Canadian Environmental Law Association
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October 26, 2020

Senior Tribunal Officer, Secretariat
Canadian Nuclear Safety Commission
280 Slater Street, P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9

Sent by email cnsc.interventions.ccsn@canada.ca

Dear Sir or Madam:

RE: PROPOSED DECOMMISSIONING LICENCE AMENDMENT - COMMENTS ON CANADIAN NUCLEAR LABORATORIES LTD. ("CNL") DECOMMISSIONING LICENCE AMENDMENT APPLICATION FOR THE DOUGLAS POINT WASTE FACILITY

I. INTRODUCTION

The Canadian Environmental Law Association (CELA) jointly with the Concerned Citizens of Renfrew County, Nuclear Waste Watch, and Northwatch (herein, the "intervenor") submits this letter in response to the Canadian Nuclear Safety Commission's (CNSC) Revised Notice of Public Hearing dated June 3, 2020 requesting comments on Canadian Nuclear Laboratories (CNL) request for a 14 year waste facility decommissioning licence for the Douglas Point waste facility.[1] A hearing for this licence amendment application is scheduled for November 25-26, 2020. Our recommendations in response to the above noted matter are summarized at **Appendix A.**

II. INTEREST AND EXPERTISE OF THE INTERVENOR

By this letter, and pursuant to the CNSC's *Rules of Procedure* ("*Rules*"), the intervenor requests status to participate in the public hearing respecting the CNL licence amendment application and an opportunity to present oral submissions. As noted below, the intervenor meets the test set out in the *Rules* for intervening on the basis of both: (1) interest in the matter being heard; and (2) expertise or information that may be useful to the CNSC in coming to a decision.[2]

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[1] Canadian Nuclear Safety Commission, *Revised Notice of Public Hearing*, 3 June 2020 (Ref. 2020-H-04 Rev 4)
[2] *Rules of Procedure*, SOR/2000-211, s. 19(1)(a)(b).

i. Canadian Environmental Law Association

CELA is a non-profit, public interest law organization. CELA is funded by Legal Aid Ontario as a speciality legal clinic to provide equitable access to justice to those otherwise unable to afford representation for environmental injustices. For nearly 50 years, CELA has used legal tools to advance the public interest, through advocacy and law reform, in order to increase environmental protection and safeguard communities across Canada. CELA has been involved in number of nuclear facility licensing and regulatory matters before the CNSC. CELA also has an extensive library of materials related to Canada's nuclear sector which is publicly available on their website.[3]

ii. Concerned Citizens of Renfrew County and Area

The Concerned Citizens of Renfrew County and Area (CCRCA) is a non-governmental, volunteer organization working to prevent radioactive pollution and encourage clean-up and responsible long-term management of nuclear industry wastes, with a focus on the Chalk River Laboratories (CRL) and other nuclear facilities in the Ottawa Valley.[4] Their particular interest in this matter relates to the overall decommissioning process, costs, and federal oversight, noting that CRL is the proposed destination for the Douglas Point decommissioning wastes.

iii. Nuclear Waste Watch

Nuclear Waste Watch (NWW) is a network of organizations concerned about radioactive waste in Canada, and was founded in 2003 to provide a public-interest response to nuclear waste proposals and policies.[5] NWW is primarily focused on high level radioactive waste and its generation through the use of nuclear power, but works to amplify the concerns of communities and organizations with respect to decommissioning projects, including concerns related to the generation of radioactive wastes through decommissioning of nuclear facilities.

iv. Northwatch

Founded in 1988 and based in Northeastern Ontario, Northwatch provides a regionally representative voice in reviews of environmental, natural resource and energy concerns.[6] Northwatch has particular concerns around nuclear waste and other nuclear projects as proposed and their potential impacts on communities and the environment in the Northeast.

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[3] Canadian Environmental Law Association, online: www.cela.ca
[4] Concerned Citizens of Renfrew County and Area, online: https://concernedcitizens.net/
[5] Nuclear Waste Watch, online: https://nuclearwastewatch.weebly.com/
[6] Northwatch, online: https://northwatch.org/

III. BACKGROUND

CNL's existing licence for the DPWF, which expires December 31, 2034, authorizes CNL to conduct decommissioning activities at the former site of the Douglas Point Nuclear Generating Station. Upon shut down of the Douglas Point nuclear reactor in 1984, the site was relicensed as waste management facility and in 2014, subsequently renamed the Douglas Point Waste Facility (DPWF). The site remains composed of a range of nuclear and non-nuclear facilities, including the reactor building, a dry storage facility for spent fuel, and administrative ancillary buildings.

CNL now requests an amendment to its existing decommissioning licence in order to undertake final decommissioning within its existing licencing period which expires in 2034.[7] As defined by the International Atomic Energy Agency (IAEA) decommissioning is the "administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility."[8] In the present context, 'decommissioning actions' are the procedures, processes and work activities (for example, dismantling, decontamination or demolition of structures, systems and components) as described in the approved final decommissioning plan.

The intervenor has reviewed CNL's licence application, the Commission Member Documents (CMDs) from both CNL and CNSC Staff, and all relevant and available supporting materials. In response, the intervenor has a number of concerns in regard to this licencing application pertaining to:

(1) The reduced opportunity for public involvement should the 14-year licence remain;

(2) The inadequate assessment of 'adverse environmental effects' for projects on federal lands per *CEAA 2012;*

(3) Discrepancies in the proponent's framing of the scope of licence sought;

(4) The licencee's insufficient application materials demonstrating compliance with the *NSCA* and its regulations including the *General Nuclear Safety and Control Regulations, Class I Nuclear Facilities Regulations* and the *Nuclear Security Regulations*;

[7] Canadian Nuclear Safety Commission (2020), "Canadian Nuclear Laboratories Ltd. Douglas Point Waste Facility" CMD 20-H4, p i **[CNSC CMD]**
[8] IAEA (2007) International Atomic Energy Agency, IAEA Safety Glossary, Terminology Used in Nuclear Safety and Radiation Protection, 2007 Edition, IAEA Vienna.

(5) CNL's use of vague, overly broad language and lack of specific references to information within supporting documents;

(6) CNL's failure to proper consider decommissioning with discussions of the CNSC's Safety and Control Areas (SCAs);

(7) Limitations posed to public interventions; and

(8) The potential for decision-making which is contrary to international guidance on decommissioning.

IV. SCOPE OF REVIEW

The intervenor received participant funding to review CNL's licence amendment application and related documentation, including CNL and CNSC Commission Member Documents (CMDs), with a focus on the environment and human health, best practices for environmental protection and sustainable development, and relevant international guidance. Our recommendations to the Commission are summarized in **Appendix A.** The intervenor also received funding to retain Dr. Hartmut Krugmann. Dr. Krugmann's expert report (see **Appendix B**) and CV (see **Appendix C**) are appended to this submission.

This intervention and expert report therefore considers the CNSC's jurisdiction per the *Nuclear Safety and Control Act* (NSCA) to ensure the adequate protection of the environmental and human health.[9] In meeting this objective, per section 24(4) of the *NSCA*, the intervenor has compiled its findings from its review of CNSC Staff and CNL Commission Member Documents (CMDs) and accompanying references, and has provided recommendations as well as suggested licence and licence condition revisions to the CNSC, to assist in its public interest and environmental review of the Douglas Point site.

Within this review, the intervenor has considered the extent to which the CNSC, enabled by section 24(4) of the *NSCA* has incorporated principles of international environmental law, such as the precautionary principle, into its licensing application review. We also draw on international benchmarks and precedents, where relevant.

[9] *Nuclear Safety and Control Act*, SC 1997, c 9

V. FINDINGS

For the reasons detailed below, we find that the requisite statutory and regulatory requirements have not been fulfilled and thus the Commission lacks the evidentiary and legal basis necessary to proceed with the licence amendment request. Namely:

(1) Fourteen-year licence reduces public involvement and potential for licence review;

(2) The CNSC's 'adverse environmental effects' assessment is unreasonable as it does not meet the purposes of *CEAA 2012*;

(3) CNL's Licence Application and CMD fail to properly describe the scope of licence sought;

(4) CNL's Licence Application insufficiently demonstrates compliance with NSCA and its regulations including the *General Nuclear Safety and Control Regulations, Class I Nuclear Facilities Regulations and Nuclear Security Regulations;*

(5) CNL's CMD is vague, contains irrelevant information, and is overly reliant on supporting documents;

(6) CNL's review of most SCA's fails to properly consider decommissioning;

(7) Public participation rights are constrained due to CNL's Licence Application and supporting CMD being too deficient in detail and analysis; and

(8) IAEA guidance regarding 'proper management' of decommissioning waste is not duly considered.

Furthermore, as the current licence is valid until 2034, there is no pressing need for the CNSC to issue the amended licence. Thus, the licence amendment application should be returned to the proponent to remedy the deficiencies noted below and if resubmitted, the CNSC should proceed with its review of potential adverse effects as required by federal environmental assessment legislation.

i. Fourteen-year licence reduces public involvement and potential for licence review

As previously submitted to the CNSC, the intervenor does not support the CNSC's transition to longer, typically 10-year licences. Shorter-term licences should be relied upon as they provide more frequent opportunities to publicly reassess a licence in accordance with licensing purposes,

including compliance with regulatory requirements like CNSC RegDocs and international guidance.[10]

In this instance, granting an amended 14-year licence would reduce the role for public involvement, despite the licensing conditions relying on a waste disposal strategy still undergoing federal environmental assessment (EA) review. It would also significantly reduce public scrutiny of licensee operations, access to information, and effectively eliminate meaningful public participation for the licence duration.[11] As the proponent in this licence amendment application relies upon the outcome of yet-to-be completed federal EAs, the Commission should not issue a 14-year licence. Instead, upon the completion of the federal EAs, the Commission should issue a notice of hearing so that the public and relevant government agencies and experts can weigh in on the decommissioning activities contemplated within CNL's decommissioning plan.

RECOMMENDATION NO. 1: The Commission should find that granting an amended 14-year licence would reduce the frequency of opportunities to review the licence alongside licensing objectives and yet-to-be-completed federal environmental assessments. Upon the completion of the federal EAs relied upon in this application, the Commission should issue a notice of hearing so that the public, experts and relevant government agencies can weigh in on the decommissioning activities contemplated within CNL's decommissioning plan.

ii. The CNSC's 'adverse environmental effects' assessment is unreasonable as it does not meet the purposes of CEAA 2012

The intervenor has reviewed the *CEAA 2012* section 67 analysis conducted by the CNSC, as set out in the Environmental Review and Protection Report ("ERP Report").[12] Section 67 of *CEAA 2012* applies to projects planned for federal lands and prohibits an authority from carrying out the project, without first determining that significant adverse environmental effects will not be caused. Accordingly:

> **Project carried out on federal lands**
> **67** An authority must not carry out a project on federal lands, or exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this

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[10] *See* S. Blake (2017) Administrative Law in Canada (6th Ed): Toronto: Lexis Nexis Canada, p 138 **[Admin Law in Canada]**

[11] Canadian Nuclear Safety Commission, "Public Hearing " Transcript (May 29, 2018), online: http://www.nuclearsafety.gc.ca/eng/the-commission/pdf/2018-05-29-HearingCorrected.pdf, p 292

[12] While this section assumes (but does not decide) that *CEAA 2012* and not the *Impact Assessment Act* applies, the intervenor retains the right to provide future submissions on whether the correct federal environmental assessment legislation was applied.

> Act that could permit a project to be carried out, in whole or in part, on federal lands, unless
>
> **(a)** the authority determines that the carrying out of the project is not likely to cause significant adverse environmental effects; or
>
> **(b)** the authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides that those effects are justified in the circumstances under subsection 69(3).

While *CEAA 2012* is silent on the process to be followed in making a determination whether a project will likely cause significant adverse environmental effects, the Canadian Environmental Assessment Agency has developed an Operational Policy Statement (herein, "Statement") as a guide.[13] As noted in the CNSC CMD, this Statement was adopted as their guide in making a section 67 determination.[14] However, despite the CNSC's reliance on this Statement, a number of omissions remain, which must be remedied prior to the matter being ready for a licencing hearing.

As detailed below, the intervenor submits the CNSC's section 67 environmental effects assessment is grossly inadequate as it:

1. Fails to have regard to certain required principles when making an environmental effects determination;
2. Proposes mitigation measures which are too deficient in detail to be acceptable offsets for potential adverse environmental effects;
3. Ignores the differing complexities and hazard potentials specific to decommissioning undertakings;
4. Reaches a finding of 'no adverse environmental effects' without any prior public comment; and
5. Disregards the purpose of the Act requiring the application of the precautionary principle for matters of uncertainty and potential risk.

First, the CNSC did not have regard to certain required principles when it made its environmental effects determination. This includes that the approach and depth of its analysis be commensurate with the risk and likelihood of significant adverse environmental effects associated with carrying out the project.[15] In fulfilling this principle, the CNSC should have

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[13] Online: https://www.canada.ca/content/dam/iaac-acei/documents/policy-guidance/projects-federal-lands/projects-on-federal-lands.pdf **[Policy Statement]**

[14] CNSC CMD, ERP Report, p 13

[15] B. Hobby, Canadian Environmental Assessment Act: An Annotated Guide (loose-leaf updated 2020), at s 67 commentary; Policy Statement p 5,

sought the expert advice of other federal departments and referenced their input and review in its findings.[16]

For instance, the CNSC should have relied on agencies, such as Health Canada, who possess specialist information and knowledge with respect to health and safety aspects of the proposed decommissioning operations. Instead, the health studies relied upon in the section 67 assessment were not health assessments completed directly for this purpose. Rather, CNSC undertook a review of existing health data collected by CNL and CNSC. The intervenor submits that the depth and rigour of the CNSC's analysis is not commensurate to the risk posed by the multitude of decommissioning activities proposed by CNL.

Second, the deficient analysis of environmental effects is not remedied by the CNCS's consideration of mitigation measures. Given the range of decommissioning activities being proposed by CNL - many of which are distinct from the decommissioning activities approved for the current licence (see Dr. Krugmann's report at Sections 3, 4 and 5.1 which summarizes the original decommissioning strategy and planning envelopes against the new decommissioning strategy and planning envelopes proposed by CNL) - the ERP Report should have required the development of follow-up programming to mitigate environmental effects.

Adaptive management, which includes follow-up monitoring to ensure compliance and verification with licensing standards, is even more necessary given the recognized complexities and unknowns that accompany decommissioning. As the International Atomic Energy Agency (IAEA) has recognized, "challenges remain in the achievement of safe and effective decommissioning."[17] Thus, given the high risk to the environment, human health and future generations posed by decommissioning - which spans the reactor's defueling, deconstruction and dismantling,[18] the decontamination of the facility's buildings and lands, and the management of resulting radioactive waste[19] - the CNSC should have incorporated different complexities and hazard potentials within its assessment.

To this end, the CNSC's review and proposed mitigation measures should have attracted the *most* in-depth consideration and analysis. Instead, the mitigation measures proposed in response to the potential environmental effects are so broadly scoped (ie. 'noise generation' and an accompanying commitment to 'adhere to appropriate hearing protection standards') as to be effectively meaningless. What should have been undertaken is a detailed review of environmental effects of each project within the proposed decommissioning envelopes and

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[16] Policy Statement, p 8
[17] IAEA (2007), Lessons Learned from Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities, online: https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1299_web.pdf
[18] World Nuclear Industry Status Report (2018), Status Report, p 134
[19] IAEA (2018) Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities

phases, and an analysis of potential mitigation measures. Within the mitigation measures proposed, the likelihood for success should have been discussed as well as the extent to which they would avoid, reduce, repair or compensate for the adverse effect. As it stands, the mitigation measures proposed are too critically deficient in detail to be accepted as offsets for potential adverse environmental effects.

Third, the CNSC's finding of 'no adverse environmental effects' is not reasonable given the cursory level of analysis it employed in its assessment. The environmental effects to be reviewed in a section 67 analysis are those set out in section 5 of the Act. In applying section 5, Justice Bell in *Maloney v. Garneau (2018)*, 2018 CarswellNat 1359, 18 C.E.L.R. (4th) 53 (F.C.) held:

> A reasonable determination of whether a project is likely to cause significant adverse environmental effects under section 67 of the *CEA Act* must consider the potential negative impact of a project on aquatic life and migratory birds, the possibility of contaminants or pollutants that could have a negative impact on the environment, habitat fragmentation, as well as the magnitude, geographic extent, timing, frequency, duration, and reversibility of such factors, among others. This includes a consideration of mitigating factors that could serve to minimize the adverse impacts of the project. The determination must also consider, where relevant and available, knowledge and experience with similar past environmental effects.[20]

Fourth, prior to reaching its finding of 'no adverse environmental effects,' the CNSC did not initiate any public comment period. For instance, in *Communities and Coal Society and Voters Taking Action on Climate Change v. Canada (Attorney General)* (2018), 2018 CarswellNat 116, 17 C.E.L.R. (4th) 12 (F.C.),[21] before a port authority reached its section 67 determination, it required the proponent to submit an environmental impact assessment (EIA). This EIA was then subject to a 30-day public comment period and a subsequent review by experts. On the basis of the public comments received, the proponent was required to conduct additional assessments (in this instance, specific to health). The findings of follow-up assessments were then incorporated into a revised EIA and subsequently reviewed by other subject matter experts. This case is telling not only of the level of detail and analysis which should have been employed by the CNSC in conducting its section 67 analysis, but the level of public engagement which should have occurred prior to the finding of 'no adverse environmental effect.'

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[20] *Maloney v. Garneau (2018)*, 2018 CarswellNat 1359, 18 C.E.L.R. (4th) 53 (F.C.), para 26

[21] Affirmed in *Communities and Coal Society v. Vancouver Fraser Port Authority* (2019), 2019 CarswellNat 1248, 24 C.E.L.R. (4th) 1 (F.C.A.)

Fifth, the CNSC disregarded the purpose of *CEAA 2012* specific to the review of projects on federal lands, which requires that an assessment of projects on federal lands be reviewed in a precautionary manner:[22]

> **Purposes**
> **4** **(1)** The purposes of this Act are […]
>
> **(g)** to ensure that projects, as defined in section 66, that are to be carried out on federal lands, or those that are outside Canada and that are to be carried out or financially supported by a federal authority, are considered in a careful and precautionary manner to avoid significant adverse environmental effects;

The precautionary principle, as relied upon in *CEAA 2012*, requires a cautionary approach, whereby if there is sufficient evidence that an activity is likely to cause irreversible harm to the environment, the decision maker is obliged to prevent or terminate the activity.[23] This principle of international environmental law has also been adopted into Canada's application of environmental law, as held by the Supreme Court of Canada in its seminal 2001 decision in *Spray-Tech*:

> The interpretation of By-law 270 contained in these reasons respects international law's "precautionary principle", which is defined as follows at para. 7 of the Bergen Ministerial Declaration on Sustainable Development (1990):
>
> > In order to achieve sustainable development, policies must be based on the precautionary principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.[24]

As such, there is a positive duty on the CNSC to ensure the activities it licences do not cause unacceptable harm to the environment.[25] It also requires that the CNSC's application of its statutory authority in its licensing and EA decisions be forward looking, as the Supreme Court of Canada held in *Castonguay:*

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[22] This is echoed in the Policy Statement as a required principle of the section 67 determination process.
[23] Cameron J and Abouchar J (1990), The precautionary principle: a fundamental principle of law and policy for the protection of the global environment, Boston College International and Comparative Law Review, 14(1), p 3 **[Cameron & Abouchar]**
[24] *114957 Canada Ltee (Spray-Tech) v Hudson (Ville)* 2001 SCC 40 (CanLII)
[25] Cameron & Abouchar (1990), 22

> This emerging international law principle recognizes that since there are inherent limits in being able to determine and predict environmental impacts with scientific certainty, environmental policies must anticipate and prevent environmental degradation (emphasis added).[26]

In light of these findings by the Supreme Court of Canada, the CNSC ought to have considered potential future harms related to proposed decommissioning activities. In adopting a forward looking decision making approach, the CNSC should also have considered how its environmental effects analysis is responsive to future change including new scientific knowledge and changes in community expectations, and anticipates new threats like climate change.[27] As a required purpose of the Act, the CNSC should have addressed these matters of uncertainty and potential risk.[28]

RECOMMENDATION NO. 2: The Commission should not proceed with licensing until the deficiencies in the *CEAA 2012*, section 67 determination have been remedied. The CNSC's finding of 'no adverse environmental effect' is not reasonable as it failed to have regard to certain required principles when making an environmental effects determination; proposed mitigation measures which are too deficient in detail to be acceptable offsets for potential adverse environmental effects; ignored the differing complexities and hazard potentials specific to decommissioning undertakings; reached a finding of 'no adverse environmental effects' without any prior public comment; and disregarded the Act's purpose requiring the application of the precautionary principle for matters of uncertainty and potential risk.

iii. CNL's Licence Application and CMD fail to properly describe scope of licence sought

Several times in the Licence Application[29] and in the CNL CMD[30] reference is made to *final* decommissioning of DPWF, which could give the reader the impression that CNL is seeking a licence that will permit CNL to carry out a complete decommissioning of all parts of the DPWF, or at least provide CNL with a licence framework, which will all but guarantee approval of its plans to carry out a complete decommissioning of the DPWF.

