Groundwater monitoring should be performed by qualified personnel. The applicant or licensee should define the qualification and training requirements for each person performing a groundwater monitoring activity.

For all facilities, in a graded approach as appropriate to their circumstances, the licensee should design the monitoring for groundwater in accordance with:

- CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [6]
- CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [3]

4.6 Environmental management system

An environmental management system (EMS) refers to the management of an organization's environmental policies, measures and procedures in a comprehensive, systematic, planned and documented manner. It includes the organizational structure, planning and resources for developing, implementing and maintaining policy for environmental protection.

An EMS is a system and database that integrates policies, measures and procedures for ensuring organizational commitment to environmental protection and continuous improvement by:

- identifying and managing environmental risks associated with a facility or activity (the ERA)
- the identification, implementation and maintenance of pollution control activities and technologies (effluent and emissions control)
- monitoring of releases (effluent and emissions monitoring)
- monitoring of contaminants and their effects in the environment (environmental monitoring)

- the identification and management of non-compliances and corrective actions within the activities, through internal and external inspections and audits
- summarizing and reporting the performance of these activities, both internally (licensee's management structure) and externally (to the Commission and the public)
- training of the personnel involved in these activities
- ensuring the availability of resources (such as qualified personnel, organizational infrastructure, technology and financial resources)
- defining and delegating roles, responsibilities and authorities essential to effective environmental management

The EMS serves as the management tool for integrating the licensee's environmental protection measures in a documented, managed and auditable process.

4.6.1 Establishing an environmental management system

Requirements

For all facilities that are required to have any of the environmental protection activities documented above, the licensee shall manage their environmental protection activities within an EMS that reflects the nature and complexity of their environmental protection activities.

The licensee shall:

- establish, implement and maintain an EMS that meets the requirements set by CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* [1]
- ensure that the scope of the EMS is consistent with the definition of environment, environmental effects and pollution prevention provided in the glossary of this regulatory document
- conduct internal audits (as per clause 4.5.5 of CAN/CSA ISO 14001 [1]) at planned intervals so that all elements of the EMS are audited on at least a five-year cycle
- conduct an annual management review (as per clause 4.6 of CAN/CSA ISO 14001 [1])

Guidance

The CNSC does not consider certification to CAN/CSA ISO 14001 by an authorized registrar or other independent third party as sufficient for demonstrating compliance with the requirements. The CNSC evaluates all activities in relation to the requirements of this regulatory document. The CNSC's compliance verification focuses on the effectiveness of the EMS rather than on the licensee's adherence to CAN/CSA ISO 14001 [1].

The EMS should incorporate and manage environmental protection measures within the formal "plan, do, check and act" framework of an ISO management system.

The EMS may consist of one or several documents. It may incorporate pertinent information directly or by reference. For large or complex facilities with multiple environmental protection activities (such as ERA, release control and monitoring, and environmental monitoring), documentation may be in the form of a stand-alone EMS manual. The EMS may also be incorporated within a larger, integrated, quality management system.

For all facilities, sufficient detail should be provided to demonstrate that all elements (such as related policies, measures and procedures) to manage the identification, control and monitoring of physical disturbances, releases, wastes and the associated environment have been documented and are managed proactively and preventively.

4.6.2 Scope of an environmental management system

The EMS is the integrated set of documented activities (policies, measures and procedures) that provide a framework for action for environmental protection. Effective management encompasses:

- control measures on releases and wastes to prevent or mitigate environmental effects
- demonstration of the effectiveness of those control measures
- training of personnel
- public disclosure and information

Guidance

In addition to the information provided in this regulatory document, the licensee should refer to the following documents:

- CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* [1]
- CAN/CSA ISO 14004, *Environmental Management Systems – General Guidelines on Principles, Systems and Support Techniques* [14]

During the design of an EMS, the ISO documents provide guidance and information that may be useful; however, the licensee should note that, as a federal agency, the CNSC has adopted certain key concepts in environmental protection from other federal statutes. Where applicable, the CNSC expects licensees to apply the more-demanding meanings from federal legislation in the scope of their EMS.

To avoid misinterpretation of these concepts, the licensee should review the following differences between key concepts in federal legislation and those in CAN/CSA ISO 14001 [1] and consider them in the scope of their EMS:

- the CNSC's definitions of environment, environmental effect (i.e., impact) and pollution prevention (i.e., prevention of pollution) in this regulatory document are taken from federal legislation and are broader than the definitions of environmental and of pollution prevention in CAN/CSA ISO 14001 [1]
- in both the NSCA and the *Canadian Environmental Protection Act, 1999* (CEPA), risk is a key concept in environmental protection
- CAN/CSA ISO 14001 [1] does not use the term risk in the context of an EMS, but instead addresses significant environmental aspects and impacts (i.e., effects); the licensee should use the ERA as the core document to inform the significant environmental aspects and effects of the EMS
- CAN/CSA ISO 14001 [1] provides only minimal guidance on the interpretation of adverse environmental effects

Pollution prevention is the key principle underlying the management of hazardous substances in Canada. Section 64 of CEPA defines the nature of toxic substances, explicitly defining unreasonable risk for certain scheduled substances. For other potentially hazardous substances

that are not subject to legislation, unreasonable risk may be interpreted in terms of likely significant adverse effects. This concept is nearly equivalent to the CAN/CSA ISO 14001 [1] concept of significant environmental effects. In the CNSC licensing process for Class I facilities and uranium mines and mills, an EA under the NSCA or the CEAA 2012 process provides an initial framework for identifying and assessing the equivalent of ISO-significant environmental aspects in an appropriate context. This information can provide the initial foundation for the scope of the EMS.

For nuclear substances, the *Radiation Protection Regulations* require exposure and doses to persons to be managed according to the ALARA (as low as reasonably achievable) principle, while taking social and economic factors into account. G-129, *Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"* [7] provides additional information.

The *Radiation Protection Regulations* define unreasonable risk for workers and the public through prescribed dose limits, and require doses to be monitored by direct measurement or by estimation of the quantities and concentrations of any nuclear substance released as a result of the licensed activity.

4.6.3 Framework of an environmental management system

The EMS framework should cover the proposed measures to control releases of nuclear substances and hazardous substances into the environment, and the measures that will be taken to prevent or mitigate the effect.

The framework should be appropriate for the facility type and licensing phase, and should be commensurate with overall regulatory requirements. In addition to the environmental protection activities described in detail earlier, the EMS should also address waste management and other site-specific considerations.

Wastes

For radioactive and hazardous wastes, the licensee should provide specific information on the name, quantity, form, origin and volume that may result from the licensed activity or facility. The licensee should include all waste that may be stored, managed, processed or disposed of at the site, and the proposed method for managing and disposing of that waste.

For uranium mines and mills, the licensee should also address management of the anticipated liquid and solid waste streams within the mine or mill, including:

- the ingress of fresh water and any diversion or control of uncontaminated surface and ground water
- the anticipated quantities, composition and characteristics of tailings (refer to RD/GD-370, *Management of Uranium Mine Waste Rock and Mill Tailings* [15])
- the proposed waste management system

Other considerations

The licensee should address environmental emergency preparedness and response in terms of:

- the proposed measures to prevent or mitigate the effects of accidental releases of nuclear and hazardous substances on the environment

- the proposed measures to ensure the availability and accessibility of environmental monitoring instrumentation during emergencies
- the inclusion of environmental monitoring instrumentation and equipment layouts in emergency plans

The licensee should address reporting requirements for potential or real emergency situations.

