Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 26-H100.14

Date: 2026-06-17

Written Submission from Northwatch

Mémoire de Northwatch

In the matter of the

À l'égard des

Canadian Nuclear Laboratories

Laboratoires Nucléaires Canadiens

Application to amend the licence and licensing basis for the Gentilly-1 Waste Facility

Demande concernant la modification de leur permis et du fondement d'autorisation pour l'installation de gestion des déchets de Gentilly-1

Hearing in writing based on written submissions

Audience par écrit fondée sur des mémoires

July 2026

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NORTHWATCH SUBMISSION

Ref. 2026-H-100

Canadian Nuclear Laboratories' Request to Amend the Licence and Licensing Basis for the Gentilly-1 Waste Facility, June 2026

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On May 12, 2025 the Canadian Nuclear Safety Commission issued a notice of the Commission's intent to conduct a hearing in writing on Canadian Nuclear Laboratories' application to amend the licence and licensing basis for the Gentilly-1 Waste Facility.

The hearing is to consider an application from Canadian Nuclear Laboratories (CNL) to amend its waste facility decommissioning licence (WFDL) for the Gentilly-1 reactor, referred to by the CNSC as a "Waste Facility".

The amendment being sought would authorize CNL to proceed with activities related to the decommissioning of all buildings and structures at the facility located in the municipality of Bécancour, Quebec along the shores of the St. Lawrence River and adjacent to the Gentilly-2 (G2) facilities which is owned and operated by Hydro Quebec. The Gentilly facilities are located on the traditional and unceded territory of the Abenaki people and the Wabanaki Confederacy and the traditional land of the Huron-Wendat.

As summarized in the CNSC staff Commission Member Document 2026-H-100, the Gentilly-1 Waste Facility (G1WF) is owned by Atomic Energy of Canada Ltd. (AECL) and operated by Canadian Nuclear Laboratories (CNL). The 250 MWe prototype CANada Deuterium Uranium (CANDU) Boiling Water Reactor was operated intermittently for a total of 183 effective full power days until 1978 and achieved a safe shutdown state in 1986. Since 1986, the facility has been maintained in a state of storage with surveillance, under which activities have been conducted in support of future decommissioning efforts (e.g. waste characterization and hazard abatement).

CNL has submitted an application to amend the G1WF licence and authorize a change to its licensing basis to proceed from the storage with surveillance phase of their decommissioning approach to the final phase – Phase 3, Decommissioning and Demolition. This phase would include removal of all aboveground and underground structures owned by AECL, and restoration of the site footprint before returning it to Hydro-Québec, who owns the adjacent Gentilly-2 site as well as space in some structures shared with the G1WF. As part of this request, CNL has requested an amendment to the G1WF licence so that it will be valid for 15 years to allow completion of the proposed decommissioning activities, expiring in 2041. The current G1WF licence expires in 2034.

CNSC staff described the transfer of radioactive wastes to licensed off-site waste receivers as being an authorized activity under the current G1WF licensing basis and indicated that CNL's application for a licence amendment does not request a change to this authorization.

Northwatch's Interests

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario. Founded in 1988 to provide a representative regional voice in environmental decision-making and to address regional concerns with respect to energy, waste, mining and forestry related activities and initiatives, we have a long term and consistent interest in the nuclear chain, and its serial effects and potential effects with respect to northeastern Ontario, including issues related to uranium mining, refining, nuclear power generation, and various nuclear waste management initiatives and proposals as they may relate or have the potential to affect the lands, waters and/or people of northern Ontario.

Northwatch has a dual mandate that includes public interest research, education and advocacy to promote environmental awareness and protection of the environment, and support and promotion of public participation in environment-related decision-making.

Northwatch's core objectives are the incorporation of environmental considerations into economic and social decision-making, and the realization of a future for northern Ontario which is environmentally and socially sustainable.

Northwatch's interests in the decommissioning project at the Gentilly nuclear site in Bécancour, Quebec are the management and generation of radioactive wastes through the decommissioning process and the ultimate disposition of the wastes, and the potential for the practices, policies and / or regulatory decision-making with respect to the proposed decommissioning approach to become precedent-setting or normative.

More specifically, our region could be impacted - as it would be by the proposed eventual transfer of the nuclear fuel waste to a location in northern Ontario selected by the nuclear industry in 2024 – if the nuclear industry developed a plan that included transfer of intermediate level radioactive wastes into northern Ontario. In addition, the interim management of the used fuel could have long-term dose consequences for those along transportation routes and final point of transfer (potentially residents of northern Ontario).

In preparing our written submission Northwatch reviewed the application by Canadian Nuclear Laboratories, the Commission Member Document prepared by Canadian Nuclear Safety Commission staff, the Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview, as referenced in the CNL application to amend the license, the Environmental Effects Review for Gentilly-1 Waste Facility – Phase 3 Decommissioning as referenced in the CNL application to amend the license, and various other materials including as found on the CNSC and CNL web sites.

Matters of Concern

Northwatch wishes to go on the record with the Commission with respect to issues which pre-dating the hearing in writing. The first is manner of the hearing itself, and the second related to the transportation of nuclear fuel waste from Gentilly I to the Chalk River Nuclear Laboratory site in advance of this hearing. A third concern is the disrespecting by CNSC staff of the rights and interests of the Algonquin people whose territory will be impacted by both the transportation and deposition of radioactive wastes as part of this decommissioning project.

No Impact Assessment Hearing

Northwatch objects to the Canadian Nuclear Laboratories' application to amend the licence and licensing basis for the Gentilly-1 Waste Facility being the subject of a "hearing in writing" rather than a full impact assessment or – at minimum – a full licensing hearing.

As noted in the CNSC staff CMD the proposed decommissioning activities at the G1WF are subject to a federal lands assessment in accordance with the Impact Assessment Act.[1]

A notice was posted on the Impact Assessment Agency of Canada's registry on December 15th of the federal authorities intent to make a determination regarding whether the carrying out of the Decommissioning of the Gentilly-1 Waste Facility project is likely to cause significant adverse environmental effects.

To help inform these determinations, the federal authorities were inviting public comment until February 5, 2026 respecting that determination; Northwatch wrote in response to that invitation.

According to the notice, Canadian Nuclear Laboratories (CNL) was proposing the decommissioning of the Gentilly-1 Waste Facility (G1WF), which consists of a permanently shut down, partially decommissioning prototype nuclear reactor and support structures.

Northwatch commented that while CNL has applied to the Canadian Nuclear Safety Commission (CNSC) for an amendment to the existing licence, which would authorize CNL to proceed with the last phase of decommissioning activities at the G1WF, the licence amendment process is not sufficient in terms of the review required for this project and Northwatch requested the following:

- That the Decommissioning of the Gentilly-1 Waste Facility project be referred for a full impact assessment and a public hearing with a review panel (i.e. not a hearing-in-writing or a licensing hearing)

[1] 26-H100 - CNSC Staff Submission, page 11

- That the "Environmental Effects Review for Gentilly-1 Waste Facility – Phase 3 Decommissioning") be released and that we be provided with a copy as part of the IAAC comment period
- That the review be comprehensive and include the impacts of transport and dispositioning of the radioactive wastes
- That the review includes an examination of need and alternatives including alternatives and alternative means including robust extended on-site storage
- That should the options for interim or long-term storage of the wastes include consideration of an off-site facility, then communities and First Nations along the transportation route be consulted and engaged in the decision-making
- That should the options for interim or long-term storage of the wastes include consideration of an off-site facility, then communities and First Nations whose region / territory where the wastes may be relocated to are consulted and engaged in the decision-making.

On April 14th 2026 a "Notice of CNSC Hearing in Writing and Section 82 Determinations" was posted to the Impact Assessment Agency registry, announcing that the Canadian Nuclear Safety Commission (CNSC) will conduct a public hearing based on written submissions in July 2026."

The notice stated that "in accordance with section 82 of the Impact Assessment Act (IAA), as a prerequisite to the licensing decision, the Commission must determine whether the proposed activities are likely to cause significant adverse environmental effects. The CNSC's determination will be made by the Commission following the July 2026 public hearing, prior to the Commission making the licensing decision. Indigenous Nations and communities, members of the public, and interested parties are invited to intervene directly to the Commission regarding CNL's licence amendment request and the federal lands assessment being conducted in accordance with the IAA."

Further the notice stated that "AECL is also responsible for making an environmental effects determination under section 82 of the IAA. AECL will make its determination separately from the Commission's determination."

Northwatch disagrees with the decision to not delegate this decommissioning project for a full impact assessment under the auspices of the Canadian Impact Assessment.

<u>Hearing in Writing</u>

Northwatch strongly objects to the Canadian Nuclear Safety Commission decision to hold the licensing hearing as a "hearing in writing" rather than as a full public hearing which is live-streamed, allows Indigenous and public intervenors to address the Commission,

observe the Commission's interactions with the licensee and CNSC staff, and has full transcripts produced. By relegating this license review to a "hearing in writing not only does the public not have an opportunity to speak to or interact with the Commission, the public and Indigenous people are also unable to observe any communications between the "Commission" and others related to the subject matter. There is no transcript. Frequently, the "Hearing Panel" is a panel of one commission member. This lack of an open and transparent process contributes to a lack of trust and confidence that the Commission is asking in the public interest.

Transport of Nuclear Fuel Waste

A second matter of concern is the transport of radioactive wastes which are not described or assessed in the CNSC staff CMD or in CNL's documents.

Included in this concern is the transportation of the nuclear fuel waste from the Gentilly I site to the Chalk River Nuclear Laboratory site between January and June 2025.

CNSC staff repeatedly stated that the transfer of nuclear substances, including radioactive wastes, is within the current licensing basis of the G1WF as described in Part IV of the WFDL and that on that basis the transportation of the decommissioning wastes is not described in detail in this CMD or CNL's application.[2] While not describing the transportation of the radioactive wastes "in detail", the CMD does note that "all used nuclear fuel that was in storage at the G1WF has been transferred to CNL's Chalk River Laboratories (CRL) site for interim storage."

They go on to restate that "the transfer of nuclear substances, including radioactive wastes, is within the current licensing basis of the G1WF as described in Part IV of the WFDL; therefore, this activity is not described in detail in this CMD or CNL's application" and that "radioactive wastes generated from the G1WF will continue to follow CNL's Transportation of Dangerous Goods Program and be placed in packages compliant with the *Packaging and Transport of Nuclear Substances Regulations, 2015*, and the *Transport of Dangerous Goods Regulations*. [3]

This is not persuasive. The inclusion of the "transfer" of materials within the site is very different from the long-distance and high-volume transportation of the decommissioning wastes, and very different from the long-distance and high-concern transportation of high-level nuclear fuel waste.

[2] CNSC CMD page 9
[3] Footnote 2 on page 14

Canadian Nuclear Laboratories in a June 2025 news release did not actually describe the transport of the fuel waste from Gentilly to Chalk River as part of the waste management facility's ongoing storage and surveillance activities but rather referred to it as the "Gentilly-1 Fuel Consolidation Project", calling it a "significant achievement".[4]

CNL also claimed that "prior to commencing the work, CNL shared information about the robust safety, security, and emergency preparedness measures in place with federal, provincial and regional stakeholders, and with Indigenous Nations, communities and organizations". There is no evidence that this is the case, and counter-indications, such as the communications from Kebaowek First Nation, that this was very much not the case.

We do not disagree with CNL characterizing the transfer of the fuel waste as a stand-alone project. We do disagree with this project having gone forward with no public notice, no public scrutiny, and no public accountability.

Indigenous Engagement

CNSC staff adopted stance which rejected or minimized Indigenous interests and rights with respect to the Gentilly I decommissioning project.

For example, the CNSC staff CMD states that "CNSC staff's considerations include but are not limited to Indigenous Nations and communities' established or potential rights pertaining to lands and waters in relation to the facility and the expected and/or potential impacts of the activities conducted on the site in accordance with a CNSC issued licence."[5]

There is a fundamental flaw in this statement, in that it is limiting the project and the project impacts to the Gentilly 1 facility or the Gentilly site, when in fact and effect the project and the project activities – which include the transportation and deposition of large quantities of radioactive wastes offsite - extend well beyond the Gentilly site and include the transportation route and any receiving location.