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[26] *Castonguay Blasting Ltd. v Ontario (Environment)*, 2013 SCC 52 (CanLII), para 20
[27] Richardson B (2017) Time and Environmental Law: Telling Nature's Time, University Press, London, p 146
[28] *Ibid*, p 150
[29] *Application for Licence Amendment to Proceed with Phase 3 Decommissioning at Douglas Point Waste Facility*, July 18, 2019. Available online: https://www.cnl.ca/site/media/Parent/Douglas%20Point%20Waste%20Facility%20Licence%20Amendment%20Application(1).pdf. **[Licence Application]**
[30] CMD 20-H4.1, *Written submission from Canadian Nuclear Laboratories Ltd. In the Matter of the Canadian Nuclear Laboratories, Douglas Point Waste Facility*, September 9, 2020. Available online: https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD20/CMD20-H4-1.pdf **[CNL CMD]**

For example, in the Licence Application the following examples can be found, which give the impression that CNL is applying for a licence to decommission the DPWF in its entirety:

- Page 1: The title of the Licence Application is worded as follows: "Application for Licence Amendment to Proceed with Phase 3 Decommissioning at Douglas Point Waste Facility" (emphasis added).
- Page 1: "The purpose of this letter is to submit an application to the Canadian Nuclear Safety Commission (CNSC) for an amendment of the Douglas Point Waste Facility (DPWF) decommissioning Licence, WFDL-W4-332.02/2034 [1] to proceed with Phase 3 Decommissioning involving dismantling and demolition of all remaining facilities of the DPWF" (emphasis added).
- Page 2: "Pursuant to the Nuclear Safety and Control Act and associated regulations, CNL is requesting that the Commission, or a person authorized by the Commission, amend the current DPWF Decommissioning Licence [1] to authorize CNL to proceed with Phase 3 Decommissioning involving dismantling and demolition of all remaining facilities of DPWF" (emphasis added).
- Page 11: "CNL is applying for a licence amendment to authorize the Phase 3 Decommissioning involving dismantling and demolition of all remaining facilities of DPWF. The details of the Phase 3 Decommissioning are documented in the Program Overview DDP Volume 1[A-4]. The Phase 3 Decommissioning work will be performed in compliance with CNL's Management System framework [A-14] and Safety Control Areas (SCAs) listed in the DPWF LCH [A-3]." (emphasis added)
- Page 11: "The proposed start date for Phase 3 Decommissioning at DPWF is 2020 and the proposed completion date is 2070" (emphasis added).

Similarly, in the CNL CMD, the following is said which suggests that the licence sought is for complete decommissioning:

- Page 1: "The purpose of this document is to present information in support of the application from CNL [1] to amend the current Waste Facility Decommissioning Licence for DPWF [2] authorizing CNL to proceed with final decommissioning" (emphasis added).
- Page 2: "In 2019, CNL requested the CNSC to amend the Waste Facility Decommissioning Licence of DPWF to enable CNL to proceed with final decommissioning at DPWF" (emphasis added).

In this context it is worth keeping in mind how final decommissioning is defined in the CNL CMD:

> Final Decommissioning: This phase includes the final decommissioning activities, implemented in a series of sub-phases that will result in the removal of the equipment and components, buildings and structures, and the return of the land for reuse consistent with its location adjacent to the Bruce site.[31]

Taken at face value, this definition implies that, when CNL requests authorization to proceed with final decommissioning, it is indeed asking for a licence permitting a complete decommissioning with removal of all parts of the DPWF, including reactor building and spent fuel. As seen in the examples above, there are indeed several instances where CNL states that the licence sought is for final decommissioning or decommissioning of all DPWF facilities.

Throughout the Licence Application and the CNL CMD, CNL continuously fails to properly distinguish between the decommissioning activities they intend to complete under the amended licence if approved (Planning Envelopes A-C) and the decommissioning activities they seek to be authorized (final decommissioning of all remaining facilities of DPWF or Planning Envelopes A-C plus D and E).

A lack of clarity on such a central aspect of the licence sought should not be accepted by the Commission for a number of reasons:

- These omissions can be easily remedied;
- They are likely to cause confusion among members of the public reading the Licence Application; and
- It sets a poor precedent for future decommissioning licence applications if such a degree of uncertainty is permissible.

The Commission can and should require far greater clarity in licence applications on matters of such significant importance. This is especially true as more decommissioning licence applications are anticipated in the coming years. According to the most recent World Nuclear Industry Status Report, a 'massive shutdown of plants' is forecasted between now and 2057. Of the 173 reactors already in permanent shut down, 216 are expected to follow by 2030 and an additional 111 by 2057.[32] By 2050, almost 400 reactors will be shut down.[33] Canada is on a similar trajectory, with nine of its twenty-two CANDU reactors to be permanently shut down by 2024.

Allowing an application of such poor quality is not conducive to ensuring future applications meet a reasonable standard. It also reflects poorly on an industry charged with the important and

[31] CNL CMD, p. 4.
[32] *Ibid.*
[33] Solovena *et al.* (2018), Forecasting the dynamics of decommissioning nuclear power plants, Journal of Physics Conference Series, p 4

high risk task of dismantling nuclear reactors. For these reasons and given the deficiencies in the Licence Application document discussed below, the intervenor **recommends** that the Commission set an appropriate standard for such applications by refusing to consider CNL's Licence Application in its current form.

RECOMMENDATION NO. 3: The Commission should not proceed with licensing given the deficiencies in CNL's Licence Application. Throughout the Licence Application and the CNL CMD, CNL continuously fails to properly distinguish between the decommissioning activities they intend to complete under the amended licence if approved (Planning Envelopes A-C) and the decommissioning activities they seek to be authorized (final decommissioning of all remaining facilities of DPWF or Planning Envelopes A-C plus D and E). Proceeding with licencing in light of these deficiencies would set a poor precedent for the content and form allowable in decommissioning licence applications.

iv. CNL's Licence Application insufficiently demonstrates compliance with NSCA and its regulations

Appendix A in CNL's Licence Application seeks to provide an overview of how the application lives up to key regulatory requirements in the *Nuclear Safety and Control Act* (NSCA) and three of its regulations. It does so by providing a table that lists the relevant regulatory requirements as well as CNL's responses aimed at demonstrating how its application meets these requirements.

Having reviewed the Licence Application's Appendix A, the intervenor finds that a number of CNL's responses are unsatisfactory or deficient in terms of addressing the regulatory requirements. The intervenor's findings are presented below for each of the three regulations.

In addition to these specific findings, the intervenor notes that a number of key documents, such as the Douglas Point Waste Facility Detailed Decommissioning Plans (DDPs), and in particular the DDP Volume 1,[34] are referenced on numerous occasions. These references do not pinpoint where the relevant information can be found, but simply ask the reader to consult the particular document in its entirety. The intervenor finds this approach unsatisfactory – as evidenced by our more specific comments below – and **recommends** providing specific references whenever a supporting document is relied upon. The intervenor furthermore **requests** that these supporting documents be included as appendices to the Licence Application, given the significant number of references that are made to the supporting documents.

RECOMMENDATION NO. 4: Licensees should not be permitted to reference the entirety of a supporting document to demonstrate compliance with regulatory requirements. There are numerous instances of this in CNL's Licence Application and the Commission should require

[34] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview, 22-00960-DDP-001

licencee's to provide sufficient citations and to pinpoint relevant information, necessary to demonstrate that regulatory requirements have been met.

General Nuclear Safety and Control Regulations, SOR/2000-202[35]

Section 3(1)(b) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain information regarding the activity to be licensed and its purpose. In CNL's Licence Application the following reply is provided:

> CNL intends to proceed with decommissioning of DPWF as described in Program Overview DDP Volume 1[A-4]. CNL requests to amend the current licence to allow to proceed with the Phase 3 Decommissioning involving dismantling and demolition of all remaining non-nuclear and nuclear buildings, structures, systems and components.[36]

The intervenor finds CNL's answer to this key question both overly vague and somewhat misleading. It is overly vague as it relies for the most part on a general reference to the lengthy DDP Volume 1, which has not been submitted/made generally available along with the Licence Application. The intervenor **recommends** requiring that CNL make this reference more specific, i.e. point out the parts of the DDP Volume 1 that describe the activity to be licenced and its purpose. The intervenor also **recommends** requiring that CNL supplement this reference to the DDP Volume 1 with a summary description of the proposed decommissioning activities. This recommendation is also supported by the fact that CNL's reply is misleading as it suggests that the licence sought will allow CNL to carry out a complete decommissioning of DPWF, which does appear to accurately reflect what CNL actually intends to do under the licence should it be granted. Requiring CNL to provide a summary description would likely help remedy the misleading nature of CNL's reply.

The intervenor has considered Sections 3(1)(c) and 3(1)(j) together as they contain related requirements. Section 3(1)(c) requires that an application include the name, maximum quantity and form of any nuclear substance to be encompassed by the licence, while section 3(1)(j) requires that the application include the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the proposed activity. CNL again relies on a generic reference to the entire 170+ page DDP Volume 1, as well as the 2018 Annual Compliance Monitoring Report so far as section 3(1)(j) is concerned. The intervenor **recommends** replacing these generic references with full citations including page pinpoints, and a review of relevant information. This information should be easily retrievable and included in the Licence Application itself. If CNL or CNSC Staff are of the view that summarizing this information within the Licence Application is too onerous, then the intervenor suggests it would

[35] The *General Nuclear Safety and Control Regulation* is covered on pp 5-9 of CNL's application
[36] Licence Application, p 6

be even more difficult for a member of the public to compile and cross-reference the information among documents. Such an approach is not conducive to public engagement and the Commission should require CNL to make the necessary efforts to provide this information in an accessible manner, in order to demonstrate compliance with the regulatory requirements.

Section 3(1)(d) requires a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence. The intervenor **recommends** requiring that CNL include a brief description of the facility as well as more specific references the parts of the DDP Volume 1 that contain the required information.

Section 3(1)(e) requires information regarding the proposed measures to ensure compliance with the Radiation Protection Regulations, the Nuclear Security Regulations and the Packaging and Transport of Nuclear Substances Regulations, 2015. CNL's reply to the requirement is as follows:

> Compliance with the Radiation Protection Regulations, the Nuclear Security Regulations and the Packaging and Transport of Nuclear Substances Regulations is ensured through the implementation of CNL's Radiation Protection Program [A-5], [A-6], the Physical and Cyber Security Programs [A-7], [A-8], [A-9], [A-10] and the Transportation of Dangerous Goods Program [A-ll], [A-12] (as per Licence Conditions 9.1, 14.1, and 16.1of the DPWF LCH [A-3].[37]

The intervenor **requests** a confirmation that these existing programs have been drafted with the proposed decommissioning activities in mind, and **recommends** that CNL be required to include specific information in the application demonstrating how these existing programs will help ensure such compliance.

Section 3(1)(f) requires inclusion of information regarding any proposed action level for the purpose of Section 6 of the Radiation Protection Regulations. CNL replies that "Action levels for the prototype waste facilities are defined in Licence Condition 9.2 of the DPWF LCH [A-3]." The intervenor **asks** whether these action levels have been set with the proposed decommissioning activities in mind, and if not, whether it has been verified that they are suitable for these activities?

In case of an application for a licence amendment, section 6(a) requires the inclusion of "a description of the amendment, revocation or replacement and of the measures that will be taken and the methods and procedures that will be used to implement it." CNL's reply is misleading once again as it states that the licence amendment is intended "to authorize the Phase 3 Decommissioning involving dismantling and demolition of all remaining facilities of DPWF"

[37] Licence Application, p 6

and includes a broad reference to the entire DDP Volume 1. The intervenor again **requests** a more specific answer, which summarizes the proposed activities in a meaningful way, in order to ensure the public and the Commission have a reasonable understanding of the goals sought by CNL in bringing its Licence Application.

Section 6(b) requires that the application include "a statement identifying the changes in the information contained in the most recent application for the licence". CNL's reply does not provide such a statement, but instead simply claims, inter alia, that "CNL's decommissioning approach and end-state for DPWF have not been changed". The intervenor does not agree with this reply. As outlined in our expert report by Dr. Krugmann (see Appendix B at Sections 3, 4 and 5.1 which summarizes the original decommissioning strategy and planning envelopes against the new decommissioning strategy and planning envelopes proposed by CNL), drastic changes are proposed in the approach to phase 3 of the decommissioning in comparison to the existing licence. Thus it is necessary to reference information in the current application which differs or modifies the existing licence. The intervenor therefore **requests** that the Licence Application be updated to include a statement that identifies the changes compared to CNL's existing licence and decommissioning plans.

Section 6(c) requires "a description of the nuclear substances, land, areas, buildings, structures, components, equipment and systems that will be affected by the amendment, revocation or replacement and of the manner in which they will be affected". Here, CNL also includes a general reference to the DDP Volume 1, without specifying where the required information can be found. The intervenor **recommends** that CNL at least be required to include a brief description of the current configuration of the DPWF, including a list of the non-nuclear buildings, structures, components and systems that have already been demolished and removed, and that all references to the DDP Volume 1 be made more specific.

RECOMMENDATION NO. 5: The Commission should not proceed with licensing until the information which demonstrates compliance with the provisions of the *General Nuclear Safety and Control Regulations* is expressly set out in the text of the Licence Application. The Commission should also require CNL to detail *how* existing programs, like their Radiation Protection Program and Physical and Cyber Security Program, allow them to conclude regulatory requirements have been fulfilled. Further, all references to DDP Volume 1 made to demonstrate compliance with the regulations should be updated with full citations and page numbers.

Class I Nuclear Facilities Regulations, SOR/2000-204[38]

Section 3 contains a number of requirements for what information must be included in an application for a licence in respect of a Class I nuclear facility, in addition to the information required by Section 3 of the General Nuclear Safety and Control Regulations. Section 3(a) requires that the licence application include "a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone," while section 3(b) requires the inclusion of "plans showing the location, perimeter, areas, structures, and systems of the nuclear facility."

In its reply, CNL simply refers to the DDP Volume 1. The intervenor **recommends** that CNL be required to include a brief description of the site in its Licence Application, a plan of the facility, well as specific references to the relevant part(s) of the DDP Volume 1.

Section 3(e) requires the inclusion of "the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on". The intervenor **reiterates** what was said above in regards to sections 3(1)(c) and 3(1)(j) of the General Nuclear Safety and Control Regulations, namely that the required information should be included in the application, and that this information should be relatively easy to include in the application itself.

Section 3(f) requires the inclusion of "the proposed worker health and safety policies and procedures". In its reply, CNL refers to the 'Occupational Safety and Health Program', as per the SCA "Conventional Health and Safety" Licence Condition 10.1 of the DPWF Licence Condition Handbook. The intervenor **requests** information on whether this program has been amended to reflect the proposed decommissioning activities, and if not, whether and how it has been confirmed that this program is sufficient in light of the proposed licence amendments.

Section 3(g) requires the inclusion of "the proposed environmental protection policies and procedures". CNL replies to this that "CNL has programs and procedures in place to protect the environment through CNL's Environmental Protection Program." The intervenor finds this reply entirely lacking, as it fails to demonstrate any specific analysis of whether and how the existing programs and procedures will be sufficient to deal with the proposed decommissioning activities. The intervenor therefore **requests** that information be provided in the application, which shows how the existing policies and programs will ensure sufficient protection of the environment if the proposed decommissioning activities are carried out. This should include a description of key decommissioning activities accompanied by a description of how the existing policies and programs will ensure that the environment is not adversely impacted by these activities.

[38] The *Class I Nuclear Facilities Regulation* is covered on pp 10-12 of CNL's application

Section 3(h) requires the inclusion of "the proposed effluent and environmental monitoring programs". In response, CNL simply refers to the DDP Volume 1. The intervenor **recommends** that summary information on these monitoring programs be included in the licence application.

Section 3(k) requires the inclusion of "the proposed plan for the decommissioning of the nuclear facility or of the site", to which CNL responds that the proposed plans for the decommissioning of DPWF are provided in the DDP Volume 1. The intervenor finds this response inadequate for the reasons outlined above regarding section 3(1)(b) of the General Nuclear Safety and Control Regulations, namely that CNL's answer to this key question is both overly vague and somewhat misleading. It is vague as it relies for the most part on a general reference to the lengthy DDP Volume 1, and it is misleading as it suggests that the licence sought will allow CNL to carry out a complete decommissioning of DPWF. The intervenor therefore again **recommends** requiring that CNL make this reference more specific, i.e. point out the parts of the DDP Volume 1 that describe the activity to be licenced and its purpose, and also **recommends** requiring that CNL supplement this reference to the DDP Volume 1 with a summary description of the proposed decommissioning activities.

Section 7(a)-(k) contain a number of requirements, which apply specifically to licences to decommission Class I nuclear facilities. CNL's response to these requirements mainly includes general references to supporting documents, including the DDP Volume 1 and the Environmental Review for DPWF.[39] The intervenor **reiterates** that such references do not live up the regulatory requirements as they are far too vague and lead to considerable uncertainty by failing to pinpoint where the relevant information can be found, and given that the supporting documents are not made available along with the Licence Application itself. This approach is likely to have a chilling effect on members of the public reading the hearing documents, and discovering that they lack most of this essential information and need to jump through additional hoops just to get access to this information. The intervenor therefore **recommends** that all these general references to supporting documents be replaced by more specific references, and that summaries of the relevant information found in the supporting documents be added to the application.

RECOMMENDATION NO. 6: The Commission should not proceed with licensing until the information which demonstrates compliance with the *Class I Nuclear Facilities Regulations* provisions is expressly set out in the text of the Licence Application. The Commission should also require CNL to detail *how* existing programs like their Occupational Safety and Health Program and Environmental Protection Program have been updated to reflect the nature of activities sought by this licence amendment application and how, on the basis of these programs, they are able to conclude that regulatory requirements have been fulfilled. Further, all references

[39] Environmental Review for Douglas Point Waste Facility - Phase 3 Decommissioning, 22-03710-ENA-001, Revision 0, 2019 July

to DDP Volume 1 made to demonstrate compliance with the *Class I Nuclear Facilities Regulations* should be updated with full citations and page numbers.

Nuclear Security Regulations, SOR/2000-209[40]

These regulations require certain security-related information to be included in CNL's application. CNL's responses to these requirements also consist mainly of broad references to supporting documents, which are, however, not accompanying the application and have not been made readily available to the public. The intervenor again **recommends** that all these broad references to supporting documents in their entirety be replaced by more specific references, and that summaries of the relevant information found in the supporting documents be added to the application.

The intervenor also **asks** whether CNL has verified if the security arrangements described in CNL's Security Program documents and Douglas Point Emergency Response Service Agreement are sufficient – or whether CNL has updated the security arrangements to handle the decommissioning activities that CNL plans to carry out.[41]

RECOMMENDATION NO. 7: The Commission should ensure that licensees, when referencing supporting documents made to demonstrate compliance with regulations including the *Nuclear Security Regulations*, provide full citations and page numbers.

v. CNL's CMD is vague, contains irrelevant information, and is overly reliant on supporting documents

Much like the Licence Application, the CNL CMD does little beyond offering what can, at best, be labelled as generic information to support its application. As such, the CNL CMD contains very little specific information regarding how CNL actually plans to carry out the decommissioning. Instead of providing such information, most of the CNL CMD speaks in very general terms about CNL as an organization and provides a significant amount of information regarding CNL's past performance and current activities, while largely neglecting to provide specifics of the proposed decommissioning activities that it is supposed to address.

More specifically, the intervenor finds that the CNL CMD is over-reliant on references to supporting documents, and that this includes issues of central importance to the Licence

[40] The *Nuclear Security Regulation* is covered on pp 13-14 of CNL's application
[41] *See* CNL Licence Application references [A-7] Security, Program Description Document, 900-508710-PDD-001, Revision 2, 2018 November; [A-34] Douglas Point Emergency Response Service Agreement, 22-08620-021-000-001, Revision 1, 2018 December

Application, that should not be addressed by referencing a supporting document as a whole. Rather, these references should be replaced by the inclusion of actual information directly in the application itself. It is insufficient to merely reference other documents – some of them very lengthy – that supposedly contain the required information. Doing so, places an undue burden on members of the public and on the Commission, as it requires them to seek out this information by themselves by parsing through lengthy supporting documents. Furthermore, where references are made, they should pinpoint where in the supporting documents the relevant information may be found and not simply refer to an entire document.

While it was beyond the scope of our review to consider and suggest all information that ought to be included in the CNL CMD, we will provide some examples below of information that we find to be absent from the CMD, and which should be brought forward and presented in a more concise manner, prior to this matter proceeding to the Commission for licensing. All in all, what the intervenor requests is that the necessary information be presented clearly in a cohesive way to give the public and the Commission a sufficiently detailed overview of what activities the licence would permit.

Additionally, where supporting documents are relied upon in the CNL CMD to a significant degree, they should be included as appendices to the CMD to facilitate public participation. As such, given its current form and significant lack of specific information, it is the intervenor's view that the CNL CMD – like the Licence Application – is far too vague to form the basis of a licence decision by the Commission.