The licensee should describe elements of the EMS related to worker training or qualifications, and the environmental protection obligations of workers. The licensee should demonstrate how training programs will enable workers to meet their obligations with respect to environmental protection.

Appendix A: Environmental assessments under the *Canadian Environmental Assessment Act, 2012*

For designated projects described in the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) that are regulated under the *Nuclear Safety and Control Act* (NSCA), the CNSC ensures that the environmental assessment (EA) requirements of CEAA 2012 are met.

An EA conducted under CEAA 2012 is a planning tool. It is carried out early in the licensing process (before any licence is granted) and considers the entire proposed lifecycle of a project. An EA under CEAA 2012 includes information prepared by the applicant and CNSC staff, as well as comments received from Aboriginal groups and the public. After reviewing the EA, the Commission determines if a proposed project is likely to cause significant adverse environmental effects, taking into consideration the implementation of mitigation measures. Licensing, compliance and verification activities by CNSC staff ensure that the applicant has implemented the mitigation measures identified in the EA. Where applicable, the licensing, compliance and verification activities will also be used to ensure the implementation of a follow-up program.

In accordance with paragraph 15(a) of CEAA 2012, the CNSC is the sole federal responsible authority (RA) for conducting an EA for designated projects regulated under the NSCA and described in the *Regulations Designating Physical Activities*. The Minister of the Environment may also designate a project not identified in the *Regulations Designating Physical Activities* if the project may cause adverse environmental effects or if there are public concerns related to those effects.

For these designated projects:

- the CNSC must make an EA decision in accordance with section 52 of CEAA 2012 before a regulatory decision can be made under the NSCA to allow the project to proceed
- if the CNSC determines that the project is not likely to cause significant adverse environmental effects in accordance with subsection 52(1) of CEAA 2012, then in accordance with section 53 and through the licensing process, the CNSC establishes the mitigation measures and, where applicable, follow-up activities that the applicant must implement
- if the CNSC determines that the project is likely to cause significant adverse environmental effects, then in accordance with section 52(2) of the CEAA 2012, the CNSC will refer to the Governor in Council the matter of whether those effects are justified in the circumstances

If an applicant proposes to carry on an activity following the completion of an EA under CEAA 2012, the applicant must complete the CNSC licensing process, including safety and control measures for protection of the environment and of the health and safety of persons.

CEAA 2012 may not apply in certain parts of Canada where there are settled land claim agreements with associated EA processes. If requested by another jurisdiction, the CNSC may act as technical advisor and be an active participant at all stages of the EA process. The CNSC retains decision-making responsibilities on all licensing matters under the NSCA.

For projects proposed to be carried out on federal lands as defined in section 66 of CEAA 2012, 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. For

additional information, refer to *Operation Policy Statement – Projects on Federal Lands and Outside Canada under the CEAA, 2012* [16].

A.1 Environmental assessment under CEAA 2012 conducted by the CNSC

CEAA 2012 does not set regulated timelines for EAs conducted by the CNSC. However (pursuant to the *Class I Nuclear Facilities Regulations* and the *Uranium Mines and Mills Regulations*), the CNSC is committed to completing this process within the 24-month timeline for a licensing decision under the integrated approach (described below). Adherence to this schedule depends on the completeness of information received from applicants, and the process will begin when the notice of commencement is posted.

Note: The 24-month timeline applies to CNSC activities, and not to the time periods required for steps outside the CNSC's control, such as time the applicant needs to prepare technical studies or to respond to requests for additional information.

The applicant chooses whether an EA under CEAA 2012 is completed via an integrated approach with the CNSC licensing process, or a sequential approach.

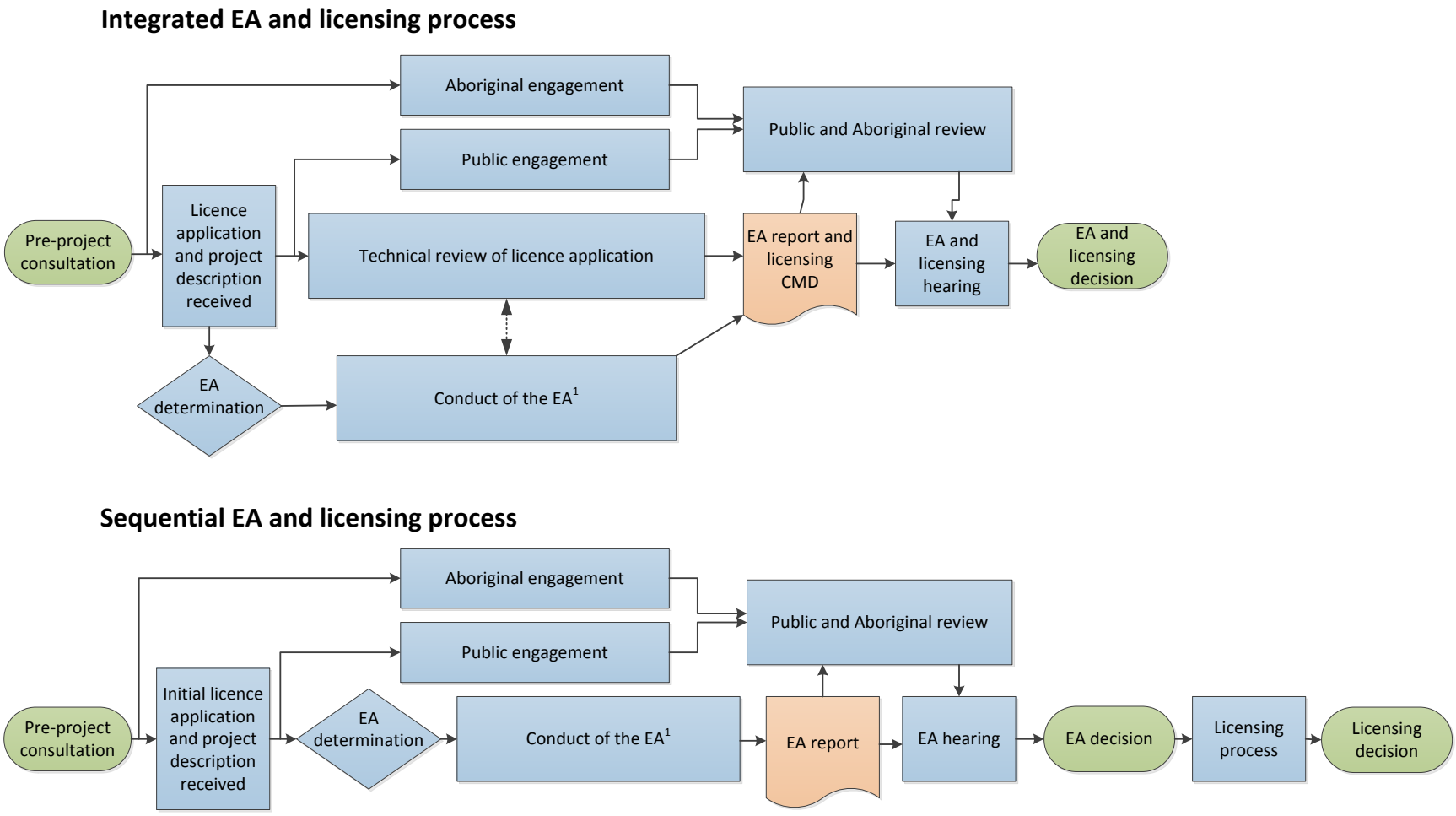
Under an integrated approach, the EA is conducted at the same time as the review of the information in the applicant's licence application, enabling the CNSC staff to present their recommendations for the EA and the licence application to the Commission at the same hearing.

