



Waste Management **Decommissioning**

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Decommissioning

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Preface

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

Regulatory document REGDOC-2.11.2, *Decommissioning*, sets out requirements and guidance regarding the planning for decommissioning, preparation for decommissioning, execution of decommissioning and completion of decommissioning of Class I nuclear facilities, uranium mines and mills, and nuclear substances and radiation devices (waste nuclear substance licensees only) activities licensed by the CNSC in Canada.

This document supersedes G-219, *Decommissioning Planning for Licensed Activities*.

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

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

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

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Decommissioning

Draft REGDOC-2.11.2, *Decommissioning*, contains references to the draft regulatory documents and draft CSA standard listed below. In addition to comments received on draft REGDOC-2.11.2, following public consultation, revisions to this regulatory document will be informed, as appropriate, by feedback on the following:

- REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* (public consultation ongoing)
- REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2* (public consultation ongoing)
- REGDOC-3.3.1, *Financial Guaranties* (public consultation ongoing)
- CSA N294-19, *Decommissioning of facilities containing nuclear substances* (public consultation ongoing)

1. Introduction

1.1 Purpose

This regulatory document provides requirements and guidance regarding the planning for decommissioning, preparation for decommissioning, execution of decommissioning, and completion of decommissioning.

The CNSC defines decommissioning as the administrative and technical actions taken to retire a facility from service or to cease licensed activities, and which allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, possessed or stored. Decommissioning actions are the procedures, processes and work activities that lead to the release of a facility or location from regulatory control, with or without restrictions on its future use (for example, decontamination and/or dismantling of structures, systems and components). The time period for the conduct of decommissioning actions typically range from a few weeks for small and simple facilities, to years or decades for larger and more complex facilities, especially in the case of deferred decommissioning.

For some small or simple facilities with a very low level of hazard, decommissioning actions may simply consist of removal and return of all the sources to the supplier, followed by a survey to verify that there are no areas with residual contamination above end-state criteria.

The CNSC reviews every licence application to verify that licensees have made adequate provisions for decommissioning, such that workers, the public and the environment are protected. All licensees for regulated facilities or activities are required to ensure that they effectively decommission all licenced locations as appropriate. Particular decommissioning plans and strategies are evaluated through the licensing process and included as part of the licensing basis.

1.2 Scope

This regulatory document establishes requirements and guidance for decommissioning activities from the planning for decommissioning to the completion of decommissioning under continuous management and regulatory oversight.

This document applies to Class I facilities, uranium mines and mills and nuclear substances and radiation devices (waste nuclear substance licensees only) that are required to have decommissioning plans or strategies as a regulatory requirement or as a condition of their licence. For all other licensees, the information in this regulatory document may be used as guidance.

This regulatory document is not intended for planning for the decommissioning of a site which is a result of an accident, but may be used as guidance. It is not intended for planning for the remediation of legacy sites for which decommissioning was not planned, but may be used as guidance for scoping the regulatory oversight of remediation activities.

This regulatory document is complemented by other [CNSC regulatory documents](#) and CSA standards, such as CSA N294, *Decommissioning of facilities containing nuclear substances* [1].

1.3 Relevant legislation

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

- subsection 24(5), and paragraphs 26(e) and 26(f) of the NSCA
- paragraph 3(1)(1) of the [General Nuclear Safety and Control Regulations](#)
- sections 7 and 8, subsections 14(3) and 14(4), and paragraphs 3(k), 5(i) and 6(h) of the [Class I Nuclear Facilities Regulations](#)
- section 7, paragraphs 8(b), 8.3(2)(c), 8.3(2)(d) and subparagraph 3(a)(viii) of the [Uranium Mines and Mills Regulations](#)

2. Background: The Lifecycle Approach to Decommissioning

The CNSC requires that planning for decommissioning take place throughout the lifecycle of a nuclear facility or for the duration of a licensed activity.

Lifecycle decommissioning planning assists in:

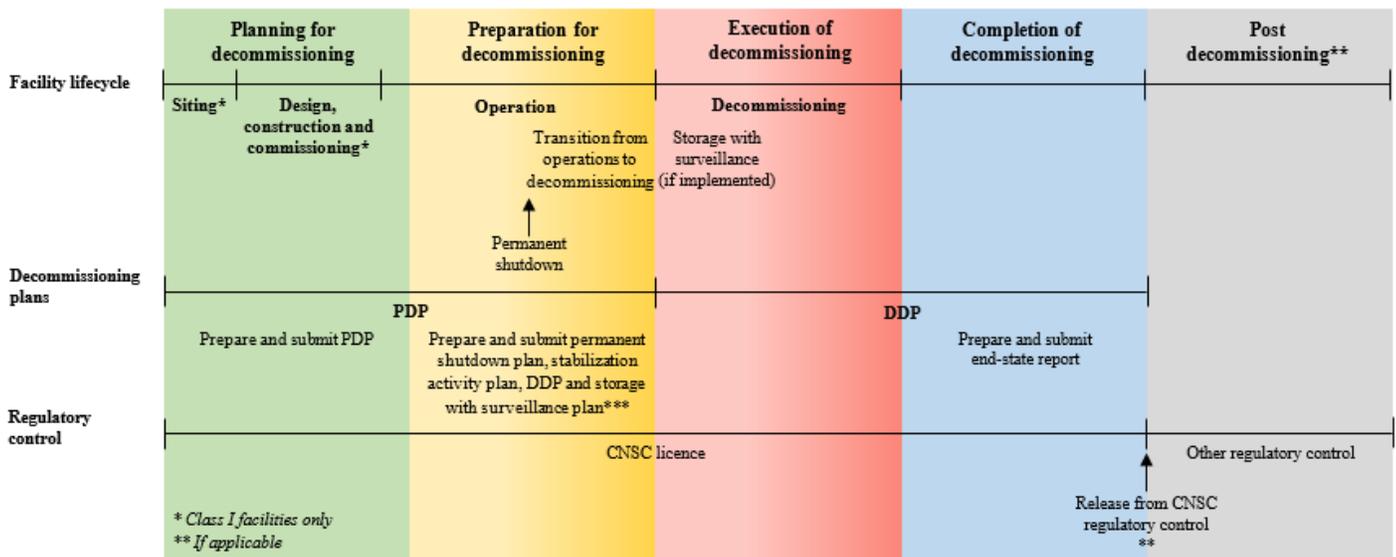
- ensuring that a nuclear facility is designed in a manner that will facilitate decommissioning
- ensuring that a nuclear facility or a licensed activity is operated in a manner that will facilitate decommissioning
- ensuring that the preferred decommissioning strategy is a technically feasible approach that protects health, safety, security and the environment
- ensuring that licensees are able to prepare for the costs of decommissioning
- ensuring that potentially difficult or challenging technical problems are identified well in advance so that solutions can be pursued in a proactive manner
- enabling portions of the facility/activity to be decommissioned, which will permit the assessment of decommissioning while the licensee continues operations
- estimating the quantities, types and classes of waste that will be generated during decommissioning
- maintaining records

Figure 1 depicts the phases of decommissioning and the indicative timing of key tasks. The phases of decommissioning include:

- planning for decommissioning
- preparation for decommissioning
- execution of decommissioning
- completion of decommissioning

These phases are discussed in sections 5 to 8 of this regulatory document.

Figure 1: Phases of decommissioning



Assessments of radiological and non-radiological conditions prior to and during decommissioning are an integral part of decommissioning planning and execution. Decommissioning characterization and surveys throughout the various stages in decommissioning are described in section 10.

3. Optimization and Graded Approach in Decommissioning

The licensee shall ensure that the protection and safety of workers, the public and the environment during decommissioning is planned and optimized.

The licensee shall apply a graded approach in all aspects of decommissioning, commensurate with the type, scale, complexity, maturity, physical state, inventory, uncertainty and reliability of information, and risk associated with the decommissioning of the facility or activity.

A graded approach shall be applied in a way that does not compromise the protection and safety of workers, the public and the environment. Further information on the graded approach can be found in REGDOC-3.5.3, *Regulatory Fundamentals* [2].

4. Decommissioning Strategy

The licensee shall select a decommissioning strategy that will form the basis for the planning for decommissioning and facilitate achieving the desired end state of the decommissioning project. For facilities and uranium mines and mills, the decommissioning strategy shall be selected early in the lifecycle of the facility.

The following decommissioning strategies should be considered individually or in combination:

- a) immediate (prompt) decommissioning – to decontaminate and dismantle without any planned delays
- b) deferred decommissioning – to place the facility in a period of storage with surveillance followed by decontamination and dismantlement, or to conduct activities directed at placing certain buildings or facilities in a safe, secure interim end state, followed by a period of storage with surveillance, and ultimately decontamination and dismantlement
- c) *in situ* decommissioning – to place the facility, or portions of the facility, in a safe and secure condition, in which some or all of the radioactive contaminants are disposed of in place, which may result in the creation of a waste disposal site

In such a case where the end state for *in situ* decommissioning results in a waste disposal site, the licensee shall satisfy all regulatory requirements for a radioactive waste disposal facility and demonstrate safety via a safety case and post-closure safety assessment of a disposal facility. Further information on safety case and safety assessment can be found in draft REGDOC-2.11.1, *Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2* [3]. For waste with other hazardous properties, the licensee shall ensure that the safety case and supporting safety assessment encompasses those hazards and is in compliance with applicable regulatory requirements regarding such hazards.

