



CMD 26-H101.5

Date: 2026-02-16

Written Submission from Northwatch

Mémoire de Northwatch

In the matter of

À l'égard d'

Hydro-Québec

Application to renew its power reactor decommissioning licence for the Gentilly-2 Facilities for a period of 20 years

Hydro-Québec

Demande visant à renouveler pour 20 ans son permis de déclassement d'un réacteur de puissance pour les installations de Gentilly-2

Hearing in writing based on written submissions

Audience par écrit fondée sur des mémoires

March 2026

Mars 2026

NORTHWATCH

February 16, 2025

Canadian Nuclear Safety Commission
c/o Senior Tribunal Officer, Commission Registry
Canadian Nuclear Safety Commission
280 Slater St, PO Box 1046 Stn B
Ottawa ON K1P 5S9

Ref. 2026-H-101

Sent by Email: interventions@cnsccsn.gc.ca

Subject: Hydro-Québec's application to renew its power reactor decommissioning licence for the Gentilly-2 Facilities for a period of 20 years

On July 28, 2025 the Canadian Nuclear Safety Commission issued a notice of its intention to conduct a "hearing in writing on" Hydro-Québec's application to renew its power reactor decommissioning licence for the Gentilly-2 Facilities for a period of 20 years. The Commission will also consider Hydro-Québec's proposed financial guarantee for decommissioning

As described in the notice, the Gentilly-2 Facilities include a defueled CANDU reactor in a "dry, safe storage state", and nuclear waste management facilities in Bécancour, Quebec, on the traditional and unceded territory of the Abenaki people and the Wabanaki confederacy and the traditional land of the Wendat.

Hydro-Québec's current power reactor decommissioning licence for the Gentilly-2 Facilities was issued in June 2016 after a hearing-in-writing for a 10-year period. This licence, which authorizes both the decommissioning of the Gentilly-2 nuclear reactor and the operation of the Gentilly-2 nuclear waste management facilities, expires on June 30, 2026. Hydro-Québec has applied to renew its licence to continue decommissioning activities and maintain the operation of the nuclear waste management facilities at Gentilly-2.

Northwatch's Interest

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, Northwatch has 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 mineral exploration and mining, uranium refining and nuclear power generation, and various nuclear waste management initiatives and proposals.



Northwatch's interests in the operations and decommissioning of the Gentilly II nuclear generation station include that it is the first such decommissioning of a CANDU reactor in Canada and so may set precedents for future decommissioning decisions in Canada, and that the fate of the high-level wastes already generated and currently in storage at the Gentilly site and the decommissioning wastes that will be generated during the next license period may be tied to our own fate.

Hydro Quebec and the Nuclear Waste Management Organization (NWMO) share a stated intention that the fuel wastes currently in storage at Gentilly would be included in the wastes to be managed by the Nuclear Waste Management Organization, meaning that Gentilly wastes are among those that would be transported to and then processed, buried and then abandoned at the NWMO's selected site in northern Ontario. In November 2024 the NWMO selected the Revell site between Ignace and Dryden as their preferred location for a deep geological repository for all of Canada's nuclear fuel waste, for which the NWMO had now initiated an impact assessment process (IAAC Ref. # 88774)

While Hydro Quebec appears to provide no long-term management plan for the low and intermediate level wastes already generated or to be generated during the decommissioning, the CNSC staff does indicate that the end-state objective includes removing all radioactive and hazardous waste which by default means moving the wastes off-site. Potentially or presumably, this transfer could be to an assumed second repository for "intermediate and non-fuel wastes" which the NWMO is also seeking to develop, and for which they will employ a siting process which the NWMO has indicated that they expect the siting process for the "second" repository to be similar to that used for the siting of the (current) repository for nuclear fuel waste. We therefore anticipate that the NWMO will employ similar strategies, such as marketing their project to northern municipalities and economic development groups as a "national infrastructure project" and inviting them to enter the NWMO process to "Learn More" about the project and its economic benefits. If this is the case, we may see some northern municipalities engage, as it is now known that there are financial payouts to municipalities at several points during site investigation. Northwatch observed the NWMO's earlier siting process to be very divisive within the communities they investigated, including 13 communities in northern Ontario.

Review of CMD 26-H101 - CNSC Staff Submission

Northwatch's ability to contribute to the review of Hydro-Québec's application for the renewal of the Gentilly-2 Power Reactor Decommissioning Licence was greatly limited by the availability of documents in English, including documents generated by the Canadian Nuclear Safety Commission which were available only in French, as was the Hydro-Québec application and other Hydro-Québec documents. As these activities have the potential to affect regions outside the borders of Quebec – such as northern Ontario – we were surprised again at these limitations, as we were when commenting on the 2016 application to renew the license for the Gentilly II nuclear generating station.

Northwatch offers the following comments and observations with respect to the CNSC staff CMD:

- Staff indicate that they have “reviewed HQ’s request for a 20-year licence term and determined that the period requested was adequately justified” but provide no basis for that statement and provide no rationale for a 20-year term; note that the previous license term was 10 years¹
- CNSC staff indicate that they have reviewed the detailed decommissioning plan (DDP); this detailed decommissioning plan should be made available to the public in both official languages and be part of a public review following a shortened licence period²
- CNSC staff describe activities completed during the current license period, including the Management of intermediate-level waste stored in storage pools, the transfer of all used fuel to CANSTOR dry storage modules at G2, and the emptying of the water from the wet fuel storage bays but provides no information about these activities or their potential environmental consequences³
- CNSC Staff state that “during the proposed licence period, HQ will continue to maintain the reactor building and operate the existing waste management facility until suitable disposal facilities become available. HQ currently has adequate authorized capacity to manage radioactive waste, including any potential waste generated by the proposed decommissioning activities” but provides no management plan for the wastes, no indication of where or what those “sustainable disposal facilities” are or where they are (to be) located, or what their contingency plan is when those disposal facilities do not become available⁴
- CNSC staff recommend that HQ provide one performance update to the Commission during the licence period to ensure that an opportunity for meaningful engagement with Indigenous Nations and communities remains available, and for HQ to provide an update on the progress of the decommissioning activities; while we support a mid-license term update, the Commission must understand that there is not an opportunity for meaningful engagement even with a ten-year license period, and a mid-term update in a twenty year license period is extremely unlikely to provide one⁵
- The staff CMD describes the response to unexpected results when HQ was monitoring the CANSTOR modules for the presence of fission products through a sampling port was suspended sampling; we find this to be an extraordinary response on the part of HQ and find it extraordinary that CNSC staff would accept such a response; in our view, unexpected results should trigger additional sampling, investigation and response rather than a