A sequential approach may be more appropriate when, for example, an applicant uses the EA to assess the feasibility of a project. Note that:

- after completion of the EA, the applicant is responsible for submitting all remaining documentation to fulfill the CNSC's licensing requirements to undertake project activities
- if significant time elapses between the EA decision and the submission of the corresponding licence application, CNSC staff may require the applicant to update the ERA to consider new science, changes in the environment and any new technology or any project modifications with a potentially different impact on the environment

Figure 5 and table A outline the CNSC's process for completing an EA under CEAA 2012.

Figure 5: Overview of the environmental assessment process under CEAA 2012, using an integrated or sequential approach



[1] The CNSC may delegate the conduct of the EA or any part thereof to another jurisdiction. In such cases, the responsibility for making a decision under the CEAA 2012 remains with the Commission.

Table A: Key steps for an environmental assessment under CEAA 2012

Step	Action
Step 1	Applicant conducts pre-project consultation with the CNSC
Step 2	Applicant submits a licence application and project description
Step 3	CNSC staff determine if an EA under the CEAA 2012 is required
Step 4	CNSC staff define participation opportunities
Step 5	CNSC staff may draft and issue EA guidelines
	Step 5a: External review period
	Step 5b: Commission hearing on the EA guidelines
	Step 5c: Finalizing and issuing the EA guidelines
Step 6	Applicant conducts technical studies and submits the environmental impact statement (EIS)
Step 7	CNSC staff perform a technical review of the EIS
Step 8	CNSC staff draft and issue the EA report
Step 9	Commission hearing on the EA report

A.2 Key steps for an environmental assessment under CEAA 2012

The process for an EA conducted by the CNSC under the CEAA 2012 includes the following key steps.

Step 1: Applicant conducts pre-project consultation with the CNSC

Applicants may begin to determine the feasibility of a project before submitting a licence application. Early communication with the CNSC is recommended, to help applicants:

- identify projects that must undergo an EA in accordance with CEAA 2012
- understand the regulatory requirements
- understand the CNSC's EA and licensing processes (that is, an integrated EA compared to a sequential EA) and the associated anticipated timelines
- clarify the information to be included in the project description
- clarify whether EA guidelines are required for a proposed project
- identify the potential involvement of other jurisdictions
- identify Aboriginal groups whose Aboriginal or treaty rights may be affected or Aboriginal groups with an interest in the project

To facilitate planning, the CNSC encourages applicants and licensees to submit their project descriptions as early as possible.

The CNSC may allow some applicants to apply a graded approach to the requirements for a project description as set out in the *Prescribed Information for the Description of a Designated Project Regulations*. This possibility should be discussed and determined during pre-project consultation.

The CNSC may initiate early discussions with other federal, provincial or territorial authorities and Aboriginal groups as soon as an applicant indicates their intent to seek regulatory approval for a proposed project. For more information, see step 4, below.

Step 2: Applicant submits a licence application and project description

For an integrated approach, the applicant submits, in addition to the licence application, a project description that provides the information set out in the *Prescribed Information for the Description of a Designated Project Regulations*.

For a sequential approach, the applicant submits a project description and an initial licence application with the minimum information needed to start the EA process.

The CNSC may request additional information, even if the project description generally conforms to these regulations, as required to complete the EA determination.

Step 3: CNSC determines if an EA under CEAA 2012 is required

A nuclear project undergoes an EA under CEAA 2012 if it meets the description of a designated project in the *Regulations Designating Physical Activities* or if it has been designated by the Minister of the Environment. Using the information provided in the project description, the CNSC determines if the project is a designated project, and completes an EA determination memorandum that documents the findings.

If an EA under CEAA 2012 is required, the CNSC informs the applicant.

If an EA under CEAA 2012 is not required, the applicant must still meet CNSC licensing requirements before the licence is issued, including submission of information that allows CNSC staff to conduct an EA under the NSCA to ensure the applicant or licensee will, in carrying out the project, ensure the protection of the environment and of the health of persons, as described in section 3.

For an EA under CEAA 2012:

- As the sole federal responsible authority for nuclear projects, the CNSC contacts other provincial and territorial jurisdictions to determine any other jurisdictional requirements for EAs. Where applicable, the CNSC works with other jurisdictions to determine if their EA requirements can be addressed through a single EA process (to reduce duplication and provide regulatory efficiency). Relevant federal and provincial EA agreements provide direction regarding jurisdictional roles and responsibilities in the assessment of such projects.

- The CNSC may delegate the conduct of an EA or any part thereof to another jurisdiction. In such cases, the responsibility for making a decision under subsection 52(1) of CEAA 2012 remains with the Commission. Delegation of EA-related matters for a given project are determined on a case-by-case basis in accordance with section 26 of CEAA 2012.

- The CNSC also contacts other federal authorities to determine if additional regulatory decisions are required to allow the project to proceed. If additional regulatory decisions are required, the CNSC engages the appropriate federal authorities to provide specialist or expert information or knowledge to support the conduct of the EA.

- The CNSC ensures that a notice of commencement of an EA is posted on the Canadian Environmental Assessment Registry (CEAR). This notice provides a brief description of the project, the jurisdictions involved, and CNSC contact information. The CNSC posts a similar notice on the CNSC website, and provides a link to the notice of commencement on CEAR. The CNSC also distributes the notice to its subscription list and sends a formal notice to identified Aboriginal groups.

Step 4: Defining participation opportunities

Aboriginal consultation activities are integrated in the EA process to the extent possible. For more information, see REGDOC-3.2.2, *Aboriginal Engagement* [9].

The CNSC ensures that the public is provided with an opportunity to participate in the EA. The breadth and timing of public participation is at the discretion of the CNSC.

Step 5: Developing the environmental assessment guidelines

The CNSC may develop project-specific guidance (EA guidelines) for the conduct of technical studies to meet CEAA 2012 requirements, with a level of detail commensurate with the nature and scope of the project and environment.

The EA guidelines contain CNSC staff recommendations to the Commission on the level of public participation in the EA. The EA guidelines also contain CEAA-related decisions such as additional factors to be considered and the scope of all factors.

If the environmental impact statement (EIS) and supporting technical studies have already been completed and the CNSC deems that project-specific EA guidelines are not required, the process may advance to a technical review of the applicant's submissions. In this case, the CEAA 2012-related decisions are made during a hearing following the technical review or are confirmed by the Commission during the hearing on the EA report.

Note: If EA guidelines are not required, interested parties are provided with an opportunity to review the EIS and supporting technical studies.

Step 5a: External review period

The CNSC may request other federal agencies to review the EA guidelines or to provide expert information or knowledge. All comments will be considered in the development of the EA guidelines.

Depending on the outcome of the public participation determination (step 4), a public review period may be conducted to solicit the views of the public, Aboriginal groups and other stakeholders on the EA guidelines. Identified Aboriginal groups are notified of the external review period, and are provided with information on the timelines and process to submit comments.

Step 5b: Commission hearing on the EA guidelines

CNSC staff prepare a document outlining the necessary EA-related decisions for the project. The document is submitted to the Commission, along with the EA guidelines (as

appropriate) and any comments received from the public and Aboriginal groups (including how the CNSC staff addressed the comments).

The Commission considers the EA guidelines in a hearing and uses this information to make a decision on the scope of the environmental assessment and whether further information is required.

Should there be an opportunity for public involvement in the hearing (through oral or written interventions), the opportunity is indicated in the notice of hearing and identified Aboriginal groups are formally notified.