In more than one instance and to more than one First Nation CNSC staff declared that the Indigenous Nation's concerns were "out of scope" and with this declaration seemingly also declared their rights and interests to be "out of scope". For example, in a letter dated April 10, 2026 and addressed to Chief Lance Haymond, Kebaowek First Nation, CNSC staff wrote:

[4] https://www.cnl.ca/canadas-national-nuclear-laboratory-achieves-major-milestone-with-successful-completion-of-gentilly-1-fuel-consolidation-project/
[5] Staff CMD Section 4.1, Page 29

> *As outlined in the CNSC's letter to Kebaowek First Nation (KFN) dated January 12, 2026, CNSC staff have evaluated KFN's concerns and have determined that due to the scope of the current G1WF licence amendment application, the distance of the G1WF from KFN's traditional territory, the localized nature of potential impacts from the proposed decommissioning activities at the G1WF, and that the spent fuel from G1WF was already transferred to CRL in accordance with the licence conditions and licensing bases for both existing licences, KFN's concerns do not fall directly in scope of the G1WF decommissioning activities that are being proposed for this licence amendment*.

Again, the fundamental flaw is that CNSC staff are attempting to limiting the project and its potential adverse effects to Gentilly 1 facility or the Gentilly site, when in fact there are large volumes of radioactive wastes that will be generated through the decommissioning and are presumably going to be transported to Chalk River Nuclear Laboratory which is very much in Algonquin territory and of direct concern and impact for Kebaowek First Nation.

Generally speaking, Northwatch does not intervene on matters related to Indigenous interests and rely on the Indigenous Nations to address them, as they so effectively do. However, we are all treaty people and as a non-Indigenous organization when the Crown does not uphold its duty to consult and accommodate it is our duty – as treaty people – to challenge the Crown, as we are so doing.

The Gentilly I decommissioning project is a single project. The decommissioning plan as presented includes the removal of all aboveground structures and underground structures including foundations to a depth of one meter below grade; this includes an intent to remove these materials from the site, and to transport them to Chalk River. The transfer of the spent fuel from G1WF to Chalk River was also part of this same project. These activities are incidental (or integral) to the decommissioning project in that they would not be occurring in the absence of the decommissioning project and the decommissioning project could not occur as planned without these activities (in the alternative, the decommissioning project could proceed absent of these activities if the plan was to store these wastes on-site at Gentilly, but this is not the plan as presented).

Given these facts and factors, Kebaowek First Nation's concerns fall directly within the scope of the Gentilly decommissioning project and should be recognized and responded to on that basis. This is inarguably an instance where the Free, Prior and Informed Consent of Kebaowek First Nation and the Algonquins of Pikwakanagan First Nation is a necessary precursor to this project going forward, as it is with the Conseil de La Nation Wendat, the Conseil des Abénakis Wôlinak and the Conseil des Abénakis Odanak.

End State Objectives

Northwatch has commissioned two expert reports with respect to the setting and application of end state objectives in decommissioning of nuclear sites.

The first, titled "Nuclear Power Plant Decommissioning - International perspectives and comparisons of standards for post-closure safety case assessments" was prepared for Northwatch by Rizwan Khan, J.D., to support Northwatch's written intervention on the Licence Application for a Nuclear Power Reactor Decommissioning Licence (PRDL) for the Gentilly-2 Nuclear Facility in 2016.

The second, titled "Report: A comparison of international and domestic standards, and end-state objectives in the decommissioning of nuclear facilities" was prepared by Tennile Sunday, Associate at Macpherson Law LLP, to support Northwatch's written intervention in Canadian Nuclear Laboratories' application to amend the licence and licensing basis for the Gentilly-1 Waste Facility in July 2026.

Both reports informed this submission and can be found as appendices to this written intervention.

End state objectives for decommissioning nuclear facilities should be determined through a comprehensive, site-specific decision-making process involving regulators, operators, the public and Indigenous peoples.

The process for developing end state objectives or site release standards should include:

- Assessing and characterizing all radiological and non-radiological hazards
- Inventorying and characterizing the radioactive wastes, including determining the waste volumes and identifying the waste management requirements
- End state / site objectives should be detailed in a preliminary decommissioning plan during the siting and operating phase, and then continually updated into a final decommissioning plan

Operationalizing the decommissioning plan should include:

- Progressive decontamination, dismantling and containment to reach the agreed-upon criteria.
- Detailed radiological and non-radiological surveys provide quantified evidence that the end state has been achieved.
- Open and transparent sharing of information with the public and Indigenous people throughout the planning and delivery of the decommissioning work, including final surveys and post-decommissioning monitoring

We found no evidence in the CNSC Staff CMD, CNL's application, or CNL's Detailed Decommissioning Plan[6] that end state objectives for the decommissioning of Gentilly I had been developed through any process that included or provided for the contribution of the public and Indigenous peoples. It is unclear what CNSC's role was in the development of end state objectives.

In their Commission Member Document CNSC staff provide various statements with respect to expected end-state objectives or site release standards, including statements that:

- Any contaminated underground structures and soil will be decontaminated to As Low as Reasonably Achievable (ALARA) levels[7]
- ALARA levels will be in accordance with CNL's environmental remediation procedures
- ALARA levels will be in accordance with criteria agreed upon with Hydro Quebec page 8
- CNL's decommissioning approach and end-state for the G1WF have not changed
- CNL's decommissioning approach includes the transfer of all radioactive wastes and non-radiological hazardous wastes to licensed storage or disposal facilities.[8]
- CNL assumes that remediation of the G1WF site will be based on industrial reuse criteria, but the exact criteria will be defined by a future agreement between CNL and HQ, and with AECL as appropriate.

These statements, taken singly or in combination or in contrast with each other, indicate that from the CNSC staff perspective the end-state objectives for the decommissioning of Gentilly I are still not determined, and are only very generally described, such as that the decontamination will be to "as low as reasonably achievable".

In Section E of the Environmental Effects Evaluation Form in Appendix A of the CNSC CMD[9] an example is provided of the lack of clarity in the CNSC staff discussion of end-state objectives in their discussion of the potential release of contaminants into the groundwater and proposed mitigation measures.

In considering that the release of contaminants into the groundwater may impact groundwater quality and quality in the area during decommissioning and post-decommissioning and cause changes to the quality of groundwater, which may in turn

[6] Detailed Decommissioning Plan Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview 61-508310-DDP-001817 Rev. 1
[7] CNSC CMD page 8
[8] CNSC CMD page 9
[9] CNSC CMD page 56

affect the health and social conditions of Indigenous Nations and communities the "mitigation measures" included using a sump pump system to bring contaminated structures and soil have been brought to free-release levels, to removal contaminated materials or manage to free-release levels, or to "decontaminate" structures deeper than 1 metre below grade that cannot be safely removed. Decontamination is not defined and the criteria or end state that must be achieved is not stated.

Canadian Nuclear Laboratories' "Detailed Decommissioning Plan Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview" creates an initial impression in Section 12.3 **"**Interim End-State Objectives" that end-state objectives have been established and will b adhered to, referencing "interim end-state objectives for the buildings and areas of each planning envelope".[10] However this positive impression unravels with further reading, when the document states that radiation surveys will be performed to "ensure no contamination is present above the reference background level (i.e., Derived Concentration Guideline Levels (DCGLs)" leaving DCGLs undescribed and unexplained until several pages later the document describes pathway modelling for the critical population group as being the means to determines the DCGLs for various radioisotopes that are contributing to the residual radioactivity on site.[11]

Section 14.1 "Final End State Objectives" sets out that "an agreement between CNL and HQ (Hydro Quebec) will have to be reached in alignment with CNL's *Land Use Process* requirements on the expected conditions for returning the land to HQ so that it is in a state suitable for other HQ uses. For planning purposes, CNL assumes that the Gentilly site will be available for industrial re-use after decommissioning and therefore, the cleanup criteria will be based on the following radiological, chemical, and physical objectives".

In summary, end-state objectives for radiological contamination have not been set. Hence, there is no quantifiable measure which the decommissioning activities must meet.

REQUEST: that CNL be required to produce a clearly stated set of end state objectives and site release criteria for public and Commission review prior to commencing the Decommissioning and Dismantling phase.

[10] Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview 61-508310-DDP-001817 Rev. 1, Page 105 of 163
[11] Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview 61-508310-DDP-001817 Rev. 1, Page 112 of 163

Waste Characterization and Dispositioning

CNSC staff indicate that "all G1WF aboveground structures and underground structures, including foundations, owned by AECL will be removed to a minimum depth of one meter below grade, followed by backfilling, grading, and landscaping (with sod or seeded)."[12]

This general description of the planned decommissioning approach raises numerous questions, including:

- Where will the structures be removed to?
- What was the basis for determining that removal would be minimum depth of one meter?
- Where is there a description of the underground structures?
- How does the one-meter depth below grade for removal compare to the total depth of the various structures?

One metre in depth is less than the required depth for foundations for a residential building (four feet or 1.2 metres), so it is reasonable to surmise that virtually all structures will be deeper than one metre.

In effect, this is de facto in-situ decommissioning, which the IAEA states is only to be utilized in an emergency situation.

This supposition is confirmed in CNL's decommissioning plan where CNL states that contaminated underground structures "that are accessible but left in-situ" will be grouted in a cement matrix.[13]

REQUEST: CNL should be required to justify their selection of in-situ decommissioning for (some) underground structures during decommissioning of Gentilly I and quantify how many of the structures of a depth greater than one metre below grade will be left in-situ.

CNSC staff summarize that CNL has indicated in the current G1WF program overview DDP that radioactive wastes to be generated during the two "planning envelopes" in the decommissioning phase are estimated to consist of:

- 428 m3 of concrete low-level waste
- 371 metric tons of mechanical & electrical low-level waste
- 260 m3 of concrete intermediate-level waste

[12] CNSC CMD Page 8
[13] Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview, 61-508310-DDP-001817 Rev. 1, Page 111 of 163

▪ 371 metric tons of intermediate-level waste from mechanical and electrical components, rebar, structural steel, and miscellaneous metals [14]

While this very general summary is mildly interesting, it fails to provide an accurate picture of the radioactive wastes on site or the wastes that will be generated during decommissioning. For example:

- There is no characterization of the wastes or description of its radioactivity, hazard life, or shielding requirements
- There is no estimation of the transportation requirements were the wastes to be moved off-site (which CNSC staff state will be the case)
- There is no description of the containment or storage systems that will be required for the wastes post-decommissioning and transfer or where that containment or storage will take place

CNSC staff also that that "Hazardous and radioactive wastes from this project are predicted to have no interaction with the environment since CNL will be removing and properly disposing of hazardous waste before starting decommissioning and demolition activities and any radioactive waste from the project will be shipped to an appropriate licensed off-site waste management facility."[15]

This statement is problematic for several reasons:

- There will be interaction with the environment at the Gentilly site during decommissioning
- There will be "an environment" in whichever location the waste is transferred to, and there will be interactions with the environment in that next location
- No description has been provided of the containment or management of the wastes if "shipped to an appropriate off-site waste management facility"

In Section 15 of the Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview CNL provides a summary of the waste types and estimated quantities of the waste that is currently stored at G1WF and the waste that will be generated due to the Phase 3 Decommissioning (i.e., D&D) activities.[16]

Table 15 "Stored Waste Inventory at G1WF" provides an extremely general summary; Table 16 "Summary of G1WF Decommissioning Waste Estimate" is dominated by a classification of the majority of the wastes as "potentially clearable" which casts the table into the realm of highly unreliable; and Table 17 "Breakdown of G1WF Decommissioning Waste Estimate" is the most detailed but also lacks precision and clarity. For example, there is no characterization of the

[14] CNSC CMD Page 28
[15] CNSC CMD Page 22
[16] Gentilly-1 Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview 61-508310-DDP-001817 Rev. 1, Page 113

wastes, it is unclear if stored wastes are included, and in some instances lacks credibility. For example, it seems incredible that wastes spent resin tank and vaults and Spent Fuel canisters would be considered to be “potentially clearable waste”.

The waste management section of the Decommissioning Plan is also incredibly weak in terms of the dispositioning of the wastes post-decommissioning.

For example, the plan indicates that “the ILW and LLW will be segregated, packaged, and shipped to one of the CRL WMAs for interim storage or to a licensed off-site facility for processing in accordance with CNL *Waste Management* [146] program, Radiation Protection [31] program, and *Transportation of Dangerous Goods* [144] program requirements.”

We don’t dispute that the management might be in keeping with CNL’s program requirements. But what we note is that the plan provides no actual solid information about the future or fate of these wastes, such as:

- What is the actual destination of the wastes? To Chalk River or some other “CRL WMA”?
- Presumably the assumed destination is Chalk River – and it is frustrating the CNL will not just state this – but up arrival at Chalk River what is the destination? The presumed Near Surface Disposal Facility whose fate is uncertain, and timeline is unclear but certainly not immediate?
- What is the containment system? Where are the design details on the intended structure?
- Is the next destination the final destination or an interim management scenario?
- What is the monitoring program? What is the mitigation or contingency plan if performance is below expectations?

REQUEST: Required CNL to produce a detailed waste inventory for the decommissioning of Gentilly I that includes volumes, characteristics, and containment / shielding requirements, with estimates identified by the degree of uncertainty accompanying it

Licensing and Approvals Process

In addition to our earlier expressed concerns about the lack of an independent impact assessment and the limitations of a "hearing in writing", and given the shortcomings of the application and supporting documents and the significance of the decommissioning project, Northwatch strongly requests that the Commission insert hold-points into the next license period, with subsequent decisions to be made by the Commission following a full public hearing at each hold point.

CNSC staff outlines in their Commission Member document:[17]

> *The proposed licence amendment would not solely enable CNL to undertake activities associated with Phase 3 of their decommissioning approach. The Compliance Verification Criteria (CVC) in the G1WF licence conditions handbook (LCH) related to Licence Condition 13.2, Decommissioning Plan, would be revised to explicitly state the requirement from REGDOC-2.11.2, Decommissioning, for CNSC acceptance of DDPs that describe decommissioning activities prior to execution of those activities.*
> *This acceptance is carried out at the CNSC staff level and would entail review of DDPs covering the two planning envelopes (A & B) described by CNL for Phase 3:*
>
> ▪ *Planning Envelope A (approximately 2026-2030): the southern portion of the Turbine Building including the tunnel to the Reactor Building and the SFCA; and the basement portion of the Service Building including the Spent Resin Storage Area (resins have been removed).*
> ▪ *Planning Envelope B (approximately 2027-2034): reactor building clear-out including the calandria and bioshield; and the reactor building dome and containment structure.*

The CNSC staff CMD further states that CNL will submit additional Detailed Decommissioning Plans covering each decommissioning planning envelope.[18] Additionally, CNL has committed to producing decommissioning safety analyses that will support forthcoming DDPs related to Phase 3 decommissioning activities at the G1WF[19]

REQUEST: the Commission hold a public hearing related to each of Planning Envelope A and Planning Envelope B which include but are not limited to examination of a detailed waste inventory and management plan, and the detailed decommissioning plan and decommissioning safety analysis support submitted by CNL for that planning envelope.

[17] 26-H100 - CNSC Staff Submission, pages 9-10
[18] CNSC CMD Page 22
[19] CNSC CMD Page 19

Northwatch Appendices

"Nuclear Power Plant Decommissioning - International perspectives and comparisons of standards for post-closure safety case assessments"

Rizwan Khan, J.D.

March 2016

"Report: A comparison of international and domestic standards, and end-state objectives in the decommissioning of nuclear facilities"

Tennile Sunday, Associate at Macpherson Law LLP

June 2026

Written Submission on the Licence Application for a Nuclear Power Reactor Decommissioning Licence (PRDL) for the Gentilly-2 Nuclear Facility

Nuclear Power Plant Decommissioning

International perspectives and comparisons of standards for post-closure safety case assessments

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Prepared for Northwatch

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1 EXECUTIVE SUMMARY

The Canadian Nuclear Safety Commission ("CNSC") will hold a hearing to consider Hydro-Québec's application for a 10-year licence to continue activities related to the preparation for the decommissioning of the Gentilly-2 nuclear facility that is currently in a safe storage state. This document reviews certain international standards and practices for the review of the decommissioning licence application and where relevant, other nuclear power plants ("NPPs"). This review is intended to assist the CNSC in understanding appropriate conditions and approval considerations for reviewing the Hydro-Québec licence application.

The CNSC is tasked with determining whether the activities related to the preparation for the decommissioning of the Gentilly-2 are adequate. Canadian standards set under the *Nuclear Safety and Control Act*, its regulations, and other guidance documents are general and do not provide sufficient detail or address all the relevant factors to guide the CNSC's review of the adequacy of a post closure safety assessment. This submission contains an overview of regulatory requirements used for the decommissioning of nuclear facilities in international jurisdictions and those developed by the International Atomic Energy Agency ("IAEA").

Other countries have also adopted general regulatory requirements for decommissioning nuclear facilities. These set out the expectations that licensees would have to meet in preparing and undertaking decommissioning actions. While consistent with the general requirements, the regulatory regimes reviewed do not adequately address the specific requirements of the approach recommended by the IAEA.

The CNSC should use the regulatory approaches of other countries and the IAEA as a guide to assess decommissioning planning by Hydro-Quebec. In lieu of specific regulations to govern the conditions for licensing, the CNSC should review the proposal in light of IAEA requirements and by comparison to international standards for nuclear facility decommissioning strategies and plans.

2 INTERNATIONAL ATOMIC ENERGY AGENCY REQUIREMENTS

The IAEA is an independent intergovernmental organization within the United Nations. It serves as the world's intergovernmental forum for scientific and technical cooperation in the peaceful use of nuclear technology. It was created to promote peaceful applications of atomic energy worldwide for humanity's benefit while guarding against the spread of its destructive use.

Under Article III of its Statute, the IAEA is authorized to establish standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards. The IAEA establishes and publishes these standards under the IAEA Safety Standards Series.[1]

The IAEA safety standards establish fundamental safety principles, requirements and measures to control the radiation exposure of people and the release of radioactive material to the environment, and to mitigate the consequences of such events if they were to occur. The standards apply to facilities and activities that give rise to radiation risks, including nuclear installations, the use of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.[2] The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. If the requirements are not met, measures must be taken to reach or restore the required level of safety.[3]

2.1 DECOMMISSIONING STRATEGIES

IAEA Safety Standards Series No. GSR Part 6, *Decommissioning of Facilities Using Radioactive Material*, establishes internationally agreed requirements for the decommissioning of facilities on the basis of the fundamental safety objective and fundamental safety principles established in the Safety Fundamentals.[4] GSR Part 6 includes the safety requirements for all aspects of decommissioning from the siting and design of a facility to the termination of the authorization for decommissioning. The objective of GSR Part 6 is to establish the general safety requirements to be met during planning for decommissioning, during conduct of decommissioning actions and during termination of the authorization for decommissioning.[5]

GSR Part 6 does not only apply to NPPs, but also research reactors, other nuclear fuel cycle facilities, including predisposal waste management facilities, facilities for processing naturally

[1] IAEA, Decommissioning of Facilities Using Radioactive Material, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2016). <online: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1652web-83896570.pdf> [**GSR Part 6**]
[2] *Ibid*.
[3] *Ibid*.
[4] International Atomic Energy Agency (IAEA), European Atomic Energy Community (Euratom), the Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO), the International Maritime Organization (IMO), the OECD Nuclear Energy Agency (OECD/NEA), the Pan American Health Organization (PAHO), the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006). <online: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1273_web.pdf>
[5] GSR Part 6, *supra*, note 1 at 1.11, 1.14-1.15.

occurring radioactive material ("NORM"), former military sites, and relevant medical facilities, industrial facilities, and research and development facilities.[6] It does not not apply to radioactive waste disposal facilities or waste from mining and mineral processing.[7]

Under GSR Part 6, the term 'decommissioning' refers to the actions, both administrative and technical, taken to remove some or all of the regulatory controls from a nuclear facility.[8] Aspects of decommissioning have to be considered throughout the five major stages of siting, design, construction, commissioning, and operation of a NPP.[9] Decommissioning is performed using a graded approach to achieve a progressive and systematic reduction in radiological hazards. Decommissioning is undertaken on the basis of planning and assessment to ensure safety, protection of workers and the public, and protection of the environment.[10] Decommissioning is concerned with 'facilities', i.e. buildings, including their associated land and equipment. There may be areas of land that have become contaminated during operation of a facility. The cleanup of these areas is part of decommissioning.[11]

Strategies for decommissioning nuclear facilities include immediate dismantling and deferred dismantling:[12]

> *Immediate dismantling*: Decommissioning begin shortly after permanent shutdown. Equipment and structures, systems and components of a facility containing radioactive material are removed and/or decontaminated to a level that permits the facility to be released from regulatory control for unrestricted use, or released with restrictions on future use.
>
> *Deferred dismantling*: After removal of the nuclear fuel from the facility, all or part of the facility is either processed or placed in such a condition that it can be put in safe storage and the facility maintained until it is subsequently decontaminated and/or dismantled. Deferred dismantling may involve early dismantling of some parts of the facility and early processing of some radioactive material and its removal from the facility, as preparatory steps for the safe storage of the remaining parts of the facility.

Immediate dismantling is the IAEA preferred decommissioning strategy but GSR Part 6 acknowledges that there may be situations in which immediate dismantling is not a practicable strategy when all relevant factors are considered.[13]

A combination of immediate and deferred dismantling may be considered on the basis of safety or environmental requirements, technical considerations and local conditions, such as the intended future use of the site, or financial considerations. GSR Part 6 does not consider entombment, in which all or part of the facility is encased in situ, a decommissioning strategy and

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[6] *Ibid*. at 1.16.
[7] *Ibid*. at 1.17.
[8] except for where radioactive waste is emplaced, for which the term 'closure' instead of 'decommissioning' is used.
[9] GSR Part 6, *supra*, note 1 at 1.1.
[10] *Ibid*. at 1.4.
[11] *Ibid*. at 1.19.
[12] *Ibid*. at 1.9.
[13] *Ibid*. at 5.1.

not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g. following a severe accident).[14]

The selection of a suitable decommissioning process is a complex task. It is therefore useful to consider the advantages and disadvantages of the various decommissioning strategies.

2.2 DECOMMISSIONING REQUIREMENTS

GSR Part 6 is divided into sections that outlines the requirements for the different concerns that are involved in the decommissioning of a nuclear facility:

- Section 2 establishes the requirements for safety, for protection of workers and the public and for protection of the environment.
- Section 3 establishes the responsibilities within the governmental, legal and regulatory framework associated with decommissioning.
- Section 4 establishes the requirements for the management of decommissioning.
- Section 5 establishes the requirements for selecting a decommissioning strategy.
- Section 6 establishes the requirements for the financing of decommissioning.
- Section 7 establishes the requirements for the planning for decommissioning that is done during the facility's lifetime.
- Section 8 establishes the requirements to be followed when conducting decommissioning actions.
- Section 9 establishes the requirements for determining when decommissioning has been completed, including the requirements for surveys to demonstrate the completion of decommissioning actions and the termination of authorization for decommissioning.

2.2.1 Specific Requirements

GSR Part 6 requirement 3 stipulates that a final decommissioning plan must be supported by a safety assessment addressing the planned decommissioning actions and incidents, including accidents that may occur or situations that may arise during decommissioning be undertaken for all facilities undergoing decommissioning and for which decommissioning is planned.[15] The safety assessment must conform to the requirements under GSR Part 4, *Safety Assessment for Facilities and Activities*.[16] This IAEA requirement is implemented in Canada by CNSC's Regdoc-2.4.1, *Deterministic Safety Analysis*.

Under requirement 4, States must establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning can be planned and carried out safely.[17] Requirements for general responsibilities within the framework are established in IAEA, *Legal and*

[14] *Ibid*. at 1.10.
[15] GSR Part 6, *supra*, note 1 at pg. 7.
[16] IAEA, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), IAEA, Vienna (2016). <online: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1714web-7976998.pdf>
[17] GSR Part 6, *supra*, note 1, at pgs. 7-8.

Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1. These requirements apply allocating responsibilities for decommissioning. [18]

The responsibilities of a State government shall include:[19]

- Establishing a national policy for the management of radioactive waste, including during decommissioning;
- Establishing and maintaining the legal, technical and financial responsibilities for organizations involved in decommissioning;
- Ensuring that the necessary scientific and technical expertise is available for the licensee and for the support of regulatory review;
- Establishing a mechanism to ensure that adequate financial resources are available when necessary for safe decommissioning and for the management of the resulting radioactive waste.

Under requirement 5, the regulatory body must regulate all aspects of decommissioning throughout all stages of the facility's lifetime. The regulatory body shall establish the safety requirements for decommissioning, including requirements for management of the resulting radioactive waste, and shall adopt associated regulations and guides. The regulatory body must also take actions to ensure that the regulatory requirements are met.[20]

Requirement 8 mandates the licensee to select a decommissioning strategy that is consistent with the national policy on the management of radioactive waste. The preferred decommissioning strategy shall be immediate dismantling. The selection of a decommissioning strategy shall be justified by the licensee. The licensee must demonstrate that under the strategy selected, the facility will be safe at all times and will reach the decommissioning end state, and that no undue burdens will be imposed on future generations.

Under requirement 9, the responsibility of the financial burden for decommissioning must be set out in national legislation. To ensure safe decommissioning, these provisions must include establishing a mechanism to provide adequate financial resources and to ensure that they are available when necessary.

If financial assurance for the decommissioning of an existing facility has not been obtained, adequate financial resources must be put in place as soon as possible. Approvals for the renewal or extension of the operation of a nuclear facility must include provisions for financial assurance. If the decommissioned facility is to be released with restrictions on its future use, financial assurances shall be such that financial resources are available for monitoring, surveillance and control of the facility throughout the necessary time period.

Requirement 10 stipulates that the licensee must prepare a decommissioning plan and maintain it throughout the lifetime of the facility in order to show that decommissioning can be accomplished safely to meet the defined end state. The State's regulatory body must ensure that the licensee takes decommissioning into account in the siting, design, construction, commissioning and operation of the facility. For existing facilities where there is no decommissioning plan, a suitable

[18] IAEA, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), IAEA, Vienna (2016). <online: http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1713web-70795870.pdf>
[19] GSR Part 6, *supra*, note 1, Requirement 4, at pgs. 7-8.
[20] *Ibid*. Requirement 5, at pg. 8.

plan for decommissioning must be prepared by the licensee as soon as possible. The plan must be periodically reviewed and updated by the licensee.

Requirement 11 stipulates that prior to the commencement of decommissioning actions, a final decommissioning plan must be approved by the State's regulatory body. The final decommissioning plan must cover the following:

- the selected decommissioning strategy;
- the schedule,
- type and sequence of decommissioning actions;
- the waste management strategy applied, including clearance, the proposed end state and how the licensee will demonstrate that the end state has been achieved;
- the storage and disposal of the waste from decommissioning;
- the timeframe for decommissioning; and
- financing for the completion of decommissioning.

If deferred dismantling has been selected as a decommissioning strategy, the licensee must demonstrate that such an option will be implemented safely in the final decommissioning plan. The availability of adequate financial resources to ensure that the facility is maintained in a safe condition during the deferral period and for subsequent decontamination and/or dismantling shall be demonstrated.

Interested parties must also be provided with an opportunity to examine and provide comments on the final decommissioning plan prior to its approval.

3 U.S.A.

The United States has extensive experience in managing the decommissioning of NPPs. Consequently, the regulatory system, Nuclear Regulatory Commission ("NRC") and Department of Energy ("DOE"), governing the decommissioning of nuclear facilities is more highly developed than in other countries. The regulatory regime for the decommissioning of civilian nuclear facilities has been defined in a series of Acts; the most important of these are:

- *Atomic Energy Act* of 1954 (as amended) – defines the responsibility for the regulation of civilian nuclear reactors and the commercial use of nuclear materials, by-products and sources;
- *National Environmental Policy Act* of 1969, as amended - requires federal agencies to consider environmental values and factors in decision making; and
- *Clean Air Act* and the *Safe Drinking Water Act* give the Environmental Protection Agency ("EPA") the responsibility for regulating and enforcing the levels of radioactivity in air emissions and in drinking water while the *Comprehensive Environmental Response, Compensation, and Liability Act* allows the EPA to determine soil cleanup values and other residual radioactivity limits at severely contaminated sites that are covered by the Superfund Program.

The NRC's decommissioning regulations are found in Chapter I of Title 10, "Energy," of the *Code of Federal Regulations* ("CFR"). Part 20, Subpart E, and Parts 50.75, 50.82, 51.53, and 51.95 provide the main decommissioning requirements. These rules require owners to provide the NRC

with early notification of planned decommissioning activities. The rule allows no major decommissioning activities to be undertaken until after certain information has been provided. Notable elements of the American system for regulating the decommissioning of nuclear power plants that do not have counterparts in the current Canadian regulatory system include:

- Requirements for certain aspects of decommissioning and licence termination of nuclear power plants are explicitly addressed in the Regulations, such as 10CFR20 Subpart E establishes the 'radiological criteria for license termination';
- NRC Regulatory Guide 1.184 provides further guidance on the actions required of nuclear power reactor licensees to meet the regulatory requirements related to decommissioning nuclear power reactors;[21]
- Several NUREG documents provide technical advice on issues related to decontamination, dismantling and site remediation;
- Extensive guidance on the development of release criteria, planning of pre-release surveys and decision making for the release of lands, buildings and materials are available in the Data Quality Objectives, MARSSIM and MARSAME publications from the NRC, EPA and other federal agencies.

The requirements for power reactor decommissioning activities may be divided into three phases:

(1) initial activities;
(2) major decommissioning and storage; and
(3) licence termination activities.

3.1.1 Initial activities

When a NPP licensee permanently shuts down a plant, the operator must submit a written certification of permanent cessation of operations to the NRC within 30 days.[22]

Within two years after submitting the certification of permanent closure, the licensee must submit a Post-Shutdown Decommissioning Activities Report ("PSDAR") to the NRC. This report provides a description of the planned decommissioning activities, a schedule for accomplishing them, and an estimate of the expected costs. The PSDAR must discuss the reasons for concluding that environmental impacts associated with the site-specific decommissioning activities have already been addressed in previous environmental analyses. Otherwise, the licensee must request a licence amendment for approval of the activities and submit to the NRC a report on the additional impacts of decommissioning on the environment.[23] After receiving a PSDAR, the NRC publishes a notice of receipt in the Federal Register, makes the report available for public review and comment, and holds a public meeting in the vicinity of the plant to discuss the licensee's intentions.[24]

[21] Decommissioning of Nuclear Power Reactors, Regulatory Guide 1.184, U.S. Nuclear Regulatory Commission, 2013. <online: http://pbadupws.nrc.gov/docs/ML1314/ML13144A840.pdf>
[22] Termination of License, 10 CFR 50.82, U.S. Nuclear Regulatory Commission, 2011, § 50.82(a)(1)(i). <online: http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0082.html> [**10 CFR 50.82**]
[23] *Ibid*. § 50.82(a)(4)(i).
[24] *Ibid*. § 50.82(a)(4)(ii).

3.1.2 Major Decommissioning and Storage

Ninety days after the NRC receives the PSDAR, the owner can begin major decommissioning activities without specific NRC approval.[25] However, decommissioning activities conducted without specific prior NRC approval must not:[26]

- prevent release of the site for possible unrestricted use,
- cause any significant environmental impact not previously reviewed, or.
- result in there being no reasonable assurance that adequate funds will be available for decommissioning.

If any decommissioning activity does not meet these terms, the licensee is required to submit a licence amendment request, which would provide an opportunity for a public hearing.

3.1.3 Licence Termination

The owner is required to submit a Licence Termination Plan ("LTP") within two years of the expected licence termination. Before the LTP can be approved, a public meeting is held near the plant site to allow for public input. If the NRC approves the LTP, the licence is amended to allow the decommissioning to proceed.[27]

If decommissioning has been completed in accordance with the approved LTP and the termination survey demonstrates that the facility and site are suitable for release, the NRC issues a letter terminating the operating licence.[28]

3.2 FUNDING

Each nuclear power plant licensee must report to the NRC every two years the status of its decommissioning funding for each reactor or share of a reactor that it owns. Licensees may alternatively determine a site-specific funding estimate, provided that amount is greater than the generic decommissioning estimate.[29] Although there are many factors that affect reactor decommissioning costs, generally they range from $300 million to $400 million.[30] Before a nuclear power plant begins operations, the licensee must establish a mechanism to ensure that there will be sufficient money to pay for the ultimate decommissioning of the facility.[31] Licensees must report on the accumulation of reactor decommissioning funds every two years. When the facility is within five years of the end of its licensed life, the fund status report must be submitted annually.[32]

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[25] *Ibid*. § 50.82(a)(5).
[26] *Ibid*. § 50.82(a)(6).
[27] *Ibid*. § 50.82(a)(9)-(10).
[28] *Ibid*. § 50.82(a)(11).
[29] Reporting and recordkeeping for decommissioning planning, 10 CFR 50.75, U.S. Nuclear Regulatory Commission, 2015, § 50.75(f). <online: http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0075.html> [**10 CFR 50.75**]
[30] Backgrounder on Decommissioning Nuclear Power Plants, U.S. Nuclear Regulatory Commission, 2015. <online: http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.html#funds>
[31] 10 CFR 50.75, *supra*, note 29, at § 50.75(f).
[32] *Ibid.*

3.3 DECOMMISSIONING STRATEGY

Licensees may choose from three alternative decommissioning strategies:[33]

- DECON, equivalent to 'immediate dismantling' under the IAEA;
- SAFSTOR, equivalent to 'deferred dismantling' under the IAEA; or
- ENTOMB, equivalent to 'in situ abandonment' under the IAEA.

The licensee may also choose to adopt a combination of the first two choices. The decision may be based on factors besides radioactive decay such as availability of waste disposal sites. In order to meet regulatory requirements, decommissioning must be completed within 60 years of the plant ceasing operations. A time beyond that would be considered only when necessary to protect public health and safety in accordance with NRC regulations.[34]

The majority of the commercial NPPs in the united states have adopted the DECON strategy. Nine of the facilities are following a SAFSTOR strategy and one (the damaged Three Mile Island Unit 2) is in "Post Defueling Monitored Storage".[35]

4 FINLAND

In Finland, the operators of nuclear facilities are responsible for waste management and decommissioning, including related planning, and for financing the costs of future management of waste and decommissioning. The State is responsible for nuclear waste after its approved disposal and has the secondary responsibility in case a producer is incapable of fulfilling the management obligation.[36]

The Radiation and Nuclear Safety Authority (STUK), is responsible for regulatory oversight, issuing safety regulations and for the technical and safety-related review of licence applications. Aside from being a regulatory body, STUK also has administrative control of an interim storage facility for small-user radioactive waste. The detailed safety regulations are given as STUK-guides. Licensees must comply with these guides unless they establish an acceptable alternate procedure or solution with a comparable safety. The YVL guide group D is relevant to nuclear waste management and decommissioning: [37]

- Guide YVL D.2 Transport of nuclear materials and nuclear waste
- Guide YVL D.3 Handling and storage of nuclear fuel

[33] *Supra*, note 36.
[34] 10 CFR 50.82, *supra, note 22* at § 50.82(a)(3); Violations, 10 CFR 52.110, U.S. Nuclear Regulatory Commission, 2007, § 52.110(c).
[35] Candesco, International Benchmarking on Decommissioning Strategies, RSP-0303, 2014, at pg. A-19. <online: http://www.nuclearsafety.gc.ca/eng/pdfs/about/researchsupport/reportabstracts/RSP-0303-Final-Report-eng.pdf> [**RSP-0303**]
[36] Radioactive Waste Management and Decommissioning in Finland, OECD/NEA, 2013. <online: https://www.oecd-nea.org/rwm/profiles/Finland_report_web.pdf>
[37] *Ibid*.

- Guide YVL D.4 Predisposal management of low and intermediate level nuclear waste and decommissioning of a nuclear facility[38]
- Guide YVL D.5 Disposal of nuclear waste

The main laws and ordinances regulating waste management activities are:[39]

- Nuclear Energy Act (1987) and Decree (1988) define the responsibilities, licensing and enforcement procedures and the financing system for future nuclear waste management
- Decree on the State Nuclear Waste Management Fund (1988) specifies the system for financing future nuclear waste management
- Radiation Act and Decree (1991) include e.g. general radiation protection principles, provisions for radiation work and provisions for management of non-nuclear radioactive waste
- Environmental Impact Assessment Act (1994) defines the EIA process to be implemented prior to the first licensing step pursuant to nuclear energy legislation
- Act and Decree on Radiation and Nuclear Safety Authority define STUK's regulatory rights and responsibilities (1991).

4.1 FUNDING

The basic goals of the financing system is to ensure that waste management and decommissioning costs are included in the price of nuclear electricity and to ensure that assets are available even in case of insolvency of the waste generator. The features of the system are the following:[40]

- It covers all spent fuel and nuclear wastes management and decommissioning activities, including R&D
- Costs estimates based on remaining management costs of existing waste amounts, current price level with no discounting and on the use of currently available technology
- The whole liability has to be covered, either by funded money or by securities
- Utilities (and operator of the research reactor) pay annually fees to cover their liability (or get paybacks if the liability decreases)
- A segregated fund, the State Nuclear Waste Management Fund, exists under the administration of the MEE for collecting, holding and investing the assets.

4.2 DECOMMISSIONING STRATEGY

According to Guide YVL D.4, the feasibility of decommissioning a nuclear facility must be addressed in order to obtain a Construction Licence. A decommissioning plan must also be submitted with the application for the Operating Licence. These plans need to be updated every 6 years.[41]

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[38] Predisposal Management of Low and Intermediate Level Nuclear Waste and Decommissioning of a Nuclear Facility, Guide YVL D.4, draft L5, 2013. <online: https://ohjeisto.stuk.fi/YVL/D.4e.pdf> [**Guide YVL D.4**]

[39] *Supra*, note 36.

[40] *Ibid*.

[41] RSP-0303, *supra* note 35, at pg. A-40.

The authorization system for decommissioning is included in the amendment of the nuclear energy legislation which entered into force in 2008. A safety guide for decommissioning became effective in 2013. Development of the decommissioning technology will be followed and the decommissioning plans and safety evaluations will be updated if substantiated by these developments. [42]

Guide YVL D.4 requirement 403 indicates that under section 7 g, subsection 1, of the Nuclear Energy Act,[43]

> the design of a nuclear facility shall provide for the facility's decommissioning. According to subsection 2, when the operation of a nuclear facility has been terminated, the facility shall be decommissioned in accordance with a plan approved by the Radiation and Nuclear Safety Authority ("STUK"). Dismantling the facility and other measures taken for the decommissioning of the facility may not be postponed without due cause

This suggests that the preferred strategy for decommissioning NPP in Finland is Prompt Dismantling, but that all options would be considered if sufficiently justified.

The decommissioning strategies for Finnish NPPs: [44]

- Loviisa NPP - Prompt Dismantling within eight years from shutdown
- Olkiluoto Units 1&2 - Deferred Dismantling with a 30 year deferral (due to likelihood of other operating units on site – Unit 3)
- Olkiluoto Unit 3 (Tentative) - Prompt Dismantling.

5 SWEDEN

In Sweden, the statues that are relevant to decommissioning of nuclear facilities include:[45]

- *The Act (1984:3) on Nuclear Activities*, which defines the licensing requirements for the construction and operation of nuclear facilities and for handling or using nuclear materials (including radioactive waste).
- *The Radiation Protection Act (1988:220)*, which defines the licensing requirements for radiation protection and for radiological work.
- *The Act on Financing of Management of Residual Products from Nuclear Activities (2006:647)* which deals with the main financial aspects, and defines the responsibilities pertaining to the management and disposal of spent nuclear fuel and radioactive waste.
- *The Environmental Code (1998:808)* is also of great importance, in particular for the siting and construction of new facilities since amongst other things it regulates the environmental impact statement that must accompany a licence application.

The Swedish Radiation Safety Authority ("SSM") is responsible for the direct regulatory control of compliance of operations with legislation and regulations. Any new nuclear facility must be licensed according to both the Act on Nuclear Activities and the Environmental Code. In both

[42] *Supra*, note 36.
[43] Guide YVL D.4, *supra* note 38, at pg. 6.
[44] RSP-0303, *supra* note 35, at pg. A-40.
[45] OECD, Radioactive Waste Management and Decommissioning in Sweden, 2013, at pg. 6 <online: https://www.oecd-nea.org/rwm/profiles/Sweden_report_web.pdf>

cases the Government grants the licence on the basis of recommendations and reviews of the competent authorities. A licence according to the Radiation Protection Act is not required for activities licensed according to the Act on Nuclear Activities.[46]

The *Regulations Concerning Safety in Certain Nuclear Facilities (SSMFS 2008:1)* contains the most important regulations for management and disposal of spent fuel and nuclear waste. The regulations are also applicable for decommissioning.[47] The regulations cover application of multiple barriers and defence-in-depth, handling of detected deficiencies in barriers and the defence-in-depth, organisation, management and control of safety significant activities, actions and resources for maintaining and development of safety, physical protection and emergency preparedness, basic design principles, assessment, review and reporting of safety, operations of the facility, on-site management of nuclear materials and waste, reporting to SSM deficiencies, incidents and accidents, documentation and archiving of safety, final closure and decommissioning.[48]

Under Swedish law, the operator of a nuclear facility is primarily responsible for the safe handling and disposal of spent nuclear fuel and radioactive waste, as well as decommissioning and dismantling of the facility.[49]

5.1 FUNDING

Section 13 of the Act on Nuclear Activities defines the responsibility for decommissioning funding:[50]

> Section 13 A party that holds a licence to conduct nuclear activities is obliged to:
>
> 1. bear the costs for the measures referred to in Sections 10 to 12, and
> 2. have an organisation for the activity with sufficient financial, administrative and human resources in order to implement:
>   a) the measures referred to in Sections 10 to 12,
>   b) measures ensuing from conditions or regulations issued under this Act, and
>   c) protective measures in the event of disruptions in the operations or accidents in the facility.

The *Act on Financing of Management of Residual Products from Nuclear Activities (2006:647)* contains provisions regarding the obligation of licensees to bear certain costs incurred by the State and to ensure financing of the costs referred to in the first paragraph."

[46] *Ibid*.
[47] *Ibid*.
[48] *Ibid*. at pg. 7.
[49] *Ibid*. at pg. 3.
[50] *The Act on Nuclear Activities (1984:3)*, at s. 13

5.2 DECOMMISSIONING STRATEGY

No particular decommissioning strategy is prescribed but section 6 of The Regulations on Planning for and during Decommissioning of Nuclear Facilities requires that the Licensee prepare an analysis of the decommissioning alternatives:[51]

> Section 6 Plans must identify possible decommissioning methods with estimated time requirements and ultimate objectives. Any consequences of the identified alternatives shall be investigated concerning
>
> 1. occupational radiation doses,
> 2. emissions of radioactive substances to the environment,
> 3. risk of unplanned events that may cause radiation doses or emission of radioactive substances,
> 4. handling and storage of radioactive material that arises and
> 5. requirements of information for and training of various personnel categories.

The main decommissioning strategy for NPPs in Sweden is that of immediate dismantling. The goal is for the site to be used for future energy production after decommissioning.[52] Dismantling commences about two years after the nuclear facility has been shut down. With a decommissioning period of about five years, a unit can be expected to be released for other uses about seven years after shutdown.[53]

6 CANADA

In Canada, the *Nuclear Safety and Control Act* ("*NSCA*") governs the development, production and use of nuclear energy in order to prevent unreasonable risk to national security, the health and safety of persons and the environment. The *NSCA* establishes the CNSC and set out the CNSC's mandate, responsibilities and powers. The CNSC, as Canada's nuclear regulator, is an independent agency of the Government of Canada. The *NSCA* provides the CNSC with the authority to regulate the development, production and use of nuclear energy and the production, possession and use of nuclear substances, prescribed equipment and prescribed information in Canada. The CNSC regulates the use of nuclear energy and materials to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.

Under the *NSCA* section 26 requires that:

> 26. Subject to the regulations, no person shall, except in accordance with a licence,
> (a) possess, transfer, import, export, use or abandon a nuclear substance, prescribed equipment or prescribed information;
> …
> (e) prepare a site for, construct, operate, modify, decommission or abandon a nuclear facility; or
> …

[51] RSP-0303, *supra* note 35, at pg. A-58.
[52] *Supra* note 45, at pg. 18.
[53] *Ibid*.

(f) construct, operate, decommission or abandon a nuclear-powered vehicle or bring a nuclear-powered vehicle into Canada.

Section 24(5) allows the CNSC to require a licensee to provide a financial guarantee for the purposes of fulfilling the requirements under the *NSCA*:

> 24(5) A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.

While no such Regulations have been made at present, section 44(1) of the *NSCA* empowers the CNSC to make regulations respecting decommissioning:

> 44. (1) The Commission may, with the approval of the Governor in Council, make regulations
> …
> (c) respecting the design, inspection during production or installation, production, possession, storage, import, export, use, decommissioning, abandonment and disposal of prescribed equipment;
> …
> (e) respecting the location, design, construction, installation, operation, maintenance, modification, decommissioning, abandonment and disposal of a nuclear facility or part of a nuclear facility;
> …
> (o) establishing requirements to be complied with by any person who possesses, uses, packages, transports, stores or disposes of a nuclear substance or prescribed equipment or who locates, designs, constructs, installs, operates, maintains, modifies, decommissions or abandons a nuclear facility or nuclear-powered vehicle;

Regulations made under the *NSCA* that would apply to decommissioning include:

- General Nuclear Safety and Control Regulations;
- Radiation Protection Regulations;
- Class I Nuclear Facilities Regulations;
- Class II Nuclear Facilities Regulations;
- Nuclear Substances and Radiation Devices Regulations;
- Packaging and Transport of Nuclear Substances Regulations; and
- Nuclear Security Regulations.

The *Class I Nuclear Facilities Regulations* and the *Class II Nuclear Facilities and Prescribed Equipment Regulations* require that an application for a license to prepare a site (for a Class I nuclear facility only), construct, or operate a nuclear facility must include the proposed plan for the decommissioning of the nuclear facility.[54] The *General Nuclear Safety and Control Regulations* contain the general requirements that apply to all licensees, including licensees for decommissioning nuclear facilities.

[54] *Class I Nuclear Facilities Regulations*, SOR/2000-204, s. 3; Class II Nuclear Facilities and Prescribed Equipment Regulations, SOR/2000-205, s.3. <online: http://laws.justice.gc.ca/eng/regulations/sor-2000-204/page-1.html> [***Class I Nuclear Facilities Regulations***]

6.1 REGULATORY AND STANDARDS DOCUMENTS

Canadian regulators address the planning for decommissioning, decommissioning cost estimating and provision of funds for decommissioning through a combination of the use of statutory authority granted to the CNSC, its regulations, regulatory documents,[55] licence conditions and code and standards.[56]

Regulatory documents support the CNSC's regulatory framework by expanding on expectations set out in the *NSCA*, its regulations and legal instruments, such as licences and orders. These documents provide instruction, assistance and information to the licensees.

Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*, provides guidance regarding the preparation of decommissioning plans for activities licensed by the Canadian Nuclear Safety Commission (CNSC) in Canada. It provides also the basis for calculating the financial guarantees discussed in the Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*. This guide describes those decommissioning planning requirements and the regulatory and policy basis for them.

The CNSC requires that decommissioning planning be completed in two phases. The preliminary decommissioning plan is filed with the CNSC as early as possible in the life-cycle of the activity or facility. The plan should be revisited and updated as necessary. The preliminary plan documents should include:[57]

- the preferred decommissioning strategy and end-state objectives;
- the major decontamination, disassembly and remediation steps;
- the approximate quantities and types of waste generated;
- an overview of the principal hazards and protection strategies;
- an estimate of cost;
- and the methods of guaranteeing financing for the decommissioning activities.

The decommissioning plan is filed with the CNSC prior to beginning decommissioning activities. This plan normally refines and adds procedural and organizational details to the preliminary plan. Once approved by the CNSC, the detailed plan will be incorporated into a licence authorizing the decommissioning.[58]

It has also become common practice for the CNSC to mandate compliance with CSA N294-09, *Decommissioning of facilities containing nuclear substances*, and other CSA standards by adding a condition to the licences issued to major nuclear facilities. Unless stipulated otherwise, the licensee would only be required to comply with the normative clauses of the CSA standard in order to meet the requirement of the licence condition.[59]

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[55] CNSC Regulatory Guide G-206, Financial Guarantees for the Decommissioning of Licensed Activities (June 2000). <online: http://nuclearsafety.gc.ca/pubs_catalogue/uploads/G206_e.pdf> [**G-206**]; CNSC Regulatory Guide G-219, Decommissioning Planning for Licensed Activities (June 2000). <online: http://nuclearsafety.gc.ca/pubs_catalogue/uploads/G219_e.pdf> [**G-219**]

[56] Decommissioning of facilities containing nuclear substances, CSA N294-09, August 2014 [**CSA N294-09**]; Management system requirements for nuclear facilities, CSA N286, 2012.

[57] G-219, *supra* note 55, at 5.1.

[58] *Ibid*.

[59] RSP-0303, *supra* note 35, at pg. 9.

According to CSA N294-09, it is intended to consolidate into one document, decommissioning principles, Canadian and international decommissioning experience, international guidance and regulatory expectations that could be applied to the decommissioning of all nuclear. CSA N294-09 is meant to be consistent with and supplement Canadian policy and regulatory guidance documents.[60]

There is no stated preference in either policy or regulation for a specific decommissioning strategy. While prompt decommissioning has been adopted for some smaller facilities (e.g. SLOWPOKE II research reactors), most licensees of large nuclear facilities have adopted deferred decommissioning in order to:[61]

- Reduce occupational doses by allowing time for radiological decay; or
- Take advantage of efficiencies of scale by coordinating the decommissioning of different facilities located on the same site.

6.1.1 Decommissioning Responsibility and Planning

The Canadian regulatory framework does not explicitly assign responsibility for the decommissioning of a nuclear facility to a specific party.[62] CSA N294-09 does require that:[63]

> Responsibility for decommissioning shall be clearly established throughout the life cycle of a facility. This responsibility includes planning and preparing for, executing, and completing decommissioning (i.e., until the final end-state objective has been achieved, all documentation completed, and all regulatory requirements satisfied). Responsibility for the funding of the decommissioning shall be identified.

The *Class I Nuclear Facilities Regulations* require that an application for a Licence for a Class I Nuclear Facility must include the proposed decommissioning plan for the nuclear facility or of the site.[64] Both CSA N294-09[65] and G-219[66] set out the required contents of a decommissioning plan.

CSA N294-09 recommends that initial decommissioning plans should be regularly updated and reviewed to reflect: [67]

(a) changes in site conditions;
(b) changes to the proposed decommissioning objectives or strategy;
(c) changes to ownership or management structure;
(d) advances in decommissioning technology;
(e) significant modifications to the facility;
(f) updated cost and funding information;
(g) revised regulatory requirements; and
(h) revised records requirements.

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[60] CSA N294-09, *supra* note 56.
[61] RSP-0303, *supra* note 35, at pg. 6.
[62] *Ibid*. at pg. A-4.
[63] CSA N294-09, *supra* note 56, at 4.1.1.
[64] *Class I Nuclear Facilities Regulations*, *supra*, note 60, at s. 3.
[65] CSA N294-09, *supra* note 56, at 6.3 & Annex A.
[66] G-219, *supra*, note 55, at 6.1.
[67] CSA N294-09, *supra* note 56, at 6.3.2.

6.2 FUNDING

The *NSCA* empowers the CNSC to prescribe terms and conditions of licences:[68]

> A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.

The *General Nuclear Safety and Control Regulations* indicates that an application for a licence must contain a description of any proposed financial guarantee relating to the activity to be licensed.[69]

G-206 requires that:[70]

> Financial guarantees must be sufficient to cover the cost of decommissioning work resulting from licensed activities that have taken place prior to the licence period, or will take place under the current licence."

Finally, CSA N294-09 requires that responsibility for the funding of the decommissioning must be identified.[71]

6.3 DECOMMISSIONING STRATEGY

G-219 recommends that the following basic alternative strategies should be evaluated for each planning envelope:[72]

- Prompt removal;
- Deferred removal (to allow for the decay of relatively short-lived nuclides (e.g., half-lives of less than 10 years), or to await the availability of waste disposal capacity);
- In-situ confinement (to secure and abandon the affected portions of the facility in place); and
- Combinations of the above.

CSA N294-09 recommends that the development of a decommissioning strategy should be based on one or a combination of the following:[73]

(a) prompt decommissioning — to decontaminate and dismantle the facility without any planned delays;
(b) deferred decommissioning
    (i) to place the facility in a period of storage-with-surveillance followed by decontamination and dismantlement; or
    (ii) 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; and

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[68] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, s. 24(5).
[69] *General Nuclear Safety and Control Regulations*, SOR/2000-202, s. 3(1)(l)
[70] G-206, *supra* note 55, at 3.0.
[71] CSA N294-09, *supra* note 56, at 4.1.1.
[72] G-219, *supra*, note 55, at 8.0.
[73] CSA N294-09, *supra* note 56, at 6.1.2.

(c) in-situ confinement — to place the facility in a safe and secure condition with the intention to abandon in-place.

Clause 6.1.3 provides guidance on the factors that should be considered when developing the decommissioning strategy.[74]

7 COMPARISON OF CANADIAN PRACTICE WITH IAEA REQUIREMENTS

The CNSC commissioned a report, *International Benchmarking on Decommissioning Strategies*, RSP-0303, from a third party consulting service that compared the Canadian regulatory framework and standards in 2014 to the requirements of IAEA *Safety Requirements, Decommissioning of Facilities Using Radioactive Material*, WS-R-5, as well as other international jurisdictions. Since that time, WS-R-5 has been superseded by IAEA *General Safety Requirements* Part 6, GSR Part 6. While an update, GSR Part 6 has substantially the same requirements as WS-R-5. Consequently, the conclusions drawn by this report with respect to the adequacy of the Canadian regimes compliance with the IAEA requirements for decommissioning of nuclear facilities remain relevant today. The report found that while many of the IAEA requirements were adequately reflected in the Canadian regulatory framework or commissioned standards, a number were not.

In addition, generally, the Canadian regulatory framework as it relates to the decommissioning of NPPs is similar to the regulatory system of most of the other countries that were reviewed in RSP-0303 (and particularly those of Finland, Italy, the UK and Sweden) in that these regimes primarily address planning for decommissioning, estimating the cost of decommissioning and assuring that funding will be available but do not extensively address the execution or completion of decommissioning.[75]

7.1 DECOMMISSIONING STRATEGY

G-219 stipulates that one of the main roles of the preliminary decommissioning planning process and plan is to document a preferred decommissioning strategy which, in light of current knowledge, represents a technically feasible, safe and environmentally acceptable approach.[76] G-219, however, does not provide any guidance on which particular decommissioning strategies may be acceptable or preferred.

CSA N294-09 recommends that a decommissioning strategy should contain a high-level approach and rationale for decommissioning the facility, be developed early, and be updated as new information is obtained. CSA N294-09 goes on to recommend that the decommissioning strategy "*should be based on one or a combination of*" prompt decommissioning, deferred decommissioning or in-situ confinement."[77] The standard does not mandate or recommend any one strategy.

[74] *Ibid*. at 6.1.3.
[75] RSP-0303, *supra* note 35, at pg. 18.
[76] G-219, *supra* note 55, at s. 6.1.1.
[77] RSP-0303, *supra* note 35, at pg. 19; CSA N294-09, *supra* note 56, at section 6.1.

The Finnish regulatory regime suggests that the preferred strategy for decommissioning is Prompt Dismantling, but that all options would be considered if sufficiently justified.[78] In Sweden, the main decommissioning strategy for NPPs is that of immediate dismantling with the overarching goal the site of the nuclear facility to be eventually used for future energy production after decommissioning.[79]

GSR Part 6 stipulates the preferred decommissioning strategy as immediate dismantling, but that when all relevant factors are considered, there may be situations where immediate dismantling is not a practical strategy.[80]

7.1.1 Recommendation

As it stands, for consistency with international standards, the Canadian regulatory regime should clarify the basis for its preferred decommissioning strategy in light of the IAEA recommendations The Canadian regulatory regime should provide guidance on the requirement to provide clear evidence for selecting a particular decommissioning strategy when all relevant factors are considered (for example, the absence of an approved off-site waste management facility).

7.2 IN SITU CONFINEMENT

The IAEA recognizes Entombment or In-Situ Confinement as a decommissioning strategy. However the IAEA advises that it would only be appropriate for short lived or limited concentrations of long lived radionuclides:[81]

> Entombment is not relevant for a facility that contains long lived isotopes because these materials are not suitable for long term surface disposal. Consequently, reprocessing facilities, fuel fabrication facilities, enrichment facilities or facilities that use or process thorium or uranium would not be appropriate for entombment. However, entombment could be a viable option for other nuclear facilities containing only short lived or limited concentrations of long lived radionuclides, i.e. in order to comply with the site release criteria.

As mentioned above, CSA N294-09 identifies in-situ confinement as a possible decommissioning strategy.[82]

Jurisdictions such as Finland and Sweden have not identified it as an appropriate decommissioning strategy for NPPs. In-situ confinement has been adopted at US Department of Energy sites for the decommissioning of:[83]

- P- and R-reactors at the Savannah River Site near Augusta, Georgia;

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[78] Guide YVL D.4, *supra*, note 38, requirement 403.
[79] *Supra*, note 45 at pg. 18.
[80] GSR Part 6, *supra*, note 1, at s. 5.1.
[81] Decommissioning Strategies for Facilities Using Radioactive Material, IAEA SRS 50, IAEA, 2007, at 3.2.2. <online: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1281_web.pdf>
[82] RSP-0303, *supra* note 35, at pg. 19; CSA N294-09, *supra* note 56, at section 6.1.
[83] DOE EM Project Experience & Lessons Learned for In Situ Decommissioning, U.S. Department of Energy, Office of Environmental Management, Office of D&D and FE, EM-13, February 2013. <online: http://energy.gov/sites/prod/files/DOE%20EM%20Project%20Experience%20%26%20Lessons%20Learned%20for%20In%20Situ%20Decommissioning%20-%20Feb.%202013.pdf>

- Two fuel processing facilities at the Idaho National Laboratory and the U Canyon at the Hanford site near Richland, Washington; and
- The below grade portion of several small reactors facilities at Idaho National Laboratory and one at the Savannah River Site

7.2.1 Recommendation

The Canadian regulatory regime should provide clear guidance on the scenarios when in situ confinement is an appropriate decommissioning strategy. Current international standards indicate that, short of an emergency scenario, this strategy should be limited to nuclear facilities that only contain short lived or limited concentrations of long lived radionuclides.

7.3 SUBMISSION OF A DETAILED DECOMMISSIONING PLAN

GSR Part 6 requires that prior to decommissioning actions, a final decommissioning plan must be prepared and submitted to the regulatory body for approval.[84]

> The licensee shall inform the regulatory body (or the government, if so required) prior to shutting down a facility permanently. If a facility is permanently shut down and/or is no longer used for its intended purpose, a final decommissioning plan shall be submitted to the regulatory body for approval within a period agreed with the regulatory body (typically within two to five years of permanent shutdown).
>
> The final decommissioning plan and supporting documents shall cover the following: the selected decommissioning strategy; the schedule, type and sequence of decommissioning actions; the waste management strategy applied, including clearance, the proposed end state and how the licensee will demonstrate that the end state has been achieved; the storage and disposal of the waste from decommissioning; the timeframe for decommissioning; and financing for the completion of decommissioning.[85]

Class I Nuclear Facilities Regulations under the *NSCA* requires that:[86]

An application for a licence to decommission a Class I nuclear facility shall contain the following information in addition to the information required by section 3:

(a) a description of and the proposed schedule for the decommissioning, including the proposed starting date and the expected completion date of the decommissioning and the rationale for the schedule;
(b) the nuclear substances, hazardous substances, land, buildings, structures, systems and equipment that will be affected by the decommissioning;
(c) the proposed measures, methods and procedures for carrying on the decommissioning;
(d) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;
(e) the nature and extent of any radioactive contamination at the nuclear facility;

[84] GSR Part 6, *Supra*, note 1 at Requirement 11.
[85] *Ibid*. at 7.9-7.10.
[86] *Class I Nuclear Facilities Regulations*, supra, note 54, at s. 7.

(f) the effects on the environment and the health and safety of persons that may result from the decommissioning, and the measures that will be taken to prevent or mitigate those effects;
(g) the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics;
(h) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;
(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;
(j) the proposed qualification requirements and training program for workers; and
(k) a description of the planned state of the site on completion of the decommissioning.

CSA N294-09 stipulates the contents of a final decommissioning plan:[87]

> The final decommissioning plan specifies the detailed work program, safety and environmental protection procedures, and management systems to be followed during decommissioning. The final decommissioning plan generally involves refining and developing procedures for the work packages established in the initial decommissioning plan. For a nuclear facility or a uranium mine or mill, the final decommissioning plan takes the form of a formal DDP."

Clause 7.8.2 provides a description of the specific inclusions in the final decommissioning plan based on the complexity of a NPP being decommissioned.[88]

Despite the required level of detain, CSA N294-09 does not provide any requirement or guidance on when the Final Decommissioning plan is to be submitted.

The US Code of Federal Regulations 10 CFR 50.82(a)(4)(i)[89] requires that prior to or within 2 years following the permanent cessation of operations, the licensee must submit a Post-Shutdown Decommissioning Activities Report (PSDAR). The PSDAR will include a description of the planned decommissioning activities, with a schedule for the accomplishment of significant milestones and an estimate of expected costs.

Further guidance of the format and content of the PSDAR is provided in Regulatory Guide 1.185, *Standard Format and Content for Post-Shutdown Decommissioning Activities Report*.[90]

7.3.1 Recommendation

While the Canadian regulations and standards meet international standards for the content of a final decommissioning plan, they fall short of providing a schedule for its submission. International requirements suggest that the Canadian regulatory framework should require that a final

[87] CSA N294-09, *supra* note 56, at 7.8.1.
[88] *Ibid*. at 7.8.2.
[89] Termination of License, 10 CFR 50.82, U.S. Nuclear Regulatory Commission, 2011.
[90] Standard Format and Content for Post-Shutdown Decommissioning Activities Report, Regulatory Guide 1.185, U.S. Nuclear Regulatory Commission, 2000. <online: http://pbadupws.nrc.gov/docs/ML0037/ML003701163.pdf>

decommissioning plan be submitted for approval prior to or within two years of permanent shutdown.

7.4 DURATION OF DECOMMISSIONING

GSR Part 6 requires that the licensee meet the end state requirements stipulated in the final decommissioning plan and authorization for decommissioning prior to gaining approval for the termination of decommissioning and release of the site from regulatory control:[91]

> On the completion of decommissioning actions, the licensee shall demonstrate that the end state criteria as specified in the final decommissioning plan and any additional regulatory requirements have been met. The regulatory body shall verify compliance with the end state criteria and shall decide on termination of the authorization for decommissioning.
>
> …
>
> Inputs from the public shall be addressed before authorization for decommissioning is terminated.

G-219 recommends that an end-state report should be submitted to the CNSC on completetion of decommissioning:[92]

> This report should review the completed decommissioning process, noting any significant deviations from the detailed decommissioning plan. It should clearly document (using actual survey results) that the planned end-state conditions have been met and, if not, why not. The report should describe any proposed further licence requirements, or long-term institutional controls for the site.

CSA N294-09 requires that the final end state will only be considered reached and a facility released from regulator control once the planned decontamination, demolition, dismantling are completed, and all materials, wastes, equipment, and structures have been removed in accordance with the final decommissioning plan requirements.[93]

The US Code of Federal Regulations, 10 CFR 52.110(c) requires:

> Decommissioning will be completed within 60 years of permanent cessation of operations. Completion of decommissioning beyond 60 years will be approved by the Commission only when necessary to protect public health and safety. Factors that will be considered by the Commission in evaluating an alternative that provides for completion of decommissioning beyond 60 years of permanent cessation of operations include unavailability of waste disposal capacity and other site specific factors affecting the licensee's capability to carry out decommissioning, including presence of other nuclear facilities at the site.

[91] GSR Part 6, *Supra*, note 1 at Requirement 15, 9.6.
[92] G-219, *supra* note 55, at 15.0.
[93] CSA N294-09, *supra* note 56, at 9.2.1.

7.4.1 Recommendation

The Canadian regulatory framework does not provide guidance on the duration for NPP decommissioning. Under these circumstances, the IAEA requirements for the approval of termination of decommissioning should be adopted. Approval should not be granted unless:

1. The CNSC verifies that the licensee has demonstrated that the end state criteria as specified in the final decommissioning plan and any additional regulatory requirements have been met, and
2. The public has been consulted before authorization for decommissioning is terminated and the site of the nuclear facility is released from regulatory control.

8 CONCLUSION

Canadian standards set under the *Nuclear Safety and Control Act*, its regulations, and other guidance documents are general and do not provide sufficient detail or address all the relevant factors to guide the CNSC's review of the adequacy of a post closure safety assessment. The CNSC should use the regulatory approaches of other countries and the IAEA as a guide to assess decommissioning planning by Hydro-Quebec. In lieu of specific regulations to govern the conditions for licensing, the CNSC should review the proposal in light of IAEA requirements and by comparison to international standards for nuclear facility decommissioning strategies and plans.

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VIA EMAIL

June 15, 2026

Brennain Lloyd
Project Coordinator, Northwatch
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Attention: Brennain Lloyd

Report: A comparison of international and domestic standards, and end-state objectives in the decommissioning of nuclear facilities.

I. Background

Northwatch has commissioned Macpherson Law LLP to produce this report, which reviews the methods, criteria and science of establishing end state objectives nationally and internationally. It is meant support Northwatch's evaluation of Canadian Nuclear Laboratories' (CNL) proposed decommissioning approach and activities for the Gentilly 1 facility.

Northwatch has provided that this report should consider several documents relevant to nuclear decommissioning, including international safety standards and guidance, Canadian regulatory documents, an overview of a Swedish regulator's firsthand experience in applying regulations to real-world decommissioning projects, and an independent structural and socio-economic regulatory analysis of best practices for decommissioning.

II. Executive Summary/Abstract

The paper compares the approaches of the International Atomic Energy Agency (IAEA), the Canadian Nuclear Safety Commission (CNSC), and the decommissioning regulatory framework and practical application of this framework in Sweden. The analysis finds that CNSC generally aligns with the IAEA but differs in key areas including decommissioning strategy preferences, site remediation and, potentially, incorporation of public input into decision-making. It also highlights the practical challenges associated with maintaining decommissioning plans.

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III. Introduction

The decommissioning of nuclear facilities involves complex legal, technical, environmental and social challenges that reach beyond the activities involved in dismantling a facility. Decommissioning strategies selected, and decisions made during this process determine how waste will be managed and how the sites and their surrounding environments will be impacted during and after decommissioning. International organizations like the IAEA provide rules and guidance for their member states to follow and refer to in the creation and execution of their own regulatory processes, yet states retain significant discretion and may deviate from IAEA best practices, in some cases, perhaps falling short, in other cases advancing their processes beyond the requirements.

Canada is entering a crucial moment in terms of decommissioning and, with a dearth of domestic successful past projects to inform the decommissioning of facilities like Gentilly-1, looking at international best practices and real-world case studies is prudent. This paper, therefore, examines Canada's approach to decommissioning through a comparative analysis of the IAEA's guidance and Sweden's hands-on experience.

This paper provides a high-level overview of decommissioning strategies, decommissioning planning versus on the ground application of such plans, ends states and remediation efforts, and the role of public engagement in regulatory decision-making processes. It identifies areas where the CNSC converges or differs from international guidance and practices.

A. Immediate, deferred and in situ decommissioning

The IAEA and the CNSC both state that acceptable strategies for decommissioning include immediate decommissioning—decontaminating and dismantling with no planned delays—and deferred decommissioning—storage and surveillance of a facility placed in a safe interim state for a period of time, followed by eventual decontamination and dismantlement.[1] While the CNSC does not appear to contemplate the future use of the decommissioned sites, the IAEA provides that these decommissioning options may lead to end states where the facility is permitted to be released from regulatory control for either unrestricted or restricted use, or put differently as brownfields or greenfields, respectively.[2] However, they differ when it comes to *in Situ* decommissioning.[3] *In Situ* decommissioning, or "entombment", refers to situations in which all or part of a facility is contained and secured and the waste is considered disposed of in place, effectively turning the entombed facility into a disposal site.[4]

[1] Canadian Nuclear Safety Commission, REGDOC-2.11.2, *Decommissioning* (January 2021) at s 4 **[CNSC REGDOC-2.11.2]**.

[2] International Atomic Energy Agency, *Decommissioning of Facilities*, Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014) at 2-3 **[IAEA Safety Standards Part 6]**.
[3] IAEA Safety Standards Part 6 at s 1.9; CNSC REGDOC-2.11.2 at s 4.
[4] IAEA Safety Standards Part 6 at s 1.10; CNSC REGDOC-2.11.2 at s 4.

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IAEA states that entombment is not considered a decommissioning strategy and is not an option for a planned permanent shutdown, rather it should only be considered a solution in exceptional circumstances such as where severe accidents have occurred.[5] The IAEA has said that "entombment is not relevant for a facility that contains long-lived isotopes because these materials are not suitable for long-term surface disposal."[6]

On the other hand, CSNC lists *in situ* decommissioning as one of its acceptable decommissioning strategies. Like the IAEA, the CNSC considers *in situ* decommissioning a viable solution under exceptional circumstances but, departing from the IAEA, it considers *in situ* an acceptable solution for legacy sites (i.e.: research and demonstration facilities or historical facilities from the launch of nuclear technologies in Canada) where there was no plan contemplated for decommissioning and the site will be under institutional control going forward.[7]

The CSNC does acknowledge the international best practice set out by IAEA and provides that, to align with these, *in situ* decommissioning should not be done where waste removal is practicable,[8] with "practicable," in this context, meaning "technically feasible and justifiable while taking cost-benefit considerations into account."[9] However, the IAEA does not factor "practicability," as defined by the CNSC or otherwise, into its stance on decommissioning. So, despite the CSNC stating that it means to align with international best practices, this remains a divergent area where the CSNC is not in full compliance with the IAEA.

The IAEA provides that even under exceptional circumstances, technical and regulatory issues may arise where entombment is chosen.[10] The IAEA acknowledges a potential lack of state regulations or guidance on entombment and considers the possibility of public pushback.[11] With consideration to these factors, the IAEA provides that all efforts should be made to reduce the parts of the facility to be entombed and reduce the radioactive inventory, especially long-lived radionuclides, to be encased on the entombed site.[12] The IAEA states that entombment should not impact surveillance or barriers. It recognizes that entombment imposes a burden on future generations due to the need for long-term monitoring and potential leakages requiring action.[13]

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[5] IAEA Safety Standards Part 6 at s 1.10.
[6] International Atomic Energy Agency, Decommissioning Strategies for Facilities Using Radioactive Material, Safety Reports Series No. 50 (Vienna: IAEA, 2007) at s 3.2.3 [IAEA No. 50].
[7] IAEA Safety Standards Part 6 at s 1.10.
[8] CNSC REGDOC-2.11.2 at s 4.
[9] Canadian Nuclear Safety Commission, "Glossary of CNSC Terminology" (February 2022) [REGDOC-3.6] at Appendix A.
[10] International Atomic Energy Agency, Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities, Safety Standards Series No. SSG-47 (Vienna: IAEA, 2018) at ss 5.17-5.18 [IAEA SSG-47].
[11] IAEA SSG-47 at s 5.18.
[12] IAEA SSG-47 at s 5.18.
[13] IAEA SSG-47 at s 5.18.

The CNSC states that a chosen decommissioning strategy must be justified and objectively compared to alternative strategies.[14] Among other factors, it provides that public and Indigenous engagement should be considered, as should the integrity of the containment structure and the assurance that the site will remain safe at all times.[15] In these ways, the CNSC considers the issue of future safety raised by the IAEA, however the CNSC does not specifically address the burden of this to future generations, nor are these factors considered bars to any selected decommissioning strategy under the CNSCs regulations.[16]

B. Gentilly-1 and Deferred Decommissioning

For Gentilly-1, deferred decommissioning—storage with surveillance—was the selected decommissioning strategy despite its status as a legacy facility. Gentilly-1 was brought to a shutdown state in 1984, and decommissioning was scheduled to begin in 2064, however this plan has changed and, conditional upon approval of the license amendment application, decommissioning is now projected to be completed by 2034, with final site remediation—turning the site into a brownfield—to be completed by 2035.[17] This would be the first complete decommissioning of a nuclear power plant in Canada.

C. Immediate Decommissioning

In contrast to the IAEA and the CNSC, Sweden, which adheres to the IAEA and respects the conditions of the Euratom treaty,[18] favours "direct dismantling" (immediate decommissioning) and does not plan for *in situ* decommissioning.[19] However, in practice, deferred decommissioning has been used in at least one case due to political decisions to close the plant, and the non-availability of disposal facilities.[20]

IV. Decommissioning Strategy Selection

A. Preliminary Decommissioning Plans and Detailed Decommissioning Plans

Under both the CNSC and the IAEA, the decommissioning strategy and the desired end state are defined early on.[21] The IAEA provides that decommissioning planning, including the "selection of a decommissioning strategy," should begin at the design stage and continue throughout the lifetime of the facility.[22] The same is true under Sweden's regulations, which require that the preliminary plan be kept up

[14] CNSC REGDOC-2.11.2 at s 4.
[15] CNSC REGDOC-2.11.2 at s 4.
[16] CNSC REGDOC-2.11.2 at s 4.
[17] Canadian Nuclear Laboratories, "Gentilly-1 Decommissioning Project" at Gentilly-1 Timeline.
[18] The Euratom treaty was signed in 1957, and it is meant to promote and facilitate nuclear research and ensure civil nuclear materials are not diverted to other uses, particularly military uses.
[19] Rebekka Bärenbold, Nuclear Decommissioning Profile: Sweden (WWZ Working Paper No 2023/02) (Basel: University of Basel, Center of Business and Economics (WWZ), 2023) at s 3.1 [Nuclear Decommissioning Profile: Sweden].
[20] Nuclear Decommissioning Profile: Sweden at s 3.1.
[21] CSNC REGDOC-2.11.2 at s 4.
[22] IAEA Safety Standards Part 6 at s 1.6.

to date during the facility's operation and reported to the Swedish Radiation Safety Authority every 10 years.[23]

Under the CNSC these selections are outlined in preliminary decommissioning plans (PDPs) that are submitted as early as possible in the lifecycle of a facility and are to be updated every five years.[24] Waste management strategies are included in these plans and must include estimates of quantities of waste that will be generated during decommissioning and the plan for disposing of the waste. In the five-year PDP updates, the following must be considered:

- 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; and,
- availability of a facility for the management of irradiated fuel and radioactive waste[25]

While the PDP is updated regularly and some of the practical elements of the strategy may be changed, such as the economic information or waste removal plan, in practice the overall decommissioning strategy and the intended end state remain unchanged. Following the PDPs, within two years of planned decommissioning, the CNSC requires detailed decommissioning plans to be submitted prior to executing decommissioning activities, this is its iteration of the IAEA's final decommissioning plan.[26] The same is true for Sweden.[27]

B. A practical assessment of planning requirements

While the regulations provide the overall expectations for information that should be provided and continually updated, for example, a waste management plan, the Swedish regulator provides its real-world experiences in complying with regulations. It has found that, in practice, ensuring that documents are updated as new information arises or developments occur can be nearly impossible.[28] It posits that the difficulty needs to be acknowledged and dealt with by the licensee and by the SSM (or the respective

[23] Henrik Efraimsson, Martin Amft & Mathias Leisvik, Lessons Learned from Application of the Swedish Regulations for Decommissioning of Nuclear Facilities – The Regulator's Perspective (Paper presented at PREDEC: International Symposium on Preparation for Decommissioning, Lyon, France, 16–18 February 2016) (Paris: Nuclear Energy Agency, Organisation for Economic Co-operation and Development, 2016) at 3 [Regulator's perspective].
[24] CSNC REGDOC-2.11.2 at s 5.1; IAEA Safety Standards Part 6 at s 1.6.
[25] CSNC REGDOC-2.11.2 at s 4.
[26] CSNC REGDOC-2.11.2 at s 6.2; IAEA Safety Standards Part 6 at s 7.10.
[27] Regulator's perspective at 5.
[28] Regulator's perspective at 8.

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safety authority).[29] It suggests that providing safety justifications or information gradually throughout the decommissioning project would be more effective than completing full updates for the whole project periodically.[30] It also explains that while, under the regulations, the final decommissioning plan should not need any revision, in reality later revisions could become necessary as a result of changes to conditions or unexpected issues such as contamination.[31]

The Swedish regulator further states that once the waste management plan has been approved, the decommissioning plan becomes essentially obsolete, in practice. Therefore, it proposes that even if data or features relevant to the plan change, as long as the plan is not changed overall, there should be no need to revise the decommissioning plan.[32] The Swedish regulator points to vagueness in the regulations regarding the safety analysis report which must be submitted before the dismantling may commence.[33] It states that it is unclear what level of detail is needed to describe and analyze the planned activities including the protection and safety measures.[34]

Importantly, the SSM recognizes that full decommissioning planning cannot be done in detail prior to the commencement of dismantling activities.[35] It acknowledges that detailed characterization of the site and circumstances might remain unclear until dismantling has begun. Therefore, instead of relying only on static plans, it incorporates the use of work packages and subprojects within the decommissioning project.[36] The CNSC also incorporates these into its planning, but they are included within the PDP and DDP and therefore (it is assumed) are subject to the same timelines for updates, and they are included in the report required upon completion of decommissioning.[37]

The fact that Sweden has struggled with the lack of specificity in the regulations and has found that the decommissioning planning in practice may vary from the timelines prescribed raises concerns about whether similar issues will present during the Gentilly-1 decommissioning. It may be the case that refinements to the requirements should be contemplated in advance of the decommissioning process.

V. End State Objectives

While the CNSC regulations address site cleanup, including waste removal and management, they do not explicitly contemplate site remediation for future use. In comparison, the IAEA provides a guidance document on remediation and end states which emphasizes remediation with respect to protection of the

[29] Regulator's perspective at 8.
[30] Regulator's perspective at 8.
[31] Regulator's perspective at 6.
[32] Regulator's perspective at 8.
[33] Regulator's perspective at 6.
[34] Regulator's perspective at 6.
[35] Regulator's perspective at 6.
[36] Regulator's perspective at 6.
[37] CSNC REGDOC-2.11.2 at s 6.2.1.

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public and the environment, as well as for future use.[38] In particular, it provides a framework for remediation of legacy sites or sites where contamination exists.[39] It stipulates that in determining whether remediation is appropriate there should be an evaluation of whether the site has the potential to harm people or the environment now or in the future.[40] This involves identifying whether radioactive contamination exists or could exist on the site, and in such cases end state determination planning intended to inform remediation may be justified.[41]

This process involves identifying parties involved, sharing information, and identifying how interested parties can be involved in the end state determination process.[42] It also requires consideration of social, economic, and environmental factors, including the cultural significance of the site and its surroundings and proximity of sensitive or protected habitats, among other considerations.[43]

In Sweden, once the end of the reactor's lifecycle has been reached, the SSM intensifies its supervision and regulatory controls over the site.[44] This is done with the recognition that adherence to safety guidelines and regulations may deteriorate when shutdown is near as operators may want to wrap up the project and reduce their financial burdens.[45] Before moving on to the defueling stage of decommissioning, Sweden's regulations require an Environmental Impact Assessment (EIA) to be approved by the environmental court. After the defueling, there is incentive for the operator to get a new Safety Analysis Report (SAR) approved by the SSM, but it is not necessary for advancement to other phases of decommissioning.[46] To move to the dismantling stage, another EIA must be approved.[47]

During the dismantling, the site is checked for radioactive substances, and the site only reaches its end state of decommissioning once there is no radioactive contamination left on site.[48]

Based on this zero-contamination end state, Sweden's approach to environmental remediation is more rigorous than the IAEA's guidance for remediation and represents a path that is as yet, uncontemplated by the CNSC, particularly as deferred decommissioning and *in situ* decommissioning yield situations in which immediate remediation is not possible.

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[38] *International Atomic Energy Agency, Determination of Environmental Remediation End States, Nuclear Energy Series No. NW-G-3.2, IAEA, Vienna (2023) at ss 1.1, 3, 3.4 [IAEA NW-G-3.2].*
[39] *IAEA NW-G-3.2 at s 3.3, 3.4.*
[40] *IAEA NW-G-3.2 at s 3.1.*
[41] *IAEA NW-G-3.2 at s 3.1.*
[42] *IAEA NW-G-3.2 at s 3.1.*
[43] *IAEA NW-G-3.2 at s 3.2.2.*
[44] *Nuclear Decommissioning Profile: Sweden at s 5.2.*
[45] *Nuclear Decommissioning Profile: Sweden at s 5.2.*
[46] *Nuclear Decommissioning Profile: Sweden at s 5.2.*
[47] *Nuclear Decommissioning Profile: Sweden at s 5.2.*
[48] *Nuclear Decommissioning Profile: Sweden at s 5.2.*

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VI. Public Input in Decision-Making

The IAEA guidance emphasizes the importance of public engagement and public opinion throughout the development, licensing and implementation of decommissioning activities. It provides that governments should develop their regulatory frameworks in consultation with the public and other stakeholders.[49] Regulatory bodies have an ongoing responsibility to inform the public and should do so as soon as information becomes available, they should communicate regularly with the public and be willing to listen and respond to concerns.[50]

It further provides that interested parties must be involved in the decommissioning licensing process and be given the opportunity to provide comments before decisions are made.[51] Consultations should also be organized for the public to give comments on the final decommissioning plan. Importantly, the IAEA suggests that public input can have a substantive influence on a decision, as it recognizes that the acceptability of a decommissioning strategy may depend on public perspectives. For example, if the public holds an expectation of a short timeframe for decommissioning, this could push the decommissioning strategy toward immediate dismantling.[52] The IAEA also provides that the results of public consultations should be shared to show how comments have been addressed.[53]

While this guidance does not suggest that public opinion should be weighed in a particular manner by the regulatory body, it implies that public input will be incorporated into decision-making, rather than as a formality. The CSNC also requires public engagement, with the PDP containing a public consultation plan, and an Indigenous consultation plan,[54] and there is a CNSC guidance document that elucidates further with regards to how engagement should be conducted. The CSNC provides “What We Heard” reports, which address the comments and questions. However, there is no discussion in the regulations or guidance that instructs with regard to how public opinion should be evaluated in decision-making.

VII. Areas for Further Comparison

Other areas that would be interesting to compare include, the economic and market impacts on nuclear decommissioning, exposure and contamination limits of decommissioned sites, the risks involved in relocating waste for storage. Time permitting, it would be advisable to explore these areas.

[49] IAEA SSG-47 at ss 3.18, 3.2.
[50] IAEA SSG-47 at s 3.18.
[51] IAEA SSG-47 at s 7.44.
[52] IAEA SSG-47 at s 5.25.
[53] IAEA SSG-47 at s 7.46.
[54] CSNC REGDOC-2.11.2 at 5.1.1.

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VIII. Conclusion

While the Gentilly-1 facility will be imminently decommissioned, other facilities will follow and the comparison of domestic and international best practices and realities will be of value to stakeholders. While the CNSC's regulatory framework generally aligns with the IAEA there are some differences. In particular, these differences exist in the areas of decommissioning strategy acceptability, end-state objectives, including remediation and future-use considerations, and the role of public input. These, and other areas, leave the door open for better definition and regulation. Further, Sweden's on-the-ground experience with decommissioning raises concerns that our regulatory framework may require adjustments to better reflect practical timelines for planning updates and submissions.

Sincerely,

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Encl.: Report