RECOMMENDATION NO. 8: The Commission should not permit CNL to reference documents of central importance to their application without including a full citation and synopsis of relevant information directly in the text of its Licence Application. It is insufficient to merely reference other documents – some of them very lengthy – that allegedly contain the requisite information. Doing so places an undue burden on members of the public and on the Commission by making this essential supporting documentation inaccessible.

vi. CNL's review of most SCA's fails to properly consider decommissioning

Most of CNL's review of SCA's in the CNL CMD provides only brief consideration of decommissioning, and for several SCA's the question of decommissioning is barely considered if at all.

Regarding the Management System SCA, a decommissioning organization chart is provided on page 29 of the CNL CMD, but no discussion is provided as to how this SCA relates to the proposed decommissioning activities. Similarly, no discussion is provided of the Human Performance Management SCA or the Operating Performance SCA, as it relates to

decommissioning. The Fitness for Service SCA is very briefly considered on page 41 regarding continued updating of relevant documents during the decommissioning, but otherwise no particular discussion is provided of the decommissioning phase. The Conventional Health and Safety SCA and decommissioning is very briefly considered on page 45 in relation to the need to consider changing hazards, but no actual considerations are made regarding such changing hazards. Regarding the Security SCA, no specific discussion of decommissioning is provided. The same is the case with the Safeguards and Non-Proliferation SCA.

Based on these findings, the intervenor **recommends** that the Commission require the inclusion of at least some basic amount of information on how each SCA relates to the proposed decommissioning activities. If CNL concludes that no particular considerations need to be made with respect to a particular SCA, then this should be noted in the CNL CMD along with reasons for such conclusions.

In addition to these comments, the intervenor also notes that while no detailed considerations are offered when it comes to decommissioning and the individual SCA's, CNL includes quite a bit of mostly generic information when discussing the SCA's. The intervenor believes the focus should be the opposite, i.e. the CNL CMD should include less generic information on CNL's existing compliance with the various SCA's, and should instead focus on providing more detailed considerations of the proposed decommissioning activities as they relate to each SCA.

Specific comments re. the CNL CMD

When discussing phase 3 final decommissioning, CNL says that this phase will result in "the return of the land for reuse consistent with its location adjacent to the Bruce site."[42] The intervenor submits that 'land for reuse consistent with adjacent land' is too vague a standard. It is additionally noted that "At the end of final decommissioning, the Douglas Point site will be suitable for other industrial or commercial use."[43] The intervenor **recommends** that the Commission request a specific standard for how clean the land must be before it can be repurposed for other use.

Further, subsection 3.3 titled Decommissioning Plans consists of less than one page of text, two tables and one figure showing the planning envelopes and overall timelines.[44] This section should contain a far more comprehensive summary of the proposed decommissioning plans covering all key aspects of the plans, and the supporting documents can then provide further detail. This approach should be taken, as the current approach requires that members of the public and the Commission will sift through all of the supporting documents to gain a reasonable

[42] CNL CMD, p 4
[43] *Ibid,* p 22
[44] *Ibid,* p 20

understanding and knowledge of the proposed decommissioning. The intervenor therefore **recommends** that the Commission require that CNL include a far more comprehensive summary of the proposed decommissioning activities in this section.

In addressing the Safety Analysis SCA, CNL proposes that:

> Safety assessments will be conducted for each Planning Envelope with areas and facilities containing radiological contamination and materials. These assessments will identify potential radiological hazards to workers and the public from both routine decommissioning activities and credible accidents during decommissioning, and address methods for mitigating the risks associated with such hazards. The safety recommendations will be captured in the respective DDPs and/or incorporated into associated Work Plans for implementation (emphasis added).[45]

The intervenor finds it highly problematic that safety assessments are planned to take place after a licence has been granted, as such assessments are needed now to help the Commission and the public identify potential issues that the proposed decommissioning activities may cause. Rather than grant a licence first and then carry out such safety assessments, the intervenor **recommends** that the Commission require these safety assessments to be carried out before granting a licence, to allow the Commission and the public to include the findings of such assessments in their overall review of the licence application, and if necessary, to include relevant safety-related requirements in the licence itself.

When addressing the Physical Design SCA, CNL notes that it "plans to design and construct a number of supporting facilities to increase reliability and enable safe decommissioning of DPWF" (emphasis added).[46] Such facilities are an integral part of the decommissioning project and should be designed and described, before a licence is granted. The intervenor **recommends** that the Commission require the inclusion of descriptions and draft designs of these support facilities in the Licence Application or the CNL CMD.

When addressing the Waste Management SCA, CNL claims that "The details of the final decommissioning planning and a conceptual decommissioning schedule is given in Section 3.3."[47] However, section 3.3. Decommissioning Plans (see pages 20-23), can hardly be said to contain the details of the final decommissioning planning, but mainly consists of very broad references to the DDP Volume 1 and the CNL licence application and two tables providing an overview of the different decommissioning planning envelopes and their timelines. The

[45] *Ibid,* p 38
[46] *Ibid,* p 40
[47] *Ibid,* p 59

intervenor strongly **recommends** including more details of the final decommissioning planning in section 3.3.

Further, CNL notes that "Based on the overall site decommissioning priority, individual DDPs covering the respective planning envelope will be developed and submitted to the CNSC staff for review and acceptance prior to execution".[48]

A similar comment is made in the Executive Summary where CNL notes that "Subject to the Commission's issuance of an amended licence, a DDP for each planned group of decommissioning activities must still be submitted to, and accepted by CNSC staff before work commences."[49] The intervenor disagrees with this post-licensing approach. It is the intervenor's submission that, in order demonstrate compliance with the licencing requirements in the NSCA and its regulations, these plans must be prepared and submitted to the CNSC and made publicly available prior to the hearing. The intervenor therefore **recommends** the Commission require this as a precondition to issuing a licence, at a minimum with regards to Planning Envelopes A-C.

RECOMMENDATION NO. 9: The Commission should require CNL to submit a DDP for each planned group of decommissioning activities *prior* to the matter proceeding to a licensing hearing. At a minimum, this should be required for Planning Envelopes A-C as a prerequisite of licensing.

vii. Public participation rights are constrained due to CNL's Licence Application and supporting CMD being too deficient in detail and analysis

In sum, the intervenor finds that the Licence Application and supporting CNL CMD contain far more information that either does not detail the proposed decommissioning or is not of central importance when deciding whether to grant a decommissioning licence, while neglecting the provision of specific information on the proposed decommissioning.

As such, the Licence Application and the CNL CMD both fail to provide essential information regarding the proposed decommissioning. Instead the documents include a significant amount of generic information and rely on overly broad references to supporting documents rather than actually include a sufficient level of information on key aspects of the proposed decommissioning in the application and CMD. This undermines the public hearing process as it makes it far more difficult and time consuming for members of the public to take part in the hearing in a meaningful way. It thus presents a significant barrier to public participation. Instead, the Commission should require licence applications to provide synopses of information and full,

[48] *Ibid*
[49] *Ibid,* p ii

detailed citations so that all reviewers can more easily access requisite information necessary to demonstrate statutory and regulatory requirements have been met.

According to section 9(b) of the NSCA, one of the Commission's two stated goals is "to disseminate objective scientific, technical and regulatory information to the public concerning the activities of the Commission and the effects, on the environment and on the health and safety of persons, of the development, production, possession and use referred to in paragraph (a)." If CNL is permitted to proceed with its application on the basis of its present, deficient Licence Application and the CNL CMD, this objective of the Commission is undermined.

Furthermore, section 40(5)(a) of the NSCA requires that the Commission hold public hearings on, among other things, licence amendments. Like any public hearing, the purpose of this hearing is to involve the public in the Commission's decision making process by providing them an opportunity to comment on the proposed decommissioning project. Again, if CNL is allowed to proceed with its application on the basis of the present deficient supporting documentation, the purpose of this hearing is undermined.

To further the objective of the Commission described in section 9(b) and to avoid undermining the requirement to hold public hearings under section 40(5), the intervenor therefore **urges** the Commission to require CNL to revise its Licence Application and the supporting CNL CMD to ensure that they contain a reasonable amount of information, and are drafted in a way that supports effective dissemination of information to the public and provide for meaningful public hearings that allow the public to participate effectively.

Allowing applicants to submit applications that contain very little specific information on the question before the Commission is clearly contrary to both section 9(b) and section 40(5). As it stands, the Licence Application and CNL CMD do not contain nearly enough specific information to allow members of the public to understand what the licence will permit, without extensively consulting a number of supporting documents, and thus undermines their ability to take part in the public hearing in accordance with section 40(5). Furthermore, relying on supporting documents, which are not made readily available to the public, exacerbates this problem and clearly runs counter to section 9(a).

With this application, CNL had ample opportunity to describe in sufficient detail how they intend to handle the decommissioning activities, yet they failed to do so in the Licence Application or the CNL CMD. The entire CMD appears more like a review of CNL's past and current activities at DPWF, rather than a document intended to describe their plans for the proposed decommissioning, leaving the reader with the impression that they have not made any specific plans, or at least have not yet fully considered how the proposed decommissioning will

live up to the regulatory requirements. The perhaps unintended message appears to be that numerous issues will be sorted out once a licence has been granted.

At the basis of this critique is the intervenor's position that the starting point and foundation for the Commission's considerations must be the Licence Application itself and the supporting CNL CMD submitted to the Commission for this hearing. In other words, the serious deficiencies in its application, and the lack of clarity regarding the perceived scope, must be remedied, before this application can be considered by the Commission.

The intervenor therefore **recommends** that the application be rejected and CNL be asked to revise its Licence Application and the supporting CNL CMD; to prepare detailed decommissioning plans (DDPs), Volume 2, 3, and 4 for planning envelopes A, B, and C, respectively (the three planning envelopes for which decommissioning activities are to be completed under the amended decommissioning licence); and to re-submit its revised Licence Application accompanied by a revised CNL CMD as well as DDP2, DDP3, and DDP4. This should be done to ensure that these documents provide all necessary information and details for the decommissioning activities proposed under the amended licence, and to make sure that the Licence Application and CNL CMD actually describe in sufficient detail what the proposed decommissioning will entail, without constantly defaulting to a reliance on supporting documents to explain the different aspects of the proposed decommissioning. Only once this has been done, should a new hearing be scheduled. Given that the Licence Application and the supporting CNL CMD are the main public facing documents submitted by CNL, these two documents must provide the public with a good understanding of what it is the applicant is seeking a licence for, before a hearing can proceed.

If a licence is granted, on the basis of the CNL's overly broad and vague Licence Application and CNL CMD, as well as an incomplete, inconsistent, and discrepant DDP (see Dr. Krugmann's report in Appendix B), this will not only run counter to the licence requirements in the NSCA and its regulations but also create the risk that future applications take a similar lax approach, further undermining public participation in the future.

RECOMMENDATION NO. 10: The Commission should require licence applications to provide synopses of information and full, detailed citations so that all reviewers can more easily access requisite information necessary to demonstrate statutory and regulatory requirements. This furthers the aims of the Commission per the *NSCA*, s 9(b) to publicly disseminate information and its obligations per s 40(5) to involve the public in licensing hearings.

RECOMMENDATION NO. 11: The Commission should require CNL to revise its Licence Application and supporting CMD to ensure both contain a reasonable amount of information,

and are drafted in a way that supports effective dissemination of information to the public and enables meaningful, fair and effective public hearings.

RECOMMENDATION NO. 12: To ensure the Commission has the information necessary and legal basis to proceed with a licensing decision, CNL's Licence Application should be rejected and returned to the licensee, with the requirement that the Licence Application, supporting CNL CMD, and detailed decommissioning plans (DDPs), Volume 2, 3, and 4 for planning envelopes A, B, and C, respectively (the three planning envelopes for which decommissioning activities are to be completed under the amended decommissioning licence) be revised. Until sufficient supporting information (including citations) is submitted for consideration, the licensing matter should not proceed.

viii. IAEA guidance regarding 'proper management' of decommissioning waste not duly considered

The IAEA's guidance on the policy and principles which should inform decommissioning strategies[50] recognizes that the decommissioning process should "include a long term commitment to ensuring that sites and waste from them are properly managed."[51] As indicated in the CNSC and CNL CMDs, CNLs approach for low-level waste is to move material off-site for storage, until permanent waste disposal facilities become available. For intermediate and high-level waste, the approach is to store the waste on-site, until long term disposal facilities become available. In both instances, CNL is presuming the availability of suitable long-term waste disposal facilities.

The intervenor submits that CNL's choice of waste management should not be implicitly scoped by the sufficiency of federal radioactive waste policies, whereby it is able to offload long term commitments and management. Per IAEA guidance, it must be demonstrated that waste from the decommissioning activities is "properly managed." In meeting this threshold, CNL should not be permitted to rely upon ongoing, federal environmental assessments by the CNSC.

RECOMMENDATION NO. 13: The Commission should require CNL to more clearly recognize, in their Licence Application and CMD, that their waste disposal strategy relies upon yet-to-be determined federal environmental assessments. The CNSC Staff CMD should also be updated to review how international guidance requiring the 'proper management' of waste produced during decommissioning is fulfilled given the limitations of Canada's radioactive waste policy.

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[50] IAEA (2012) Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities, No. NW-G-2.1

[51] United Nations Conference on Environment and Development (1992) Rio Declaration on Environment and Development, UN, New York

VI. ORDER REQUESTED

For the foregoing reasons provided in this intervention, the intervenor seeks:

(1) An order declaring CELA, CCRCA, NWW and Northwatch the status of intervenor;

(2) An order granting the intervenor an opportunity to make an oral presentation at the November 5-6, 2020 hearing;

(3) An order denying CNL's request to amend the decommissioning licence for the Douglas Point Waste Facility; and

(4) An order to the proponent remitting the licence application with direction that all deficiencies noted in Appendix A be remedied and the information demonstrating fulfillment of all statutory and regulatory requirements be clearly set out prior to proceeding with a licence amendment application.

Sincerely,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Kerrie Blaise
Counsel

Morten Siersbaek
Counsel

APPENDIX A

Summary of Recommendations

RECOMMENDATION NO. 1: The Commission should find that granting an amended 14-year licence would reduce the frequency of opportunities to review the licence alongside licensing objectives and yet-to-be-completed federal environmental assessments. Upon the completion of the federal EAs relied upon in this application, the Commission should issue a notice of hearing so that the public, experts and relevant government agencies can weigh in on the decommissioning activities contemplated within CNL's decommissioning plan.

RECOMMENDATION NO. 2: The Commission should not proceed with licensing until the deficiencies in the *CEAA 2012*, section 67 determination have been remedied. The CNSC's finding of 'no adverse environmental effect' is not reasonable as it failed to have regard to certain required principles when making an environmental effects determination; proposed mitigation measures which are too deficient in detail to be acceptable offsets for potential adverse environmental effects; ignored the differing complexities and hazard potentials specific to decommissioning undertakings; reached a finding of 'no adverse environmental effects' without any prior public comment; and disregarded the Act's purpose requiring the application of the precautionary principle for matters of uncertainty and potential risk.

RECOMMENDATION NO. 3: The Commission should not proceed with licensing given the deficiencies in CNL's Licence Application. Throughout the Licence Application and the CNL CMD, CNL continuously fails to properly distinguish between the decommissioning activities they intend to complete under the amended licence if approved (Planning Envelopes A-C) and the decommissioning activities they seek to be authorized (final decommissioning of all remaining facilities of DPWF or Planning Envelopes A-C plus D and E). Proceeding with licencing in light of these deficiencies would set a poor precedent for the content and form allowable in decommissioning licence applications.

RECOMMENDATION NO. 4: Licensees should not be permitted to reference the entirety of a supporting document to demonstrate compliance with regulatory requirements. There are numerous instances of this in CNL's Licence Application and the Commission should require licencee's to provide sufficient citations and to pinpoint relevant information, necessary to demonstrate that regulatory requirements have been met.

RECOMMENDATION NO. 5: The Commission should not proceed with licensing until the information which demonstrates compliance with the provisions of the *General Nuclear Safety and Control Regulations* is expressly set out in the text of the Licence Application. The Commission should also require CNL to detail *how* existing programs, like their Radiation Protection Program and Physical and Cyber Security Program, allow them to conclude regulatory requirements have been fulfilled. Further, all references to DDP Volume 1 made to demonstrate compliance with the regulations should be updated with full citations and page numbers.

RECOMMENDATION NO. 6: The Commission should not proceed with licensing until the information which demonstrates compliance with the *Class I Nuclear Facilities Regulations* provisions is expressly set out in the text of the Licence Application. The Commission should also require CNL to detail *how* existing programs like their Occupational Safety and Health Program and Environmental Protection Program have been updated to reflect the nature of activities sought by this licence amendment application and how, on the basis of these programs, they are able to conclude that regulatory requirements have been fulfilled. Further, all references to DDP Volume 1 made to demonstrate compliance with the *Class I Nuclear Facilities Regulations* should be updated with full citations and page numbers.

RECOMMENDATION NO. 7: The Commission should ensure that licensees, when referencing supporting documents made to demonstrate compliance with regulations including the *Nuclear Security Regulations*, provide full citations and page numbers.

RECOMMENDATION NO. 8: The Commission should not permit CNL to reference documents of central importance to their application without including a full citation and synopsis of relevant information directly in the text of its Licence Application. It is insufficient to merely reference other documents – some of them very lengthy – that allegedly contain the requisite information. Doing so places an undue burden on members of the public and on the Commission by making this essential supporting documentation inaccessible.

RECOMMENDATION NO. 9: The Commission should require CNL to submit a DDP for each planned group of decommissioning activities *prior* to the matter proceeding to a licensing hearing. At a minimum, this should be required for Planning Envelopes A-C as a prerequisite of licensing.

RECOMMENDATION NO. 10: The Commission should require licence applications to provide synopses of information and full, detailed citations so that all reviewers can more easily access requisite information necessary to demonstrate statutory and regulatory requirements. This furthers the aims of the Commission per the *NSCA*, s 9(b) to publicly disseminate information and its obligations per s 40(5) to involve the public in licensing hearings.

RECOMMENDATION NO. 11: The Commission should require CNL to revise its Licence Application and supporting CMD to ensure both contain a reasonable amount of information, and are drafted in a way that supports effective dissemination of information to the public and enables meaningful, fair and effective public hearings.

RECOMMENDATION NO. 12: To ensure the Commission has the information necessary and legal basis to proceed with a licensing decision, CNL's Licence Application should be rejected and returned to the licensee, with the requirement that the Licence Application, supporting CNL CMD, and detailed decommissioning plans (DDPs), Volume 2, 3, and 4 for planning envelopes A, B, and C, respectively (the three planning envelopes for which decommissioning activities are to be completed under the amended decommissioning licence) be revised. Until sufficient supporting information (including citations) is submitted for consideration, the licensing matter should not proceed.

RECOMMENDATION NO. 13: The Commission should require CNL to more clearly recognize, in their Licence Application and CMD, that their waste disposal strategy relies upon yet-to-be determined federal environmental assessments. The CNSC Staff CMD should also be updated to review how international guidance requiring the 'proper management' of waste produced during decommissioning is fulfilled given the limitations of Canada's radioactive waste policy.

APPENDIX B

Expert Report by Dr. H Krugmann

Appendix B

Decommissioning Douglas Point, Canada's First Full-Scale Nuclear Power Plant

The Need for Revamping the Proposed New Decommissioning Strategy to Fill Gaps, Address Inconsistencies, and Consider Alternatives

A report presenting comments on a
Licence Amendment Application submitted by
Canadian Nuclear Laboratories (CNL) Ltd. to the
Canadian Nuclear Safety Commission (CNSC)

Prepared by Hartmut Krugmann, PhD
October 24, 2020

On behalf of
Canadian Environmental Law Association (CELA)
Concerned Citizens of Renfrew County and Area (CCRCA)
Northwatch
Nuclear Waste Watch (NWW)

Table of Contents

Executive Summary

This report presents analysis, findings, conclusions, and recommendations from a review of decommissioning plans and related documents for the Douglas Point Waste Facility (DPWF) that were prepared by Canadian Nuclear Laboratories (CNL) Ltd. as part of its application submitted to the Canadian Nuclear Safety Commission (CNSC) on 18 July 2019 to request an amendment to its current decommissioning licence for DPWF. The review is an integral part of a broader review of CNL's DPWF decommissioning licence amendment application undertaken by the Canadian Environmental Law Association jointly with Concerned Citizens of Renfrew County and Area (CCRCA), Northwatch, and Nuclear Waste Watch (NWW), under a Participant Funding Program Contribution Agreement with CNSC.

The Douglas Point Nuclear Generating Station (DPNGS), now known as the Douglas Point Waste Facility (DPWF), was Canada's first full-scale nuclear power plant. It was a joint project between Atomic Energy of Canada Limited (AECL), as owner, and the former Ontario Hydro (OH) (now Ontario Power Generation (OPG)), as operator. The DPWF is located on a small piece of federal land that forms an enclave within the much larger Bruce Nuclear Site on the east shore of Lake Huron in the Province of Ontario.

The DPNGS was operated from 1968 to 1984. In January 1985 Atomic Energy of Canada Limited (AECL) opted for the permanent shutdown and eventual decommissioning of the reactor. AECL selected a strategy of "Deferred Decommissioning" which envisioned a gradual, step-wise decommissioning of the DPNGS in three phases: Phase 1 (1984 - 1994): Safe Sustainable Shutdown; Phase 2 (1994 - present): Storage with Surveillance (SWS); and Phase 3: Final Decommissioning.