Step 5c: Finalizing and issuing the EA guidelines

When the Commission approves the EA guidelines, CNSC staff ensure that any additional requirements identified by the Commission are included and formally issue the final EA guidelines to the applicant.

Step 6: Applicant conducts technical studies and submits the EIS

The conduct of the technical studies and preparation of an EIS are typically delegated to the applicant. The EIS must meet the requirements of the EA guidelines and of CEAA 2012. The applicant submits the EIS and any supporting technical studies to the CNSC for a technical review.

Note: To meet CEAA 2012 requirements, the applicant should complete a baseline characterization (see appendix B), and conduct an ERA (see section 4). Specific requirements under CEAA 2012 are described in subsection A.3.

Step 7: Technical review of the EIS

CNSC staff perform an in-depth technical review of the EIS and supporting technical studies. If certain areas need to be clarified, confirmed or improved based on the technical review, the CNSC may ask the applicant to provide additional information to resolve these issues.

When CNSC staff are satisfied that the applicant has adequately addressed all information gaps, the technical review is considered to be complete.

Step 8: EA report

The CNSC must ensure that an EA report is prepared. The EA report includes CNSC staff's conclusions regarding the potential environment effects, the proposed mitigation measures, and whether the project is likely to result in significant adverse environmental effects, as well as follow-up program requirements.

CNSC staff draft the EA report, which synthesizes the applicant's technical information and takes into account the results of the technical review, including any comments received from other parties.

The CNSC may request other federal agencies to review the EA report or to provide expert information or knowledge. Comments received will be considered in the development of the EA report.

Step 9: Commission hearing on the EA report

CNSC staff prepare a document summarizing the EA report's conclusions and recommendations, and outlining the EA-related decisions that the Commission needs to make. This document and the EA report are submitted to the Commission, along with any public comments received (including how the CNSC staff addressed the comments). The Commission uses this information to inform its decision.

The Commission considers information during a public hearing on the EA report.

For public hearings, a notice of public Commission hearing is posted on the CNSC website at least 60 days before the scheduled hearing. The CNSC sends the notice to identified Aboriginal groups, and provides information on how to intervene. This procedure enables interested parties to request intervenor status from the Commission for the public hearing and to send their comments on the EA report.

Public hearings are usually held at the CNSC headquarters in Ottawa, but the Commission may decide to hold such a hearing in a community in the vicinity of the proposed project.

The exact nature of the public hearing depends on whether the project is following an integrated or sequential EA and licensing process. This information is provided in the notice of public Commission hearing.

Following the public hearing, the Commission makes a decision, based on the EA, on whether the project is likely to cause significant adverse environmental effects, taking into account mitigation measures that were identified during the EA. This decision must be made before a licensing decision can be made on allowing the project to proceed.

If the Commission concludes that a project is not likely to cause significant adverse environmental effects in accordance with subsection 52(1) of CEAA 2012, the Commission (in accordance with section 53) must establish through the licensing process, the mitigation measures and follow-up activities that the applicant must implement.

If the Commission concludes that a project is likely to cause significant adverse environmental effects in accordance with subsection 52(2) of CEAA 2012, the Commission refers to the Governor in Council the matter of whether those effects are justified in the circumstances.

The Commission's decision is published on the CNSC website and the CEAR. Aboriginal groups and members of the public who have expressed an interest in a particular project may be directly notified of the decision.

A.3 Specific CEAA 2012 environmental assessment requirements

Where the information is common to both the EIS and the licence application, the applicant may provide the information in either the application or the EIS, with appropriate cross-referencing between the submissions. The applicant shall clearly indicate where the requirements of both the NSCA and CEAA 2012 are addressed.

The EA of a designated project shall take into account the following factors:

- the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and

any cumulative environmental effects that are likely to results from the designated project in combination with other physical activities that have been or will be carried out

- the significance of those environmental effects
- comments from the public that are received in accordance with CEAA 2012
- mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project
- the requirements of the follow-up program in respect of the designated project
- the purpose of the designated project
- alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means
- any changes to the designated project that may be caused by the environment
- the results of any relevant study conducted by a committee established under section 73 or 74 of CEAA 2012
- any other matter relevant to the EA that the responsible authority requires to be taken into account

The EIS and supporting technical studies are completed to meet the requirements of CEAA 2012, paragraphs 19(1)(*a*), (*b*), (*d*), (*e*), (*f*), (*g*), (*h*) and, if appropriate, (*i*) and (*j*). The completion of the EIS and, as necessary, supporting technical studies is typically delegated to the applicant in accordance with section 23 of CEAA 2012. This regulatory document provides requirements and guidance to support project planning and early development of these documents by the applicant. These requirements and guidance do not negate the importance of pre-project consultation or the potential for project-specific EA guidelines.

A.3.1 Purpose of the project

Paragraph 19(1)(*f*) of CEAA 2012 states that the EIS shall identify the purpose of the project (defined as what is to be achieved by carrying out the project).

For additional information, see *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* [17].

A.3.2 Alternative means for carrying out the project

Paragraph 19(1)(*g*) of CEAA 2012 states that the EIS shall identify and describe alternative means to carry out the project that are, from the perspective of the applicant, technically and economically feasible.

The EIS should also describe the environmental effects of each alternative means. The criteria used to identify alternative means as unacceptable, and how these criteria were applied, should be described, as should the criteria used to examine the environmental effects of each remaining alternative means to identify the preferred alternative.

For additional information, see *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* [17].

A.3.3 Environmental effects

Paragraph 19(1)(*a*) of CEAA 2012 states that the EA must take into account the environmental effects of the designated project.

The environmental effects that must be considered in an EA under CEAA 2012 are also requirements under the NSCA. As described in section 4, the applicant should conduct an ERA in accordance with CSA 288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5].

A.3.4 Malfunctions and accidents

Paragraph 19(1)(*a*) of CEAA 2012 states that malfunctions and accidents shall be assessed in the EA. Malfunctions and accidents should be separated into radiological and non-radiological (conventional).

The applicant should provide an assessment of potential health and environmental effects resulting from postulated radiological and conventional malfunctions or accidents. The EIS should also include any mitigation measures such as monitoring, contingency, clean-up or restoration work in the surrounding environment that would be required during or immediately following the postulated malfunction and accident scenarios.

The EIS should provide a description of postulated malfunction and accident sequences leading to a radiological or non-radiological release considering, as appropriate, internal events, external events and human-induced events, including their frequency and an explanation of how these events were identified, and any modeling that was performed.

The applicant can use a bounding approach or use facility-specific information (for example, design, operation, projected environmental releases) in the assessment of radiological accidents and malfunctions. If a bounding approach is used, the applicant should provide a detailed rationale for the selection of each bounding scenario.

The EIS should include the source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the postulated malfunctions and accidents.

Note: Malfunctions and accidents are reviewed in depth under the NSCA for licensing purposes (for example, under REGDOC-2.4.1, *Deterministic Safety Analysis* [18], REGDOC-2.4.2, *Probabilistic Safety Assessments for Nuclear Power Plants* [19] and RD-346, *Site Evaluation for New Nuclear Power Plants* [20]). These scenarios should be taken into consideration by the applicant when designing environmental protection measures (see section 4).

If applicable, the applicant should use operating experience (OPEX) to identify any past abnormal operations, accidents and spills to the extent that they are relevant to the current assessment for the purposes of identifying malfunction and accident scenarios to be assessed.

A.3.5 Cumulative effects

Paragraph 19(1)(*a*) of CEAA 2012 states that the applicant shall assess any residual adverse environmental effects of the project in combination with other past, present or reasonably foreseeable projects and/or activities within the study area.