In situ decommissioning with a disposal end-state is an accepted and acceptable practice for uranium mines and mills. Further requirements and guidance for waste management at uranium mines and mills are provided in [REGDOC-2.11.1, Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings](#) [4]. Additionally, *in situ* decommissioning may be considered a viable solution under exceptional circumstances (e.g., following a severe accident) or for legacy sites for which decommissioning was not planned as part of the design (e.g. in situations where the fuel has been removed and the use of *in-situ* will be protective of workers, public and the environment), and which will remain under institutional control for the foreseeable future. In order to align with international best practice, *in situ* decommissioning should not be considered a reasonable decommissioning option for situations where removal is practicable.

Note: In Canada, legacy sites specifically refer to research and demonstration facilities or facilities dating back to the birth of nuclear technologies in Canada for which decommissioning was not planned as part of the design.

The licensee shall justify the selected strategy and should conduct a comparison of alternative decommissioning strategies. The evaluation method used to select the decommissioning strategy should ensure that the relative advantages and disadvantages of the remaining strategies can be objectively compared in a systematic and traceable fashion.

When determining the appropriate decommissioning strategy, the licensee should consider the following, as appropriate:

- public and Indigenous engagement
- potential impacts on Indigenous and/or treaty rights
- use of operational experience and lessons learned
- forms and characteristics of radioactive and hazardous contamination
- the integrity of containment and other structures, systems and components over time
- the availability of decontamination and disassembly technologies
- the potential for recycling or reuse of equipment and materials
- the availability of knowledgeable staff
- potential environmental impacts
- potential worker and public radiological doses
- end-state objectives and site redevelopment plans
- potential revenues, costs and available funding
- the availability of waste management facilities and disposal capacity
- the availability of a fuel disposal facility if applicable
- other political, social and economic considerations
- interdependencies with other facilities or infrastructure located at the same site
- assurance that the facility will be maintained in a safe configuration at all times
- the principles of radiation protection, justification, optimization and application of dose limits

The decommissioning strategy should be reviewed and updated in light of:

- changes in site conditions, or incidents and events with relevant consequences for decommissioning
- changes to the proposed decommissioning objectives
- changes to ownership or management structure
- advances in decommissioning technology
- significant modifications to the facility
- updated schedule, cost and funding information
- operational experience and lessons learned
- revised regulatory requirements
- availability of a facility for the management of irradiated fuel and radioactive waste

If shutdown of a facility is sudden, the decommissioning strategy shall be reviewed on the basis of the situation that initiated the sudden shutdown, in order to determine whether revision of the strategy is required.

5. Planning for Decommissioning

Where required by a condition of the licence, the licensee shall maintain a financial guarantee acceptable to the CNSC for decommissioning. Information on financial guarantees can be found in draft REGDOC-3.3.1, *Financial Guarantees* [5].

The licensee shall prepare a waste management strategy that identifies the categories and estimated quantities of all waste streams that will be generated during decommissioning, and the planned disposition path in compliance with the applicable clauses of draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [6]. The waste management

strategy can be submitted as a stand-alone document or included in the preliminary decommissioning plan (PDP).

5.1 Preliminary decommissioning plan

The licensee shall prepare a PDP and submit it to the CNSC for acceptance as early as possible in the lifecycle of the facility or the conduct of licensed activity. The PDP should document the post-operational conditions, the selected decommissioning strategy, the radiological monitoring and survey commitments, a waste management strategy, a cost estimate and financial guarantee arrangements.

The licensee shall review and update the PDP and submit it to the CNSC every five years or as requested by CNSC staff. The PDP should be updated in light of the considerations listed at the end of section 4.

The licensee may consider dividing a complex site or facility into a number of relatively independent decommissioning projects. For example, a large facility may be divided into areas (i.e., planning envelopes) that, from the point of view of decommissioning, are relatively physically independent from one another.

For sites with more than one facility, the licensee shall submit a PDP for the entire site to the CNSC for acceptance. In such cases, the site PDP should be prepared to cover all planning envelopes. The sequence of executing the planning envelopes and any interdependencies would also be included in both the site PDP and the facility-specific PDPs.

5.1.1 Content of the preliminary decommissioning plan

A PDP for a nuclear facility with a Class I or uranium mines and mills licence shall include:

- a description of the location of the facility, including:
 - a map of the facility and its specifications
 - geographic information
 - details regarding the surrounding environment
 - land used
 - illustrations and maps of the facility in relation to the municipality
- the purpose and description of the facility, including:
 - primary components and systems
 - the building type and construction, including location of any hazardous building materials (e.g., asbestos, polychlorinated biphenyls)
 - the building services (e.g., power, heating, ventilation, sewer, water, fire protection)
 - laboratories and other hazardous handling areas
 - the type, quantity, and form of radioactive and hazardous materials stored, produced or used during operation
 - the design features used to reduce the spread of contamination and facilitate decontamination and dismantling
- the post-operational conditions, including:
 - a summary of the shutdown process, including planned removal of stored inventories of hazardous materials
 - the predicted nature and extent of contamination remaining in the primary systems and components (in list or table format with reference to applicable illustrations)