In July 2014, the Canadian Nuclear Safety Commission (CNSC) issued a 20-year Waste Facility Decommissioning Licence (WFDL) that covered DPWF as well as two other Prototype Waste Facilities. In 2015, the tri-facility licence (WFDL) was transferred to Canadian Nuclear Laboratories (CNL), a new subsidiary of AECL, whose ownership was transferred, later in 2015, to the Canadian National Energy Alliance (CNEA), a newly-formed multinational consortium. In February 2019, CNSC granted individual decommissioning licences for DPWF and the other two waste facilities. Later in February 2019, CNL notified CNSC in writing of their intention to proceed with Phase 3 Decommissioning at the DPWF site, and in July 2019, CNL submitted an application for licence amendment to that effect.

CNL's original decommissioning policy and strategy

In accordance with AECL's selected 'Deferred Decommissioning' strategy for DPWF in three phases, CNL's Preliminary Decommissioning Plan (PDP) of April 2016 opts for deferred dismantling as the 'preferred decommissioning alternative' from among three alternative decommissioning approaches – immediate dismantling, deferred dismantling, and entombment (in-situ confinement).

Based on CNL's 'preferred decommissioning alternative' for DPWF, the PDP sets out CNL's (then) 'preferred strategic decommissioning approach' as one of pursuing a deferred decommissioning strategy, whereby DPWF is decommissioned in three phases (as indicated above), according to a schedule that focuses on: a) reducing the amount of radiation exposure to workers, the public, and the environment as much as reasonably achievable (ALARA principle); b) awaiting the availability of waste disposal facilities; and c) decommissioning the DPWF site when Bruce Power starts its decommissioning process.

For the purpose of decommissioning planning under the 'preferred strategic decommissioning approach', the PDP identified two distinct decommissioning planning envelopes (PEs) and schedules:

- PE-A for Non-Nuclear Area buildings & structures, to be decommissioned during 2021-2029
- PE-B for Nuclear Area buildings & structures (PE-B), to be decommissioned during 2059-2070

CNL's proposed new decommissioning strategy

CNL's proposed new decommissioning strategy, as set out in the DDP1, continues to adhere to deferred decommissioning as the 'preferred approach'. CNL's new strategy is also broadly consistent with AECL's and CNL's previous strategies in decommissioning DPWF in three main phases, as outlined above. Where CNL's new strategy markedly departs from CNL's original strategy is with respect to how Phase 3 Decommissioning is structured in terms of the scheduling and organization of decommissioning work. CNL, as per the DDP1, proposes:

- To split the previous (PDP) Nuclear Area planning envelope (PE-B) into four planning envelopes (PE-B through PE-E) to be decommissioned in four sub-phases (sub-phases B through E); and
- to advance the decommissioning of the first two Nuclear Area planning envelopes for completion already by 2030, along with the Non-Nuclear planning envelope, while leaving the last two -- Spent Fuel Canister Area (PE-D) and Reactor Building (PE-E) -- for decommissioning (during unspecified sub-periods) within the period 2030 – 2070.

Judging from CNSC's Regulatory Guide G219 for Decommissioning Planning, this strategic departure of the DDP1 from the PDP is unusual, yet it remains largely unexplained in the DDP1.

Gaps, discrepancies, and inconsistencies of the proposed new decommissioning strategy

Dubious rationale for accelerating and sub-phasing Phase 3 Decommissioning

In proposing a much earlier decommissioning of (parts of) DPWF's Nuclear Area forward, CNL's proposed new strategy would result in <u>increases</u> in radioactivity levels, occupational doses, and decommissioning costs. Other risk-increasing and/or cost-increasing disadvantages of the new strategy vis-à-vis the original strategy are that:

- it would no longer be possible to coordinate and synchronize the decommissioning of (much or all of) the DPWF with the eventual decommissioning of the surrounding Bruce nuclear plants;
- LLW generated from decommissioning would have to be stored in some place for some time, as Canada currently does not have any licenced facility for the disposal of any type of radioactive waste -- which could lead to double-handling and double-transporting of LLW if the sites that will be selected for final waste disposal are different from the temporary waste storage site(s).

On the other hand, earlier decommissioning has the advantage of reducing the time period over which storage-with surveillance (SWS) monitoring and maintenance activities need to be maintained, which would lower radiation-related risks and SWS costs.

DDP1 provides little, if any, quantitative information on this balance of risks and costs. In the absence of a more systematic and comprehensive analysis of the balance of risks and costs of the proposed new decommissioning strategy against the original strategy and other possible strategies, CNL fails to make a sound case for moving the final Phase 3 decommissioning of nuclear buildings forward.

Unexplained de-linking of the decommissioning of DPWF from the decommissioning of the Bruce nuclear power plants

The original strategy's aim of coordinating and synchronizing the decommissioning of DPWF with the decommissioning of the Bruce Power plants so as to benefit from efficiency gains no longer figures in the proposed new strategy. While DDP1 is silent on why this is no longer seen as an opportunity, CNL staff have hinted at the planned re-building of the Bruce plants as a factor that would lengthen the plants' lifetimes, thus extending Bruce plant decommissioning timelines further into the future and implying (even) longer deferment periods for DPWF decommissioning, which would drive up building age management costs further and render DPWF's SWS Phase too costly.

However, the Bruce reactor re-builds are extremely expensive and hence far from certain under the prevailing strained fiscal situation in Ontario. Given these uncertainties, CNL should not discard the original strategic aim of synchronizing the decommissioning schedules between DPWF and the Bruce reactors. Rather, CNL should consider different scenarios, examine their implications for the risks and costs of decommissioning DPWF, rank the scenarios in terms of risks and costs, and identify the preferred strategy on that basis. The scenarios should consider both linked and de-linked decommissioning of DPWF and the Bruce nuclear plants and span shorter and longer decommissioning timelines, particularly in the case of linked decommissioning.

Lack of consideration/analysis of alternatives for storing LLW from decommissioning DPWF

DDP1 indicates, and CNL staff have confirmed, that most of the LLW generated from hazard reduction and decommissioning activities at DPWF is shipped to Chalk River Laboratories (CRL) for (interim) storage and that this practice will continue as decommissioning enters the intended more active phase.

An alternative would be to store low-level decommissioning waste at Bruce Power's Western Waste Management Facility (WWMF), a licenced LLW storage facility, where LLW from the Bruce Power nuclear plants, and LLW transferred from other OPG commercial power plants, has been stored. Making use of the WWMF would practically amount to on-site storage of LLW, given the proximity of the WWMF. This LLW storage option would make it possible to substantially reduce, if perhaps not entirely avoid, double-handling and double-transporting of LLW for permanent disposal. Also, LLW from DPWF would add relatively little to the LLW already stored at the WWMF.

Given the partnership between AECL and OPG (also in its former incarnation as Ontario Hydro) to date, in sharing services and infrastructure between DPWF and Bruce sites and most significantly, in cooperating on running DPNGS during 1968-1984 as respective owner and operator of the nuclear plant, there does not seem to be any good reason why AECL, the owner of DPWF, should not collaborate with OPG/Bruce Power, the owner/operator of WWMF, on storing LLW in the WWMF.

Hence storing LLW at WWMF should not be ignored as an alternative to transferring LLW to CRL. Indeed, given the current lack of availability of disposal capacity for LLW in Canada, storing low-level DPWF decommissioning waste at WWMF should be evaluated as a strategic alternative to shipping LLW to CRL for storage. The evaluation should compare the advantages and disadvantages of these two alternatives and possible other alternatives in terms of radiation-related risks and waste management (transport and storage) costs.

Discrepancies and inconsistencies in estimated radioactive waste inventories (LLW and ILW) from decommissioning

DPWF's existing LLW inventory has been variable over the last few years (since 2014), reflecting the net effect of inventory-increasing decontamination, hazard reduction, and decommissioning activities on the one hand and inventory-reducing waste transfers from DPWF to off-site facilities on the other. But the way existing waste inventories are estimated and documented has not always have been consistent and/or transparent. The extent to which this might have contributed to the apparent variations in documented waste inventories is not clear. As of 2019, DPWF's existing inventory of LLW amounted to approximately 100 m^3.

Up until 2018, DPWF's existing inventory of ILW consisted of about 54 m^3 of spent ion exchange resin and 6 m^3 of miscellaneous dismantled equipment and materials. In 2018, the spent resin was sent to an off-site facility for processing and volume reduction and subsequently transferred to CRL for storage, which reduced the amount of ILW at DPWF to 6 m^3.

In contrast to the estimated existing ILW and LLW inventories (from past decommissioning and operational activities) which are consistently documented in terms of volume (m^3) across the different source documents, consistency ends when it comes to estimates of projected ILW and LLW inventories (from future decommissioning activities). While CNL's PDP, NRCan's end-of-2016 waste inventories and CNL's CMD all provide their waste estimates in volumetric terms (m^3), CNL's PPD1 and EER unhelpfully present their LLW and ILW waste estimates partly (for some types of waste streams) in terms of volume (m^3) and partly (for other types of waste streams) in terms of weight (metric tons or MT). Nor do the definitions and names used for different waste categories always seem to be consistent within and across source documents. These inconsistencies make comparisons of projected ILW and LLW inventories across source documents challenging.

Additional complicating factors and potential confusion arises from the circumstance that decommissioning waste projections (LLW and ILW) vary with respect to which decommissioning planning envelopes they include or exclude and whether estimated LLW and ILW inventories are provided as lumped or disaggregated figures. CNL's PDP, DDP1, and CMD provide projected radioactive waste inventory estimates for the decommissioning of the whole DPWF, excluding the Spent Fuel Canister Area, while the decommissioning waste estimates in CNL's EER also excludes the Reactor Building. As for providing disaggregated or lumped LLW and ILW figures, CNL's DDP1, EER, and CMD as well as NRCan do the former, while CNL's PDP does the latter.

There are huge discrepancies across source documents in projected LLW inventories from decommissioning. CNL's recent DDP1 (Dec 2019) estimates up to 8 times less LLW than the earlier PDP (April 2016), and up to 6 times less LLW than NRCan's projected end-pf 2016 inventory. CNL's even more recent CMD (Sep 2020) projects even less low-level decommissioning waste than DDP1, by a factor of at least 4. When compared with CNL's projection in the earlier PDP, CNL's CMD projects 33 times less low-level decommissioning waste.

On the other hand, DDP1's projected overall (radioactive plus non-radioactive) decommissioning waste inventory is reasonably comparable to PDP's. This suggests that the huge discrepancies in projected LLW

inventories between CNL's PDP, DDP1, and CMD are essentially due to greatly diverging assumptions about the proportions of decommissioning waste that will end up as (low-level) radioactive waste. Indeed, the proportions of waste streams that DDP1 expects to be radioactive are, on average, an order of magnitude smaller than the 18% of overall waste the PDP estimates to be radioactive. No explanations are given in CNL's DDP1 and CMD as to why their projected radioactive waste inventories are so much smaller than CNL's PDP. Assumptions underlying the now projected greatly reduced proportions of waste are not revealed – they remain hidden.

As for ILW inventories from decommissioning, CNL's CMD comes up with an estimate that is more than twice the inventory projected by NRCan, and DDP1's estimate is even larger, by up to 60%, than that in CNL's CMD. Neither DDP1 nor the CMD give any reasons for these discrepancies.

Unexplained gaps and inconsistencies in estimated decommission costs

CNL's 2019 'direct cost' estimate (DCE) update for decommissioning DPWF ($317 million, as per DDP1), which includes costs associated with the "disposal of ILW and LLW", is significantly lower than a previous liability cost estimate (LCE) update by the Nuclear Legacy Liability Review in 2013, which excluded ILW/LLW disposal costs. DDP1 ascribes the cost difference -- $68 million in 2019 Canadian Dollars, assuming general price inflation of 10% between 2013 and 2019 -- mainly to the "reduction in [non-nuclear area] decommissioning liabilities at the DPWF that has been achieved since 2013". But the cost difference is much larger than the $40.2 million figure given by DDP1 for the cost of decommissioning all still remaining non-nuclear buildings and structures (which constitute the bulk of the original non-nuclear area). This suggests that there must be other (unidentified) factors that explain the lower 2019 DCE.

Furthermore, it is not clear what is meant by "ILW and LLW disposal costs". There have been no licenced radioactive waste disposal facilities so far in Canada, so presumably this refers to ILW and LLW storage costs. But this question cannot be settled, as there are no details on how these costs are estimated. Nor is it clear whether/how the cost of landfill disposal of so-called clean/clearable waste has been accounted for.

The 2019 direct cost estimate (DCE) explicitly accounts for cost escalation over time that "may occur because of the delay in commencing Phase 3 decommissioning for certain decommissioning projects", applying a (compounded) annual cost escalation rate of 4% uniformly across building-specific decommissioning projects. DDP1 neither provides a general rationale for the assumed cost escalation nor any reasons for expecting cost escalation to be exponential at a uniform compounded rate of 4% per annum across all decommissioning projects and planning envelopes.

If, as is likely, cost escalation refers to the cost of DPWF's life management program, i.e., SWS costs that are increasing with the number of years over which buildings have to be maintained and essential systems have to be kept functional, until final decommissioning begins, then it is reasonable to expect these costs to increase with time, as buildings, structures and systems get older. But DDP1 provides no explanation or evidence that these costs will increase exponentially over time, and that it is reasonable to anticipate these costs to escalate at a rate of 4% per annum.

1 Introduction

On 18 July 2019, Canadian Nuclear Laboratories (CNL) submitted an application to the Canadian Nuclear Safety Commission (CNSC) for an amendment of their current decommissioning licence for Canada's first full-scale nuclear power plant, the former Douglas Point Nuclear Generation Station (DPNGS), now referred to as Douglas Point Waste Facility (DPWF).

CNSC has scheduled public hearings for 25-26 November 2020 to discuss CNL's licence amendment application. Civil society stakeholders, in particular indigenous peoples, non-governmental organizations and members of the public, will have an opportunity to inform and influence the decision-making process by preparing and presenting comments on CNL's licence renewal application and related documentation, for consideration by the Commission in reaching a final decision on the application.

The Canadian Environmental Law Association (CELA) jointly with Concerned Citizens of Renfrew County and Area (CCRCA), Northwatch, and Nuclear Waste Watch (NWW) applied for and were granted financial assistance under the Commission's Participant Funding Program (PFP) in support of their participation in the licence amendment application review and Commission hearing process. CELA is a non-profit, public-interest organization established in 1970 for the purpose of using and improving existing laws to protect public health and the environment. CCRCA is a non-governmental, volunteer organization working to prevent radioactive pollution and encourage clean-up and responsible long-term management of nuclear industry wastes. Northwatch, founded in 1988 and based in NE Ontario, provides a regionally representative voice in reviews of environmental, natural resource and energy concerns. NWW is a network of organizations concerned about radioactive waste in Canada, which was founded in 2003 to provide a public interest response to nuclear waste proposals and policies.

According to the terms of reference of the PFP contribution agreement, it is envisaged that:

- CELA (Kerrie Blaise and Morten Siersbaek) will focus their review of the CNL's licence amendment application and related documentation on issues relating to the potential adverse effects of the project, CNSC requirements and conditions, the (requirements of the) *Nuclear Safety and Control Act*, and relevant international guidance, whereas
- The present review of CNL's application and related documentation will examine issues and choices with respect to how CNL proposes to carry out the decommissioning work, including aspects of how radioactive waste is managed and how much decommissioning costs, based on an analysis of the decommissioning plan and other documents submitted by CNL along with its application.

While the two reviews have benefitted from cross-fertilization and some level of integration of ideas and perspectives, the results are presented in two separate documents. This present report summarizes the author's own comments on CNL's application in terms of the analysis, findings, conclusions, and recommendations from the review of CNL's decommissioning plans and related documents. CELA's comments on CNL's application are presented in a companion document.

2 Brief profile of the author

Dr Hartmut Krugmann has more than 40 years of international professional experience broadly in the fields of energy (including nuclear energy), environment, and sustainable development. He currently works as an independent consultant out of Ottawa, Canada. Educated in Germany, Switzerland and the USA, Hartmut holds (the equivalent of) a Master's degree in nuclear physics from the Swiss Federal Institute of Technology in Zurich, and a multi-disciplinary PhD degree (Engineering, Economics, Climatology, Energy and Environment) from Princeton University, US., where he conducted research on nuclear energy policy and technology issues, completing a PhD thesis entitled "Radioactive Waste Disposal – a Comparison of Alternative Nuclear Fuel Cycles".

In his subsequent career in international development, as university professor, programme/project manager and consultant, based in Brazil, Canada, Kenya, South Africa, Namibia, and Angola, nuclear energy and radioactive waste management have remained topics of active personal and professional interest. In 2019, Hartmut conducted an integrated review of a decommissioning licence extension application by CNL for Whiteshell Laboratories (WL), under a Participant Funding contribution agreement between CNSC and two civil society organizations (CCRCA and Northwatch). Results of Hartmut's nuclear energy related work have been published in leading scientific journals, including *Science* and *Bulletin of the Atomic Scientists.*

The author's CV is appended to this report (as **Appendix C**) for more details.

3 Background and context

The Douglas Point Nuclear Generating Station (DPNGS), now known as the Douglas Point Waste Facility (DPWF), was Canada's first full-scale nuclear power plant which had an installed power capacity of 200 MWe (megawatt electrical). It was a joint project between Atomic Energy of Canada Limited (AECL), as owner, and the former Ontario Hydro (OH) (now Ontario Power Generation (OPG)), as operator **[1]**.

The DPWF is located on a small piece of federal land that forms an enclave within the much larger Bruce Nuclear Site on the east shore of Lake Huron in the Province of Ontario. The DPWF site is situated right next to the lake shore, surrounded by the Bruce nuclear plant units and support facilities. The DPWF consists of the permanently shut-down, partially-decommissioned prototype CANDU reactor and associated structures and ancillaries.

The DPNGS was operated from 1968 to 1984 under a licence from the Atomic Energy Control Board (AECB), the then Canadian nuclear regulatory agency. Following the shutdown of the DPNGS in May 1984, a decision was taken to discontinue the DPNGS' operation, as the plant was considered to have achieved its prototype objectives and its power output lost significance with the arrival of the newer and much larger Bruce nuclear plants. Consequently, in January 1985 Atomic Energy of Canada Limited (AECL) opted for the permanent shutdown and eventual decommissioning of the reactor.

AECL selected a strategy of "Deferred Decommissioning" which envisioned a gradual, step-wise decommissioning of the DPNGS in three phases **[1], [2]**:

- **Phase 1 (1984 - 1994)**: **Safe Sustainable Shutdown –**

During this initial phase, the facility was brought to a "safe and sustainable shutdown state", suitable for a period of Storage with Surveillance (SWS). This included the following major activities:

- Defueling of the reactor;
- Removal of heavy water (D2O) from Heat Transport and Moderator systems;
- Removal of booster rods and their assemblies;
- Identification and removal of hazardous materials;
- Transfer of spent fuel from wet storage in the reactor pool to a dedicated dry-storage facility (i.e., Spent Fuel Canister Area);
- Major and minor decontamination activities (disassembly, decontamination, and consolidation);
- On-site consolidation of radioactive or radioactively contaminated components; and
- Radiological surveys on completion of each decommissioning activity.

- **Phase 2 (1994 - present): Storage with Surveillance (SWS) –**

This is the current phase of the facility, referred to as SWS phase. During this phase, all required equipment and safety related systems are retained and kept functional in order to ensure a continued safe and secure storage-with-surveillance state of all of DPWF's buildings, structures, and components. Systems and equipment that are required to be kept functional include:

- Radiological monitoring equipment/instruments;
- Fire detection and alarm system;
- Compressed air;
- Reactor Building ventilation system (including the HEPA filtration system);
- Sump system;
- Domestic water system;
- Sewage system;
- Active Liquid Handling System;
- Fuel Canister containment structure;
- Reactor Building containment structures;
- Tools and Test equipment used during inspection and maintenance; and
- Fire suppression equipment such as extinguishers and sprinklers.

- **Phase 3: Final Decommissioning –**

This phase is comprised of a range of decommissioning activities that will involve the dismantling, demolition, and removal of the equipment and components, buildings and structures including foundation and footings, and result in the return of the land for reuse consistent with its location adjacent to the Bruce Site.