The applicant should explain the approach and methods used to identify and assess cumulative effects. The approach and methods should be consistent with *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* [21].

A.3.6 Significance of residual effects

Paragraph 19(1)(*b*) of CEAA 2012 states that the applicant shall assess the significance of any residual effects that persist, taking into consideration the proposed mitigation measures. These residual effects are identified during the ERA or a characterization of the environmental effects.

In the EIS, the applicant should include a detailed analysis of the significance of each residual effect. The applicant should clearly explain the method and definitions used to describe the level of the residual adverse effect (for example, low, medium, or high) for each of the issues. The applicant should also describe any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried on and how these levels were combined to reach an overall conclusion on the significance of the adverse effects for each valued ecosystem component (VEC).

Guidance

Some specific issues to be assessed are:

- magnitude of the effect
- spatial extent of the effect
- duration and frequency of the effect
- degree to which the effect can be reversed or mitigated
- ecological importance
- societal value

The method used to describe the level of the adverse effect should be transparent and reproducible.

The EIS should identify additional criteria used to assign significance ratings to any predicted adverse effects. It should contain clear and sufficient information to enable the CNSC and the public to understand and review the applicant's judgement of the significance of effects. The applicant should define the terms used to describe the level of significance. In assessing significance against the criteria, the EIS should, where possible, employ relevant existing regulatory documents, environmental standards, guidelines or objectives such as prescribed maximum levels of emissions or discharges of specific hazardous substances into the environment or maximum acceptable levels of specific hazardous substances in the environment.

A.3.7 Socio-economic environment

The applicant should characterize the socio-economic environment and identify all indirect socio-economic effects.

An indirect effect is a secondary environmental effect that occurs as a result of a change that a project may cause in the environment. Paragraph 5(2)(*b*) of CEAA 2012 refers to any change to the environment caused by the project on health and socio-economic conditions, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

For additional guidance, refer to *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environment Assessment Act, 2012* [22].

A.3.8 Community and Aboriginal traditional knowledge

Subsection 19(3) of CEAA 2012 states that community and Aboriginal traditional knowledge may be considered in the EA. CNSC staff will provide guidance to the applicant at the earliest possible stage in the EA process concerning the extent to which community and Aboriginal traditional knowledge shall be considered in the EA.

For additional information, refer to:

- *Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act, 2012* [23]
- REGDOC-3.2.2, *Aboriginal Engagement* [9] (for further information on the CNSC's expectations of applicants for Aboriginal engagement)

A.3.9 Assessment of effects of the environment on the project

Paragraph 19(1)(*h*) of CEAA 2012 states that the EIS shall take into account how the environment could adversely affect the project. The applicant shall also take into account any potential effects of climate change on the project, including an assessment of whether the project might be sensitive to changes in climate conditions during its lifecycle.

Some adverse environmental conditions are flooding, severe weather, biophysical hazards (such as algae), geotechnical hazards and seismic events.

The applicant should apply the methodology described in CSA N288.6, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [5]. The methodology in this document can be applied to all activities and facilities regulated by the CNSC.

A.3.10 EA follow-up program

Paragraph 19(1)(*e*) of CEAA 2012 states that the EIS shall include a framework or preliminary program upon which EA follow-up actions will be managed throughout the life of the project.

The applicant should design the follow-up program to verify the accuracy of the EA predictions and to determine the effectiveness of the measures implemented to mitigate the potential adverse environmental effects of the project.

The applicant should also design the follow-up program to incorporate pre-project information that would provide the baseline data; compliance data such as established benchmarks; regulatory documents, standards or guidelines; and real-time data consisting of observed data gathered in the field. As part of the follow-up program, the applicant should describe the compliance reporting methods to be used, including reporting frequency, methods and format.

Note: The CNSC verifies and monitors all EA follow-up activities through the CNSC licensing and compliance process.

Appendix B: Characterization of the Baseline Environment for an Environmental Risk Assessment

For a new licence, the applicant should use the information in this appendix to develop a characterization of the baseline environment. During the lifecycle of the facility or activity, the licensee should use this information to review and update the characterization, and also use the information in appendix C to document and predict the future environmental effects compared to this baseline characterization.

For additional information, see appendix D for a sample matrix for mapping the facility/activity-environmental-component interactions.

B.1 Atmospheric environment

The atmospheric environment includes the climate conditions at the site and in the local and regional study areas. It includes the seasonal variations in weather conditions within the study areas, to allow the assessment of effects on the facility or activity.

The applicant or licensee should provide a description of the ambient air quality in the study areas, with emphasis on those parameters for which radiological and non-radiological emissions will result from the facility or activity.

The description should include meteorological information such as air temperature, relative humidity, precipitation, wind speed and direction, atmospheric pressure, and solar radiation. It should also include the occurrence of weather phenomena (for example, lightning, temperature inversions and fog). Special consideration should be given to the analysis of extreme and rare meteorological phenomena (for example, tornadoes).Uncertainties should be described and taken into account when discussing the reliability of the information presented.

The description should also include current ambient daytime and nighttime noise levels at the site and local study areas, and include information on its source(s), geographic extent and temporal variations. The description should provide ambient noise levels for other areas that could be affected by the facility or activity. Some examples are:

- increased traffic along transportation corridors to and from the site during construction
- receptors at residences and sensitive sites (such as hospitals, schools, daycare facilities, seniors' residences, and places of worship)

The applicant or licensee should describe the influence of regional topography or other features that could affect weather conditions in the study areas.

The baseline information should be sufficient to support the use of an atmospheric dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the project (for example, tornadoes).

B.2 Surface water environment

The surface water environment includes all surface water features and hydrology that affect surface water at the site or in the local and regional study areas. The applicant or licensee should include delineation of drainage basins at appropriate scales.

When documenting the water quality of all surface water, the applicant or licensee should demonstrate the use of appropriate sampling and analytical protocols, for the range of analytical

parameters with the potential to be influenced by the facility or activity. This information should be presented using tables, maps and figures to provide an understanding of surface water characteristics and conditions at the site and in the local and regional study areas.

The applicant or licensee should describe hydrological regimes within the drainage basin, including seasonal fluctuations and year-to-year variability of all surface waters. The applicant or licensee should assess normal flow, flooding and drought properties of water bodies as well as the interactions between surface water and groundwater flow systems. The applicant or licensee should describe all water sources used for drinking water in the area, including source water intakes for drinking water treatment facilities.

The baseline information should be sufficient to support the use of an aquatic dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the facility or activity (for example, flooding).

The applicant or licensee should document the sediment quality of all water bodies to be affected by the facility or activity, demonstrating the use of appropriate sampling and analytical protocols, for the range of analytical parameters with the potential to be influenced by the facility or activity. This information should provide an appropriate understanding of sediment characteristics and conditions on the site and in the local and regional study areas.

The study design should be fully described, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.

B.3 Aquatic environment

The aquatic environment includes the aquatic and wetland species at the site and within the local and regional study areas, including the flora, fauna and their habitats.

The applicant or licensee should seek information from relevant authorities (such as Fisheries and Oceans Canada (DFO) and provincial or territorial authorities) on aquatic and wetland species and habitat for the local and regional study areas. The applicant or licensee should also undertake independent studies to gather the necessary information.

The applicant or licensee should include a description of the food chain and food web dynamics as a habitat component as this relates to fish populations, and potential effects resulting from the facility or activity (such as impingement and entrainment).

The applicant or licensee should provide detailed habitat mapping that demonstrates habitat usage by fish within the study area. This information should include depth profiles, substrate mapping, water temperature profiles, and a description of known and potential habitat usage (such as spawning, nursery, rearing, feeding and migratory) by fish that occur in the study areas.