- the predicted nature and extent of contamination on floors, walls, work surfaces, ventilation systems, etc.
- an overview of the principal chemical conditions anticipated to exist
- the identification of any separate planning envelopes
- the decommissioning strategy, including:
 - the final end-state objective
 - the rationale for:
 - the decommissioning strategy selected
 - the interim end states
 - the periods of storage with surveillance
 - any institutional controls
 - the assessment of alternative strategies (or a rationale for why alternatives do not exist or do not warrant consideration)
- a work breakdown structure, including:
 - a summary of the main steps for decontamination, disassembly and removal of each of the systems, preferably grouped into work packages (Note: the number and scope of work packages is a function of where the principal hazards are expected to exist in the decommissioning process; higher hazard areas should be represented by a finer work-package breakdown)
 - an identification of those types of activities that could pose a significant hazard to workers, the public or the environment, for each work package
 - the role of existing operational standard procedures for radiation protection, hazardous materials handling, industrial safety, and environmental protection in managing hazards
 - the specific activities for which additional protection/mitigation procedures will be required at the detailed planning stage
 - a summary of the final dismantlement of the structures
 - a conceptual schedule showing the approximate year of facility shutdown and the approximate sequencing and duration of the decommissioning work packages and, where relevant, storage periods
- the radiological monitoring and survey commitments, including:
 - a program for conducting periodic contamination surveys and the recording of contamination events during facility operation
 - a commitment to develop plans and protocols acceptable to the CNSC at the detailed planning stage for monitoring:
 - work hazards during decommissioning
 - personnel dosimetry
 - environmental emissions and effluents
 - materials, sites and structures to be cleared from regulatory control
- a waste management strategy specifying:
 - the conservative quantities and characteristics of radioactive and chemically hazardous wastes expected to arise from the decommissioning (tied to specific work packages, if possible)
 - the anticipated final disposition of radioactive and chemically hazardous materials
 - a commitment to segregate as much material as possible for reuse and recycling
- a commitment to prepare a detailed decommissioning plan (DDP) for CNSC acceptance prior to dismantling and demolition
- a commitment to periodically review and update the PDP, in accordance with section 5.1
- the physical state of the facility at:
 - the end of operations

- the start of decommissioning
- the records required for decommissioning, including a description of the facility's operational records that will be maintained to periodically update the PDP and prepare the DDP(s)
- a public consultation plan, including a public information program and avenues for public participation as per the requirements and guidance of REGDOC-3.2.1, *Public Information and Disclosure* [7]
- an Indigenous engagement plan as per the requirements and guidance of REGDOC-3.2.2, *Aboriginal Engagement* [8]
- the cost and a financial guarantee, specifying:
 - an estimate of the total present-value cost of the decommissioning
 - a reasonable basis for how cost estimates were derived
 - a description of how the required funds will be provided
 Note: the cost and financial guarantee could be maintained as part of the PDP or as a stand-alone document
- the identification of any features of the surrounding natural and social environment that could be significantly affected by the decommissioning process

Waste nuclear substance licensees may consult the above list for guidance, in accordance with a graded approach.

5.1.2 Uncertainty

The licensee should describe uncertainties in the PDP. Significant uncertainties may exist at the preliminary decommissioning planning stage, particularly where decommissioning is not scheduled to take place for several decades, where highly complex operations may be involved, and where the evolution of regulatory requirements, technologies and waste management services is unknown.

The PDP should be based on the best available conservative information and predictions, and consider any special issues should an earlier, unscheduled facility closure occur. The PDP may be refined over time as the execution of decommissioning phase approaches and the uncertainty decreases.

6. Preparation for Decommissioning

During the preparation for decommissioning phase, the licensee shall review and revise, as appropriate, all program documents to ensure that they align with the decommissioning activities.

The licensee shall inform the CNSC in writing prior to shutting down a facility permanently or ceasing to manage, possess or store nuclear substances.

Prior to the permanent shutdown of a facility or ceasing to manage, possess or store nuclear substances, the licensee should discuss with the CNSC the timing of decommissioning, the proposed decommissioning actions, applicable regulations and guidance, and relevant requests of the CNSC.

For nuclear facilities with a Class I or a uranium mines and mills licence, the licensee shall prepare and submit to CNSC staff, for acceptance, the following documents:

- a permanent shutdown plan – this plan includes the steps to transition the facility from operation to a permanent shutdown state

- a stabilization activity plan – this plan comprises steps for the facility’s transition from a permanent shutdown state to a stable state
- a DDP – see section 6.2

Specifically, the stabilization of reactor facilities includes the following key activities: defueling the reactor, draining and storing of the cooling water from the reactor main systems, draining water from secondary and auxiliary cooling systems, cleaning and decontaminating, maintaining cooling for the irradiated fuel bays, transferring the spent fuel to dry storage, modifying the operating conditions/programs to align with the state of the facility, performing extensive radiological surveys and maintaining routine surveillance of the facility.