¹ CMD 26-H101, Page 1

² CMD 26-H101, Page 2

³ CMD 26-H101, Page 5

⁴ CMD 26-H101, Page 5

⁵ CMD 26-H101, Page 6

suspension of sampling; the Commission and the public deserve a detailed description and explanation, including the cause of the “unexpected results” and the rationale for why suspending sampling would ever be an appropriate response to unexpected sampling or monitoring, and why CNCS staff accepted it as a response in this instance.⁶

- CNCS describe HQ as having contracted the design and engineering of new sampling modules to improve the quality of results and worker safety with the first new port scheduled to be received by HQ in April 2026;⁷ the Commission and the public deserve a precise description of the timeline related to the suspension and resumption of sampling of the CANSTOR modules for the presence of fission products, including the period of time between suspension of sampling in response to “unexpected results” and the resumption of regular monitoring and sampling, as well as a detailed description of that monitoring and sampling program and the results
- CNCS staff write that at the time this CMD was drafted, water remained in the used fuel bay, CNCS staff had reviewed and were satisfied with HQ’s plans for draining the water in the used fuel bay and HQ is waiting on the review and acceptance by Environment and Climate Change Canada (ECCC) before undertaking this activity; the CMD omitted to describe the plan for draining the water or the destination of the water from the used fuel bay⁸
- Table 2 in the CNCS staff CMD presents the effective dose statistics for all workers at HQ G2 during the licensing period;⁹ we note that the *Average effective dose (mSv)* was at its highest point in 2024, and *Maximum individual effective dose (mSv)* was significantly higher, approximately double the previous highest year (2018) and approximately triple the average of all other years in the license period, and no explanation is provided, other than the very general statement that the rises in 2023 and 2024 are due to the work involving the disposition of medium activity waste stored in the pools; a more detailed explanation is required, as is a more detailed of how HQ will improve work practices to better protect workers, rather than simply reviewing them on an annual basis¹⁰
- Table 4 and 5 present the main DRL for gaseous emissions and liquid radioactive discharges at the G2 facility and the CNCS Staff CMD indicate that in 2017, HQ revised the DRLs “to better reflect the decommissioning context of the G2 facilities and to account for the relocation of the liquid radiological effluent discharge point, which is now submerged and located at the center of the southern channel of the St. Lawrence River”; it would have been helpful to have the previous DRLs presented to allow comparison, and a description of how

⁶ CMD 26-H101, Page 20

⁷ CMD 26-H101, Page 21

⁸ CMD 26-H101, Page 24

⁹ CMD 26-H101, Page 30

¹⁰ CMD 26-H101, Page 31

this revision of the DRLs was presented to the Commission during the 2016 license review¹¹

- The CNSC staff CMD does not provide a description of the long-term management plans for the Low-level waste (LLW), Intermediate-level waste (ILW) or High-level waste (HLW) currently at the Gentilly II site or which will be generated during the decommissioning period, and makes contradictory statements, stating both that “all ILW and LLW will be stored on-site, at the IGDRS”¹² and that “the end-state objectives of decommissioning are to completely and permanently remove all buildings and structures from the G2 site, remove all radioactive and hazardous waste and materials and bring the site in a condition acceptable for release from CNSC regulatory control”¹³ which directly contradicts the statement that storage would be on-site; a detailed description of the various waste categories over various timescales is not provided
- The CNSC staff CMD states that “in December 2024, HQ submitted a DDP for G2 including a Storage with Surveillance Plan and Waste Management Strategy for the storage with surveillance phase of G2” and indicates that between a Preliminary Decommissioning Plan (PDP), submitted in 2020 (which described a deferred decommissioning strategy) and the Detailed Decommissioning Plan submitted in 2024 Hydro Quebec had reassessed its approach and “is currently selecting a hybrid decommissioning approach”¹⁴; this indicates a significant change in approach, and further supports a full public review of the decommissioning approach proposed and being implemented by Hydro Quebec
- According to the CNSC staff CMD, HQ is relying on Nuclear Waste Management Organization’s (NWMO) schedule for transferring the used fuel to a future deep geological repository. Transfer of used fuel is scheduled from 2050 to 2054; the source of this estimate is presumably NWMO’s “Deep Geological Repository Transportation System Conceptual Design Report Crystalline / Sedimentary Rock”,¹⁵ which was a concept report produced by a consultant on behalf of the NWMO and has already shown itself to be highly unreliable (for example, it also indicated that the wastes from Gentilly 1 would be moved in 2050, which is now known to be clearly not the case); as is the case more generally, the summary description of the decommission plan provided in the staff CMD is wholly inadequate; the Commission and the public must be engaged in a detailed review of the decommissioning plan as a precursor to approving the next license for Gentilly II
- According to the CNSC staff CMD the end-state objectives of decommissioning are “to completely and permanently remove all buildings and structures from the G2 site, remove all

¹¹ CMD 26-H101, Page 39

¹² CMD 26-H101, Page 49

¹³ CMD 26-H101, Page 51

¹⁴ CMD 26-H101, Page 51

¹⁵ “Deep Geological Repository Transportation System Conceptual Design Report Crystalline / Sedimentary Rock”, APM-REP-00440-0209 R001, September 2021

radioactive and hazardous waste and materials and bring the site in a condition acceptable for release from CNSC regulatory control. Details on the final use, industrial or without restrictions, will be provided in the decommissioning phase. Since the decommissioning is deferred, the DDP provides interim end-states objectives for the different phases of decommissioning”¹⁶ but no details are provided and there is apparently no long-term management plan for the various categories of wastes other than to send it off-site, which is the equivalent of not having a plan for the long-term containment and isolation the radioactive wastes

CNSC Public consultation and engagement

While we agree with CNSC’s staff CMD statements that the Nuclear Safety Control Act (NSCA) mandates the CNSC to disseminate objective scientific, technical and regulatory information to the public concerning its activities and the activities it regulates we would disagree with any assertion from CNSC staff that the CNSC is carrying out this mandate, or carrying it out effectively.

We further comment that the increasing occurrence of “public hearings” without a public, i.e. hearings in writing, is problematic, and further undermines public confidence in the CNSC and in the Commission itself, and further reduces the opportunity for the Commission to hear from – and learn from – the public and experts who are independent of the Commission and of the nuclear industry.

Northwatch has reviewed the Record of Decision for the 2016 license renewal from the Gentilly II reactor station, and noted – with frustration – that that public hearing to which the public was excluded created the opportunity for the Commission staff and Hydro-Quebec to dismiss, deflect or rebut positions or observations made by Northwatch without the opportunity for the Commission to hear a response from Northwatch. This is not only unfair but undermining of even the semblance of a public process.

Conclusions and Recommendations

CNSC staff is recommending that the Commission grant Hydro-Quebec a 20-year license to carry out their evolving decommissioning approach without further scrutiny from either the public or the Commission itself (with the exception of “1 performance update to the Commission during the licence period”)¹⁷ and that the delegation of authority to CNSC staff as set out in section 5.4 of the CNSC staff CMD continue.¹⁸

¹⁶ CMD 26-H101, Page 51

¹⁷ CMD 26-H101, Page 6

¹⁸ CMD 26-H101, Page 69

Northwatch strongly disagrees with these recommendations.

Northwatch requests that the Commission:

- Renew the Gentilly II decommissioning license for a two-year period to provide license continuity while a full public review of Hydro Quebec’s decommissioning plan can be undertaken
- Work collaboratively with the Impact Assessment Agency of Canada (IAAC) and the Bureau d'audiences publiques sur l'environnement (BAPE) to determine the best approach for a full impact and environmental assessment of Hydro-Quebec’s decommissioning plan as submitted in December 2024 to the CNCS or as further revised since that submission
- Ensure that a full public assessment is undertaken of the of Hydro-Quebec’s decommissioning plan as submitted in December 2024 to the CNCS or as further revised since that submission is undertaken within the next two years, with a one-year license extension granted to Hydro-Quebec if necessary, in order to complete the assessment of the decommissioning plan
- Without prejudice to the above requests, that the Commission make publicly available and readily accessible the full version of the Hydro-Quebec’s most recent detailed decommissioning plan in both official languages of Canada
- Convene a public workshop on REGDOC-1.1.4, Licence Application Guide: Licence to Decommission a Reactor Facility which the CNSC web site describes as “currently being under development”¹⁹ with a comment period to follow

In closing, please find our submission of 2016 and the associated report “Nuclear Power Plant Decommissioning - International perspectives and comparisons of standards for post closure safety case assessments” attached. Many or most of the issues addressed in our 2016 submission remain current, as does the associated expert report.

Thank you for your consideration.



Brennain Lloyd
Northwatch Project Coordinator

¹⁹ As found at <https://www.cnscccsn.gc.ca/eng/acts-and-regulations/regulatory-documents/>

Appendices

REVIEW OF CMD 16-H4 AND CMD 16-H4.1 - Comments on the Application for a Nuclear Power Reactor Decommissioning License for the Nuclear Facility and the Waste Facilities at Gentilly-2, Northwatch, 4 April 2016

“Nuclear Power Plant Decommissioning - International perspectives and comparisons of standards for post closure safety case assessments”, prepared for Northwatch by Rizwan Khan, J.D., Counsel, Canadian Environmental Law Association, March 2016



GENTILLY II

Hydro-Quebec

REVIEW OF CMD 16-H4 AND CMD 16-H4.1

**Comments on the
Application for a Nuclear
Power Reactor
Decommissioning License
for the Nuclear Facility and
the Waste Facilities at
Gentilly-2**

Northwatch

4 April 2016

Précis

- Power generation has ceased at the Gentilly Nuclear Generating Station and Hydro-Quebec has commenced decommissioning activities prior to completing, filing and receiving approval from the CNSC of a decommissioning plan
- The submissions filed by Canadian Nuclear Safety Commission staff and Hydro-Quebec provide inadequate information about Hydro-Quebec's decommissioning plan and their long-term strategy for the management of radioactive wastes
- Hydro-Quebec's approach to decommissioning has – to date – been inconsistent with international practice and does not meet the requirements as set out by the International Atomic Energy Agency
- Hydro-Quebec has greatly reduced their programs for environmental and radiation monitoring and have reduced their staffing at the Station to only four days per week; the Canadian Nuclear Safety Commission staff have vacated the generating station
- The Canadian Nuclear Safety Commission is considering issuing a ten-year license for a first-ever decommissioning license for a commercial power reactor, after providing the public with only a very limited amount of time to review the information provided and with no opportunity to make presentations during a public hearing on the matter
- Northwatch is recommending a short license extension, followed by a full public review of a comprehensive decommissioning plan for Gentilly I and II

1. Context

The Gentilly Nuclear Generating Station is located on the south shore of the St. Lawrence River in the municipality of Bécancour, about 15 km east of the city of Trois-Rivières, Quebec. The nuclear station includes Atomic Energy of Canada Limited's Gentilly-I reactor, Hydro-Québec's Gentilly-II reactor, and associated waste management facilities and auxiliary buildings.

Gentilly-II is a CANDU pressurized heavy water reactor with a nominal capacity of 675 megawatts electric (MW(e)). The nuclear power plant (NPP) began commercial operation on October 1, 1983 and ceased operating on December 28, 2012. The operating licence for the facility was renewed in 2011 (Power Reactor Operating Licence (PROL) 10.00/2016) for a period of five years and expires on June 30, 2016. After the licence was issued, the Government of Quebec decided to cease commercial operation of the NPP and shut down the facility. Since 2013, Hydro-Québec has initiated stabilization measures: unloading the reactor core, draining and shutting down various systems, etc.

Gentilly-2 is currently in safe storage state (SSS) with the spent fuel stored in pools provided for this purpose (SSS pools). Achievement of dry safe storage state (SSS (dry)) is the next significant step to move the nuclear facility toward complete decommissioning. In that state, all fuel will be removed from the pools and placed in dry storage in the CANSTOR outdoor modules provided for this purpose.

On September 30, 2015, the CNSC Secretariat received a single decommissioning licence application for a 10-year period expiring on June 30, 2026, for both the Gentilly-2 nuclear power reactor and waste management facilities.¹

On November 17th, 2015 the Canadian Nuclear Safety Commission (CNSC) issued a notice that it would hold a public hearing on May 4th of 5th, 2016 to consider an application from Hydro-Québec for a 10-year power reactor decommissioning licence to continue activities related to the preparation for the decommissioning of the Gentilly-2 nuclear facility, located near Bécancour,

¹ Environmental Assessment Report: Hydro-Québec Application for a Decommissioning Licence for the Gentilly-2 Nuclear Power and Waste Management Facility, Canadian Nuclear Safety Commission, March 2016

Quebec. The current operating licence authorizes Hydro-Québec to maintain the Gentilly-2 nuclear facility in a “safe storage state”.

Hydro-Québec’s submission and CNSC staff’s recommendations to be considered at the hearing were to be available after March 4, 2016. Written submissions were required by April 4th, 2016. CSNC staff confirmed following the issuing of the public notice that there would be no opportunity for the public to speak at the public hearing. Northwatch requested Commission Member Documents and received the French version on March 7th and the English version on March 18th. This submission is in response to that notice of November 17th, 2015, and subsequent to Northwatch’s review of CMD 16-H4 received on March 18th.

The application is for an unprecedented decommissioning license for a full-scale commercial reactor. What is also unprecedented is that the Canadian Nuclear Safety Commission would hold a public hearing on an application for a ten-year license for a nuclear power reactor (albeit a reactor in shut-down state) and not allow the public to speak at that public hearing. Further, as noted above, the period available to the public to review the Commission Member Documents was extremely short.

These serious issues related to public participation rights in this review process support Northwatch’s recommendations made later in this document – on different grounds – that the operating license be extended for a maximum two year period, during which time the proponent(s) can prepare a decommissioning plan, consult with the public and First Nations with respect to their decommissioning proposal, and submit an application for a decommissioning license.

2. Northwatch's Interest

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, Northwatch has 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 mineral exploration and mining, uranium refining and nuclear power generation, and various nuclear waste management initiatives and proposals.

Northwatch has a longstanding interest in the management of nuclear waste, as well as other environmental and social impacts of using nuclear power for the purpose of electricity generation. Our interests are primarily with respect to the impacts and potential impacts of the nuclear chain on the lands, water, and people of northeastern Ontario. Our interest in nuclear waste was initiated by proposals dating back to the 1970's to site nuclear waste "disposal" projects in northern Ontario. There have been numerous proposals over the last several decades, including proposals for the import and burial of high-level waste in the 1970s and 1980s and for low level waste in the 1990s. Currently there are nine municipalities participating in a siting exercise related to a potential burial location for all of Canada's high level nuclear fuel waste. Six of those municipalities are in northern Ontario, and eighteen areas associated with those municipalities – totalling 310,321.10 hectares or over 310 square kilometres – have been identified for more detailed investigation. No potential areas have been identified in association with the three other municipalities, which are in the general vicinity of the Bruce Nuclear Generating Station.

Northwatch's interests are potentially affected by the outcome of decisions related to the Gentilly decommissioning given that:

- it is the first such decommissioning in Canada,
- it may set precedents for future decommissioning decisions in Canada,
- an application for a decommissioning license for the Pickering Nuclear Generating Station in Ontario is anticipated within the next several years,

- OPG has stated on the record their intention to place decommissioning wastes in a proposed deep geological repository on the eastern shore of Lake Huron and Northwatch's review has determined that such placement has the potential for adverse effects on the north shore of Lake Huron which is within Northwatch's geographic area.

Northwatch's issues and concerns are focused primarily on the Hydro-Quebec relicensing application for Gentilly II being the first application for a license to decommission a commercial reactor in Canada and the potential for the decision on this application to be precedent-setting and normative for the nuclear industry in Canada more generally.

Northwatch's general interest in the long-term management of radioactive wastes, including reactor decommissioning wastes, encompasses the wastes that are currently on-site at the Gentilly Nuclear Generating Station and those which would be generated during decommissioning. At present, there is a stated intention that the fuel wastes currently in storage at Gentilly would be included in the wastes to be managed by the Nuclear Waste Management Organization, meaning that Gentilly wastes are among those that are part of the burial project for which over 310 square kilometres in northern Ontario is currently under investigation. While we are not aware of any such proposal specific to the wastes that will be generated with the decommissioning of the Gentilly II reactor, our practice is to maintain a watching brief on all major waste generation projects (reactor new builds, refurbishment projects, and now decommissioning projects) in order to be informed of any developments in this area, and in order to provide the Commission with appropriate advice.

3. Review of the Gentilly-II Application

Northwatch's review of Hydro-Québec's application for a 10-year power reactor decommissioning licence for Gentilly-II includes a review of submissions to the Commission made by Hydro-Québec and Canadian Nuclear Safety Commission staff, a cross-jurisdictional comparison of decommissioning standards and approaches, and application of the findings of the cross-jurisdictional review to the approach set out by Hydro-Québec in CMD.

3.1 Review of CMD 16-H4 and CMD 16-H4.1

Northwatch's review of Hydro-Québec's application for a Nuclear Power Reactor Decommissioning License for the nuclear facility and the waste facilities at Gentilly-2 was limited by Northwatch's operating language being English and the majority of the core documents being available only in French, and by the limited time provided for review and comment between the documents being made available and the deadline for submissions. An English-language translation of the CNSC staff submission was provided two weeks after the anticipated date of March 4th (i.e. on March 18th), which was eleven days after the French language version was provided. The translation included the CNSC staff submission and environmental assessment report, but excluded the proposed license, the license condition handbook and the current license. Hydro-Québec's submission was available only in a French language version.

As set out in CMD 16-H4, Hydro-Québec's operating licence for Gentilly II, renewed in 2011 (PROL 10.00/2016) for a period of five years, expires on June 30, 2016.²

Shortly after the licence was issued, the government of Québec decided to cease commercial production and to close down Gentilly-II. The reactor was permanently shut down on December 28, 2012.

3.1.1 Decommissioning

² CMD 16-H4 regarding a Licence application from Hydro-Québec for a Nuclear Power Reactor Decommissioning Licence (PRDL) for the nuclear facility as well as the waste facilities at Gentilly-2 (hereafter referred to as CMD 16-H4)

Despite the fact that the last public hearing³ was for an operating license, since 2013, Hydro-Québec has initiated the decommissioning process, including a number of activities that are clearly outside the realm of those anticipated under a power reactor operating licence,⁴ including:

- completely unloading the reactor core and draining and shutting down various systems at the station
- the main nuclear systems were taken out of service, drained, dried and placed in a “safe state”

Although not reported on in CMD 16-H4, and seemingly as a stand-in for a license amendment to address the significant change in activities at Gentilly II, CNSC staff developed and signed a protocol with Hydro-Québec to guide decommissioning activities that would be undertaken under the operating license for the several years prior to Hydro-Québec applying for a decommissioning license. The protocol set out the framework within which both organizations will work, and establishes a high-level estimate of the timeline. The protocol covers the period from December 2012 to mid-2014, during which the licensee will shut down the reactor in December 2012, carry out decommissioning activities, which were described in the Protocol as “reactor stabilization activities and transition the reactor to a safe state of storage”.⁵

The CMD describes Gentilly-2 as currently being in a “safe storage state with the spent fuel stored in the pools (reception, inspection and storage) provided for this purpose [SSS (pools)]”, and indicates that “achieving dry safe storage state [SSS (dry)] is the next significant milestone to transition the nuclear facility toward eventual dismantling.”

³ On June 3, 2015 the Canadian Nuclear Safety Commission (CNSC) issued a notice that it would hold a hearing in June 2015 to consider Hydro-Québec’s application to amend its operating licence to replace the reference to a regulatory document that details the information that nuclear power plant (NPP) licensees must report to the CNSC, and for a reduction in reporting requirements. The Commission did not hold a public hearing. Only one member of the Commission was present for the closed session. (CNSC Ref. 2015-H-105). On July 3, 2014 the Canadian Nuclear Safety Commission (CNSC) issued a notice that it would hold a hearing in July 2014 to consider Hydro-Québec’s application to remove licence conditions which they felt no longer applied, and modify other licence conditions to reflect the decreased risk presented by the current state of the station. The Commission did not hold a public hearing. Only one member of the Commission was present for the closed session. (CNSC Ref. 2014-H-103). While written submissions were accepted were accepted for 2014-H-103, neither session was public.

44

⁵ Protocol on the End of Commercial Operation of the Gentilly-2 Nuclear Reactor, April 26, 2013, Revision 4, as found online at <http://nuclearsafety.gc.ca/eng/pdfs/Protocols/April-2013-Protocol-on-the-End-of-Commercial-Operation-of-the-Gentilly-2-eng.pdf>

According to the staff submission, on September 30, 2015, the CNSC secretariat received a dual decommissioning licence application for a 10-year period expiring on June 30, 2026, for the Gentilly-2 nuclear power reactor and waste management facilities (ref. 1). This period covers the transition of the facility from SSS (pools) state to SSS (dry) state (expiring in 2020).

CMD 16-H4 presents CNSC staff's assessment for the current licence period, the main issues identified by CNSC staff and their follow up, as well as CNSC staff's expectations for the next licence period. The CMD includes the licence and the proposed Licence Conditions Handbook describing each licence condition and the necessary compliance verification criteria for assessing the performance of Hydro-Québec's programs. It includes an environmental assessment report related to Hydro-Québec's application for a decommissioning license.⁶

Northwatch's primary areas of interest in this review are with respect to decommissioning strategies and waste management. These two areas are marked by an extreme paucity of information having been provided.

The licence application is for a decommissioning license, but decommissioning activities commenced under the current operating license, and a detailed decommissioning plan has not yet been provided:

*This period covers the transition of the facility from SSS (pools) state to SSS (dry) state (in 2020), which will be the start of the dormancy phase. Hydro-Québec will have to submit a detailed decommissioning plan in 2019 to cover this phase in its entirety.*⁷

This absence of a decommissioning plan or even a detailed outline of Hydro-Québec's proposed decommissioning approach is reflected in the CNSC staff CMD, with its own lack of information, analysis or description of decommissioning work, completed or intended.

Even the limited information that is provided lacks clarity. Examples include:

- Two photographs and a graphic are presented that bear some relationship to the transfer of spent resins, but there is no description or discussion of the work package related to the transfer of spent resins at the solid waste management facility

⁶ CMD 16-H4

⁷ CMD 16-H4, page 7

- the timing and sequencing of the construction of the additional dry storage units is not described
- the site configuration or any reconfiguration of the site that will be required to accommodate the additional dry storage units is not discussed
- how the design of the storage units – initially approved in the 1990s – has been reviewed and (potentially) amended or improved based on twenty years of operating experience is missing

CNSC staff note in their submission that as well as still having to submit a detailed decommissioning plan in (est. 2019), Hydro-Québec will also have to submit an interim report when a dry storage state has been achieved (est. 2020).⁸

RECOMMENDATION: Extend the current license for a two-year period, allowing Hydro-Québec sufficient time to complete a detailed decommissioning plan; the interim report on having achieved dry storage state would then become an interim report in a five year license.

3.1.2 Waste Management

The CNSC staff commission discussion of waste management was comprised almost entirely of their rating of waste management experience to date, and provided very little insight or analysis with respect to the intended management of the wastes generated through decommissioning. That said, even this text provided some indications of staff’s assumptions, however unfounded. For example, the CMD indicates that “An acceptable waste management program covers the production of radioactive waste from daily operations until they are removed and transported to another licensed facility”⁹, revealing an assumption that there is some place else for this waste to go. Nowhere in the CNSC or Hydro-Quebec CMDs is this mythical “other place” identified.

Low and Intermediate Level Waste

This failing is not limited to these two CMDs. In the course of reviewing CMDs 16-H4 and 16-H4.1 we looked elsewhere for this crucial but missing information, and found other documents

⁸ CMD 16-H4, page 7

⁹ CMD 16-H4, page 53

similarly lacking. For example, while the Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Fifth Report, October 2014)¹⁰ provides a description of the low and intermediate level radioactive wastes generated through operations at Gentilly I and II and some discussion of its current storage, it provided no indication of the longer term management plan for these wastes.

In contrast, the same National Report provided considerable discussion of Ontario Power Generation's long term management plan for low and intermediate level radioactive wastes generated from both the operating and decommissioning phases. The inclusion of this information for these wastes from Ontario's reactors indicates that it is information that is relevant and within scope of the National Report. The omission of any information about the long-term management plans for the low and intermediate level wastes generated during the operating and decommissioning phases by Gentilly-II suggests that there is no plan or strategy.

As described in CMD 16-H4, the waste management "method" at Gentilly II for low and intermediate level wastes is described as follows:

*The activities conducted focus on the principle of minimizing the production of radioactive waste and reuse of materials where possible. All low- and intermediate-level radioactive waste is prepared and transferred to Solid Radioactive Waste Management Facilities (SRWMF) or to the Radioactive Waste Storage Area (RWSA) depending on the nature of the waste. Hydro-Québec's waste management process is described in document PROG-150 - Programme de gestion des déchets " [waste management program]."*¹¹

Hydro Quebec is similarly silent on the proposed long-term management of low and intermediate level radioactive wastes.¹²

Irradiated Fuel

Spent fuel bundles that are removed from the reactor are placed in containers and stored in the storage pool provided for this purpose where they remain for a period of approximately seven years. Also in the pool, the bundles are transferred into stainless steel baskets. Once

¹⁰ Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, © Canadian Nuclear Safety Commission (CNSC) 2014 PWGSC catalogue number CC172-23/2014E-PDF, ISSN 2368-4828

¹¹ CMD 16-H4, page 53

¹² Mémoire de Hydro-Québec, CMD 16-H4.1, Section 3.11

filled, the baskets are removed, cleaned and sealed by welding. Finally, they are transferred in CANSTOR modules for dry storage.¹³

To ensure adequate radioactive shielding, CANSTOR modules consist of a sealed steel jacket inside a 96.5 cm thick reinforced concrete structure which ensures adequate radiological shielding. Each CANSTOR module measures 8.1 m x 7.5m x 21.6 m and contains 20 cylinders that can each hold 600 spent fuel bundles, for a total of 12,000 bundles per CANSTOR module.

Hydro-Quebec received approval in 1995 – more than two decades ago – for the use of the CANSTOR module for the storage of irradiated fuel. Use of the CANSTOR module is unique to Gentilly II. We found nothing on the public record with respect to performance reviews for this canister design, or design modifications.

We did note that – outside of the Commission’s review of licencing for Gentilly II – Hydro-Quebec has received permission from CNSC staff to a) build additional canisters of the 1995 design, and to reconfigure the Gentilly station to accommodate the staff-approved dry storage modules for irradiated fuel.

There are currently nine CANSTOR modules in the Spent Fuel Dry Storage Area (SFDSA). Hydro-Quebec has already received permission from the CNSC to build two additional CANSTOR modules that will be required to receive and store all of the bundles currently in the storage pool.

To ensure safety and simultaneously transfer the 2016 fuel and build two new CANSTOR modules, Hydro-Québec submitted a request in February 2015 (ref. 43) to alter the limits of the SFDSA to consider the south area of the SRWMF phase 2 as part of the SFDSA. CNSC staff reviewed Hydro-Québec’s request and concluded that the Hydro-Québec’s request met all of the requirements specified in the CNSC approval granted in 1995 for the construction of CANSTOR modules. For this reason, CNSC staff approved Hydro-Québec’s request. They plan to proceed with the work in the summer of 2016.

RECOMMENDATION: As part of preparing their application for a decommissioning license, Hydro-Quebec should be required to investigate and report on:

- **performance of the CANSTOR module, and design developments since its design and approval in the mid-1990s**
- **options for the long-term management of the low and intermediate level radioactive wastes (generated through operations and decommissioning) including long-term management *in situ*; this investigation should take an environmental assessment**

¹³ CMD 16-H4, page 53-54

approach, including investigation of alternatives and alternative means of carrying out the project

- **any reconfiguration of the site that might be required to accommodate various developments to accommodate waste management components, including configuration of the site to accommodate additional dry cask storage modules (the Commission should rule that this decision should be made as part of a license review, in the context of a license review of a decommissioning plan)**

Proposed license condition 11.2 sets out that “The licensee must implement the planning and preparation program for decommissioning the nuclear facility and the waste management facility.”

We concur with this proposed license condition.

RECOMMENDATION: Detail Licence Condition 11.2 to incorporate the above noted recommendations with respect to Hydro-Quebec’s future application for a decommissioning license. Limit the current license extension to no more than two years, given the absence of a decommissioning plan.

3.1.3 Additional Issues

- Once again, we are underwhelmed by the rating assigned to each relevant safety and control area. While it may, as the CMD states, indicate “overall compliance with the regulatory requirements”, it is by no means a confidence booster; it may be worth noting that Gentilly II was the only reactor in Canada that failed to achieve even a single “fully satisfactory” rating in 2014¹⁴

¹⁴ Regulatory Oversight Report for Canadian Nuclear Power Plants: 2014, Canadian Nuclear Safety Commission (CNSC) 2015, PWGSC catalogue number CC171-25E-PDF

Table 1: Canadian nuclear power plant safety performance ratings for 2014

Safety and control area	Bruce A	Bruce B	Darlington	Pickering	Gentilly-2	Point Lepreau	Industry average
Management system	SA	SA	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA	SA	SA
Operating performance	SA	FS	FS	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA	SA	SA
Radiation protection	SA	SA	FS	FS	SA	SA	SA
Conventional health and safety	FS	FS	SA	SA	SA	FS	FS
Environmental protection	SA	SA	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA	SA	SA
Waste management	FS	FS	FS	SA	SA	SA	FS
Security	FS	FS	FS	FS	SA	SA	FS
Safeguards and non-proliferation	SA	SA	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA	SA	SA
Integrated plant rating	SA	FS	FS	SA	SA	SA	SA

- Hydro-Québec has gained approval for several reductions in reporting requirements, including reduction in reporting frequency and in the number of safety performance indicators, removal of the requirement for personnel reports; in addition, a probabilistic safety assessment is no longer required and up-to-date environmental risk assessment reports are no longer required; in addition, the work force has been reduced and is only on-site for four days of the week and there is no longer a CNSC staff presence.¹⁵ While acknowledging that these reductions have already been approved, we wish to note our concern about this relaxation of regulatory oversight as Gentilly II proceeds through decommissioning. This is the first full-scale decommissioning of a commercial reactor in Canada (Douglas Point is variously described as being decommissioned or partially decommissioned but is not of equivalent scale) and involves several transfers of high level radioactive wastes and materials; spikes in worker exposure at various points since the 2012 end of operations attest to the continued risk. In addition, there is only limited

¹⁵ CMD 16-H4, page 21

reduction in risks associated with human error in the management of the wastes or of malevolent acts targeting the stockpiles of highly radioactive wastes, including those wastes classified as “intermediate” but which are highly radioactive.

Commercial operation of the Gentilly-2 facility ceased on December 28, 2012. For 2011 and 2012, the collective doses are associated with radiation work performed during routine operations and plant shutdowns, while the collective doses from 2013 to 2015 are associated with the required stabilization activities to place Gentilly-2 in a safe storage state. As expected, the collective dose in 2014 is higher than that received in 2013 due to the higher number of radiological activities in 2014, such as the draining and drying of the moderator and coolant circuits, the transfer of purification resins to the solid radioactive waste management facility (SRWMF) and the transfer of spent fuel from the storage pool to the spent fuel dry storage area [CMD 16-H4, page 32]

- While shutting down of the reactor may have eliminated the major source of tritium releases from the facility, operation of the radioactive waste storage areas will remain a potential and well known source of airborne radiological release; in addition, tritium concentrations in seepage and surface around the storage areas for radioactive waste persist at approximately 1000 Bq/l for seepage and between 500 and 1000 Bq/l for surface waters;¹⁶ despite CNSC staff’s referencing them as being below the limit of 7000 Bq/l set by Health Canada, these levels are a continued concern
- Environmental monitoring has been reduced from “dozens” of systems to four¹⁷; the CMD provides inadequate detail and no clear explanation or rationale for this radical reduction in monitoring, beyond earlier noted very generic statements about reduced risk with the ceasing of operations
- Monitoring of airborne radioactive emissions have also been reduced, with the removal of radioactive iodine and noble gasses from the monitoring program¹⁸; only tritium, aerosols and carbon-14 will be measured in airborne emissions
- The radioactive waste contained in the RWSA vaults is undergoing chemical and microbiological degradation – reportedly a “well known source of carbon-14” - and since 2013, Hydro-Québec has measured increased in annual concentrations of carbon-14; the

¹⁶ CMD 16-H4, page 42

¹⁷ CMD 16-H4, page 43

¹⁸ Environmental Assessment Report: Hydro-Québec Application for a Decommissioning Licence for the Gentilly-2 Nuclear Power and Waste Management Facility, Canadian Nuclear Safety Commission, March 2015, e-Doc: 4940841 (WORD), page 8

EA report indicates that these increases are the result of transfer of ion-exchange resins to the SRWMF.¹⁹

- a tritium contamination plume in seepage water from radioactive waste storage areas is advancing towards the St. Lawrence River; annual tritium averages around the RWSA, SFDSA and SRWMF have been declining since 2010 but remain between 500 and 1,000 Bq/L²⁰
- the “Independent Environmental Monitoring Program” is extremely limited, reporting on only two to five contaminants per media²¹
- Beginning in January 2016, Hydro-Quebec reduced the staff presence on the site to four days a week (Monday to Thursday)²²
- A safety analysis for the waste facility is currently under review (proposed amendments submitted to CNSC staff in December 2015) but has not been included in this review²³

Singly and in combination, the above noted matters are items of concern. They are evidence of continued risk to the environment and human health as a result of the hazards at the Gently site, and of a reducing level of attention being paid to these risks and hazards. Regrettably, the situation has been allowed to evolve outside of Commission oversight or public engagement, and outside of an appropriate license being in place.

3.2 Cross-Jurisdictional Comparison of Decommissioning Standards and Approaches

Northwatch retained counsel with the Canadian Environmental Law Association to conduct and provide a cross-jurisdictional comparison of decommissioning standards and approaches.

Included jurisdictions are Canada, the U.S., Sweden and Finland; IAEA standards are also included.

¹⁹ EA Report, page 29

²⁰ EA Report, page 31-32

²¹ EA Report, page 46-47

²² Mémoire de Hydro-Québec, CMD 16-H4.1, Section 3.2.2

²³ Mémoire de Hydro-Québec, CMD 16-H4.1, Section 3.4.2

The report is summarized here and appended in full. The report 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 report concludes that 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.

3.3 Evaluation of Hydro-Québec Decommissioning Approach Relative to International Standards

Hydro-Quebec is still without a decommissioning plan for the Gentilly Nuclear Generating Station, or even a decommissioning approach, beyond the most basic of outlines, sketched in a back-of-the-envelope style, as summarized in the submission of both the Canadian Nuclear Safety Commission staff and Hydro-Quebec. That said, it must be acknowledged that a large volume of information has been provided

to the Canadian Nuclear Safety Commission that has been referenced in the CMDs but is not described or at least not in any detail; we speculate that additional information may have been provided which has not been referenced.

Given the very summary information provided about Hydro-Quebec’s decommissioning approach, only a very summary evaluation of the decommissioning approach against international benchmarks can be made.

Direction with respect to direct/immediate/accelerated decommissioning versus delayed / deferred decommissioning	Hydro-Quebec appears to have opted for deferred commissioning; no information is provided as to the basis for this selection, or the outcome of any evaluation of the various options that resulted in Hydro-Quebec selecting deferred commissioning.
Expected end-state for the decommissioned site	No expected end-state for the decommissioned site is stated.
Anticipated timelines for achieving end-state	2065-2066 is the stated end-date for “restauration du site” but no specifics of the required or anticipated end-state for the site have been stated.

It should also be noted that the site is also occupied by Atomic Energy of Canada Limited, who are the owner and retain responsibility for Gentilly I and the associated waste management facility.

RECOMMENDATION: Concurrent with Hydro-Quebec’s obligations to develop and submit a full and comprehensive decommissioning plan (including public consultation during its development), Atomic Energy of Canada Limited has a parallel responsibility to develop and submit a decommissioning plan for Gentilly I and its associated waste facilities.

4. Conclusions

Northwatch engaged in this review of the application by Hydro-Quebec for a decommissioning license for the Gentilly II reactor because of its precedent nature, and the potential for it to influence future decommissioning practices in Canada. Having now reviewed the application and several supporting and related documents, we can only hope that this is not the case.

In this application, Hydro-Quebec has failed to provide the necessary information to support an application; indeed, they have failed to provide a decommissioning plan. CNSC staff have aided and abetted in this, providing several piece-meal approvals that form part of an emerging decommissioning approach – despite the continued lack of a decommissioning plan – an accepting Hydro-Quebec’s filing of aspects of what could become a decommissioning plan at disparate dates – some in 2015, some promised for 2016, and some later yet. Further, this ad hoc decision-making is being made without the rigour that a full Commission hearing can provide. It is also, quite notably, proceeding without public engagement.

The Commission must assert itself over this *laissez-faire* situation. Public hearings without the public are not acceptable; a Canadian Nuclear Safety Commission without a Commission is not accountable.

Appendix

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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March, 2016

Prepared for Northwatch

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

Nuclear Power Plant Decommissioning

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assessments**

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TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTERNATIONAL ATOMIC ENERGY AGENCY REQUIREMENTS.....	2
2.1	DECOMMISSIONING STRATEGIES	2
2.1.1	<i>Immediate dismantling</i>	<i>Error! Bookmark not defined.</i>
2.1.2	<i>Deferred dismantling</i>	<i>Error! Bookmark not defined.</i>
2.1.3	<i>Entombment.....</i>	<i>Error! Bookmark not defined.</i>
2.2	DECOMMISSIONING REQUIREMENTS	4
2.2.1	<i>Specific Requirements</i>	4
3	U.S.A.....	6
3.1.1	<i>Initial activities</i>	7
3.1.2	<i>Major Decommissioning and Storage</i>	8
3.1.3	<i>Licence Termination</i>	8
3.2	FUNDING.....	8
3.3	DECOMMISSIONING STRATEGY	9
4	FINLAND.....	9
4.1	FUNDING.....	10
4.2	DECOMMISSIONING STRATEGY	10
5	SWEDEN.....	11
5.1	FUNDING.....	12
5.2	DECOMMISSIONING STRATEGY	13
6	CANADA.....	13
6.1	REGULATORY AND STANDARDS DOCUMENTS.....	15
6.1.1	<i>Decommissioning Responsibility and Planning</i>	16
6.2	FUNDING.....	17
6.3	DECOMMISSIONING STRATEGY	17
7	COMPARISON OF CANADIAN PRACTICE WITH IAEA REQUIREMENTS.....	18
7.1	DECOMMISSIONING STRATEGY	18
7.1.1	<i>Recommendation</i>	19
7.2	IN SITU CONFINEMENT	19
7.2.1	<i>Recommendation</i>	20
7.3	SUBMISSION OF A DETAILED DECOMMISSIONING PLAN	20
7.3.1	<i>Recommendation</i>	21
7.4	DURATION OF DECOMMISSIONING	22
7.4.1	<i>Recommendation</i>	23
8	CONCLUSION	23

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 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 begins 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

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

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 facility³⁸
- 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

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 statutes 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

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 N294-09⁶⁵ and G-219⁶⁶ 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.

⁶⁰CSA N294-09, *supra* note 56.

⁶¹RSP-0303, *supra* note 35, at pg. 6.

⁶²*Ibid.* at pg. A-4.

⁶³CSA N294-09, *supra* note 56, at 4.1.1.

⁶⁴*Class I Nuclear Facilities Regulations, supra*, note 60, at s. 3.

⁶⁵CSA N294-09, *supra* note 56, at 6.3 & Annex A.

⁶⁶G-219, *supra*, note 55, at 6.1.

⁶⁷CSA N294-09, *supra* note 56, at 6.3.2.

6.2 FUNDING

The *NCSA* 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

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;

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 detail, 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 completion 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.