The applicant or licensee should identify any biological species of natural conservation status (that is, rare, vulnerable, endangered, threatened or uncommon at a federal, provincial or municipal level) and their critical habitats.

The applicant or licensee should fully describe the study design, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline date and methods, as well as the method(s) by which they have been addressed.

B.4 Geological and hydrogeological environment

The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.

B.4.1 Geology

The applicant or licensee should characterize the geomorphology, topography, quaternary geology and soil characteristics, structural geology, petrology, geochemistry, economic geology and hydrogeology. The applicant or licensee should also describe the geomechanical properties that apply to the region and at the site that will be disturbed.

The applicant or licensee should provide the geotechnical properties of the overburden, including shear strength and liquefaction potential, to allow for the assessment of slope stability and bearing capacity of foundations under both static and dynamic conditions.

The description of the structural geology should include regional, local and site-specific documentation of fractures and faults. It should include a description of primary geological features and deformation fabrics both at the site and within the local and regional study areas.

If applicable, the applicant or licensee should describe the coastal geomorphology and should include the characteristics of any lakefront or ocean bluffs, shoreline, and both near-shore zone and offshore zones.

The baseline characterization should be sufficient to assess effects of the environment on the facility or activity (for example, seismic effects).

The applicant or licensee should present a geological model that incorporates all overburden and bedrock information. If extrapolation is required to derive the stratigraphy, the applicant or licensee should explicitly discuss the uncertainties and the need for additional field investigations to reduce those uncertainties.

The applicant or licensee should describe the geotechnical and geophysical hazards including the consideration of subsidence, uplift, seismicity (and active faulting), and consider the potential for movement at the ground surface (including co-seismic rupture) and earthquake ground motions. A seismic hazard assessment should be provided. Where appropriate, the narrative descriptions should be supplemented by geological maps, figures, cross-sections, borehole logs and photographs (with specific location information).

B.4.2 Hydrogeology

The applicant or licensee should describe the hydrogeology at the site and in the local and regional study areas. The description should characterize the physical and geochemical properties of all overburden and bedrock hydrogeological units (from the ground surface to the uppermost basement unit, which is site dependent).

Units may be characterized as aquifers or aquitards, and unit descriptions should include their geochemical characteristics, vertical and lateral permeabilities, transport mechanism (diffusion versus advection) and directions of groundwater flow.

The applicant or licensee should identify the groundwater recharge and discharge areas, and describe in detail the groundwater interactions with surface waters.

The applicant or licensee should present a conceptual and numerical hydrogeological model that discusses the hydrostratigraphy and groundwater flow systems. The assessment should describe anticipated or potential changes to groundwater quality related to any interactions with surface waters.

The applicant or licensee should provide a description of baseline groundwater quality at the site and in the local study area. The applicant or licensee should also describe local and regional potable groundwater supplies, including their current use and potential for future use.

B.5 Terrestrial environment

The terrestrial environment includes flora and fauna, their habitats, any wildlife corridors and the soil.

The applicant or licensee should describe the terrestrial species at the site and within the local and regional study areas, including flora, fauna and their habitat. The applicant or licensee should identify all biological species of conservation concern at a federal, provincial or municipal level known to occur or with a reasonable potential to occur at any time in the area.

The applicant or licensee should describe the presence and importance of wildlife habitat within the study areas, including critical habitats for listed species (if identified). The applicant or licensee should also describe any wildlife corridors and physical barriers to movement that exist or will exist as a result of the facility or activity.

The applicant or licensee should identify all protected and conservation areas established by federal, provincial and municipal jurisdictions (for example, wilderness areas, parks, sites of historical or ecological significance, nature reserves, federal migratory bird sanctuaries and wildlife management areas).

The applicant or licensee should describe the existing soil quality (including hazardous and radiological substance concentrations) for all study areas, as well as any additional soil quality parameters potentially relevant for modelling purposes (such as transport and bioavailability of contaminants of potential concern).

The applicant or licensee should provide baseline characterization of radionuclide and hazardous substance levels in vegetation and other non-human biota to support human and ecological risk assessment. The characterization should also take into consideration the baseline conditions of other applicable environmental components (such as the atmospheric environment).

The applicant or licensee should undertake independent studies to gather the necessary information as appropriate. The applicant or licensee should describe field studies in terms of representativeness of the target populations where possible. The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.

B.6 Ambient radioactivity

The ambient radioactivity arises from the sources, their activity levels and their origin, for all applicable environmental media (including air, soil, food, water, aquatic sediments and plant or animal tissue).

The applicant or licensee should describe the ambient radiological conditions at the site and in the local and regional study areas. The applicant or licensee should include information on the existing conditions, including an inventory of sources, their activity levels and their origin (natural or anthropogenic), for all applicable environmental media.

The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results.

The description should include an assessment of any limitations or gaps in the quality and extent of the baseline data and methods, as well as the method(s) by which they have been addressed.

B.7 Human health

The potential effects of the facility or activity on human health include both radiological sources and non-radiological contaminants.

The applicant or licensee should describe the current health profiles of the communities likely to be affected by the facility or activity, including information on population health of the communities in the local and regional study areas.

The applicant or licensee should provide, to the extent available, information on current consumption of locally grown harvests and country foods, and the quality by food type, amounts consumed, parts consumed (whole body or specific organs).

B.8 Aboriginal land and resource use

Aboriginal land and resource use includes lands, waters and resources of specific value; traditional activities and lifestyle; and traditional dietary habits.

Traditional land use may include areas where traditional activities such as establishing seasonal camps, camping, travel on traditional routes, gathering of country foods and medicines (hunting, fishing, trapping, planting and harvesting) are being carried out. Traditional land use also includes spiritual sites of significance to Aboriginal people.

The applicant or licensee should identify the lands, water and resources of specific social, economic, archaeological, cultural or spiritual value to Aboriginal people, including established and asserted Aboriginal or treaty rights that may be affected by the facility or activity.

The applicant or licensee should describe Aboriginal land and resource use at the site and in the local and regional study areas. The applicant or licensee should identify traditional activities, including activities for food, social, ceremonial and other cultural purposes, in relation to such lands, waters and resources with a focus on the current use of lands, waters and resources for traditional purposes.

The applicant or licensee should describe the traditional dietary habits and dependence on country foods and harvesting for other purposes, including harvesting of plants for medicinal purposes. The analysis should focus on the identification of potential adverse effects of the facility or activity on the ability of future generations of Aboriginal people to pursue traditional activities or lifestyle.

Appendix C: Environmental Effects for an Environmental Risk Assessment

The licensee should have already developed a characterization of the baseline environment (see appendix B) and should use the information in this appendix to document the environmental effects of a facility or activity. For additional information, see appendix D for a sample matrix for mapping the facility/activity-environmental-component interactions.

C.1 Atmospheric environment

The licensee should characterize the effects of the facility or activity on the atmospheric environment during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios.

The licensee should identify and characterize all atmospheric emissions (radiological and non-radiological) expected to be generated during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios. This information should include average and maximum emissions from planned discharges, point sources and fugitive (non-point source) releases (including greenhouse gases).

The licensee should complete modelling that incorporates site-specific atmospheric characteristics (such as shoreline fumigation) to assess potential effects on air quality, the transport of atmospheric contaminants and any associated exposure to humans and non-human biota receptors.

The licensee should describe predicted effects of noise on terrestrial and aquatic species as well as on nearby residents and communities. The description should include both daytime and nighttime noise levels and tonal noise. The predicted sound levels should be compared against baseline levels and any guidelines published by recognized organizations.