Depending on the site-specific licence and in consultation with the CNSC, stabilization activities may be performed under a CNSC licence for operating or for decommissioning, depending on how the licensee transitions the facility to decommissioning.

Notification for the permanent shutdown of a facility should be:

- two years, at a minimum, before the planned shutdown of Class I facilities and uranium mines and mills
- as soon as practicable for the unplanned shutdown of Class I facilities and uranium mines and mills

For waste nuclear substance licensees, notification for ceasing to manage, possess or store nuclear substances should be made as soon as practicable.

6.1 Storage with surveillance plan

For deferred decommissioning, as described in section 4, Class I facilities and uranium mines and mills licensees shall prepare a storage with surveillance plan and submit it to the CNSC for acceptance, in addition to the DDP. The storage with surveillance plan may be submitted as part of the DDP or as a stand-alone document. This plan should be updated as necessary and submitted to the CNSC every five years throughout the storage with surveillance phase, or as requested by CNSC staff. The storage with surveillance plan should outline:

- responsibilities
- functional services and systems
- maintenance, inspection and surveillance
- building hazard identification
- hazard control measures
- activities envisioned or planned to reduce the risks
- access control and zoning
- environmental protection control measures
- emergency plan and procedures
- usage boundaries during storage with surveillance
- facility change or modification process
- waste management
- quality assurance
- qualification and training program
- records

6.2 Detailed decommissioning plan

Prior to executing decommissioning activities, the licensee shall prepare and submit a DDP to the CNSC for acceptance. The DDP refines and adds details to the PDP. The DDP should document the final end-state objectives; a description of any institutional controls; a decommissioning strategy; a waste management plan; potential environmental effects; a cost estimate; and financial guarantee arrangements. Once accepted by the CNSC, the DDP will be incorporated into a licence authorizing decommissioning.

If permanent shutdown of the facility is not anticipated, the facility shall be brought to a safe condition by the licensee, under an appropriate licence. If permanent shutdown takes place before a DDP has been prepared and accepted, the licensee shall prepare one as soon as possible.

For deferred decommissioning, prior to the execution of decommissioning, the DDP shall be revised and submitted to the CNSC for acceptance, detailing the dismantling work to be completed. Where the execution takes longer than five years, the DDP should be updated every five years.

The DDP should be reviewed and updated in light of incidents or events with relevant consequences for decommissioning, revised regulatory requirements, operational experience and lessons learned, and advances in decommissioning technology.

For sites preparing to undergo decommissioning with more than one facility, the licensee should submit a DDP for the entire site to the CNSC for acceptance. In such cases, the site DDP should be prepared to cover all planning envelopes. The sequence of executing the planning envelopes and any interdependencies would also be included in both the site DDP and the facility-specific DDPs.

6.2.1 Content of the detailed decommissioning plan

A DDP for a nuclear facility with a Class I or uranium mines and mills licence shall include:

- a description of, and diagram showing, the areas, components and structures to be decommissioned and grouped where appropriate into logical decommissioning planning envelopes
- the operational history, including incidents or accidents that could affect decommissioning
- the storage with surveillance stage and requirements of the:
 - functional building services
 - monitoring and surveillance activities
 - inspection activities
 - usage boundaries during storage with surveillance
- the final radiological, physical and chemical end-state objectives. Where more than one DDP is required in a phased program, interim end-state objectives and monitoring programs for deferral periods must be provided for each detailed plan, for example aging management, radiation protection and environmental protection programs
- a description of the requirements for any institutional controls
- comprehensive and systematic survey results of radiological and other potentially hazardous conditions, including identification and description of the remaining significant gaps or uncertainties in the measurement or prediction of such conditions

- a decommissioning strategy for each planning envelope that highlights any significant changes from the strategy identified in the PDP
- a description of the decommissioning work packages, including:
 - a step-wise technical approach
 - the nature and source of potential significant risks to workers, the public and the environment (including estimates of doses), as well as species at risk
 - how protection and safety in decommissioning will be optimized
 - the procedures or technologies proposed to mitigate risks
 - the quantities, characteristics and disposition methods of waste
- a schedule showing:
 - the proposed start date
 - the approximate duration and sequence of work packages (and periods of storage with surveillance, if applicable)
 - the anticipated completion date
- a waste management plan (see section 6.4)
- a characterization of potential environmental effects and the measures that will be employed to mitigate and monitor the effects
- a conservative cost estimate (based on the work packages) for labour, materials, equipment, waste management, environmental assessment, monitoring and administration (e.g., training, safety, licensing, project management, government and public liaison)
- financial guarantee arrangements
- a summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned
- the project management structure
- applicable programs (e.g., management system, emergency response, site security, radiation protection, environmental protection, fire, and personnel training) (Note: this includes program application during storage with surveillance and decommissioning)
- a human factors program that includes:
 - human factors analysis
 - training provisions
 - use of contractors
 - procedural development
 - ergonomic issues
- conventional occupational health and safety issues and associated training and protection programs
- a listing of federal and provincial regulatory agencies involved in the project
- the final survey program with interpretation criteria
- the operating and decommissioning records that will be retained, and the method of retention
- a table of contents for the final end-state report that outlines the topics to be covered
- operational experience and lessons learned from the decommissioning of similar nuclear facilities
- criticality safety assessment and planned actions involving fissile material

Waste nuclear substance licensees may consult the above list for guidance, in accordance with a graded approach.

6.3 Safety assessment for decommissioning

The licensee shall perform a safety assessment to identify hazards to workers and the public from both routine decommissioning activities and credible accidents during decommissioning. The safety assessment should be conducted in accordance with a graded approach.

The results of the safety assessment should be used to:

- support the development of the decommissioning plan
- specify the program for maintenance, surveillance and inspection
- specify the procedures to be put in place for all operational activities significant to safety for responding to accidents
- specify the necessary competencies for the staff involved in the facility or activity
- make decisions using an integrated, risk-informed approach

The safety assessment should be updated as necessary in light of revised regulatory requirements, advances in decommissioning technology, changes in site characteristics, modifications to the design or operations, effects of aging, and operational experience and lessons learned.

The safety assessment may be a stand-alone document or may be included in the DDP.

For a nuclear facility with a Class I or uranium mines and mills licence, the licensee shall ensure that the safety assessment:

- identifies hazards to workers, the public and the environment from planned decommissioning activities, accidents and natural events that may arise during decommissioning
- describes the relative importance of the hazards and identifies the methods for mitigating the risks associated with such hazards
- determines the safety functions necessary in decommissioning, and the related SSCs that will deliver these safety functions
- demonstrates whether adequate defence in depth has been provided
- demonstrates whether adequate measures have been taken to prevent accident conditions and whether any consequences can be mitigated if accidents do occur
- determines the site characteristics relating to the safety of the facility or activity
- demonstrates that adequate measures have been taken to control hazards to an acceptable level, both in the present and in the long term, and to optimize protection and safety in decommissioning
- demonstrates that interdependencies between planned decommissioning actions are taken into account, and that any negative impacts of one action on another, as well as the possible generation of additional hazards, are properly taken into account

Information on safety analysis can be found in REGDOC-2.4.1, *Deterministic Safety Analysis* [9].

Waste nuclear substance licensees may consult the above list for guidance, in accordance with a graded approach.

For *in situ* decommissioning, a long-term safety case (see section 4) shall be provided in addition to the decommissioning safety assessment.

6.4 Waste management plan

Prior to decommissioning, the licensee shall prepare a waste management plan that considers the waste hierarchy and identifies the waste streams together with the estimated quantities and characteristics of the waste.

The licensee shall prepare a waste management plan that describes the systematic process for how materials will be moved from the disassembly areas to the areas for the subsequent steps of waste management. The monitoring and processing areas should be designed and operated to keep recyclable and reusable materials separate from waste materials.

The licensee shall ensure the availability of packages for radioactive waste, the disposition path of radioactive waste arising from decommissioning activities, and the ability of those disposition paths to accommodate the types and volumes of material.

The licensee shall assess the potential for generating non-radiological hazardous substances and incorporate the necessary precautions and reporting into their programs and procedures.

The licensee shall maintain up-to-date records of the waste generated, stored in the facility or transferred to another facility or waste organization, specifying its quantities, characteristics and destination.

The licensee should optimize the clearance of materials and sites from CNSC regulatory control. Exemption quantities, conditional clearance levels and unconditional clearance levels are specified in the *Nuclear Substances and Radiation Devices Regulations*.

Further information on radioactive waste management and waste management plans can be found in draft REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste* [6].

7. Execution of Decommissioning

The licensee shall:

- execute decommissioning in accordance with the accepted DDP and written procedures
- implement and maintain a decommissioning program and supporting programs, as applicable, to ensure safety
- ensure that a methodology for issuing, modifying and terminating work procedures is established
- maintain an up-to-date list of SSCs important to safety, as well as surveillance and maintenance plans for the SSCs
- consider the waste hierarchy, including preventing generation, reducing volume and radioactivity content, reusing and recycling materials and components, and disposing of the waste
- characterize and manage all remaining operational waste from the facility and all waste from decommissioning

- ensure traceability of all waste generated

As decommissioning actions progress, new hazards might emerge. New hazards should be assessed and addressed so as to maintain overall safety of the decommissioning actions undertaken.

7.1 Storage with surveillance

If deferred decommissioning is selected, the licensee shall ensure that the facility is maintained in a safe configuration so that subsequent decontamination and/or dismantling can be carried out. The licensee shall implement and maintain appropriate storage with surveillance programs to confirm that the SSCs needed to maintain safe storage are functioning as required. These programs should provide for surveillance, inspection, servicing and maintenance.

If storage with surveillance is undertaken, the licensee may perform activities to reduce risks at the facility during a period of storage with surveillance, in accordance with the licence and communication with the CNSC. These may include:

- reduction or removal of combustibles
- removal and recycling of non-contaminated or slightly-contaminated equipment (e.g., turbines, pumps and heat exchangers)
- reduction or isolation of asbestos
- demolition of non-nuclear facilities
- removal of radioactive waste to an offsite licensed storage facility
- reduction or removal of hazardous wastes

8. Completion of Decommissioning

Upon completion of decommissioning, the licensee shall demonstrate that the end-state criteria, as specified in the DDP, have been met.

The licensee shall prepare and submit an end-state report to CNSC staff for acceptance.

For a nuclear facility with a Class I or uranium mines and mills licence, the end-state report shall include:

- document (for example, using actual survey results) that the planned end-state conditions have been met, and if not, why they have not been met
- describe any proposed further licence requirements or institutional controls for the site
- describe the release criteria
- describe the decommissioning work undertaken, noting any significant deviations from the DDP
- describe any remaining entities
- describe the final physical and radiological status, including any remaining hazards
- include a list of structures, areas and equipment designated for restricted use
- describe waste quantities and dispositions
- include a summary of the radiological doses received by workers during the decommissioning activities
- include a summary of any abnormal occurrences or incidents that occurred during decommissioning activities
- describe any lessons learned

- provide references to decommissioning records
- describe the future use of, or any restrictions on the future use of, the lands and remaining structures

Where decommissioning of the facility or location is to take place in discrete stages, an interim end-state report shall be prepared when each planned interim end state is achieved. This report should describe the decommissioning work undertaken, the physical condition of the facility or location, the remaining hazards, the interim end state achieved, the results of surveys, the hazards and physical condition of the facility or location, and the remaining decommissioning tasks or work packages to be completed.

9. Post Decommissioning

If institutional controls are required to be in place, the licensee shall prepare plans to address the post-decommissioning phase. The post-decommissioning plans include programs for monitoring and surveillance that will be established and maintained for the optimization of protection and safety, and for the protection of the environment. The licensee shall clearly assign responsibility for implementing and maintaining the post-decommissioning plans and institutional controls.

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

- implementation of a visual inspection plan for periodic examination of the site to look for signs of deterioration of the facility or location (e.g., slumping of the ground), or erosion of the surface
- operation and maintenance of a monitoring system to provide early warning of the release of radionuclides before they leave their site boundary
- implementation of active controls to prevent unrestricted access to the site

10. Radiological and Hazardous Surveys

The licensee shall perform radiological and non-radiological surveys throughout the various phases in the lifecycle to support decommissioning.

The licensee should establish survey objectives that are to be met by characterization methods throughout the various stages of decommissioning. These objectives may include:

- identifying potential radiation risks for workers, the public and the environment associated with specific decommissioning activities
- addressing uncertainties in information regarding the locations, levels and types of contaminants that may be present
- obtaining hazard information to support the selection of a decommissioning strategy, sequence of decommissioning activities, decontamination options, selection of dismantlement methods, etc.
- achieving progressive and systematic reductions in radiological hazards
- demonstration that decommissioning end-state criteria has been met

10.1 Pre-operational surveys

Prior to construction of a nuclear facility, baseline radiological surveys should be performed at the proposed site of a facility and the surrounding area in order to establish background

concentration levels of radionuclides. Prior to the performance of these surveys, the proponent should identify the media to be sampled (e.g., soil, sediment, surface water) and the parameters to be measured (e.g., radionuclides, hazardous chemicals). This information will be useful for:

- future evaluation of the impact of the facility on the site and the surrounding area from its operation
- establishment of decommissioning end-state criteria

Background radiation data should also be assessed and updated prior to commissioning of a nuclear facility, particularly for areas that are not expected to be affected (e.g., activated or contaminated) by future operations.

Prior to commencement of a licensee's operation, samples of non-activated and non-contaminated materials should be retained and assessed to determine the concentrations of naturally occurring radionuclides.

If a pre-construction background survey was not performed for the site, survey data from an undisturbed area with similar characteristics or results of a survey of similar building materials should be used.

10.2 Operational surveys

During operational periods, the licensee should retain records of the hazards associated with the facilities and activities, particularly those that may be encountered during decommissioning activities. These may include chemical, biological and industrial hazards, in addition to radiological hazards.

Detailed characterization surveys should be performed by the licensee during operational periods to support the development of the final DDP. Radiological characterization data should include a description of the area (e.g., the premises of the facility, the surrounding environment, ground and surface water, soil and sediments, as applicable), contamination levels, dose rate levels, and chemical and physical forms of material.

As necessary, characterization surveys should be conducted to establish the penetration depth of contamination or activation in structures, soil and sediments, and the extent of radioactivity. Radioactive contaminants in shielded or self-shielded components, such as inside pipes and other equipment, should be determined to the extent possible.

Characterization surveys should also identify adjacent uncontaminated zones. During planning of decommissioning actions, special attention should be given to preventing cross contamination of such zones.

10.2.1 Transition from operation to decommissioning surveys

In preparing for decommissioning, surveys should be performed to the extent necessary to confirm the effectiveness of these transitional activities. The information provided should be used to validate or revise, if necessary, the decommissioning strategy.

10.3 Decommissioning surveys

Radiological conditions shall be monitored throughout decommissioning activities to confirm that radiation risks to workers, the public and the environment are being adequately controlled.

Surveys shall be performed throughout decommissioning to confirm the effectiveness of decommissioning activities used to reduce radiological risks (e.g., removal of excess radioactive material, decontamination of process equipment and immobilization of remaining contamination).

Surveys of radiological hazards shall also be performed to support the safe performance of surveillance and maintenance activities during periods when decommissioning is deferred.

Surveys should be performed to demonstrate that adjacent uncontaminated zones remain unaffected by decommissioning activities.

10.4 Decommissioning end-state surveys

The licensee shall conduct a final end-state survey in accordance with a survey plan. The survey plan should define:

- final radiological survey objectives
- methodology for conducting the survey
- sampling parameters and background radiation levels
- equipment, instruments, techniques and procedures
- methodology for evaluating the final survey results

Glossary

For definitions of terms used in this document that are not defined below, see [REGDOC-3.6, *Glossary of CNSC Terminology*](#), which includes terms and definitions used in the [Nuclear Safety and Control Act](#) and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

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

Decommissioning

Administrative and technical actions taken to retire a facility from service or to cease licensed activities, and that allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, possessed or stored. Decommissioning actions are the procedures, processes and work activities that lead to the release of a facility or location from regulatory control, with or without restrictions on its future use (for example, decontamination and/or dismantling of some or all structures, systems and components).

References

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

1. CSA Group, CSA N294, *Decommissioning of facilities containing nuclear substances*, Mississauga, 2009.
2. CNSC, [REGDOC-3.5.3, Regulatory Fundamentals](#), Ottawa, 2018.
3. CNSC, draft [REGDOC-2.11.1, Waste Management, Volume III: Safety Case for Long-Term Radioactive Waste Management, Version 2](#). (Version 2 under development)
4. CNSC, [REGDOC-2.11.1, Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings](#). Ottawa, 2018.
5. CNSC, draft REGDOC-3.3.1, *Financial Guarantees*. (under development).
6. CNSC, draft [REGDOC-2.11.1, Waste Management, Volume I: Management of Radioactive Waste](#). (under development)
7. CNSC, [REGDOC-3.2.1, Public Information and Disclosure](#), Ottawa, 2018.
8. CNSC, [REGDOC-3.2.2, Aboriginal Engagement](#), Ottawa, 2016.
9. CNSC, [REGDOC-2.4.1, Deterministic Safety Analysis](#), Ottawa, 2014.

Additional Information

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

- International Atomic Energy Agency (IAEA), IAEA Safety Standards, General Safety Requirements Part 6, [*Decommissioning of Facilities*](#), Vienna, 2014.
- IAEA, IAEA Safety Standards, General Safety Requirements Part 4, [*Safety Assessment for Facilities and Activities*](#), Vienna, 2016.
- IAEA, IAEA Safety Standards, Specific Safety Guide No. SSG-47, [*Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities*](#), Vienna, 2018.
- IAEA, IAEA Safety Standards, Safety Guide No. WS-G-5.2, [*Safety Assessment for the Decommissioning of Facilities Using Radioactive Material*](#), Vienna, 2008.
- Nuclear Energy Agency (NEA), [*Radiological Characterisation for Decommissioning of Nuclear Installations*](#), Paris, 2013.
- NEA, [*Preparing for Decommissioning During Operation and After Final Shutdown*](#), Paris, 2018.

CNSC Regulatory Document Series

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

CNSC regulatory documents are classified under the following categories and series:

1.0 Regulated facilities and activities

- Series
- 1.1 Reactor facilities
 - 1.2 Class IB facilities
 - 1.3 Uranium mines and mills
 - 1.4 Class II facilities
 - 1.5 Certification of prescribed equipment
 - 1.6 Nuclear substances and radiation devices

2.0 Safety and control areas

- Series
- 2.1 Management system
 - 2.2 Human performance management
 - 2.3 Operating performance
 - 2.4 Safety analysis
 - 2.5 Physical design
 - 2.6 Fitness for service
 - 2.7 Radiation protection
 - 2.8 Conventional health and safety
 - 2.9 Environmental protection
 - 2.10 Emergency management and fire protection
 - 2.11 Waste management
 - 2.12 Security
 - 2.13 Safeguards and non-proliferation
 - 2.14 Packaging and transport

3.0 Other regulatory areas

- Series
- 3.1 Reporting requirements
 - 3.2 Public and Indigenous engagement
 - 3.3 Financial guarantees
 - 3.4 Commission proceedings
 - 3.5 CNSC processes and practices
 - 3.6 Glossary of CNSC terminology

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