Early during the SWS Phase, in 2000, the Atomic Energy Control Board replaced DPNGS' operating licence with a Waste Facility Operating Licence which renamed DPNGS as Douglas Point Waste Facility (DPWF). In July 2014, the Canadian Nuclear Safety Commission (CNSC) issued a 20-year Waste Facility Decommissioning Licence (WFDL) that covered DPWF as well as two other Prototype Waste Facilities (Gentilly-1 Waste Facility (G-1WF) and Nuclear Power Demonstration Waste Facility (NPDWF)),

continuing to restrict decommissioning to SWS type activities. In 2015, the tri-facility licence (WFDL) was transferred to Canadian Nuclear Laboratories (CNL), a new wholly owned subsidiary of AECL that was put in charge of operating DPWF as well as G-1WF and NPDWF on behalf of AECL.[1] Later in 2015, ownership of CNL was transferred to a newly-formed multinational consortium calling itself the Canadian National Energy Alliance (CNEA).[2]

In July 2018, CNL requested the CNSC to split WFDL into three separate licences, one for each of the three Waste Facilities (DPWF, G-1WF, and NPDWF), arguing that they envisaged different decommissioning strategies and timelines for the three facilities. In response, CNSC granted individual decommissioning licences for DPWF and the other two waste facilities, effective 08 February 2019, still on the basis of continued Phase 2 SWS activities only. However, five days later, on 13 February 2019, CNL notified CNSC in writing of their intention to proceed with Phase 3 Decommissioning at the DPWF site -- and five months later, on 18 July 2019, CNL submitted an application for licence amendment to that effect. The application was accompanied by two documents outlining CNL's proposed new program of accelerated or earlier decommissioning of DPWF – the Detailed Decommissioning Plan, Vol.1: Program Overview, hence forth referred to as DDP1 **[1]** and an associated Storage-with-Surveillance (SWS) Activities and Schedules document **[3]** – as well as several other documents summarizing the results of assessments of the environmental and human health risks and impacts associated with the new program.[3]

In its application letter, dated 18 July 2019, CNL points out: "Canadian Nuclear Laboratories is now planning to enter into an active phase of decommissioning at the DPWF site in which all [emphasis is the author's] remaining facilities will be dismantled and demolished by following a graded approach, which requires the current DPWF licence to be amended". **[4]** CNL's application letter goes on "to notify [CNSC] that the DPWF Preliminary Decommission Plan (PDP) **[5]** is cancelled and superseded by Detailed Decommissioning Plan (DDP) Volume 1 – Program Overview **[1]** subject to the CNSC acceptance and … [furthermore, that the] DPWF SWS Plan document **[6]** is also cancelled and superseded by DDP Volume 1 **[1]** and SWS Activities and Schedules". **[3]**

4 CNL's original decommissioning policy and strategy

In accordance with AECL's selected 'Deferred Decommissioning' strategy for DPWF in three phases , CNL's Preliminary Decommissioning Plan (PDP) of April 2016 opts for **deferred dismantling as the 'preferred decommissioning alternative'** from among three alternative decommissioning approaches – immediate dismantling, deferred dismantling, and entombment (in-situ confinement) -- defined by the International Atomic Energy Agency (IAEA). Prompt decommissioning, according to PDP, was seen as problematic in resulting in higher occupational radiation exposures and increased decommissioning

[1] CNL had been created the year before, in 2014, to implement a new Government-owned, Contractor-operated (GoCo) model for managing and operating AECL's properties, which had been announced by the Government of Canada in 2013.
[2] Initially, CNEA was composed of two U.K. companies, two U.S. companies, and one Canadian company. CNEA is currently composed of two Texas-based companies (Fluor and Jacobs) and SNC-Lavalin.
[3] These documents include: an Environmental Effects Review (EER) for DPWF – Phase 3 Decommissioning **[7]**; an Environmental Risk Assessment for Douglas Point **[8]**; and a Safety Analysis Report (SAR) for the DPWF **[9]**.

costs and in requiring off-site interim radioactive waste storage until permanent waste disposal facilities would become available, thus implying the need for double-handling and double-transporting of radioactive waste. Entombment was ruled out as an option, as this decommissioning approach would be entirely incompatible with bringing the DPWF site to an end-state suitable for other industrial uses by OPG/Bruce Power who are deemed to have the first right to acquire the land, and also in view of the totally unsuitable hydrological conditions at the DPWF site (the site is situated within meters from Lake Huron, the water table is shallow, and the groundwater flows toward Lake Huron). **[5]**

The **benefits of the SWS period under a deferred decommissioning regime**, according to PDP (Sub-section 8.2), include:

- A reduction in the dose commitment associated with the handling of radioactive materials due to the decay of shorter-lived radionuclides that remain on site;
- Additional planning time, which may result in more effective long-term management of the radioactive wastes generated as a result of decommissioning activities; and
- The potential implementation of lessons learned from other waste management and decommissioning activities within CNL and internationally that is more likely with the additional planning time.

In line with CNL's 'preferred decommissioning alternative', as rationalized in Section 8 of the PDP, the PDP highlights up-front in the Introduction (Section 1) **CNL's decommissioning policy approach** as one of exercising **deferred decommissioning** to take advantage of radioactive decay so as to reduce occupational radiation doses to staff and lower radiation related risks to the public and to the environment, while:

- aiming to achieve efficiency gains by **synchronizing the decommissioning of DPWF with the future decommissioning of the Bruce nuclear power plants**; and
- seeking to avoid double-handling of waste by **awaiting the availability of new long-term waste storage or disposal facilities** before decommissioning activities are completed.

Based on CNL's 'preferred decommissioning alternative' for DPWF and reflecting the above decommissioning policy approach, the PDP sets out CNL's (then) '**preferred strategic decommissioning approach'** (Section 8) as follows:

- using a **deferred decommissioning strategy**, DPWF is being decommissioned in a phased manner, according to a schedule that is based on a) Health, Safety, Security, and Environment (HSSE) considerations, b) availability of waste disposal facilities, and c) other business factors, whereby:
  - **HSSE considerations** focus on reducing the amount of radiation exposure to workers, the public, and the environment as much as reasonably achievable (i.e., based on the ALARA principle.
  - **'Availability of waste disposal facilities'** is considered essential to completing the decommissioning of the DPWF site;
  - **The business strategy** is centered on decommissioning the DPWF site when Bruce Power starts its decommissioning process; and

- Decommissioning in a 'phased manner' refers to AECL's original decommissioning strategy of completing the decommissioning of DPWF in three phases:
  i. Safe sustainable shutdown, ii. Storage with surveillance, and iii. Final decommissioning.

For the purpose of decommissioning planning and prioritization of work under the 'preferred strategic decommissioning approach', the PDP identified **two distinct decommissioning planning envelopes (PEs) --** one for the **Non-Nuclear Area** buildings and structures **(PE-A)**,[4] and the other one for the **Nuclear Area** buildings and structures **(PE-B)[5].** PDP goes on to describe and characterize these two planning envelopes in the following ways:

- Given the very low levels of radioactive contamination in the Non-Nuclear Area buildings and structures and in order to minimize SWS costs (i.e., costs associated with keeping these buildings and structures stable and functional), the **final decommissioning** (dismantling, demolition and removal) of **PE-A** is expected to take place **in the near-term**. By contrast, the final decommissioning of **PE-B** will require much **longer term planning and execution** to coordinate activities and **synchronize schedules with the eventual decommissioning of the Bruce site** and depending on the **availability of long-term waste storage/disposal facilities**.
- PE-A decommissioning work (dismantling, demolition, waste disposal, site restoration, final survey and close-out) can be carried out largely independently from PE-B decommissioning work.
- PE-A decommissioning work is notionally scheduled to be completed during the period 2021-2029, while PE-B decommissioning is envisaged to take place much later, in the period 2059-2070.
- For each PE, a detailed decommissioning plan (DDP), describing the work to be performed during dismantling, demolition, disposal and site restoration in more detail, is expected to be submitted 3-4 years prior to the time work is to begin:
  - One DDP (DDP1) for PE-A, and
  - another DDP (DDP2) for PE-B
  - Decommissioning work is to be organized in terms of work packages (WPs). A total of seven (7) work packages (WPs) are expected to be prepared, one (1) WP encompassing all of PE-A (Non-Nuclear Area) and six (6) separate WPs covering PE-B.

[4] PE-A comprises the following Non-Nuclear Area installations: Service Building Annex (former Stores/Tool Crib area); Turbine Building; Administrative Building; Plate Shop and Machine Shop Building; Emergency Coolant Injection System (ECIS) Pump House and Storage Tank; Ancillary Facilities (Carpenter's Shop, Garage, Water Treatment and Diesel rooms); Guardhouse; Transformer Station; Parking Lots; and the Outfall Discharge pipe (shared with Bruce Power).

[5] PE-B comprises the following Nuclear Area installations: Reactor Building; Purification Building; Service Building (excluding former Stores and Tool Crib area); Ventilation/Exhaust Stack (annexed to Service Building); Spent Fuel Canister Facility/Area; and Ancillary Facilities (the Resin Storage Tanks and Vault, and the Active Liquid Handling System).

5 CNL's proposed new decommissioning strategy

CNL's proposed new decommissioning strategy, as set out in the DDP1 **[1]**, continues to adhere to '**deferred decommissioning'** as the **'preferred approach',** with the following stated benefits, based on health, safety, security, environmental & quality control (HSSE&Q) considerations:

- A reduction in the dose commitment associated with the handling of radioactive materials due to the decay of short-lived fission products and activation products;
- Additional planning time, which may result in more effective long-term management of the wastes generated as a result of decommissioning activities;
- The potential implementation of lessons learned from other waste management and decommissioning activities within CNL and internationally.

CNL's new strategy is also broadly consistent with AECL's and CNL's previous decommissioning strategies in segmenting the overall process of decommissioning DPWF into **three main phases**:

- **Phase 1** -- safe, sustainable reactor shutdown (1984-1994);
- **Phase 2** -- storage-with-surveillance (SWS) (1994 – up to the point in time when Phase 3 decommissioning is initiated, which may be different for different parts of DPWF; and
- **Phase 3** -- final decommissioning, involving the complete removal of the entire DPWF facility and ending at the time when the final end-state is achieved and the land is returned for alternative industrial use.

Where CNL's proposed new decommissioning strategy markedly departs from the previous strategy is with respect to how the final phase (Phase 3 Decommissioning) is (to be) structured in terms of the timing, scheduling, and organization of decommissioning work. In a nutshell, what CNL now proposes is:

- to decommission in the near-term (by 2030, i.e., within the period of the current and amended licence) not only DPWF's Non-Nuclear Area, as envisaged in the PDP, but also a substantial part of the Nuclear Area whose decommissioning was to take place much later, notionally starting in 2059 and ending in 2070, as per the PDP;
- to retain the whole Non-Nuclear Area as one planning envelope (PE-A) to be decommissioned within an initial sub-phase (sub-phase A) while splitting the previous (PDP) decommissioning planning envelope 'Nuclear' Area' (PE-B) into four smaller planning envelopes (PE-B through PE-E) to be decommissioned in four subsequent sub-phases (sub-phases B through E);
- to advance the decommissioning of two of the four Nuclear Area planning envelopes and sub-phases --
    - demolition, and removal of Nuclear buildings other than the Reactor Building (calandria, dome, and containment wall) and Spent Fuel Canister Area (PE-B and sub-phase B); followed by
    - Reactor Building clear-out, i.e., the dismantling of all peripheral reactor service support systems, structures, and components (tanks, pipes, etc) and their removal from the Reactor buildings (PE-C and sub-phase C).

    These planning envelopes/sub-phases are to be completed already by 2030, along with the Non-Nuclear planning envelope PE-A (sub-phase A), while leaving the other two Nuclear planning

envelopes (Spent Fuel Canister Area (PE-D) and Reactor Building (PE-E)) for decommissioning (during unspecified sub-periods) within the period 2030 – 2070.

CNL's proposed DPWF decommissioning timeline is depicted in **Figure 1** below. The timeline ends with the five proposed Phase3 decommissioning planning envelopes/sub-phases on the right.

CNSC's Regulatory Guide G-219 (Decommissioning Planning for Licenced Activities), Sections 6 ("Structure and Content of Decommissioning Plans") expects a detailed decommissioning plan (DDP) "normally to be a refinement and procedural "fleshing out" of the work package structure established in the PDP" **[10]**. DDP1, however, clearly marks a significant strategic departure from the PDP [emphasis is the author's]. Although one would expect such an unusual departure of a DDP to be explained and justified carefully and in detail, it is remarkable that the DDP1 leaves most of the strategic points of departure unexplained, as will be seen in Section 5.

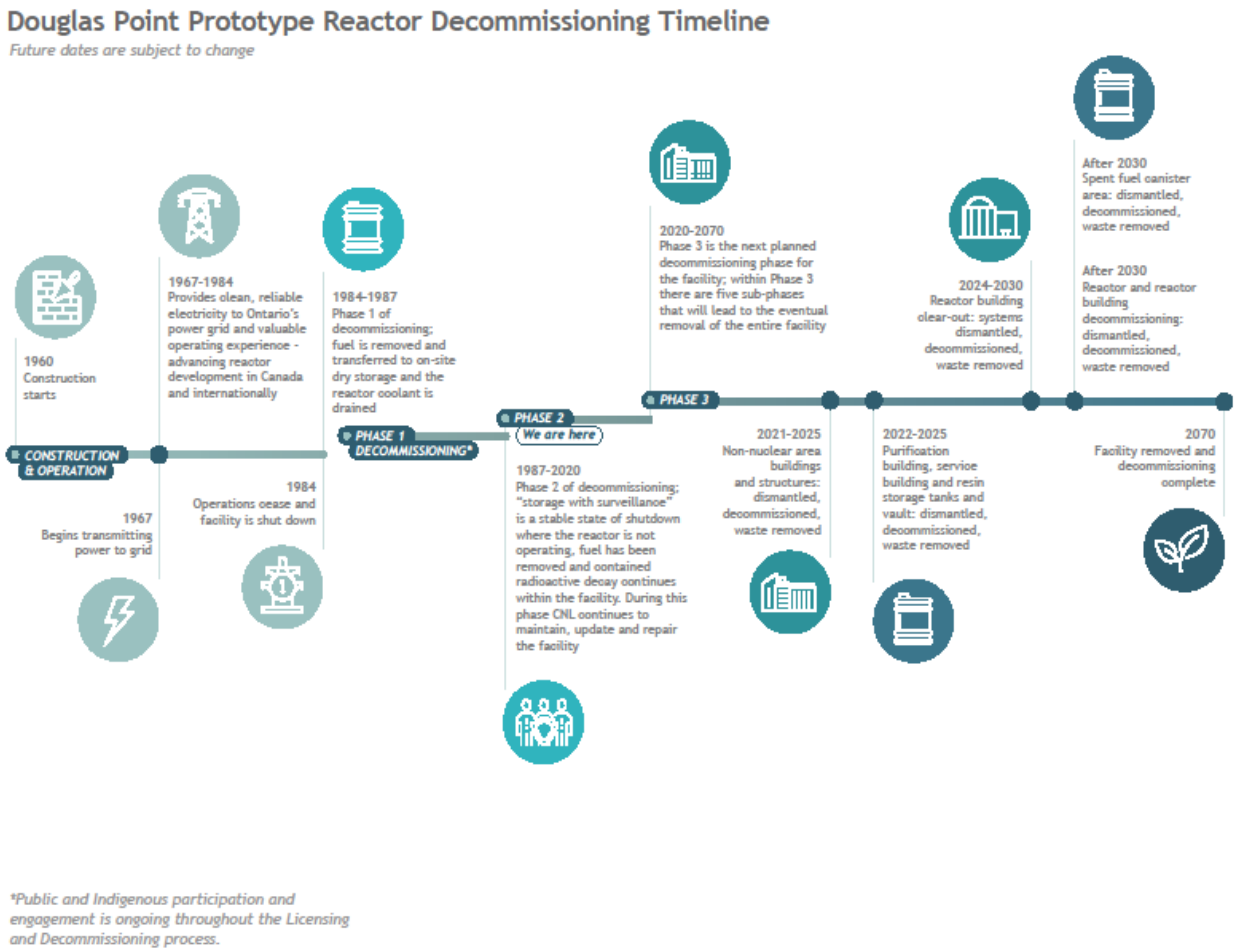

Figure 1: Proposed new DPWF Decommissioning Timeline, reproduced from CNL's webpage for Douglas Point **[11]**

6 Gaps, discrepancies, and inconsistencies of the new decommissioning strategy

This section examines (unexplained) points of departure of CNL's proposed new decommissioning strategy (as set out in the DDP1) from CNL's original decommissioning strategy (as presented in the PDP). Apparent gaps in rationale and lack of consideration of alternative options are identified and analyzed, and apparent discrepancies and inconsistencies in quantitative estimates of decommissioning 'variables' such as decommissioning waste inventories and decommissioning costs and missing or 'hidden' underlying assumptions are pinpointed and discussed by the author.

6.1 Dubious rationale for accelerating and sub-phasing decommissioning Phase 3 decommissioning

Table 1 summarizes the proposed new timing, planning and scheduling for Phase 3 decommissioning, according to DDP1, versus the original timing, planning and scheduling, as per the PDP.

Table 1: PDP versus DDP1: decommissioning planning envelopes (PEs), detailed decommissioning plans (DDPs), and expected decommissioning schedules, as compiled by the author, based on information presented in Sections 1, 4 and 11 of the PDP **[5]** and Sections 1, 6, and 10 of the DDP1 **[1]**

CNL, PDP, Rev.2, 29 April 2016			**CNL, DDP1, Rev.1, 12 Dec 2019**		
PEs	**DDPs**	**Schedules**	**PEs**	**DDPs**	**Schedules**
PE-A [a/] (Non-Nuclear Area)	DDP1 (due 2-4 yrs in advance)	2021-2029	PE-A [b/] (Non-Nuclear)	DDP2 (due in 2020)	Sub-phase A (2021-2025)
PE-B [c/] (Nuclear Area - organized in 6 work packages)	DDP2 (due 2-4 yrs in advance)	2059-2070	PE-B [d/] (Nuclear)	DDP3 (due 2022)	Sub-phase B (2023-2025)
			PE-C [e/] (Nuclear)	DDP4 (due 2022)	Sub-phase C (2029-2030)
			PE-D [f/] (Nuclear)	DDP5 (due 2-4 yrs in advance)	Sub-phase D Sometime during (2030-2070)
			PE-E [g/] (Nuclear)	DDP6 (due 2-4 yrs in advance)	Sub-phase E Sometime during (2030-2070)

Notes to Table 1:

[a/] This comprises all Non-Nuclear Area buildings & structures.

[b/] Remaining Non-Nuclear buildings & structures to be decommissioned include: *Turbine Building, Administration Building, Ancillary Facilities (Carpenter's Shop, Water Treatment Area, Garage, Storage Area, and Diesel Room), and Steam Bridge.*

[c/] This comprises all Nuclear Area buildings & structures.

[d/] This includes the following Nuclear buildings & structures: *Purification Building, Service Building (incl. Ventilation Stack, Fuel Bays, and Active Liquid Handling System), Weld Test Shop, and Resin Storage Tanks and Vault*.

[e/] Reactor clear-out refers to the dismantling and removal of all peripheral reactor service support systems, structures, and components (tanks, pipes, etc) in the Reactor building.

[f/] This refers to the *Spent Fuel Canister Area, including the Spent Fuel.*

[g/] This refers to the *Reactor Building (calandria, dome, and containment wall*).

As already indicated in Section 4 above, CNL's proposed new strategy is intended to re-organize the Phase 3 decommissioning work into five planning envelopes (one non-nuclear and four nuclear envelopes) to be decommissioned in five corresponding sub-phases, some of which are to partially overlap. The idea is to move the first two of the nuclear envelopes/sub-phases (B and C) forward in time to fall into the current licence period (along with the non-nuclear envelope/sub-phase A), while leaving for later (i.e., for the time after the current/amended licence period) the decommissioning of those parts of DPWF whose radiation fields are more intense and whose decommissioning will therefore be more challenging and risky, generating intermediate-level and high-level waste (ILW and HLW) in the process.

In Section 6 ("Decommissioning Approach") of the DDP1, CNL justifies the proposed re-organization of Phase 3 decommissioning as follows: "After a deferment period of 35 years, the radioactivity levels from short-lived radionuclides at DPWF have reduced to such an extent that most of the nuclear buildings can be decommissioned safely without exposing the workers to any significant occupational doses. However, decommissioning of the Reactor Building (calandria, dome and the containment) and the Spent Fuel Canister Area (see Table 10-1) will be delayed until proper disposal/storage facilities are available for intermediate- and high-level wastes, and is [therefore] not expected during the current licence period which expires in 2034."

While it is true that after a deferment period of 35 years, radioactivity levels and occupational doses from decommissioning DPWF would be considerably lower than at the time of reactor shutdown, the radioactivity levels and occupational doses associated with the original CNL strategy of decommissioning the nuclear area much later, during the period 2059-2070, i.e., after a deferment period of 75 years would be even lower. In other words, compared with the original strategy, CNL's proposed new strategy implies an increase in radioactivity levels and occupational doses at the time of decommissioning.

Another disadvantage of the proposed new strategy vis-à-vis the original strategy is that it would not be possible to coordinate and synchronize the decommissioning of (much or all of) the DPWF with the eventual decommissioning of the surrounding Bruce nuclear plants (see sub-section 5.2). A further drawback is related to the fact that Canada currently does not have any licenced facility for the disposal of any type of radioactive waste, including LLW. For LLW generated from decommissioning in the near term, as is envisaged under the proposed new strategy, that would mean that this LLW would have to be stored in some place for some time before it could be permanently disposed of. That could lead to double-handling and double-transporting of LLW in case the disposal facility ends up not being established at the site where the waste might have already been shipped for temporary storage (see also sub-section 5.3).

While these disadvantages tend to increase the risks[6] and cost of earlier final nuclear-area decommissioning, earlier decommissioning has the advantage of reducing the time period during which ongoing storage-with-surveillance monitoring and maintenance activities need to be carried out and the stability of buildings and functionality of essential systems needs to be guaranteed, thus lowering risks and costs (see Section 5.5 for more discussion on this).

[6] This refers broadly to risks to workers, the public and the environment from radiation-related hazards associated with the decommissioning of DPWF.

DDP1 provides little, if any, quantitative information on this balance of risks and costs. In the absence of a more systematic and comprehensive analysis of the balance of risks and costs of the proposed new decommissioning strategy against the original strategy and other possible strategies, CNL fails to make a sound case for moving the final Phase 3 decommissioning of nuclear buildings forward.

> Recommendation I:
> CNL should analyze the balance of risks and costs for the proposed new strategy of accelerated and sub-phased Phase 3 decommissioning, as set out in DDP1, against the original strategy, as presented in the PDP, and against other possible strategies. CNL should expand DDP1 to present such a comparative analysis so as to shed light on both the advantages and the disadvantages in terms of risks and costs of adopting the proposed new decommissioning strategy versus sticking to the original strategy or pursuing yet another strategy.

6.2 Unexplained de-linking of the decommissioning of DPWF from the decommissioning of the Bruce nuclear power plants

As highlighted in Section 3, one of the aims of CNL's original DPWF decommissioning policy was to achieve efficiency gains by synchronizing the decommissioning of DPWF with the future decommissioning of the Bruce nuclear power plants. Accordingly, "decommissioning the DPWF site when Bruce Power starts its decommissioning process" was an explicit business factor in CNL's 'original 'preferred strategic decommissioning approach' for DPWF.

However, this policy aim and business consideration does not figure any longer in CNL's proposed new decommissioning strategy. The DDP1 is entirely silent on whether the decommissioning of DPWF should be coordinated with the decommissioning of the surrounding Bruce nuclear power plants -- and if so, how this might best be done.

This issue was raised during a CNL webinar on the Decommissioning of DPWF on 25 June 2020. In response to a question by the author of this report on why CNL wants to decommission DPWF now, rather than waiting until the Bruce plants are up for decommissioning, Mr. Ian Bainbridge, CNL Director for Decommissioning, pointed out that the planned re-building of the Bruce plants would lengthen their lifetimes; and maintaining the DPWF buildings and structures stable and functional for even longer time periods under the CNL's Life Management Program for DPWF would be too costly.

However, whether the Bruce reactors will be re-built is far from certain. As a result of the Covid-19 pandemic, a moratorium appears to have been put in place on Ontario's nuclear re-builds.[7] The cash-strapped Government of Ontario may well find itself unable any time soon, if ever, to take on hugely expensive nuclear re-builds while shouldering rising Covid-19 related public expenditures as well as rising debt service payments.

[7] On 25 March 2020, Bruce Power suspended work on the re-building of its Unit 6 nuclear reactor. One day later, Ontario Power Generation (OPG) announced that it will not proceed with the re-building of its Unit 3 nuclear reactor at this time **[12].**

Given these uncertainties, CNL should not discard the original strategic aim of synchronizing the decommissioning schedules between DPWF and the Bruce reactors. Rather, CNL should consider different scenarios, examine their implications for the risks and costs of decommissioning DPWF, rank the scenarios in terms of risks and costs, and identify the preferred strategy on that basis. The following alternative scenarios might be considered:

a. Original DPWF decommissioning strategy and scheduling, original Bruce reactor decommissioning scheduling, DPWF and Bruce reactor decommissioning to coincide;
b. Original DPWF decommissioning strategy, delayed Bruce reactor decommissioning because of longer lifetimes due to reactor re-build, DPWF and Bruce reactor decommissioning to coincide at a later point in time; and
c. Proposed new DPWF decommissioning strategy whose scheduling and operations are completely de-linked from Bruce reactor decommissioning.

Recommendation II:
CNL should not discard the original strategic aim of synchronizing the decommissioning schedules between DPWF and the Bruce reactors. Rather, CNL should consider different scenarios (including the ones associated with the original and proposed new DPWF decommissioning strategy, respectively), examine their implications for the risks and costs of decommissioning DPWF, rank the scenarios in terms of risks and costs, and identify the preferred strategy on that basis. CNL should revise the DDP1 to integrate this scenario analysis and reflect the results in decommissioning planning and scheduling.

6.3 Lack of consideration/analysis of alternatives for storing LLW from decommissioning DPWF

DDP1 indicates that most of the LLW so far generated from decontamination, hazard reduction and decommissioning activities at DPWF has been shipped to Chalk River laboratories (CRL) for (interim) storage and that this practice will continue as decommissioning enters the intended more active phase. This was also confirmed by Mr. Ian Bainbridge, Director of Decommissioning at CNL, at a CNL webinar on DPWF decommissioning held on 25 June 2020.

An alternative would be to store low-level decommissioning waste at Bruce Power's Western Waste Management Facility (WWMF), a licenced LLW storage facility, where LLW from the Bruce Power nuclear plants, and LLW transferred from other OPG commercial power plants has been stored. Making use of the WWMF to store DPWF LLW would practically amount to on-site storage, given that the WWMF is located 'next-door' to DPWF. This LLW storage option would therefore require little handling and transporting prior to storage, thus making it possible to substantially reduce double-handling and double-transporting of LLW for permanent disposal once a facility for that purpose becomes available at another site.

Also, the amount of LLW from DPWF decommissioning, while substantial, would add relatively little to the much larger quantities of LLW (from the Bruce reactors and other commercial nuclear plants in

Canada) that are already stored at the WWMF, and even less to the even larger LLW inventory projected to be stored at WWMF further down the road.[8] Furthermore, AECL/CNL have already relied on Bruce Power for some of DPWF's services, such as emergencies (e.g., fire protection) and security services, and in the past, AECL has also shared DPWF infrastructure with Bruce Power.[9] Most significantly, OPG is the owner of the Bruce site and the owner/operator of the WWMF and in its previous incarnation (as Ontario Hydro (OH)) operated the Douglas Point nuclear plant in partnership with AECL, the owner of the Douglas Point plant and site.

Given such past cooperation and partnership between AECL and OPG, there does not seem to be any good reason why CNL could not collaborate with Bruce Power on storing LLW in the WWMF. Hence storing LLW at WWMF should not be ignored as an alternative to transferring LLW to CRL.

As far as the consideration of alternatives is concerned, Section 8 ("Choosing a basic strategy for decommissioning") of CNSC's Regulatory Guide G-219, listed as guidance document by DDP1[10], the CNSC CMD[11], as well as the licence condition handbook for the current DPWF decommissioning licence[12] and CNSC's draft licence condition handbook for CNL's applied-for amended DPWF decommissioning licence[13] is clear: "Where a clear strategic preference is not immediately apparent, the alternative strategies should be compared using a simple detriment-benefit evaluation method. The evaluation method should ensure that the relative advantages and disadvantages of the remaining strategies can be objectively compared in a systematic and traceable fashion"; and "In some cases, after a preferred general strategy has been identified for a planning envelope, it may be necessary to conduct secondary strategic evaluations of the alternative methods of implementing that strategy".

While a clear primary strategic preference – deferred decommissioning -- is apparent, the decommissioning of DPWF is a case where it seems necessary and desirable to conduct secondary strategic evaluations. Indeed, given the current lack of availability of disposal capacity for LLW in Canada, storing low-level DPWF decommissioning waste at WWMF should be evaluated as a secondary-level strategic alternative to shipping LLW to CRL for storage. The evaluation should compare the advantages and disadvantages of these two alternatives and possible other alternatives in terms of radiation-related risks and waste management (transport and storage) costs.

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[8] CNL's estimates of the volumes of LLW to be generated from the decommissioning of DPWF vary from 267 m^3 to 9,000 m^3 (see Table 4, Section 5.4.3, below). As of the end of 2016, a total of 83,466 m^3 of LLW from Bruce reactors and other operating nuclear power plants in Canada were stored at WWMF, and the LLW volume stored at WWMF is projected to increase to 141,215 m^3 in 2050 and 147,417 m^3 in 2100 (**[13]**, Tables 14 & 16).

[9] DPWF's recently decommissioned Plate and Machine Shop buildings, erected in 1990/91, were used as fabrication shops to support construction activities of the Bruce Engineering and Construction Services group on the Bruce site and were never used for DPWF operational requirements. However, after ceasing the activities of the Bruce Engineering Services group, these buildings were occasionally used for storage of surplus equipment and materials during DPWF's SWS phase CNL CMD, sub-section 2.3 **[2].**

[10] DDP1, sub-section 4.2.3 **[1]**

[11] CNSC, CMD, Basis for Recommendations, B.2 Technical Basis **[14]**.

[12] Licence Condition 2.1 ("Decommissioning Plans"), Licence Condition Handbook (LCH), DPWF decommissioning licence, 14 June 2019 **[15}**

[13] Licence Condition 11.2 ("Decommissioning Plans"), Draft Licence Condition Handbook (LCH), CNSC CMD, Dec 2020 **[14]**

Recommendation III:
CNL should consider the storage of low-level DPWF decommissioning waste at Bruce Power's Western Waste Management Facility (WWMF) as an alternative to shipping the LLW to CRL for storage and compare the advantages and disadvantages of these two waste management alternatives in terms of radiation related risks and costs. CNL should revise and broaden the scope of DDP1 to integrate this comparative analysis.

6.4 Discrepancies and inconsistencies in estimated radioactive waste (LLW and ILW) inventories from decommissioning

5.4.1 Variations in existing radioactive waste inventory (LLW and ILW) at DPWF

Decontamination, hazard reduction and decommissioning activities during various stages of Phase 1 (safe, sustainable and permanent shutdown; 1984-1994) and Phase 2 (storage with surveillance: 1994-present), have resulted in low-level radioactive waste (LLW) and intermediate-level radioactive waste (ILW) being generated and stored in different buildings and structures of the Douglas Point Waste Facility (DPWF).

Estimated existing LLW and ILW inventories from past DPWF decommissioning, hazard reduction and decontamination activities and operations are summarized in **Table 2.**

Table 2: Estimates of existing radioactive waste inventories (LLW and ILW) at DPWF, compiled by the author based on data and information available from the listed source documents

Source Document	LLW Inventory (m^3)	ILW Inventory (m^3)
CNL, PDP, April 2016 **[5]**	3 a/	60 b/
NRCan, (end of) 2016 waste inventory **[13]**	101 c/	60 d/
CNL, 2014 ACR **[16]**	3 e/	60 d/
CNL, 2015 ACR **[17]**	19 f/	60 d/
CNL, 2016 ACR **[18]**	28 g/	60 d/
CNL, 2017 ACR **[19]**	51 m^3 (solid waste) plus (44,000 L (liquid waste)) h/	60 d/
CNL, 2018 ACMR **[20]**	122 m^3 (solid waste) plus 20,000 L (liquid waste) i/	6 k/
CNL, 2019 ACMR **[21]**	102 m^3 (solid waste) plus 4,250 L (liquid waste) l/	6 k/
CNL, SAR, July 2019 **[9]**	Refers to 2017 ACMR	Refers to 2017 ACMR
CNL, DDP1, Dec 2019 **[1]**	102 m/	6 g/
CNL, EER, Feb 2020 **[7]**	Refers to DDP1	Refers to DDP1
CNL, CMD, 10Sep20 **[2]**	103 n/	6 n/

Notes to Table 2:

a/ 16 drums of low-level contaminated soil collected from a property clean-up in 2001 and stored in a designated area of the Service Building. Other LLW waste stored in the Reactor Building (brought in from other parts of DPWF), elsewhere in the Service Building, or elsewhere at DPWF is mentioned, but not quantified.

b/ This comprises of 53.7 m^3 of spent resin from the Primary Heat Transport and Moderator System stored in two tanks (7914-TK1 and 7914-TK2) in an Underground Vault as well as 6 m^3 of ILW stored in the Underground Spent Fuel Transfer Passageway and comprised of Booster Flow Tubes (18 Zr-2 tubes), 6 stainless steel tubes), Ram Extensions (14 stainless steel rods), an empty fuel bundle flask (aluminum clad and lead filled), and active pool debris (fuel end-plates, broken sheath, and tools, etc)

c/ This comprises of 66 m^3 of contaminated soil from operations as well as 35 m^3 of LLW of which 32 m^3 is classified as waste and 2 m^3 as contaminated soil. A footnote points out that LLW volumes have decreased since 2013 as a result of off-site supplier processing services or transfers to Chalk River Laboratories (see separate Table on waste transfers from DPWF).

d/ This comprises spent ion exchange resin and solid ILW stored in the Underground Spent Fuel Passageway (see note b).

e/ This refers to the 16 drums of low-level contaminated soil collected from a property clean-up in 2001 that are mentioned in note a.

f/ This comprises: 16 drums of low-level contaminated soil collected from a property clean-up in 2001 (3 m^3); and 8 waste containers containing dry radiological waste such as metals, combustibles, Personal Protective Equipment and Clothing (PPE&C), etc. (16.23 m^3).

g/ This comprises: 16 drums of low-level contaminated soil collected from a property clean-up in 2001 (3 m^3); and 10 waste containers containing dry radiological waste such as metals, combustibles, Personal Protective Equipment and Clothing (PPE&C), etc. (25 m^3).

h/ This comprises: 16 drums (3 m^3) of contaminated soil collected from property clean-up in 2001; two B-25 waste containers containing) Personal Protective Equipment and Clothing (PPE&C), and one partially-filled B-25 container of metal waste (sub-total of 6m^3); 40 m^3 of legacy contaminated material stored in the Purification Building (metal, wood, lead, bricks, concrete); 2 m^3 of legacy contaminated material stored in the Purification Building (Hazardous Materials); and 44,000 L of legacy liquid waste contained in the Hold-up Tank (7921-TK1) and Evaporator Feed Tank (7921-TK4) in the Service Building.

i/ This comprises: 70 m^3 of existing stored waste throughout the Reactor Building (metal, wood, lead bricks, concrete); an empty fuel bundle flask (aluminum clad and lead filled) stored in the fuel transfer tunnel in the Service Building (estimated volume: 1 m^3); 16 drums (3 m^3) of contaminated soil collected from property clean-up in 2001, currently stored in the Service Building; two B-25 waste containers containing Personal Protective Equipment and Clothing (PPE&C), and one partially-filled B-25 container of metal waste, currently stored in the Service Building (total of 6m^3); 40 m^3 of legacy contaminated material stored in the Purification Building (metal, wood, lead, bricks, concrete); 2 m^3 of legacy contaminated material in Purification Building (Hazardous Materials); and 20,000 L of legacy water used to cover spent resins in resin tanks (7914-TK1 and 7914-TK2).

k/ Only the ILW stored in the Underground Spent Fuel Passageway (6 m^3) remained at the end of 2018, since the spent resin was recovered from both tanks (7914-TK1 and 7914-TK2) and transferred to Energy Solutions, Erwin Processing Facilities, Erwin, Tennessee in several shipments during Oct-Nov 2018 for processing (volume reduction) (see also notes b and d).

l/ The solid LLW comprises: 70 m^3 of solid LLW stored in the Reactor Building, consisting of metal, wood, lead bricks, and concrete, contaminated soil collected from property cleanup in 2001, two B-25 waste containers containing PPE&C, and one partially-filled B-25 container of metal waste; a total of about 10 m^3 of solid LLW stored in the Service Building, comprising an empty fuel bundle flask placed in the fuel transfer tunnel (1 m^3), 16 drums of contaminated soil collected from property cleanup in 2001 (3 m^3); two B-25 waste containers containing PPE&C, and one partially-filled B-25 container of metal waste (6 m^3); a total of 22 m^3 of contaminated materials stored in the Purification Building, comprising metal, wood, lead bricks, concrete and other miscellaneous items that were generated during the operation and the permanent shutdown activities of the DPNGS (20 m^3) as well as about 2 m^3 of mixed waste, mainly consisting of legacy contaminated materials.
The liquid LLW comprises: Legacy water used as commissioning water on the spent resins removal project (2.25 m^3), which will be characterized and sent to CRL in 2020, and Evaporator Tank 7941-TK4 water generated internally through sumps and floor drains (2.0 m^3).

m/ This refers to the solid LLW component of the LLW itemized in note l.

n/ As per CNL, CMD, 10 September 2020, Section 14.1.2, p.58.

Low-level waste (LLW) --

As **Table 2** shows, DPWF's existing LLW inventory has been variable over the last few years (since 2014). Variations in the LLW inventory reflect the net effect of inventory-increasing decontamination, hazard reduction, and decommissioning activities on the one hand and inventory-reducing waste transfers from DPWF to off-site facilities on the other.[14] But the way existing waste inventories are estimated and documented has not always have been consistent and/or transparent. The extent to which this might have contributed to the apparent variations in documented waste inventories is not clear.

From the documented information available, it appears that as of 2019, DPWF's existing inventory of LLW amounted to approximately 100 m^3.

Intermediate-level waste –

Up until 2018, DPWF's existing inventory of ILW consisted of two items:

- about 54 m^3 of spent ion exchange resin from filtering the heavy water used to moderate and cool the DP nuclear generating station (DPNGS), which was stored in two tanks located in an underground vault; and
- 6 m^3 of miscellaneous dismantled equipment and materials, generated as ILW-type waste in the process of reactor shutdown (1984) and post-shutdown phase 1 decommissioning activities (1984-1994) aimed at placing the facility into a safe, sustainable and permanent shutdown state. This ILW-type waste has been stored in an underground passageway built for transferring the used fuel from its initial wet storage in the fuel bays of the Reactor Building to a separate facility (the used fuel canister area) for longer-term dry storage in concrete canisters.

In 2018, the spent resin was recovered from the tanks, removed from DPWF for processing and volume reduction at an off-site facility and subsequently transferred to CRL for storage. This reduced the amount of ILW at DPWF to 6 m^3. More information on radioactive waste transfers (ILW and LLW) from DPWF is provided in the next sub-section.

5.4.2 Radioactive waste transfers (LLW and ILW) from DPWF

Estimates of amounts of radioactive waste transferred from DPWF in recent years are found in CNL's annual compliance monitoring reports (ACMR) and in DDP1. These estimates are shown in **Table 3**.

It appears that most of the waste transfers had Chalk River Laboratories (CRL) as their ultimate destination, although that is not always made explicit in the documents.

Table 3: Radioactive waste transfers (LLW and ILW) from DPWF in recent years, as compiled by the author based on data and information available from the listed source documents

Source Document	LLW transfers (m^3)	ILW transfers (m^3)
CNL, 2014 ACMR **[16]**	107,019 kg [a/]	0.0
CNL, 2015 ACMR **[17]**	0.0	0.0
CNL, 2016 ACMR **[18]**	0.0	0.0
CNL, 2017 ACMR **[19]**	25 m^3 (solid waste) plus 100,400 L (liquid waste) [b/]	0.0
CNL, 2018 ACMR **[20]**	44,000 L (liquid waste) [c/]	55.7 [d/]

[14] For a synopsis of waste transfers, see **Table 3** below.

CNL, 2019 ACMR **[21]**	55,107 kg (solid waste) plus 19,200 L (liquid waste) [e/]	0.0
CNL, DDP1, Dec 2019 **[1]**	370 m^3 / 107,000 kg (solid waste) [f/] plus 20,000 L (liquid waste) [g/]	54.5 m^3 (solid waste) plus 8,800 L (liquid waste) [h/]

Notes to Table 3:

[a/] A total of 52,341 kg of solid LLW (289 drums of contaminated stainless steel fuel tray pieces (50,009 kg); 12 empty Freon drums (250 kg); and three pallets of fuel tray segments (2,082 kg)) were **transferred to Energy Solutions Canada (Brampton, Ontario in shipments on 08, 09, 10, and 11 Sep 2014;** another total of 54,678 kg of solid waste (unpackaged debris (dry active waste, wood, plastic, metal, equipment) contained in six sealed containers (22,386 kg); unpackaged debris (dry active waste , wood, plastic, metal, equipment) contained in 12 B-25 bins (5,512 kg); Forklift (4,987 kg); Lead items (14,134 kg); and concrete shield blocks (7,659 kg) were **transferred to Perma-Fix Northwest Inc. (Richland, Washington, USA) in shipments on 16 Sep 2014**; the two transfers add up to a grand total of 107,019 kg transferred from DPWF.

[b/] This comprises: 25 m^3 (8081 kg) of trash generated from routine radioactive work such as PPE&C, housekeeping clean-up in Zone 2 and Zone 3 areas, High-Efficiency Particulate Air (HEPA) filters, and plastic pails – **transferred on 28 Feb 2017 to Waste Management Area at CRL**; 100,400 L of legacy liquid waste from shutdown activities (from Dispersal Tanks 7921-TK2 and 7921-TK3 in storage since 1998) – **transferred on 02, 06, 07, and 30 Nov 2017 to Waste Management Area at CRL.**

[c/] 44,000 L of legacy liquid waste contained in the Hold-up Tank (7921-TK1) and Evaporator Tank (7921-TK4) – **transferred to Waste Treatment Centre (WTC), CRL, on 08 and 22 March 2018.**

[d/] Spent resin recovered from 7914-TK1 (27.3 m^3) and 7914-TK2 (28.4 m^3) – **transferred to Energy Solutions, Erwin Processing Facilities, Erwin, Tennessee in several shipments during Oct-Nov 2018.**

[e/] Solid LLW: 32,014 kg of legacy metal and general waste) was transferred from the Purification Building (3 shipments on 11, 18, and 20 March 2019 to Energy Solutions, Brampton, Ontario) for processing and RTC (Return to Client) waste will be transferred to CRL for storage), and 23,093 kg of legacy metal and general waste was transferred from the Service Building (2 shipments on 10 and 17 Dec 2019 to Energy Solutions, Brampton, Ontario) for processing, and RTC waste will be transferred to CRL for storage).
Liquid LLW: In 2018, the spent resins in tanks 7914-TK1 and 7914-TK2 were removed, but the legacy waste water used to cover the spent resins were stored in the Service Building over the winter. In 2019 July, the legacy waste water was sent to the WTC at CRL for processing (2 shipments on 30 and 31 July 2019 (13.2 m^3 + 6 m^3 = 19.2 m^3)).

[f/] In 2014, DPWF underwent a waste reduction and disposal campaign of low-level solid waste, removing 370 m^3 of it (weighing approximately 107,000 kg) that was stored in the Reactor Building, Purification Building and certain areas of the Service Building; **Waste consisting mainly of combustibles, metals and lead and concrete blocks used for shielding was shipped off-site for processing and/or disposal.** This corresponds to the 2014 ACMR figure (see note a).

[g/] 94 drums (about 20 m^3 or 20,000 L) of LLW legacy water which included the water in the tanks that was used to keep the spent resin immersed/ covered and the extra water added at the time of extracting the spent resin was temporarily stored in the Service Building until 2019 July, at which time the water was shipped to CRL for treatment and disposal. This liquid LLW was recovered from resin tanks (7914-TK-1 and 7914-TK-2) during the Resin Retrieval Project.

[h/] Spent resin (54.5 m^3) and contaminated water **(**8.8 m^3 or 8,800 L) have been removed from the Resin Storage Tanks and Vault (loose and fixed contamination may be present in emptied tanks and vault). The retrieved spent resin was treated and volume reduced (to 1/12th of the original volume) at an external waste processing facility (Energy Solutions, Erwin Processing Facilities, Erwin, Tennessee). **The resulting waste residue (4.49 m^3) was returned to CRL for storage.**

5.4.3 Discrepancies in estimated inventories of projected new radioactive waste (LLW and ILW) from decommissioning DPWF

Estimates of projected radioactive waste inventories (LLW and ILW) from future decommissioning activities are presented in the following CNL documents: PDP (April 2016) **[5]**, DDP1 (Dec 2019) **[1]**, EER (Feb 2020) **[7]** and CMD (Sep 2020) **[2]**, as well as by NRCan's end-of 2016 radioactive waste inventories published in 2018 **[13]**. These estimates are displayed in **Table 4**.

In contrast to the estimated existing ILW and LLW inventories (from past decommissioning and operational activities) which are consistently documented in terms of volume (m^3) across the different source documents, as shown in **Table 2**, consistency unfortunately ends when it comes to estimates of

projected ILW and LLW inventories (for future decommissioning activities). While CNL's PDP, NRCan's 2016 waste inventories and CNL's CMD all provide their waste estimates in volumetric terms (m^3), CNL's PPD1 and EER unhelpfully present their LLW and ILW waste estimates partly (for some types of waste streams) in terms of volume (m^3) and partly (for other types of waste streams) in terms of weight (metric tons or MT).[15] Nor do the definitions and names used for different waste categories always seem to be consistent within and across source documents.[16] For these reasons, comparing estimates of projected waste quantities from future decommissioning activities across documents presents a challenge.

Additional complicating factors and potential sources of confusion arise from the circumstance that estimated radioactive waste projections (LLW and ILW) vary with respect to which decommissioning planning envelopes they include or exclude and whether estimated LLW and ILW inventories are provided as lumped or disaggregated figures. CNL's PDP, DDP1, and CMD provide projected radioactive waste inventory estimates for the decommissioning of the whole DPWF, excluding the Spent Fuel Canister Area, while the decommissioning waste estimates in CNL's EER also excludes the Reactor Building (see notes g and h to **Table 4**) whose decommissioning is not scheduled to take place under the amended licence, if approved. As for providing disaggregated or lumped LLW and ILW figures, CNL's DDP1, EER, and CMD as well as NRCan do the former, while CNL's PDP does the latter.

Table 4: Estimated projected new radioactive waste inventories from decommissioning DPWF, as compiled by the author based on data and information available from the listed source documents

Source Document	LLW Inventory (m^3)	ILW Inventory (m^3)	Total (m^3)
CNL, PDP, April 2016 **[5]**	9,110 [a/]		9,110
NRCan, (end of) 2016 waste inventory **[13]**	6,509 [b/]	142 [c/]	6,651
CNL, DDP1, Dec 2019 **[1]**	109 m^3 plus 509 MT [d/] (~ 1,127 - 2,145 m^3) [e/]	221 m^3 plus 281 MT [d/] (~ 361 – 502 m^3) [f/]	390 m^3 plus 790 MT (~ 1,488 – 2,647)
CNL, EER, Feb 2020 **[7]**	22 m^3 plus 233 MT [g/] (~ 488 – 954 m^3) [i/]	0 [h/]	22 m^3 plus 233 MT (~ 488 – 954 m^3)
CNL, CMD, 10Sep20 **[2]**	267 [k/]	308 [k/]	575

Notes to Table 4:

[a/] This figure is based on an estimated overall waste volume of 49,700 m^3 for recyclable, potentially clearable waste (i.e., waste suitable for landfill disposal), and active waste (LLW & ILW). **This implies that of this total waste volume, about 82% is estimated to be likely clean waste (landfill and recyclable) and about 18% active waste (LLW & ILW).** The estimated overall waste volume is considered an upper estimate in that it ignores potential reuse of waste material, which is expected to be insignificant. Of the total of active waste (LLW & ILW), virtually all (9,100 m^3) is estimated to result from the decommissioning of Nuclear Area facilities (excluding the Spent Fuel Canister facility), a tiny amount (10 m^3) from the decommissioning of Non-Nuclear Area facilities, and no waste from the decommissioning of the Spent Fuel Canister facility (excluding the used fuel).

[b/] NRCan provides the following estimates for the projected LLW inventories in 2019, 2050, and 2100: 35 m^3, 35 m^3, and 6,544 m^3, respectively. Given that 35 m^3 equals the estimate provided by NRCan for the existing LLW inventory from past

[15] In **Table 4**, for purposes of comparing waste volumes across documents, waste streams that are quantified in terms of weight (MT) have been converted to volumetric quantities, using average waste density ranges that are considered representative for the waste types in question (see notes e, f, and i to Table 4).

[16] For instance, it is not always clear what the terms 'clean waste', clearable waste', and 'potentially clearable waste' are supposed to mean, i.e., whether these terms are used interchangeably for the same category of waste (i.e., waste below a specified radioactive clearance level that can be re-used, recycled, or go to a landfill) or whether these terms may refer to different waste categories in different contexts.

decommissioning activities (see Table 1, Note c), this figure needs to be deducted from the year-2100 inventory to calculate the total LLW volume from future decommissioning activities.

c/ NRCan provides the following estimates for the projected ILW inventories in 2019, 2050, and 2100: 60 m^3, 60 m^3, and 202 m^3, respectively. Given that 60 m^3 equals the estimate provided by NRCan for the existing LLW inventory (see Table 1), this figure needs to be deducted from the year-2100 inventory to calculate the total LLW volume from future decommissioning activities.

d/ These composite figures are for Planning Envelopes (PEs) A, B, C, and E (i.e. they exclude PE-D: spent fuel canister area). The figures are based on estimated waste volumes and weights, respectively, for the following seven (7) assumed waste streams:

- **38,259 m^3 of Concrete Waste** (99.1% potentially clearable and **0.9% radioactive, of which 33.0% LLW and 67.0% ILW**)
- 2,129 m^3 of Masonry Waste (100% potentially clearable)
- 3,234 m^3 of Miscellaneous Construction Waste (89.5% potentially clearable and 10.5% hazardous waste)
- 26,762 m^3 of Excavated Materials, i.e. excavated soil to expose foundations (100% potentially clearable)
- **5,621 metric tons (MT) of Structural Steel & Miscellaneous Metals** (96.9% potentially clearable and **3.1% radioactive, of which 100% ILW)**
- **4,796 MT of Rebar** (99.6% potentially clearable and **0.4% radioactive, of which 100% ILW)**
- **3,045 MT Mechanical and Electrical Waste** (79.4% potentially clearable, 1% hazardous waste, and **19.6% radioactive, of which 85.4% LLW and 14.6% ILW).**

e/ All of the LLW whose estimate is given in terms of weight belongs to the category Mechanical and Electrical Waste. This type of waste stream is likely to consist of smaller, diverse, and more heterogeneous items, which when packaged should have a relatively low average specific density. Lower-density packages shipped from DPWF to CRL in the period from January 2017 to January 2019 had **average densities in the range of 0.25 – 0.5 MT/m^3 [22].** This average density range has been used to calculate the range of total ILW volumes shown in brackets.

f/ The ILW whose estimates are given in terms of weight belong to the waste stream Structural Steel & Miscellaneous Metals (62% of total ILW), Rebar (7% of total ILW), and Mechanical and Electrical Waste (31% of total ILW). The first two ILW waste stream (2/3 of total ILW) are likely to consist of larger, heavier, and more uniform items, which even when packaged should have relatively high specific densities, while the last ILW waste stream (1/3 of the total ILW) should have a relatively low average specific weight (see note e above). This mix of higher- and lower-density ILW waste, when packaged, might have a **average density in the range of 1-2 MT/m^3**, to judge from the specific weights of waste packages received by CRL from other AECL sites in the period from January 2017 to January 2019 **[22].** This specific weight range has been used to calculate the range of total ILW volumes shown in brackets.

g/ EER's estimated waste volumes are only for those decommissioning planning envelopes that are relevant for the current licence period ending 2034: PE-A, PE-B, and PE-C. In other words, they exclude the decommissioning of the Reactor Building (PE-E) and the Spent Fuel Canister Area (PE-D). As far as composite waste estimates are concerned, note d above applies.

h/ No ILW is projected for decommissioning planning envelopes PE-A (Non-Nuclear Area), PE-B (Nuclear Area, excluding the Reactor Building), and PE-C (Reactor Building Clear-out).

i/ See note e above regarding the conversion of waste weight figures into waste volume figures. The same average density range (**0.25 – 0.5 MT/m^3**) has been used for that conversion.

k/ These figures are totals for Planning Envelopes (PEs) A, B, C, and E, i.e. they exclude PE-D (Spent Fuel Canister Area).

In what follows, estimated LLW and ILW radioactive waste inventories are compared across those of the source documents listed in **Table 4** that provide estimates for the whole DPWF minus the Spent Fuel Canister Area: PDP, NRCan, DDP1, and CMD.

Low-level waste (LLW) –

The discrepancies in estimated low-level decommissioning waste volumes across source documents are huge. CNL's recent DDP1 (Dec 2019) projects up to 8 times less low-level decommissioning waste than the earlier PDP (April 2016) and up to 6 times less low-level decommissioning waste than NRCan.

CNL's even more recent CMD (Sep 2020), prepared for the DPWF decommissioning licence amendment application hearings scheduled for 25-26 November 2020, projects even less low-level decommissioning

waste than DDP1, by a factor of at least 4. When compared with CNL's projection in the earlier PDP, CNL's CMD projects 33 times less low-level decommissioning waste!

On the other hand, DDP1's projected overall (radioactive plus non-radioactive) decommissioning waste inventory is reasonably comparable to PDP's.[17] Indeed, PDP anticipates an overall inventory of 49,700 m^3 (see **Table 4**, note a). DDP1 expects an inventory of 43,622 m^3 plus 13,462 MT (based on note d to **Table 4**), with 'excavated materials' (excavated soil to expose foundations excluded), which translates into an overall waste inventory of approximately 57,100 m^3, assuming an average specific weight of 1 MT/m^3 for the (higher-density) Metal waste and (lower-density) Mechanical and Electrical waste streams that DDP1 quantifies in terms of weight.

In conclusion, the huge discrepancies in projected low-level decommissioning waste inventories between CNL's PDP, DDP1, and CMD essentially seem to reflect greatly diverging assumptions about the proportions of decommissioning waste that will end up as (low-level) radioactive waste. Indeed, the PDP anticipates that 18% of the overall waste volume will be radioactive (see **Table 4**, note a), while DDP1 expects an order of magnitude smaller proportions of waste streams to be radioactive (see **Table 4**, note d). Presumably, the inventory of low-level decommissioning waste projected by CNL's CMD (267 m^3) is based on even smaller assumed proportions of waste to be radioactive.[18]

No explanations are given in CNL's DDP1 and CMD as to why their projected radioactive waste inventories are so much smaller than CNL's PDP. Assumptions underlying the greatly reduced proportions of waste that are now expected by CNL to be radioactive are not revealed – they remain hidden. DDP1 presents no more than general observations and references about decommissioning practices involving decontamination of structures, equipment and materials and volume reduction of waste streams to minimize quantities of radioactive waste generated from decommissioning activities, to the extent feasible and cost-effective. However, for each type of waste stream listed in note d to **Table 4,** DDP1 should be explicit as to what radioactive clearance level has been assumed and what assumptions have been made about the scope for waste decontamination and volume reduction.

Intermediate-level waste (ILW) –

CNL's CMD projects an inventory of ILW from decommissioning DPWF that is more than twice the projected ILW inventory provided by NRCan. The ILW inventory provided by DDP1 is even larger, up to 60% larger, than that projected by CMD.

No reasons are given in DDP1 and CNL's CMD for why their projected ILW inventories is so much larger than NRCan's figure.

> Recommendation IV:
> CNL should present all estimates of decommissioning waste inventories consistently in the same units, preferably volumetric terms, to facilitate comparisons across source documents, rather than providing some estimates in volumetric terms and others in terms of weight, or a combination of the two, as in DDP1 .

[17] CNL's CMD does not provide any estimate for the projected overall waste inventory (radioactive plus non-radioactive).

[18] As pointed out in footnote 7, CNL's CMD does not come up with an independent estimate of the overall decommissioning waste inventory.

Recommendation V:
CNL should provide a clear explanation of the causes of the huge discrepancies in the quantitative projections of LLW from DPWF decommissioning between CNL's PDP (April 2016), the end-of-2016 NRCan waste inventory, and CNL's more recent DDP1 (Dec 2019) and CMD (Sep 2020). In so doing, CNL should provide detailed information on the factors and assumptions that underlie their quantitative LLW projections and shed light on how they intend to achieve the enormously large implied LLW volume reductions. Currently implicit or hidden assumptions about what volumetric proportions of different decommissioning waste streams are expected to end up as LLW should be made explicit.

Recommendation VI:
CNL should explain the discrepancies in the quantitative projections of ILW from DPWF decommissioning between the end-of-2016 NRCan waste inventory, and CNL's more recent DDP1 (Dec 2019) and CMD (Sep 2020). In so doing, CNL should provide detailed information on the factors and assumptions that underlie their quantitative ILW projections and shed light on why they now project the ILW inventory to be significantly larger than NRCan previous estimate.

6.5 Unexplained gaps and inconsistencies in estimated decommissioning costs

5.5.1 Updated year-2019 DPWF decommissioning cost estimate

Based on **[23],**[19] CNL's DDP1 (Section 10), provides an updated Year-2019 direct cost estimate (DCE) for the decommissioning of DPWF in Canadian dollars (CAD) (March-2019 value), which excludes the cost of decommissioning the Spent Fuel Canister Area (PE-D). Table 5 summarizes that cost estimate, with all cost figures rounded to the third digit.

Table 5: Summary of DPWF decommissioning direct cost estimate (DCE) for the year 2019, as compiled by the author, based on cost figures presented in Tables 10-3 and 10-4, Section 10, DDP1**[1]**

Cost Elements	**PE-A** [h/] (million $)	**PE-B** [i/] (million $)	**PE-C** [k/] (million $)	**Sub-total** [l/] (million $)	**PE-E** [m/] (million $)	**Total** [n/] (million $)
Hard Cost [b/]	19.9	10.1	28.6	**58.6**	98.7	**157**
Soft Cost [c/]	16.6	8.44	23.8	**48.8**	82.1	**131**
Reserve [d/]	3.70	1.88	5.32	**10.9**	18.3	**29.2**
Direct Cost [e/]	**40.2**	**20.5**	**57.7**	**118**	**199**	**317**
Escalation Allowance [f/]	3.35	3.40	12.0	**18.8**	427	**446**
Total Cost [g/]	**43.6**	**23.9**	**69.7**	**137**	**626**	**763**

[19] This main reference document for the 2019 DCE summarized in CNL's DDP1, was not accessible, as CNL was not willing to make it available, unless a formal Access to Information (ATIP) request was made.

Notes to Table 5:

[a/] The (aggregate and rounded) cost figures presented in this table are based on DDP1, Tables 10-3 and 10-4. This excludes the costs of decommissioning the spent fuel storage facility and disposing of the spent fuel. All cost figures are in million Canadian dollars (March 2019 value).

[b/] Hard Cost refers to EPC Contractor cost and allowances.

[c/] Soft Cost refers CNL project-related costs.

[d/] Reserve refers to CNL risk and management reserve.

[e/] Direct Cost = Hard Cost + Soft Cost + Reserve

[f/] The 2019 Direct Cost estimate (DCE) **[23]** *s*eparately accounted for cost escalation that may occur because of the delay in commencing Phase 3 decommissioning for certain decommissioning projects, especially the reactor and Reactor Building decommissioning which is expected to take six years to complete but not expected to commence before 2050 April. An escalation rate of 4% per annum was applied to each building-specific project cost up to the mid-point of the project schedule duration to cover the increased cost escalation between 2019 March and the anticipated bid dates for the project.

[g/] Total Cost = Direct Cost + Escalation Allowance. This excludes indirect costs associated with operating the site infrastructure (utilities, insurance, and the CNSC site licence fee) and providing the CNL corporate services and HSSE&Q (health, safety, security, environment, and quality control) program support.

[h/] Under planning envelope PE-A, Non-Nuclear Area buildings and structures that remain on site -- Administration Building, Turbine Building, Steam Bridge, and Non-Nuclear Ancillary Facilities (Carpenter's Shop, Water Treatment Area, Garage, Storage Area, and Diesel Room) -- are to be decommissioned.
(During the last few years, a number of Non-Nuclear Area facilities have already been demolished and removed from the DPWF site. These include: Tool Crib, Plate Shop, Machine Shop, Emergency Coolant Injection System (ECIS) Tank and ECIS Bunker.)

[i/] Under planning envelope PE-B, the Non-Nuclear Weld Test Shop as well as the following Nuclear-Area Buildings and structures are to be decommissioned: Purification Building, Service Building, and Spent Resin Tanks and Vault.

[k/] Planning envelope PE-C comprises a Reactor Building Clear-Out.

[l/] The Sub-total column shows the sum of the cost figures for planning envelopes PE-A, PE-B, and PE-C, which represents the total cost of completing all decommissioning activities proposed to be completed within the period, ending 2034, of the amended licence, if approved, which is proposed to be the same as the current licence period.

[m/] Planning envelope PE-E comprises the demolition and removal of what is left of the Reactor Building: core components (Calandria), Dome, and the containment wall (Biological Shield).

[n/] Total = Sub-total + cost figure for PE-E. The cost of the disposal and/or management of spent fuel (planning envelope PE-D) is not included in this Total.

As can be seen from Table 5, CNL's DDP1 estimates the total direct cost associated with decommissioning DPWF, excluding the spent fuel storage facility, at $317 million (in 2019 March dollar value). This includes $157 million in total hard costs (i.e., EPC Contractor cost and Allowances) and $131 million in total soft costs (i.e. CNL project-related costs), and $29 million (i.e., ~10% of the sum of total hard & soft costs) as CNL Risk and Management Reserve.

The direct cost of completing all decommissioning activities proposed under the applied-for amended licence, i.e., under planning envelopes PE-A, PE-B, and PE-C, is estimated at $118 million or about 37% (somewhat more than one third) of the total. The estimated direct cost of decommissioning the Reactor Building (planning envelope PE-E) – an activity that is proposed to take place sometime during the period 2035-2070, i.e., after the period of the requested licence -- amounts to $199 million or about 63% (somewhat less than two thirds) of the total.

5.5.2 Inconsistencies and gaps in the 2019 direct cost estimate (DCE)

According to a previous 'Liability Cost Estimate' (LCE) made by the Nuclear Legacy Liability Review – 2013 Update (and referred to in Section 10 of the DDP1), the "Direct Cost" for the decommissioning of DPWF was $350 million **[24]**. This LCE excluded indirect costs and costs associated with the disposal of ILW and LLW. By contrast, CNL's 2019 DCE estimates the "Direct Cost" at approximately $317 million (in 2019 Canadian Dollar) which includes the cost associated with the disposal of ILW and LLW, as stated in DDP1 [emphases are the author's].

First of all, it is not clear what is meant by "LLW and ILW disposal costs". No radioactive waste disposal has so far taken place in Canada, so there is no experience on which a LLW and ILW disposal cost estimate could be based. This suggests that the DDP1 means LLW and ILW storage costs [emphases are the author's]. Second, it is not clear how these disposal/storage costs have been estimated and what they are assumed to amount to. Third, it is not even clear if/how the cost of disposing of the anticipated large volumes of clean and/or "clearable" wastes[20], either by recycling these wastes or by sending them to a landfill,[21] has been accounted for, as the DDP1 summary of the 2019 DCE mentions only the disposal of radioactive waste.

DDP1 ascribes the lower 2019 DCE, when compared with the 2013 LCE, mainly to the "reduction in decommissioning liabilities at the DPWF that has been achieved since 2013". That is difficult to comprehend. Assuming conservatively a general price inflation of 10% from 2013 to 2019, the 2013 LCE of $350 million (in 2013 Canadian Dollars) corresponds to $385 million (in 2019 Canadian Dollars). That is $68 million (2019 Canadian Dollars) more than the 2019 DCE of $317 million. This difference of $68 million is 170% of the estimated total direct cost ($40.2 million) of decommissioning all remaining non-nuclear buildings & structures (PE-A).

That cannot possibly be due mainly to the decommissioning activity so far. As summarized in note h to **Table 5** above, only a few smaller structures have been decommissioned so far, and the two by far largest non-nuclear buildings (Turbine Building and Administration Building) as well as other structures are yet to be decommissioned. Also, the waste so far generated from decommissioning of PE-A structures (about 2,500 m^3, according to the CNL CMD, Section 2.3 **[2]**) is only about 10% of the waste still to be generated (about 25,000 m^3, according the DDP1, Tables 7-2 **[1]**). So, there must be other (unexplained) reasons that explain why the 2019 DCE ($317 million) is approximately 20% lower than the 2013 LCE (about $385 million).

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[20] This includes non-contaminated waste as well as contaminated waste streams whose radioactivity levels are expected to be below the (to be) specified clearance level or whose radioactivity levels can be brought down below the clearance level though decontamination.

[21] The costs of recycling or landfill disposal can be substantial for larger amounts of clean and/or clearable waste and should not be ignored. Regarding landfill disposal, municipal or private sector landfills will not accept such waste for free. Municipal landfills around the DPWF/Bruce site usually charge $100 per tonne for rubble, concrete and brick (John Jackson, Nuclear Waste Watch, private communication, 09 Oct 2020). Compared to landfill disposal, the cost of recycling such waste tends to be lower (according to Wikipedia), but given the large waste volumes, it is likely to be significant.

Recommendation VII:
CNL should review and address the inconsistencies and gaps in its decommissioning cost estimate flagged above by revisiting and correcting its 2019 DCE and/or its explanation for why it is so much lower than the 2013 LCE. CNL should revise the DDP1 accordingly.

5.5.3 Unexplained cost escalation

The 2019 direct cost estimate (DCE) separately accounts for cost escalation that "may occur because of the delay in commencing Phase 3 decommissioning for certain decommissioning projects, especially the reactor and Reactor Building decommissioning which is expected to take six years to complete but is not expected to commence before 2050 April". An annual escalation rate of 4% was uniformly applied to each building-specific project cost up to the mid-point of the project schedule duration to cover the increased cost escalation between 2019 March and the anticipated bid dates for the project.

Because of the assumed annual compounding of cost escalation, the latter increases exponentially with the number of years decommissioning is delayed. Thus, in **Table 5** cost escalation makes by far the greatest difference for the Reactor Building (PE-E) for which costs are assumed to escalate for a period of 37 years, resulting in a cost escalation of $427 million, more than double the direct cost of decommissioning the Reactor Building ($199 million) and considerably more than the total direct cost of decommissioning DPWF ($317 million). Cost escalation is also quite significant for Reactor Clear-Out (PE-C) for which costs are assumed to escalate for a total of 6 years, yielding a cost escalation of $12 million, or about 20% of the direct cost of the Reactor Clear-Out.

Neither the general rationale behind cost escalation nor the reasons for expecting cost escalation to be exponential are provided in DDP1, and no explanation is given in DDP1 for why decommissioning costs are anticipated to escalate at a uniform rate of 4% per annum across all building-specific projects and hence for each decommissioning planning envelope as well.

DDP1's estimated cost figures, as summarized in **Table 5** above, are given in constant Canadian (March 2019) dollars and CNL receives funding allocations of public money via AECL, so price inflation and the rising costs of borrowed money can be ruled out as factors behind cost escalation. That leaves the ongoing costs of Phase 2 'storage with surveillance' (SWS) activities as the likely reason why CNL accounts for decommissioning cost escalation as a result of delays in the start of the Phase 3 decommissioning phase.

Under the SWS regime, CNL maintains a life management program for all DPWF buildings, structures and essential systems to keep buildings in a safe, stable and sustainable state and to ensure the functionality of essential systems. Age management activities and operations include monitoring, testing, surveillance, repairs and maintenance. For each building, structure and system, these activities and operations are maintained until the final Phase 3 decommissioning begins. The longer building-specific or decommissioning planning specific SWS related activities and operations are maintained, the higher SWS related costs tend to be. So, it is reasonable to expect these costs to increase with time, as

buildings, structures and systems get older. But DDP1 provides no explanation or evidence (based on past experience at DPWF, elsewhere in Canada, or in other countries) that these costs will increase exponentially with time, and that it is reasonable to anticipate costs to escalate at a rate of 4% per annum across different buildings, structures, and systems. Nor is there any evidence that DDP1's decommissioning cost estimate takes into account reductions in decommissioning costs (and risks) that may result from delays in final Phase 3 decommissioning because of reduced radiation levels (see related discussion in Section 5.1 above).

It is not inconceivable that CNL decided to factor in a hefty cost escalation allowance into their DPWF decommissioning licence amendment application proposal mainly as a way to motivate for an earlier decommissioning of the DPWF Reactor Building, arguing that this would make it possible to save a lot of money, i.e., to help set the stage for plans to tackle planning envelope PE-E (Reactor Building) sooner rather than later after the expiry of the current/amended licence period.

Recommendation VIII:
CNL should expand DDP1, Section 10, to explain the rationale for factoring escalation costs into its direct decommissioning cost estimate, provide hard evidence supporting the implicit expectation that SWS related costs will increase exponentially with the age of buildings, structures, and systems, back up the assumption that SWS costs will escalate at a compounded rate of 4% per annum, and make sure that estimated final Phase 3 decommissioning costs reflect potential cost reductions as a result of falling radiation levels over time.

7 Conclusions

Contrary to established practice, as outlined in CNSC's Regulatory Guide G-219, CNL's proposed new strategy for decommissioning the Douglas Point Waste Facility (DPWF), as presented in its Detailed Decommissioning Plan, Volume 1 – Program Overview (DDP1), marks a strategic departure from the original strategy set out in CNL's Preliminary Decommissioning Plan (PDP) of April 2016, in terms of how the final decommissioning phase (Phase 3 Decommissioning) is to be planned, scheduled and organized. Not only is the decommissioning of parts of DPWF's nuclear area to be moved forward by as much as four decades to be completed already by 2030 under the applied-for amended decommissioning licence, but the remaining most radioactive and most risky-to-decommission parts of DPWF (Reactor Building and Spent Fuel Canister Area) are to be left for decommissioning at an unspecified time after 2030, which would require another decommissioning licence amendment or a new decommissioning licence.

Although one would expect such an unusual strategic departure from established decommissioning planning procedures to be explained and justified carefully and in detail, DDP1 leaves most of the strategic points of departure unexplained. Indeed, DDP1 neither provides a comprehensive and coherent rationale for the proposed new decommissioning strategy nor considers alternative decommissioning strategies against which the advantages and disadvantages of their proposed strategy, in terms of radiation exposures, human and environmental health risks, and decommissioning costs, could and should be compared. Moreover, DDP1 lacks transparency and displays major discrepancies and inconsistencies as far as quantitative estimates of decommissioning waste inventories and costs are concerned. Underlying assumptions for these estimates often remain hidden.

Recommendation IX:

CNL should not be granted the requested licence amendment at this stage. CNL should be requested to revise the DDP1 on the basis of the recommendations 1 through 8 and re-submit their application for a licence amendment or for a new licence, accompanied by the revised DDP1, at least six months prior to the date new hearings would be held on this application. In the meantime, CNL may continue to decommission the remaining buildings and structures of DPWF's Non-Nuclear Area (PE-A), upon submission and approval of building-specific detailed decommissioning plans (DDPs), on the basis of the current decommissioning licence for DPWF.

8 Recommendations

I. CNL should analyze the balance of risks and costs for the proposed new strategy of accelerated and sub-phased Phase 3 decommissioning, as set out in DDP1, against the original strategy, as presented in the PDP, and against other possible strategies. CNL should expand DDP1 to present such a comparative analysis so as to shed light on both the advantages and the disadvantages in terms of risks and costs of adopting the proposed new decommissioning strategy versus sticking to the original strategy or pursuing yet another strategy.

II. CNL should not discard the original strategic aim of synchronizing the decommissioning schedules between DPWF and the Bruce reactors. Rather, CNL should consider different scenarios (including the ones associated with the original and proposed new DPWF decommissioning strategy, respectively), examine their implications for the risks and costs of decommissioning DPWF, rank the scenarios in terms of risks and costs, and identify the preferred strategy on that basis. CNL should revise the DDP1 to integrate this scenario analysis and reflect the results in decommissioning planning and scheduling.

III. CNL should consider the storage of low-level DPWF decommissioning waste at Bruce Power's Western Waste Management Facility (WWMF) as an alternative to shipping the LLW to CRL for storage and compare the advantages and disadvantages of two waste management alternatives in terms of radiation related risks and costs. CNL should revise and broaden the scope of DDP1 to integrate this comparative analysis.

IV. CNL should present all estimates of decommissioning waste inventories consistently in the same units, preferably volumetric terms, to facilitate comparisons across source documents, rather than providing some estimates in volumetric terms and others in terms of weight, or a combination of the two as in DDP1 .

V. CNL should provide a clear explanation of the causes of the huge discrepancies in the quantitative projections of LLW from DPWF decommissioning between CNL's PDP (April 2016), the end-of-2016 NRCan waste inventory, and CNL's more recent DDP1 (Dec 2019) and CMD (Sep 2020). In so doing, CNL should provide detailed information on the factors and assumptions that underlie their quantitative LLW projections and shed light on how they intend to achieve the enormously large implied LLW volume reductions. Currently implicit or hidden assumptions about what volumetric proportions of different decommissioning waste streams are expected to end up as LLW should be made explicit.

VI. CNL should explain the discrepancies in the quantitative projections of ILW from DPWF decommissioning between the end-of-2016 NRCan waste inventory, and CNL's more recent DDP1 (Dec 2019) and CMD (Sep 2020). In so doing, CNL should provide detailed information on the factors and assumptions that underlie their quantitative ILW projections and shed light on why they now project the ILW inventory to be significantly larger than NRCan previous estimate.

VII. CNL should review and address the inconsistencies in its decommissioning cost estimate flagged above by revisiting and correcting its 2019 DCE and/or its explanation for why it is so much lower than the 2013 LCE. CNL should revise the DDP1 accordingly.

VIII. CNL should expand DDP1, Section 10, to explain the rationale for factoring escalation costs into its direct decommissioning cost estimate, provide hard evidence supporting the implicit expectation that SWS related costs will increase exponentially with the age of buildings, structures, and systems, back up the assumption that SWS costs will escalate at a compounded rate of 4% per annum, and make sure that estimated final Phase 3 decommissioning costs reflect potential cost reductions as a result of falling radiation levels over time.

IX. CNL should not be granted the requested licence amendment at this stage. CNL should be requested to revise the DDP1 on the basis of the recommendations 1 through 8 and re-submit their application for a licence amendment or for a new licence, accompanied by the revised DDP1, at least six months prior to the date new hearings would be held on this application. In the meantime, CNL may continue to decommission the remaining buildings and structures of DPWF's Non-Nuclear Area (PE-A), upon submission and approval of building-specific detailed decommissioning plans (DDPs), on the basis of the current decommissioning licence for DPWF.

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24. Nuclear Legacy Liability Review – 2013 Update, Revision 1, 2013 October

APPENDIX C

Curriculum Vitae of Dr. H Krugmann

Appendix C Curriculum Vitae (CV) of the author

Dr Hartmut Krugmann

International Energy, Environment, and Sustainable Development Consultant
Ottawa, Ontario, Canada
Tel: +1 (613) 371-7833 (mobile); Email: hkrugmann@primus.ca

Nationality / Residence: German / Permanent Resident of Canada

EDUCATION / ACADEMIC QUALIFICATIONS

1979 PhD, multi-disciplinary (Engineering, Economics, Climatology, Energy and Environment), Princeton University, Princeton, USA
- **Main field of research: nuclear energy policy and technology, with a focus on radioactive waste management and disposal**
- Completed a PhD thesis with the following title: "Radioactive Waste Disposal – a Comparison of Alternative Nuclear Fuel Cycles".

1972 Diplom ETH (equivalent to M.Sc.), Physics, ETH (Swiss Federal Institute of Technology), Zürich, Switzerland
- **Main field of studies: nuclear physics**
- Completed M.Sc. thesis with the following title (translated from German): "On the Discrimination between Fission Products and Alpha-Particles by means of Gas Absorbers and Semiconductor Counters".

1969 Vordiplom (roughly equivalent to B.Sc.), Physics, Ludwig Maximilians University Munich, München, Germany

RELEVANT CONSULTING ASSIGNMENTS AND RESEARCH (SELECTED)

- **Consultant to the Canadian Nuclear Safety Commission (CNSC), under contract by Concerned Citizens of Renfrew County and Area (CCRCA) and Northwatch (regional coalition of environmental and citizen organizations and individual members in northeastern Ontario), 2019 –** conducted an integrated review of an application, submitted by Canadian Nuclear Laboratories Ltd (CNL) to CNSC, for the 10-year renewal (2020-2029) of their licence to decommission the Whiteshell Laboratories (WL) federal nuclear research site at Pinawa, Manitoba Province, Canada;
  The integrated review of CNL's licence renewal application was conducted under two separate Participant Funding Program Contribution Agreements between CNSC and CCRCA and between CNSC and Northwatch, respectively. The review covered issues relating to the characteristics and hazards of WL decommissioning wastes and how to manage these wastes as well as issues and risks associated with the transportation of the WL radioactive wastes.
  - Reviewed a range of information and documentation of relevance to CNL's decommissioning licence renewal application;
  - Prepared a report, submitted jointly to CCRCA and Northwatch, summarizing the findings of the review and presenting comments and recommendations on how CNSC should respond to the decommissioning licence renewal application.

- **Consultant to the Southern African Institute for Environmental Assessment (SAIEA), 2011 --** acted as external reviewer of a Radiological Public Hazard Assessment for the Phase 2 Expansion of Rössing Uranium Mine in Namibia carried out by the South African Nuclear Energy Corporation (NECSA), as a specialist study for the Phase 2 Social and Environmental Impact Assessment (SEIA);
    - Reviewed an initial and final draft of NECSA's specialist report of the Radiological Public Hazard Assessment and prepared a report summarising the findings, recommendations of the review.

- **Consultant to the Southern African Institute for Environmental Assessment (SAIEA), 2009-2010** – contributed to a Strategic Environmental Assessment (SEA) of the Uranium Exploration and Mining Rush in the Central Namib Desert (Namibia's Erongo Region) commissioned by the Geological Survey, Ministry of Mines and Energy of Namibia, and financially supported by the Federal Institute for Geosciences and Natural Resources of Germany (Bundesanstalt für Geowissenschaften and Rohstoffe);
  The SEA was intended to assess the range of cumulative, synergistic and antagonistic environmental, social, and economic impacts of the multiplicity of projects and activities constituting the current Uranium Exploration and Mining Rush in the Central Namib (in relation to an established baseline situation) and to develop a set of recommendations on how negative impacts could be avoided or mitigated and how positive impacts enhanced (Strategic Environmental Management Plan or SEMP).
    - Reviewed the literature on: global energy and power markets; the past, current and projected future contribution of nuclear power to global electricity supply; risks and costs of nuclear power; and the global uranium market, including past, present and projected future demand for uranium and supply of (primary and secondary) uranium; an assessment of the global and local factors contributing to the uranium exploration and mining rush experienced in Namibia and the preparation of an analytical paper on the "Forces and Dynamics of the Uranium Rush in Namibia";
    - Reviewed the global and local literature on radiation sources, environmental pathways and human radiation exposures associated with uranium mines during operation and after closure and the preparation of a theme report on "Radiation Sources, Pathways and Human Exposures" for uranium mining;
    - Assisted in the conceptualization of an Air Quality and Radiation Study and helped to develop its ToR;
    - Assisted in the conceptualization of an Economic Study and provided a detailed written review of the resulting draft final thematic report;
    - Assisted in the conceptualization and review of other project outputs, including the thematic paper on mining, a paper on policy & legal issues, the formulation of environmental quality objectives and monitoring indicators for the Namibia Erongo Region "Uranium Province", and the final overall SEA/Strategic Environmental Management Plan (SEMP) reports;
    - Participated in, and presented work-in-progress during two team workshops.

- **Assistant Professor, Energy Group, Institute of Physics, University of São Paulo, Brazil, 1979 - 1981**
    - Carried out research on energy and environmental technology and policy issues in Brazil (and relating to developing countries more generally).
    - In particular, examined the role that nuclear power might play in meeting the energy needs and development aspirations of Brazil (and developing countries more generally).
    - More specifically, assessed an ambitious German – Brazilian nuclear deal under which Germany was to supply Brazil with at least eight (8) nuclear power plants over the course of the 1980s & 1990s and assist the country in developing its own domestic know-how and institutional capacities in the field of nuclear power

RELEVANT PUBLICATIONS (SELECTED)

H. Krugmann, book review: *"Nuclear Power in Developing Countries"*, Lexington Books, 1981; in **Bulletin of the Atomic Scientists**, 1982.

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H. Krugmann, *"West Germany's Efforts to Close the Nuclear Fuel Cycle: Strategies for Radioactive Waste Management",* **International Journal of Energy Research,** Vol.2, pp.107-121, April 1978.

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H. Krugmann, *"Capital Energy Investment in a Nuclear Power Plant"*, Report PU/CES No.37, **Center for Energy and Environmental Studies, Princeton University,** June 1976.

F. von Hippel, M. Fels, and H. Krugmann, *"The Net Energy from Nuclear Reactors"*, **FAS Professional Bulletin,** Vol.3, No.4: 5-6, April 1975.

WORK HISTORY

International Energy, Environment, and Sustainable Development Consultant, based in Ottawa, Canada (**2014 – present**)

Managing Director & Principal Consultant, Southern Sustainable Development Corporation (SSDC)
ran a consultancy business, successfully completing over 60 consulting assignments for a wide variety of government, civil society, private sector, and donor clients on energy, environmental, and sustainable development issues, mainly in Southern Africa, based in Windhoek, Namibia (**1999 – 2004 & 2006 – 2014)**

UN Chief Technical Advisor and GEF Project Manager,
led a regional GEF project "Environmental Protection and Sustainable Management of the Okavango River Basin" (Angola, Botswana, and Namibia), based in Luanda, Angola (**2004 – 2006**)

International Environment and Development Consultant,
based in Johannesburg, South Africa (**1998 - 1999**);

Senior Program Specialist, International Development Research Centre (IDRC),
based at:
Regional Office for Southern Africa (ROSA), Johannesburg, South Africa (**1997 - 1998**);
Regional Office for Eastern & Southern Africa (EARO), Nairobi, Kenya (**1995 - 1996**);
Environment and Natural Resources Division (ENRD), EARO, Nairobi, Kenya (**1991 - 1995**);

Secondment to United Nations Environment Program (UNEP), Nairobi, Kenya (**1995**);

Special IDRC-funded sabbatical research leave, based in Nairobi (**1994 - 1995**);

Senior Program Officer, International Development Research Centre (IDRC),
based at:
Environmental Policy Program, Social Sciences Division (SSD), EARO, Nairobi, Kenya (**1989 - 1991**);
Unit for Environment and Natural Resource Management, SSD, Ottawa, Canada (**1988 - 1989**);

Program Officer, International Development Research Centre (IDRC),
Science, Technology and Energy Policy Program (STEP), SSD, Ottawa, Canada (**1983 - 1988**);

Associate Professor, *Energy Planning Program, Graduate Engineering School (COPPE),* ***Federal University of Rio de Janeiro***, Rio de Janeiro, Brazil (**1981 - 1982**);

Assistant Professor, *Energy Group, Institute of Physics****, University of São Paulo***,
São Paulo, Brazil (**1979 - 1981**);

Research and Teaching Assistant, *Mechanical and Aerospace Engineering Department,* ***Princeton University***, Princeton, New Jersey, USA (**1974 - 1978**);

Research Assistant, *European Research Laboratory,* ***International Business Machines (IBM)***, Rüschlikon, Switzerland (**1973 - 1974**);

Research Associate, *Laboratory of Solid State Physics,* ***Swiss Federal Institute of Technology in Zurich*** *(ETH Zürich),* Zürich, Switzerland (**1973**)