C.2 Surface water environment

The licensee should describe the effects of the facility or activity on the surface water environment during all phases of the lifecycle for the facility or activity, including accident and malfunction scenarios.

The licensee should identify and characterize all liquid effluents that could be generated during all phases of the facility or activity. Some examples are:

- average and maximum emissions from point sources
- planned discharges
- fugitive releases
- deposition from airborne particulates
- surface runoff

C.3 Aquatic environment

For all phases of the lifecycle for the facility or activity, the licensee should describe the effects of the facility or activity on aquatic flora and fauna, and include a full accounting of effects on species of natural conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment.

The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected reference condition for unexposed biota on a biological population basis,

taking natural variation into account. Predictions of effects should include sufficient detail to allow follow-up verification.

Some potential effects are:

- effects on habitat, including aquatic vegetation and sensitive areas such as spawning grounds, nursery areas, winter refuges and migration corridors
- effects on aquatic species, including rare or sensitive species
- effects of blasting on fish and fish habitat on local aquatic systems
- contaminant exposures through environmental and food-chain transport
- effects on aquatic biota due to impingement and entrainment
- effects of infilling on loss of fish habitat and changes to productive capacity
- effects of thermal plume(s) on fish and fish habitat
- effects on wetlands

Under the NSCA, the CNSC assesses the ongoing operation of nuclear facilities to ensure protection of the environment and the health and safety of persons while carrying on a licensed activity.

C.4 Geological and hydrogeological environment

The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.

C.4.1 Geology

The licensee should fully describe any changes to the geology and geomorphology resulting from the facility or activity.

The licensee should describe any changes to the environment resulting from the removal of bedrock and/or unconsolidated deposits. The licensee should also describe the disturbance of soils or sediments that may be stockpile, used for construction purposes or otherwise perturbed.

The licensee should include an assessment of changes made that would affect coastal processes and features (such as changes to the shoreline morphology due to construction, erosion or sediment transport).

C.4.2 Hydrogeology

The licensee should describe and assess any effects the facility or activity may have on the groundwater regime including the quantity and quality of groundwater. The licensee should carry out modelling as needed to develop and test the predicted effects.

C.5 Terrestrial environment

The licensee should describe the effects of the facility or activity on terrestrial fauna and flora and include a full accounting of effects on species with elevated conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment. The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected “reference condition” for unexposed biota on a biological population basis taking into account natural variation. Predictions of the effects should include sufficient detail to allow follow-up verification.

Some potential effects that should be considered are:

- loss of terrestrial habitat and the quality of lost habitat for relevant species
- disturbance of feeding, nesting or breeding habitats
- physical barriers to wildlife
- disruption, blockage, impediment and sensory disturbance (such as light effects, noise and vibration) of daily or seasonal wildlife movements (such as migration or home ranges)
- direct and indirect wildlife mortality
- reduction in wildlife productivity
- contaminant exposures through environmental and food-chain transport
- effects on biodiversity

C.6 Ambient radioactivity

The licensee should describe the effects of the facility or activity on ambient radioactivity. Humans and non-human biota exposed to ambient radioactivity should be assessed for all relevant routes of exposure (both internal and external exposure scenarios).

To support the assessment of human health (see section 3.2.7), the licensee should provide information on radiation levels to which members of the public may be exposed, including consideration of consumers of country food whose exposure pathways may differ due to cultural norms; for example, any dietary characteristics of Aboriginal peoples.

C.7 Human health

The licensee should describe the potential effects of the facility or activity on the physical well-being of Aboriginal groups and other people resulting from biophysical effects, including the effects of the facility or activity on all environmental components (for example, atmospheric environment) and the resulting effects on human health.

Some examples are:

- an analysis of the effects of the facility or activity on the health and safety of the public, including the possible effects from malfunctions and accidents (radiological and conventional)
- the predicted radiation doses to members of the public resulting from activities within the scope of the facility or activity and any resulting health effects
- a description of quantitative risk assessment modeling conducted, where necessary, for any malfunctions and accidents
- an assessment of the potential effects on human health from all non-radiological contaminants released from the facility or activity, through all potential exposure pathways
- potential effects of noise generated from the facility or activity on human receptors within the study area(s)

C.8 Aboriginal land and resource use

The licensee should identify any change that the facility or activity is likely to cause in the environment and any effect of any such change on the health and socio-economic conditions, physical and cultural heritage and on the current use of lands and resources for traditional purposes by any Aboriginal group including effects on hunting, trapping, fishing and gathering.

The licensee should identify any concerns raised by Aboriginal people about the facility or activity in relation to any Aboriginal or treaty rights.

For further information on the CNSC's expectations of licensees for Aboriginal engagement, see REGDOC-3.2.2, *Aboriginal Engagement*. [9]

Appendix D: Sample Matrix of Biophysical Interactions

Pathways to residual effects from the facility or activity on the environment

Phase (if applicable)	Activity	Atmospheric environment		Surface water environment				Aquatic environment				Geological and hydrogeological environment		→
		Air quality	Noise levels	Surface hydrology /drainage	Lake level	Shoreline / basin integrity	Water quality	Sediment quality	Aquatic habitat	Benthic invertebrate and fish population / distribution	Aquatic health	Groundwater quality and quantity	Flow or water table elevation	*(continued on next page…)*
Site preparation (e.g., site clearing, excavation)														→
														→
Construction (e.g., pouring foundations, facility construction)														→
														→
Operation (e.g., emissions and effluents)														→
														→
Decommissioning (e.g., cleanup and decontamination)														→
														→

○ = Facility/activity-environment interactions that have been determined to result in no residual effects
● = Facility/activity-environment interactions that have been determined to result in potential residual environmental effects *(continued on next page)*

Pathways to residual effects from the facility or activity on the environment (continued)

Phase (if applicable)	Activity	Terrestrial environment					Ambient radio-activity		Human health					Aboriginal Land and resource Use	
		Soil quality and quantity	Vegetation communities / species / listed plants	Wildlife habitat	Wildlife population / distribution	Wildlife health	Radiation exposure and levels	Food stuffs	Radiation doses to the general public	Radiation doses to workers	Non-radioactive contaminant exposure to the general public	Non-radioactive contaminant exposure to workers	Conventional health and safety	Social or economic, archaeological, cultural or spiritual value for traditional purposes	Asserted Aboriginal Rights or Title
Site preparation (e.g., site clearing, excavation)															
Construction (e.g., pouring foundations, facility construction)															
Operation (e.g., emissions and effluents)															
Decommissioning (e.g., cleanup and decontamination)															

○ = Facility/activity-environment interactions that have been determined to result in no residual effects
● = Facility/activity-environment interactions that have been determined to result in potential residual environmental effects

Glossary

Aboriginal *(autochtones)*
Section 35 of *Canada's Constitution Act, 1982*, identifies Aboriginal peoples of Canada as the Indian (First Nations), Inuit and Métis people of Canada.

action level *(seuil d'intervention)*
A specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program and triggers a requirement for specific action to be taken. (Source: *Radiation Protection Regulations*)

or

A specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program or environmental protection program, and triggers a requirement for specific action to be taken. (Source: *Uranium Mines and Mills Regulations*)

adaptive management *(gestion adaptative)*
A planned and systematic process for continuously improving environmental management practices by learning from their outcomes.

as low as reasonably achievable (ALARA) *(niveau le plus bas qu'il soit raisonnablement possible d'atteindre [ALARA])*
A principle of radiation protection that holds that exposures to radiation are kept as low as reasonably achievable, social and economic factors taken into account. Section 4 of the *Radiation Protection Regulations* stipulates licensee requirements for ALARA.

best available technology and techniques economically achievable (BATEA) *(meilleures techniques existantes d'application rentable [MTEAR])*
Minimum pollution prevention performance standards for which effluent and/or emission concentrations have been demonstrated to be achievable within an industrial sector and are therefore economically achievable across a given industrial sector. BATEA takes into account both treatment technologies and techniques used to achieve the desired effluent and/or emission concentrations. Technique includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned. BATEA may change over time as technologies and techniques are improved and this should be reviewed on a predetermined regular interval.

CEAA *(LCEE; ACEE)*
Canadian Environmental Assessment Act, Canadian Environmental Assessment Agency

designated project *(projet désigné)*
One or more physical activities that

- are carried out in Canada or on federal lands;
- are designated by regulations made under paragraph 84(*a*) [of CEAA 2012] or designated in an order made by the Minister [of the Environment] under subsection 14(2) [of CEAA 2012]; and
- are linked to the same federal authority as specified in those regulations or that order.

It includes any physical activity that is incidental to those physical activities. (Source: CEAA 2012)

effluent *(effluent)*
A liquid release of a hazardous or nuclear substance to the environment.
Note: The licensee should be aware that this definition is different from that in CSA N288.6 [5], which define effluent as "the release of contaminants into the environment (including both air and water) as a result of a licensed activity during normal operations."

emission *(émission)*
An airborne release of a hazardous or nuclear substance to the environment. An emission may include point sources, fugitive emissions or area sources.

environment *(environnement)*
The components of the Earth:
- land, water and air, including all layers of the atmosphere
- all organic and inorganic matter and living organisms
- the interacting natural systems that include the above components

environmental assessment (EA) *(évaluation environnementale [EE])*
An evaluation of the potential significant short-term and long-term adverse environmental effects of a project on the surrounding environment.

environmental assessment (EA) under the NSCA *(évaluation environnementale [EE] en vertu de la LSRN)*
A review by CNSC staff of information used to support the Commission's determination on whether the applicant or licensee will make adequate provisions for the protection of the environment and the health and safety of persons while carrying on a licensed activity.

environmental control *(contrôle environnementale)*
Environmental management procedures or engineering technology and/or techniques that prevent or minimize the release of nuclear and hazardous substances to the environment.

environmental effects *(effets environnementaux)*
The environmental effects described in section 5 [of CEAA 2012]. (Source: CEAA 2012.)

Note: Section 5 of CEAA 2012describes environmental effects as follows:

5. (1) For the purposes of this Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are

(*a*) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:

(i) fish and fish habitat as defined in subsection 2(1) of the *Fisheries Act*,

(ii) aquatic species as defined in subsection 2(1) of the *Species at Risk Act*,

(iii) migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*, and

(iv) any other component of the environment that is set out in Schedule 2;

(*b*) a change that may be caused to the environment that would occur

(i) on federal lands,

(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or

(iii) outside Canada; and

(*c*) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

(2) However, if the carrying out of the physical activity, the designated project or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than this Act, the following environmental effects are also to be taken into account:

(*a*) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and

(*b*) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

(3) The Governor in Council may, by order, amend Schedule 2 to add or remove a component of the environment.

environmental impact statement *(énoncé des incidences environnementales)*
A document that presents the findings of an environmental assessment.

environmental management system (EMS) *(système de gestion de l'environnement [SGE])*
The part of an organization's management system used to develop and implement its environmental policy and manage its environmental aspects. An EMS consists of policies, measures and procedures forming an integrated set of documented activities to provide a framework for action for environmental protection.

environmental risk assessment (ERA) *(évaluation des risques environnementaux [ERE])*
A process that evaluates the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more stressors. An ERA is a practice or methodology primarily developed by regulatory agencies to provide scientific input to decision makers. As such, ERAs commonly serve as a supportive tool providing technical information in a manageable form to a larger EA.

licensing basis *(fondement d'autorisation)*
A set of requirements and documents for a regulated facility or activity comprising:

- the regulatory requirements set out in the applicable laws and regulations
- the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence
- the safety and control measures described in the licence application and the documents needed to support that licence application

mitigation *(atténuation)*
Measures aimed at eliminating, reducing or controlling the adverse effects of a licensed activity, substance, equipment or facility. Mitigation may include restitution for any damage caused by such effects, such as through replacement, restoration or compensation.

performance indicator (PI) *(indicateur de rendement)*
A quantifiable variable related to the actions of a proposed or licensed activity that may cause or indicate an adverse environmental effect if a certain threshold value is reached.

performance target *(objectif de rendement)*
A limit on a performance indicator designed to prevent unreasonable risks to the environment.
Note: More than one limit may be set or considered for a performance indicator.

pollution prevention *(prévention de la pollution)*
The use of processes, practices, materials, products, substances or energy that avoid or minimize the creation of pollutants and waste and reduce the overall risk to the environment or to human health. (Source: *Canadian Environmental Protection Act, 1999*)
Note: Within pollution prevention, the CNSC also includes, where necessary, the use of environmental controls to prevent or minimize releases to the environment.

polluter pays *(pollueur-payeur)*
A principle that is based on the concept that users and producers of pollutants and wastes should bear the responsibility for their actions. This concept – that companies or people that pollute should pay the costs they impose on society – is one of the guiding principles of the *Canadian Environmental Protection Act, 1999*.

precautionary principle *(principe de la prudence)*
The principle that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (Source: *Federal Sustainable Development Act, Canadian Environmental Protection Act, 1999 (preamble)*)
Note: In other words, the absence of complete scientific evidence to take precautions does not mean that precautions should not be taken – especially when there is a possibility of irreversible damage.

risk-informed approach *(approche en fonction du risque)*
An approach to decision making that includes risk insights as one of the factors in determining a course of action.

site characterization *(caractérisation du site)*
The distinguishing characteristics, qualities, physical features and environment of the piece of land on which the nuclear activity or facility is located.

sustainability *(durabilité)*
The capacity of a thing, action, activity or process to be maintained indefinitely. (Source: *Federal Sustainable Development Act*)

sustainable development *(développement durable)*
Development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. (Sources: CEAA 2012, *Federal Sustainable Development Act, Canadian Environmental Protection Act*)

toxicity identification and evaluation (TIE) *(identification et évaluation de la toxicité (IET))*
A process that identifies the toxic components of an effluent or ambient medium by chemically manipulating the effluent or medium and testing the resulting material.

valued ecosystem component (VEC) *(composante valorisée de l'écosystème [CVE])*
An environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or esthetic importance. **Note:** VECs are selected from the abiotic and biotic information collected as part of the baseline characterization. They may be surrogate organisms rather than actual plant or animal species (for example, a theoretical benthic feeding fish species), communities (for example, a benthic macroinvertebrate community) or specific species (for example, an endangered species), but may also include significant ecological features of the environment, such as wetlands.

water frequented by fish *(eaux où vivent des poissons)*
Canadian fisheries waters. (Source: *Fisheries Act*)

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CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the Canadian Nuclear Safety Commission (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.

Effective April 2013, the CNSC's catalogue of existing and planned regulatory documents has been organized under three key categories and twenty-five series, as set out below. Regulatory documents produced by the CNSC fall under one of the following 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 Aboriginal engagement
- 3.3 Financial guarantees
- 3.4 Commission proceedings
- 3.5 CNSC processes and practices

Note: The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. For the latest list of regulatory documents, visit the CNSC's website at nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents