Canadian Environmental Law Association
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SUBMISSION BY THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION TO THE CANADIAN NUCLEAR SAFETY COMMISSION REGARDING THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR CNL'S PROPOSED NEAR SURFACE DISPOSAL FACILITY

Hearing Reference: 2022-H-07

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April 11, 2022

April 11, 2022

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

Sent by email interventions@cnsc-ccsn.gc.ca

Dear Sir or Madam:

Re: Submission by the Canadian Environmental Law Association to the Canadian Nuclear Safety Commission Regarding the Final Environmental Impact Statement for CNL's Proposed Near Surface Disposal Facility (Ref. 2022-H-07)

The Canadian Environmental Law Association has enclosed its comments on the Final Environmental Impact Statement for CNL's proposed Near Surface Disposal Facility at the Chalk River Laboratories site.

Please find attached in this email our submission for your review.

Sincerely,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Theresa McClenaghan
Executive Director and Legal Counsel

CONTENTS

LIST OF ACRONYMS

ACES	Former Advisory Committee on Environmental Standards of the Ontario Government
AECL	Atomic Energy of Canada Limited
Bq	Becquerel (of Radioactivity)
CERRIE	UK Government's Committee Examining the Radiation Risks of Internal Emitters
CSA	Canadian Standards Association
CSAR	Criticality Safety Analysis Report
DDREF	ICRP's Dose and Dose Rate Effectiveness Factor
ECM	Engineered Containment Mound
EPA	US Environmental Protection Agency
EIS	Environmental Impact Statement
GW	Gigawatt
HLW	High-Level Radioactive Waste
IAEA	UN's International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ILW	Intermediate-Level Radioactive Waste
INWORKS	International Nuclear Workers' Study
LNT	Linear No-Threshold Model of Radiogenic Risks
kW	Kilowatt
LLW	Low-Level Radioactive Waste
mSv	Millisievert
NSDF	Near Surface Disposal Facility
ODWAC	Ontario Drinking Water Advisory Council of the Ontario Government
PA	CNL's Performance Assessment for Near Surface Disposal Facility report
SAR	CNL's Safety Analysis Report
WAC	CNL's Waste Acceptance Criteria Report

I. INTRODUCTION

The Canadian Environmental Law Association ("CELA") submits this intervention in response to the Canadian Nuclear Safety Commission's ("CNSC") Revised Notice of Public Hearing[1] dated February 16, 2022 requesting comments on the application by Canadian Nuclear Laboratories ("CNL") to amend its nuclear research and test establishment operating licence for the Chalk River Laboratories ("CRL") site to authorize the construction of the proposed near surface disposal facility ("NSDF") for low-level radioactive waste. A public hearing with respect to this matter is scheduled to start on May 31, 2022.

II. INTEREST AND EXPERTISE OF THE INTERVENOR

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 over 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 including federal environmental assessments. CELA also maintains an extensive library of public legal education materials related to Canada's nuclear sector on its website.[2]

Supporting this intervention are experts Dr. Tanya Markvart and Dr. Ian Fairlie, who CELA has retained to provide advice on CNL's final Environmental Impact Statement ("EIS") and CNSC's Environmental Assessment Report ("EA Report").

III. BACKGROUND/FACTS

A. Project

Canadian Nuclear Laboratories ("CNL") is applying to the Canadian Nuclear Safety Commission ("CNSC") to amend its nuclear research and test establishment operating licence for the Chalk River Laboratories ("CRL") site to authorize the construction of the proposed near surface disposal facility ("NSDF") for low-level radioactive waste. The CRL site is located in Deep River, Ontario, and on the traditional unceded territory of the Algonquin Nation.

The current licence authorizes CNL to operate the CRL site, composed of a range of nuclear facilities, radioisotope labs, waste management facilities and other supporting facilities. The NSDF is considered to be a new Class IB facility pursuant to paragraph 19(a) of the *General Nuclear*

[1] Online: http://www.nuclearsafety.gc.ca/eng/the-commission/pdf/NoticeRev1-PublicHearing-CNL-NSDF-22-H7-e.pdf
[2] Canadian Environmental Law Association, online: www.cela.ca

Safety and Control Regulations[3] (the "General Regulations") and section 1 of the *Class I Nuclear Facilities Regulations*[4] (the "Class I Regulations"). CNL proposes to construct the NSDF within the next 3 years and operate the facility (waste emplacement) for 50 years. This would be followed by a 30-year period to decommission redundant supporting facilities, with capping and closure of the mound ending by the year 2100.[5]

In May 2016, CNSC Staff determined that the proposed NSDF meets the definition of a "designated project" under section 37(b) of the *Regulations Designating Physical Activities*[6] and is therefore subject to an environmental assessment ("EA") under the *Canadian Environmental Assessment Act, 2012*[7] ("CEAA 2012"). Although the *Impact Assessment Act*[8] came into force in August 2019, replacing CEAA 2012, it includes provisions to allow ongoing projects with EAs initiated under CEAA 2012 to continue under their existing EA processes. As a prerequisite to the licence amendment decision, the CNSC must also make an EA decision to determine whether the proposed activities are likely to cause significant adverse environmental effects.

B. Scope of Review

CELA received participant funding to review CNL's final EIS, CNSC's EA Report and related documentation, including CNL and CNSC Commission Member Documents ("CMDs"), and comment on human health, sustainable development principles, and compliance with CEAA 2012 and international best practice.

Pursuant to our Participant Funding Program application, CELA has engaged the professional services of Dr. Tanya Markvart and Dr. Ian Fairlie. Section V of this report, titled Sustainable Development, evaluates the project's documentation and assessment of effects in compliance with the statutory purpose of CEAA 2012 and the principle of sustainable development. Section VI of the report, titled Human Health and Safety, comments on the human health implications of this project.

CELA's intervention aims to advance the objects of the CNSC and is directly relevant to the CNCS's duty under section 24(4) of the *Nuclear Safety and Control Act*[9] ("NSCA") to ensure the applicant will "make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed."[10]

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[3] *General Nuclear Safety and Control Regulations*, SOR/2000-202 [**General Regulations**].
[4] *Class I Nuclear Facilities Regulations,* SOR/2000-204 [**Class I Regulations**].
[5] Canadian Nuclear Safety Commission, Notice of Public Hearing dated October 28, 2021.
[6] *Regulations Designating Physical Activities*, SOR/2012-147 at s 37(b) [**Physical Activities Regulation**].
[7] *Canadian Environmental Assessment Act, 2012*, SC 2012, c 19, s 52 [**CEAA 2012**].
[8] *Impact Assessment Act,* SC 2019, c 28, s 1.
[9] *Nuclear Safety and Control Act*, SC 1997, c 9 [**NSCA**].
[10] NSCA at s 24(4).

CELA has made recommendations both to inform the decision the CNSC's decision on whether the project is likely to cause significant adverse environmental effects pursuant to sections 52 and 53 of CEAA 2012[11] and whether the licensee has made adequate protection for human health and the environment pursuant to section 24(4) of the NSCA. Our recommendations, including suggested licence conditions and licence condition revisions, are summarized in **Appendix A**.

The review herein builds on CELA's earlier submissions from May 19, 2017, and August 15, 2017, where we provided extensive comments and recommendations on CNL's draft Environmental Impact Statement. We submit these previous materials remain relevant and ought to be reviewed by the CNSC in this matter.[12]

C. Disclaimer

This submission by the intervenor is not an endorsement of the CNSC's hearing process[13], its independence as a regulator, or its outcomes. To the contrary, the intervenor submits there is a need for legislative review of the CNSC in order to address weaknesses in the current legal framework.[14]

IV. LEGAL FINDINGS & ANALYSIS

The intervenor submits the requisite statutory and regulatory requirements of CEAA 2012 and the NSCA have not been fulfilled and the licence amendment should be denied for the following reasons, each detailed below:

A. CNL and CNSC staff's "adverse environmental effects" assessment is unreasonable as it does not meet the purposes of CEAA 2012;
B. CNL and CNSC staff have failed to adequately consider key factors required under CEAA 2012; and

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[11] CEAA 2012 at ss 52-53.
[12] *See* CELA's Submission to the CNSC on the Draft Environmental Impact Statement (May 19, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1112CNLDraftEIS-NearSurface.pdf at p 3; CELA's Updated Submission to the CNSC on the Draft Environmental Impact Statement (August 15, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1199-Updated-Submission-to-the-CNSC-Comments-on-NSDF.pdf at p 6.
[13] *See* Appendix B for a letter from CELA and others providing input on the hearing process for the NSDF; *See also* Appendix C for CNSC's response letter.
[14] The *Convention on Nuclear Safety* requires that all Contracting Parties (including Canada) take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy; *See also:* Kerrie Blaise, Theresa McClenaghan and Richard Lindgren, "Nuclear Law, Oversight and Regulation: Seeking Public Dialogue and Democratic Transparency in Canada" in Black-Branch J., Fleck D. (eds) *Nuclear Non-Proliferation in International Law - Volume IV* (2019), T.M.C. Asser Press, The Hague, online: https://doi.org/10.1007/978-94-6265-267-5_12; CELA letter to Prime Minister Trudeau re: CNSC oversight (2021), online: https://cela.ca/wp-content/uploads/2022/01/CNSC_Oversight_22NOV21.pdf.

C. CNL's EIS and CNSC staff's EA Report insufficiently demonstrate compliance with the NSCA and its regulations, including the *General Nuclear Safety and Control Regulations*, *Class I Nuclear Facilities Regulations* and *Nuclear Security Regulations*.

Given the significant unresolved issues and gaps in information needed to fully assess the project and its impacts, CELA submits the CNSC is unable to find under section 7 of CEAA 2012 that the project is not likely to not cause significant adverse environmental effects.

As a result, the CNSC is prohibited from granting a licence amendment because CEAA 2012 prohibits a proponent, like CNL, from doing "any act or thing in connection with the carrying out of the designated project" without first having an EA decision statement finding the project will not likely cause significant adverse environmental effects.[15]

A. CNL and CNSC Staff's "Adverse Environmental Effects" Assessment Does not Meet the Purposes of the Canadian Environmental Assessment Act, 2012

CELA has reviewed CNL's final EIS and the CEAA 2012 analysis conducted by CNSC staff, as set out in the Environmental Assessment Report ("EA Report").[16] As a federal authority with designated decision-making authority, section 7(b) of CEAA 2012 requires the CNSC to decide whether "the designated project is not likely to cause significant adverse environmental effects or that the significant adverse environmental effects that it is likely to cause are justified in the circumstances."[17]

It is CELA's position that several of the purposes set out in section 4 of CEAA 2012 have not been met, or only partially met in CNL's final EIS nor remedied by CNSC staff's assessment of "adverse environmental effects".

The purposes of CEAA 2012 are as follows:

> **Purposes**
>
> **4 (1)** The purposes of this Act are
>
> > **(a)** to protect the components of the environment that are within the legislative authority of Parliament from significant adverse environmental effects caused by a designated project;

[15] CEAA 2012 at ss 6 and 7(b).
[16] Canadian Nuclear Laboratories, "Near Surface Disposal Facility – Environmental Impact Statement" (2021) [**CNL's Final EIS**]; CNSC Staff, CMD 22-H7 [**CNSC Staff CMD**].
[17] CEAA 2012 at s 7(b).

> **(b)** to ensure that designated projects that require the exercise of a power or performance of a duty or function by a federal authority under any Act of Parliament other than this Act to be carried out, are considered in a careful and precautionary manner to avoid significant adverse environmental effects;
>
> **(c)** to promote cooperation and coordinated action between federal and provincial governments with respect to environmental assessments;
>
> **(d)** to promote communication and cooperation with aboriginal peoples with respect to environmental assessments;
>
> **(e)** to ensure that opportunities are provided for meaningful public participation during an environmental assessment;
>
> **(f)** to ensure that an environmental assessment is completed in a timely manner;
>
> **(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;
>
> **(h)** to encourage federal authorities to take actions that promote sustainable development in order to achieve or maintain a healthy environment and a healthy economy; and
>
> **(i)** to encourage the study of the cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments.
>
> **Mandate**
>
> **(2)** The Government of Canada, the Minister, the Agency, federal authorities and responsible authorities, in the administration of this Act, must exercise their powers in a manner that protects the environment and human health and applies the precautionary principle.[18]

As detailed below, the intervenor submits the CNL's EIS and CNSC staff's EA Report's consideration of "environmental effects" are grossly inadequate as they:

1. Reach a finding of "no significant adverse environmental effects" based on incomplete and insufficient environmental data;
2. Disregards the purpose of the Act requiring the application of the precautionary principle for matters of uncertainty and potential risk per section 4(b) of CEAA 2012;

[18] CEAA 2012 at s 4.

3. Is based on sustainability evaluation criteria which are insufficient to maintain a healthy environment and a healthy economy per section 4(h) of CEAA 2012; and
4. Ignores serious deficiencies in CNL's human health analysis.

First, both CNL and CNSC staff reach a finding of "no significant adverse environmental effects" based on incomplete and insufficient environmental data.[19] In addition to concerns raised in our 2017 submissions which remain applicable to this EA review, we note the following deficiencies with the environmental data provided in CNL's final EIS and associated documents:

- As discussed in more detail in Part VI.E. below, CNL's final EIS lacks key information about the radioactive waste or hazardous waste that may result from the activity to be licensed, including names, forms, and origins. For example, no information is contained in the CNL documents as to precisely what "packaged" waste contains. The intervenor **submits** this lack of a detailed inventory means the CNSC cannot confidently determine whether the NSDF is likely to cause significant adverse environmental effects.

- CNL's final EIS provides insufficient detail about how long-lived radionuclides will be dealt with in order to protect against significant adverse environmental effects. As discussed in more detail in Part VI.F. below, the final EIS asserts that long-lived radionuclides cannot be separated from the waste streams at CRL and other CNL sites, but fails to explain or justify this assertion. Indeed, large amounts of long-lived radionuclides are included in the proposed NSDF inventory despite the fact that the NSDF is not designed to contain such a significant amount of long-lived radionuclides. CELA **submits** this casts doubt on whether or not the NSDF will cause significant adverse environmental effects, and therefore, the CNSC cannot make an "environmental effects" determination without more information about why these long-lived radionuclides cannot be separated and how CNL intends to deal with them.

Second, as discussed in more detail in Part V.C. below, both CNL and CNSC Staff disregard a fundamental purpose of CEAA 2012 which requires the application of the precautionary principle for matters of uncertainty and potential risk.[20] The precautionary principle, as relied upon in section 4(2) of 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.[21] 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*:

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[19] Canadian Nuclear Laboratories, CMD 22-H7.1 at p 4; CNSC Staff CMD at p 2.
[20] CEAA 2012 at s 4(2).
[21] Cameron J and Abouchar J, "The precautionary principle: a fundamental principle of law and policy for the protection of the global environment" (1990) 14:1 Boston College International and Comparative Law Review at p 3 [**Cameron & Abouchar**].

> 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.[22]

As such, there is a positive duty on the CNSC to ensure the activities it licences do not cause unacceptable or irreversible harm to the environment.[23] However, the intervenor **submits** that critical questions remain about whether an above-ground concrete vault will allow for safe retrieval of nuclear waste in the future, which, if not possible, could result in irreversible harm to the environment. CNL's failure to devote appropriate attention to retrievability in the design of the project is a critical flaw, especially considering the long-lived nature of many of the radionuclides destined for the mound and the potential for substantial environmental contamination. As a required purpose of CEAA 2012, CNL ought to have addressed these matters of uncertainty and potential risk.

Third, both CNL and CNSC staff's assessment is based on sustainability evaluation criteria which is insufficient to maintain a healthy environment and a healthy economy as required under section 4(1)(h) of CEAA 2012. As further detailed in Part V.A., CNL's final EIS fails to clearly and fully address key aspects of sustainability, including the lack of consideration of the financial risks and burdens of possible environmental impacts to present and future generations over the lifetime of the project.

The reason for this is that CNL's evaluation criteria fail to capture the intergenerational and intragenerational justice concerns surrounding the distribution of economic, health and safety, and environmental costs, risks, and burdens of the project over its lifetime. In addition, each criterion is too narrowly defined to capture all relevant, context-specific issues surrounding the long-term impacts of the alternative means.

Fourth, both CNL and CNSC staff's analysis ignores serious deficiencies in CNL's human health assessment and disregards the purpose of the Act which requires the CNSC to exercise their powers in a manner that protects human health.[24] In addition to the issues highlighted in CELA's 2017

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[22] *114957 Canada Ltee (Spray-Tech) v Hudson (Ville)*, 2001 SCC 40 (CanLII) at para 31.
[23] Cameron & Abouchar at p 22.
[24] CEAA 2012 at s 4(2).

submissions, which are included in Part VI.A. below, serious problems exist with CNL's assessment of human impacts in their final EIS and its conclusions on radiation doses and risks. These problems are further explored in Part VI.B. below, and include the following:

- Lack of transparency, as the models and assumptions used by CNL to derive its estimated radiation risks are neither listed nor discussed, making it impossible to assess or critique the cited doses and risks.
- Large uncertainties in CNL's estimates of radiation doses and risks – particularly for risks arising from postulated exposures centuries into the future.
- No explanation of why dose and risk uncertainties arise in the first place.
- No discussion of new evidence from the International Nuclear Workers' Study ("INWORKS"), showing that radiation risks are far greater than currently acknowledged.

As such, it is CELA's view that the doses and risks cited in CNL's final EIS are unreliable for use in decision-making, especially the issuing of licenses and licence amendments. The intervenor submits the CNSC cannot grant a licence amendment on the basis of exposure estimates that are fraught with sometimes very large uncertainties and fail to address recent studies that show greater radiation risks than currently acknowledged in the EIS.

Furthermore, as discussed below in Part VI.C., CNL estimates a high annual dose to workers of 10.4mSv. Therefore, if workers were to be employed for 20 years, their dose would be over 200 mSv—a seriously high level which would significantly increase the risk of cancer, birth defects and cardiovascular disease. CELA **submits** this is contrary to the purposes of CEAA 2012 and the objects of the CNSC which, in issuing a licence amendment, require the CNSC to exercise their powers in a manner that protects human health.[25]

Finally, the intervenor submits CNL's final EIS does not provide enough information about the form and origin of cobalt-60 in the NSDF waste inventory for the CNSC to determine that CNL will be able to protect human health. As discussed in Part VI.F. below, large amounts of cobalt-60 are to be disposed of in the NSDF. While this large amount is not explained in the final EIS, it is surmised to be due to the planned disposal of disused cobalt irradiation devices currently being stored at Chalk River. In CELA's view, this large number of potentially dangerous cobalt-60 devices should be placed in much more robust containment than the proposed NSDF, as it has the potential to cause significant adverse human health effects.

Recommendation No. 1: Given the significant lack of a detailed inventory, the CNSC cannot make a finding under section 7 of the CEAA 2012 that the NSDF is not likely to cause significant adverse environmental effects. CNL should be required to provide a detailed inventory of the

[25] NSCA at s 24(4)(b).

wastes in question given the stated interest of the public in this project and its impact on findings of adverse environmental effects.

Recommendation No. 2: The final EIS should explain why long-lived radionuclides cannot be separated from the waste stream, including why a more suitable design was not chosen in order to reduce the risk of significant adverse environmental effects in the centuries to come.

Recommendation No. 3: CNL should be required to explain the significant amount of Cobalt-60 in the NSDF waste inventory, as well as how the NSDF is expected to contain this to avoid significant adverse environmental effects.

Recommendation No. 4: To ensure adherence to the purposes set out in sections 4(1)(b) and 4(2) of CEAA 2012, greater attention must be paid to the precautionary principle, including by incorporating the notion of reversibility into the consideration of alternatives and by ensuring that future retrievability of the waste is possible no matter what design is chosen.

Recommendation No. 5: To reflect the purpose set out in section 4(1)(h) of CEAA 2012, CNL's sustainability evaluation criteria must be broadened to make it clear that appropriate attention has been devoted to the NSDF project's potential intergenerational and intragenerational distributive justice impacts, including economic risks and burdens.

Recommendation No. 6: CNL should be required to provide a detailed explanation of the models it is relying on, as well as the large uncertainties in its radiation doses and risks. Furthermore, given the uncertainty and the estimated high doses to workers, the CNSC cannot conclude that adequate protection of human health is ensured per the NSCA, and thus cannot grant a licence amendment to CNL.

B. CNL and CNSC Staff Fail to Consider Key Factors Required Under the Canadian Environmental Assessment Act, 2012

CEAA 2012 enumerates the factors to be considered when conducting an EA—some of which CELA has found not to have been properly considered in CNSC staff's EA Report and CNL's final EIS. The factors that must be considered are set out in section 19 of the Act as follows:

> **Factors**
>
> **19 (1)** The environmental assessment of a designated project must take into account the following factors:
>
> > **(a)** the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the

> designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;
>
> **(b)** the significance of the effects referred to in paragraph (a);
>
> **(c)** comments from the public — or, with respect to a designated project that requires that a certificate be issued in accordance with an order made under section 54 of the National Energy Board Act, any interested party — that are received in accordance with this Act;
>
> **(d)** mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project;
>
> **(e)** the requirements of the follow-up program in respect of the designated project;
>
> **(f)** the purpose of the designated project;
>
> **(g)** alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means;
>
> **(h)** any change to the designated project that may be caused by the environment;
>
> **(i)** the results of any relevant study conducted by a committee established under section 73 or 74; and
>
> **(j)** any other matter relevant to the environmental assessment that the responsible authority, or — if the environmental assessment is referred to a review panel — the Minister, requires to be taken into account.[26]

First, CELA submits opportunities have not been provided for meaningful public participation, contrary to the purposes of CEAA 2012 and the factors which ought to inform an EA. The intervenor submits section 19(1)(c) of CEAA 2012, which requires an EA to account for comments received from the public, should be read in conjunction with section 4(1)(e) of the Act, which requires opportunities be provided for "meaningful public participation during an environmental assessment".[27] CELA expressed a number of valid concerns in our 2017 submissions which remain either unaddressed or not addressed in full in CNL's final EIS and must be considered by the

[26] CEAA 2012 at s 19.
[27] CEAA 2012 at ss 4(1)(e) and 19(1)(c) [emphasis added].

CNSC in its deliberations. Based on our experience thus far and CNL's failure to account for our concerns in the EA process, it is CELA's position that the EA process has not provided for meaningful public participation as envisaged in sections 4(1)(e) and 19(1)(c).

Second, the "alternatives assessment" conducted by CNL – which is a fundamental to a sound EA process –fails to undertake a transparent comparison of all alternatives with the aim of identifying the best option. CNL was obliged by CEAA 2012 section 19(1)(g) and the *CNL-CNSC Administrative Protocol for the Near Surface Disposal Facility Project at Chalk River Laboratories*[28] ("the Administrative Protocol") to evaluate feasible "alternative means of carrying out the designated project". In carrying out an "alternative means" assessment, the CNSC's *Generic Guidelines for the Preparation of an Environmental Impact Statement* (the "Generic Guidelines") require the proponent to[29]:

- Identify and describe in sufficient detail the alternative means to carry out the project
- Identify the effects of each technically and economically feasible alternative means:
- Describe the methodology used for the analysis of alternative means and the conclusion reached (i.e., preferred means).

RegDoc 2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures* similarly requires the EIS describe "the criteria used to identify alternative means as unacceptable, and how these criteria were applied". [30]

As discussed in more detail in Part V.B. below, CELA submits CNL's "alternative means" analysis within the final EIS is inadequate because it gives priority to cost considerations over the need to ensure long-term containment and protection of the environment and human health. As a result, CNL's final EIS fails to undertake a transparent comparison of all alternatives with the aim of identifying the best option and instead rests on the assumption that the preferred option is the NSDF option.

Furthermore, as highlighted in Part V.B. below, the comparison of alternatives in CNL's final EIS uses a flawed evaluation method that allows for the systematic elimination of facility type and facility design options based on one criterion or two criteria, as opposed to a comparative evaluation of options based on a comprehensive set of sustainability criteria. As such, critical

[28] Canadian Nuclear Safety Commission, "CNL-CNSC Administrative Protocol for the Near Surface Disposal Facility Project at Chalk River Laboratories" (2019) required CNL to prepare an EIS that meets the requirements of the *Generic Guidelines for the Preparation of an Environmental Impact Statement* [**Administrative Protocol**].
[29] CEAA 2012 at s 19(1)(g); Canadian Nuclear Safety Commission, "*Generic Guidelines for the Preparation of an Environmental Impact Statement*" (2016), online: https://www.nuclearsafety.gc.ca/eng/pdfs/Environmental-Assessments/CEAA-2012-Generic-EIS-Guidelines-eng.pdf at s 4.2 [**Generic Guidelines**].
[30] Canadian Nuclear Safety Commission, RegDoc 2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures* (2016), online: https://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-9-1-new/index.cfm at s A.3.2 [**RegDoc 2.9.1**].

questions remain about whether the impacts of transporting the waste off-site are preferrable to the impacts associated with using the CRL site.

Given the nature of the project in question, CNL's consideration of alternative means does not live up to the requirement set out in section 19(1)(g) of CEAA 2012, nor as explained in the CNSC's RegDoc 2.9.1 and its Generic Guidelines.

Recommendation No. 7: All comments in this submission should be addressed to ensure the EA process reflects the requirements in sections 4(1)(e) of CEAA 2012, which requires opportunities be provided for "meaningful public participation during an environmental assessment", and 19(1)(c), which requires an EA to account for comments received from the public.

Recommendation No. 8: CNL's final EIS fails to undertake a transparent comparison of all alternatives with the aim of identifying the best option. As such, CNL's consideration of alternative means does not live up to the requirement set out in section 19(1)(g) of CEAA 2012 and further explained in the CNSC's RegDoc 2.9.1 and Generic Guidelines. CNL should be required to provide a more fulsome comparison of alternatives, in line with expectations set out in these legislative and policy documents.

C. CNL's EIS and CNSC Staff 's EA Report Insufficiently Demonstrate Compliance with the NSCA and its Regulations

The intervenor has reviewed CNL's final EIS, CNSC staff's EA Report and related documentation, and submits that CNL has not fulfilled the statutory and regulatory requirements of the NSCA.

i. CNSC staff's assessment disregards the objects of the CNSC as set out in the Nuclear Safety and Control Act

CELA submits CNSC staff's assessment in their EA Report disregards the statutory object of the CNSC which requires they "prevent unreasonable risk, to the environment and to the health and safety of persons, associated with that development, production, possession or use".[31] According to the NSCA, the objects of the CNSC are as follows:

> **9** The objects of the Commission are
>
> > **(a)** to regulate the development, production and use of nuclear energy and the production, possession and use of nuclear substances, prescribed equipment and prescribed information in order to

[31] NSCA at s 9.

> **(i)** prevent unreasonable risk, to the environment and to the health and safety of persons, associated with that development, production, possession or use,
> **(ii)** prevent unreasonable risk to national security associated with that development, production, possession or use, and
> **(iii)** achieve conformity with measures of control and international obligations to which Canada has agreed; and
>
> **(b)** 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).

The intervenor submits that, based on the deficiencies in CNL's final EIS and associated documents (highlighted above in Part IV.A. and Part IV.B. of this submission), the CNSC cannot proceed with licensing when it cannot confidently conclude that the NSDF will not result in "unreasonable risk to the environment and to the health and safety of persons".

ii. CNL's final EIS does not fulfill statutory conditions for issuance of a licence

Pursuant to section 24(4) of the NSCA, nuclear facilities defined as Class I nuclear facilities are required to meet the following legislated licence pre-conditions:

> **24(4)** No licence shall be issued, renewed, amended or replaced — and no authorization to transfer one given — unless, in the opinion of the Commission, the applicant or, in the case of an application for an authorization to transfer the licence, the transferee
>
> **(a)** is qualified to carry on the activity that the licence will authorize the licensee to carry on; and
>
> **(b)** will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.[32]

CELA submits, for the following reasons, CNL has not demonstrated they will "make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed" as required under section 24(4)(b) of the NSCA.

[32] NSCA at s 24(4).

First, as further detailed in Part V below, the intervenor **submits** that CNL has not demonstrated they will make adequate provision for the protection of the environment as required under section 24(4)(b). For instance, CNSC RegDoc 2.9.1, as well as the human health and EA obligations under the NSCA[33], provide an opening for applicants to devote explicit attention to the guiding principles of sustainability, precaution, and adaptive management. CELA submits that CNL's final EIS and CNSC's EA Report are fundamentally flawed in their consideration of these factors in ways that are critical to the CNSC's final decision under section 24(4)(b).

Specifically, while CNL's final EIS and CNSC's EA Report touch on some sustainability concerns in so far as they focus on the effects of the proposed NSDF on human health and ecological systems, they do not explicitly devote attention to the guiding principle of sustainability by incorporating the concept in a systematic way throughout analysis. In addition, CNL's flawed analysis of alternatives ignores critical sustainability concerns about which the public should have a good understanding.

Second, the intervenor **submits** that CNL has not demonstrated they will make adequate provision for the health and safety of persons. As outlined further in Part VI below, critical questions remain about radiation doses and risks to workers and the public, tritium levels in drinking water, and containment of long-lived radionuclides.

Third, the NSCA decision-making framework requires that international law be applied, pursuant to sections 3, 9 and 24(4).[34] In particular, a licensing decision made under section 24(4) provides that a licence shall not be renewed if the licensee does not make adequate provision for measures "required to implement international obligations to which Canada has agreed".[35]

CELA **submits** CNL has failed to consider the international law principle of justification, which is one of the International Commission on Radiological Protection's ("ICRP") three core principles of radiation protection.[36] The ICRP establishes that the principle of justification requires that "any decision that alters the radiation exposure situation should do more good than harm."[37] The principle of justification is a central component of protecting workers and the public from radiation from nuclear facilities, and it requires that collective doses arising from a project or activity have to be evaluated and compared with any benefits accruing from the facility. The intervenor submits that the term "international obligations" under section 24(4)(b) of the NSCA includes the ICRP's three core principles of radiation protection. Despite this, no attempt has been made to "justify" the radiation exposures to people living nearby from the routine emissions of the proposed facility

[33] NSCA at ss 3, 9 and 24(4).
[34] NSCA at ss 3, 9 and 24(4).
[35] NSCA at s 24(4)(b).
[36] International Commission on Radiological Protection, "Recommendations of the International Commission on Radiological Protection – ICRP Publication 103" (2007) [**ICRP Publication 103**].
[37] ICRP Publication 103 at p 14.

in CNL's final EIS. CELA **submits** that CNL must be required to provide justification for the increased radiation exposures to people living nearby from the routine emissions of the proposed facility.

Subsequently, in determining whether or not to grant the licence amendment, the CNSC must also ensure it considers whether these increased exposures are justified based on benefits to individuals and society, not just proponent profit.

Further, in light of the above noted deficiencies in CNL and CNSC's materials, the intervenor **submits** that, should the CNSC grant the licence amendment, it would be inconsistent with the precautionary principle. As noted above, in circumstances of potentially serious or irreversible environmental harm, the CNSC must only licence activities which prioritize environmental protection, and human health and safety. As this threshold has not been met, it would be contrary to the international obligations to which Canada has agreed to grant the licence amendment.

Recommendation No. 9: In accordance with the international law principle of justification, CNL must be required to justify the radiation exposures to people living nearby from the routine emissions of the proposed facility. The CNSC must also ensure it considers in its own decision-making whether the benefits of the proposed facility to individuals and society outweigh the risks posed by increased radiation exposures from the facility.

Recommendation No. 10: The CNSC must ensure its decision-making aligns with the precautionary principle and thus, only licence CNL's activities to the extent they are carried out in a way which ensures protection of the environment and human health and safety.

iii. CNL's licence application does not satisfy the requirements of the General Nuclear Safety and Control Regulations

The intervenor submits CNL's licence application[38] does not satisfy all requirements under section 3 of the *General Nuclear Safety and Control Regulations* (the "General Regulations").[39] Section 3 of the General Regulations lists all of the information which must be provided in a licence application, including:

> […]
>
> **(j)** the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored,

[38] Canadian Nuclear Laboratories, Updated Application for Licence Amendment to add the Near Surface Disposal Facility to the Chalk River Laboratories Licencing Basis (2021).
[39] General Regulations at s 3.

> managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;[40]

As discussed in more detail in Part VI.D. below, the licence application and final EIS lack key information required under section 3(1)(j) of the General Regulations, including the names, forms, and origins of many of the waste types that may result from the activity to be licenced.[41] For example, no information is contained in the CNL documents as to precisely what "packaged" waste contains. This lack of a detailed inventory means the CNSC cannot confidently determine whether the NSDF is likely to cause significant adverse environmental effects.

Recommendation No. 11: The CNSC cannot grant the licence amendment until the licence application contains all information required by section 3 of the *General Nuclear Safety and Control Regulations*.

iv. CNL's licence application does not satisfy the requirements of the Class I Nuclear Facilities Regulations

Section 3 of the *Class I Nuclear Facilities Regulations*[42] (the "Class I Regulations") 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 Regulations.

Section 3(e), for example, 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".[43] As such, the intervenor reiterates what was said above in regard to sections 3(1)(j) of the General Regulations—namely that the required information should be included in the application and final EIS.

Recommendation No. 12: The CNSC should not grant the licence amendment until the information which demonstrates compliance with section 3 of the *Class I Nuclear Facilities Regulations* is provided by CNL.

V. SUSTAINABLE DEVELOPMENT (EXPERT REPORT BY DR. MARKVART)

Sustainable development is a fundamental component of EA, and CEAA 2012 specifically requires that actions be taken to "promote sustainable development."[44] For the purposes of this chapter, sustainable development is the process that allows for development which meets the needs of the

[40] General Regulations at s 3(1)(j).
[41] *Ibid.*
[42] Class I Regulations.
[43] Class I Regulations at s 3(e).
[44] CEAA 2012 at s 4(1)(h).

present without compromising the ability of future generations to meet their own needs.[45] The philosophy of sustainable development, which often invokes the precautionary principle and the polluter pays principle, encourages society to act for the long-term protection of the planet and future generations.[46]

Given the centrality of sustainable development to EA, and to the CNSC's decision as to whether the project is likely to cause significant adverse environmental effects, this chapter provides a sustainability-based evaluation of CNL's final EIS for the NSDF as reviewed and written by Dr. Tanya Markvart.

As found by Dr. Markvart, CNL's final EIS and CNSC staff's EA Report fail to adequately consider sustainable development and, as a result, the CNSC cannot make a determination that the NSDF is not likely to not cause significant adverse environmental effects as required under section 7 of CEAA 2012.[47] As this is a precondition to the issuance of the licence amendment, CELA subsequently finds the CNSC does not have the requisite basis to grant a licence amendment to CNL in order to construct and operate its proposed NSDF at Chalk River.

The sustainability-based evaluation in this chapter considers CNL's 2020 responses to CELA's 2017 Information Requests submission, and rests in part on the purpose of CEAA 2012, as set out in sections 4(1)(b), (h), and (i):

> **4(1)** The purposes of this Act are
>
> […]
>
> **(b)** to ensure that designated projects…are considered in a careful and precautionary manner to avoid significant adverse environmental effects;
>
> […]
>
> **(h)** to encourage federal authorities to take actions that promote sustainable development in order to achieve or maintain a healthy environment and a healthy economy; and
>
> **(i)** to encourage the study of the cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments.[48]

[45] Kerrie Blaise and Shawn-Patrick Stensil, "Small Modular Reactors in Canada: Eroding Public Oversight and Canada's Transition to Sustainable Development" in Jonathan L Black-Branch and Dieter Fleck (eds), Nuclear Non-Proliferation in International Law – Volume V – Legal Challenges for Nuclear Security and Deterrence (2020, Asser Press: The Hague) 209 at p 211 [**Blaise and Stensil, 2020**].
[46] Blaise and Stensil, 2020 at p 211.
[47] CEAA 2012 at s 7.
[48] CEAA 2012 at s 4(b)(h) and (i).

The following sections describe the remaining critical deficiencies in CNL's final EIS with respect to four key considerations of sustainability-based environmental assessment best practices:

- Evaluation criteria and process (see section 2);
- Consideration of trade-offs (see section 3);
- Consideration of the precautionary principle and associated concepts (see section 4); and
- Long-term monitoring (see section 5).

A. Evaluation Criteria and Process

An adequate consideration of sustainability in environmental assessment must demonstrate that the preferred option emerged from a comparative evaluation of options in light of their relative contributions to a comprehensive set of generic and context-specific sustainability concerns. The proponent must clearly demonstrate to the public that the preferred option will contribute the greatest net social, economic, and environmental benefits to society while avoiding significant adverse effects.[49]

To clearly demonstrate to the public that the NSDF option is the best option in light of net contributions to sustainability, CNL should have provided:

- a description of the sustainability-based criteria that CNL adopted to evaluate and compare the alternative means as well as the effects of the preferred NSDF option;
- a description of how the three criteria (technical feasibility, economic feasibility, and likely environmental effects) constitute relevant sustainability considerations;
- a description of the process by which CNL incorporated consideration for sustainability contributions throughout the assessment and design of the preferred NSDF option; and
- a description of the relative contributions to sustainability of the alternative means and the preferred NSDF option.

With respect to the above criteria and processes for incorporating sustainability in environmental assessment, CELA found critical inadequacies in CNL's draft EIS[50], and in 2017 CELA submitted the following Information Requests:

a) Describe how sustainability-based criteria were used to evaluate and compare the alternative means as well as the effects of the preferred NSDF option.

[49] *See* Gibson, R.B., Hassan, S., Holtz, S., Tansey, J., & Whitelaw, G., "Sustainability Assessment: Criteria and Processes" (2005) London, Sterling: Earthscan [**Gibson 2005**]; Gibson, R.B. (2016). (Ed.). "Sustainability Assessment: Applications and Opportunities." (2016) London: Routledge/Taylor & Francis [**Gibson 2016**].
[50] Online: https://www.ceaa-acee.gc.ca/050/documents/p80122/118380E.pdf

b) Describe how the three evaluation criteria (technical feasibility, economic feasibility, and likely environmental effects), CNL design principles, INPO nuclear safety culture principles, IAEA safety principles, and CNSC licensing requirements constitute relevant sustainability considerations.
c) Provide a description of the process by which consideration for sustainability contributions was incorporated throughout the assessment and design of the preferred NSDF option.[51]

CNL's December 2020 response table[52] and final EIS provide a list of policies, guidelines, and standards upon which its evaluation is based, including CNL's environmental policy, CNSC guidelines, the International Finance Corporation 2012 standards for environmental and social sustainability performance, and CEAA 2012 operational policy statement for addressing "purpose of" and "alternative means". In addition, in section 2.5.1 of CNL's final EIS, CNL sets out the criteria (technical feasibility, economic feasibility, likely environmental effects) upon which its evaluation of alternative means is based.

While these policies, guidelines and standards highlight important sustainability considerations in nuclear waste management (e.g., energy efficiency, pollution prevention, community engagement, etc.), they do not constitute a comprehensive, integrated conceptual framework and steps for evaluating impacts. Rather, they merely stand as a set of ideas that implicitly guide the evaluations.

CELA's 2017 Information Request underscored the need for CNL to describe how the three evaluation criteria (technical feasibility, economic feasibility, likely environmental effects) constitute a comprehensive suite of sustainability concerns. But CNL's response document and final EIS fail to provide adequate information in this regard.

One critical flaw of CNL's consideration of sustainability throughout planning and evaluation is that CNL's evaluation criteria do not capture the intergenerational and intragenerational justice concerns surrounding the distribution of economic, health and safety, and environmental costs, risks, and burdens of the project over its lifetime. In addition, each criterion is too narrowly defined to capture all relevant, context-specific issues surrounding the long-term impacts of the alternative means.

The inter- and intragenerational distributive justice issues associated with nuclear waste management stem from the degradation and depletion of natural resources and transboundary

[51] *See* CELA's Submission to the CNSC on the Draft Environmental Impact Statement (May 19, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1112CNLDraftEIS-NearSurface.pdf at p 3; CELA's Updated Submission to the CNSC on the Draft Environmental Impact Statement (August 15, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1199-Updated-Submission-to-the-CNSC-Comments-on-NSDF.pdf at p 6.
[52] CNL's December 2020 Response Table: Consolidated Public and Indigenous Groups' Comments on the Near Surface Disposal Facility Project Draft EIS, https://iaac-aeic.gc.ca/050/documents/p80122/139599E.pdf [**CNL's 2020 Response Table**].

effects, and the distribution of the associated impacts on human health and safety, the economy, and the environment, especially within the context of uncertainty and climate change. With respect to the NSDF project, it is plausible that citizens who reside within the vicinity of the site will assume disproportionate (financial, health and safety, and environmental) risks and burdens, and these risks and burdens will vary depending on the preferred alternative.

One example of the inadequacy of CNL's criteria to capture relevant, context-specific sustainability concerns is that CNL's economic feasibility criterion does not consider the financial risks and burdens of possible environmental impacts to present and future generations over the lifetime of the project.

CNL's failure to appropriately consider sustainability concerns in the final EIS is a critical flaw. As the Concerned Citizens of Renfrew County and Area assert, 25 of the 31 radionuclides destined for the NSDF are long lived with half-lives ranging from 1,600 to 14 billion years.[53] The public must be assured that CNL has devoted appropriate attention to the potential inter- and intragenerational distributive justice issues, including the economic risks and burdens of related impacts, surrounding the NSDF project.

B. Consideration of Trade-Offs

One key step in the evaluation and comparison of alternatives in light of sustainability contributions is the transparent consideration of trade-offs among the options. Gibson[54] and others[55] provide an in-depth explanation of trade-offs and guidelines for dealing with them in sustainability-based EA. As Gibson explains, substantive trade-offs[56]:

> involve choices about what purposes to serve, what alternatives to favour, what design features to incorporate, what enhancements and mitigations to consider adequate and what undertakings to approve with what conditions and implementation controls, etc. Most significantly, substantive trade-offs are about the anticipated effects resulting from these choices. They centre on what predicted damages and risks are accepted as the price to pay for what expected benefits.

[53] Concerned Citizens of Renfrew County and Area, "Critical Flaws, Errors and Omissions in CNSC Staff's Environmental Assessment Report and Case to Approve the Chalk River Mound" (2022), online: https://concernedcitizens.net/2022/02/21/critical-flaws-errors-and-omissions-in-cnsc-staffs-ea-report-and-case-to-approve-the-chalk-river-mound-2/ at p 1 [**CCRCA 2022**].
[54] Gibson 2005; Gibson, R.B., "Avoiding sustainability trade-offs in environmental assessment" (2013) 31:1 Impact Assessment and Project Appraisal at pp 2-12 [**Gibson 2013**].
[55] *See* Morrison-Saunders, A., & Pope, J., "Conceptualising and managing trade-offs in sustainability assessment" (2013) 38 Environmental Impact Assessment Review at pp 54–63 [**Morrison-Saunders & Pope, 2013**].
[56] Gibson 2013 at p 2.

CELA's 2017 submission highlighted some critical trade-offs that remained unaddressed in CNL's draft EIS and included the following Information Requests:

- Provide a comparative evaluation of the alternative means in terms of their relative contributions to sustainability to clearly demonstrate to the public that the NSDF is the best option with respect to net contributions to sustainability.
- Describe and demonstrate how trade-offs were considered among the options in the comparative evaluation of alternative means.[57]

With respect to the consideration of trade-offs, CELA submits there are critical inadequacies in CNL's final EIS because:

- CNL's evaluation is based on flawed evaluation criteria;
- CNL's evaluation rests on the assumption that the preferred option is the NSDF option; and
- CNL fails to assess the predicted risks and expected benefits of the NSDF compared to other alternatives with respect to contributions to sustainability and sustainable development.

First, CELA submits CNL's assessment of alternatives and consideration of trade-offs is based on flawed evaluation criteria. CNL's 2020 response to CELA's information requests reiterated the foundation for its evaluation of alternatives were the CNSC's Generic Guidelines, CEAA 2012, and the three evaluation criteria (technical, economic, and environmental). In addition, CNL gave an example of how its evaluation illuminated key factors that influenced the design and location of the preferred NSDF option.[58]

The CNSC's Generic Guidelines and CEAA 2012 require the EIS to identify "alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means".[59] CELA submits that CNL's three evaluation criteria represent a narrow interpretation of these factors because they fail to consider critical sustainability concerns, as outlined above.

Second, CNL's final EIS fails to undertake a transparent comparison of all alternatives with the aim to identify the best option, considering the impacts and trade-offs of each, and instead rests on

[57] *See* CELA's Submission to the CNSC on the Draft Environmental Impact Statement (May 19, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1112CNLDraftEIS-NearSurface.pdf at p 3; CELA's Updated Submission to the CNSC on the Draft Environmental Impact Statement (August 15, 2017), online: https://cela.ca/wp-content/uploads/2019/07/1199-Updated-Submission-to-the-CNSC-Comments-on-NSDF.pdf at p 6.
[58] *See* CNL's 2020 Response Table.
[59] Generic Guidelines at s 4.2; CEAA 2012 at s 19(1)(g).

the assumption that the preferred option is the NSDF option. Indeed, CNL identifies the preferred NSDF option using a flawed evaluation method that allows for the systematic elimination of facility type and facility design options based on one criterion or two criteria, as opposed to a comparative evaluation of options based on a comprehensive set of sustainability criteria, weighing the relative costs and risks of all options in this light. This stepwise, criteria-based process of eliminating options to select the preferred option does not constitute a full comparative analysis and, as such, it is unacceptable.[60]

CNL's flawed analysis of alternatives also ignores critical concerns about which the public should have a good understanding. For example, CNL's comparative analysis of facility locations concentrates primarily on the NSDF engineered containment mound facility design option, as opposed to a transparent comparative evaluation of all options, including facility types and facility designs.

Critical questions remain about whether the possible impacts of transporting the waste to an off-site location suitable for an above-ground concrete vault design or shallow or intermediate depth cavern design are preferrable, especially considering the inter- and intragenerational, economic, health and safety, and environmental impacts of locating the NSDF within the CRL site, immediately adjacent to the Ottawa River, a drinking source for millions of Canadians.

Third, CNL's evaluation of facility design alternatives ignores critical questions about trade-offs. CNL must provide an adequate rationale for the selection of the engineered containment mound facility design. This rationale must include an investigation and discussion about whether or not it would be more beneficial with respect to contributions to sustainability to devote more money and time on the above-ground concrete vault option, which would require more packaging and more land/area but could provide greater durability and increased protection to groundwater and from weathering and erosion over the long term.

Other crucial concerns remain unaddressed by CNL's inadequate evaluation of alternative means, including, to name a few, a comparison of the expected radiation doses to members of the public as a function of time, and the impacts of the alternative means, considering all phases, from construction through to post-closure, and possible accidents and malfunctions.

C. Consideration of the Precautionary Principle

CELA's 2017 submission provided an explanation of the concept of adaptive management capacity and associated design concepts (reversibility, retrievability, diversity and redundancy), which are central to a precautionary approach in nuclear waste management planning and

[60] CNL's Final EIS at p 105-171.

assessment. We asserted that it was unclear how these concepts influenced CNL's evaluation of alternative means and proposed NSDF, and we submitted the following Information Request:

- Describe how reversibility, retrievability, diversity, and redundancy were incorporated in the comparative evaluation of alternative means and the design and assessment of the preferred NSDF option.

CNL's final EIS defines adaptive management and explains that the concept will be incorporated in various management plans that track the development and implementation of mitigation measures. Adaptive management is conceived primarily as a means to respond by adjusting practices and programs, to uncertainty and changes identified through monitoring the performance of the NSDF.

With respect to consideration of the precautionary principle, CELA again submits that CNL's final EIS fails to adequately address the concept of adaptive management capacity and associated design concepts such as reversibility, retrievability, diversity and redundancy.

CNL explains the notion of adaptive management in various parts of the final EIS; however, the discussion is narrowly focused on monitoring the performance of the NSDF containment system. For example, CNL's technical feasibility consideration, "disposal facility design robustness"[61], is too narrowly focused on the design life and construction materials of the NSDF option.

While reversibility and retrievability are vital to adaptive management capacity in nuclear waste management,[62] the notion of retrievability has been the subject of multiple information requests submitted by organizations and concerned individuals.[63] Designing a nuclear waste management project so that waste can be deposited or stored in a retrievable manner enhances the reversibility of decisions by providing an additional degree of flexibility. It will give future generations access to the stored nuclear waste, to undertake necessary monitoring and repairs, move the waste to a safer storage facility if needed, and take advantage of new, safer technologies for nuclear waste management in the future.

As drafted, CNL's final EIS rests on an unacceptable assumption that future generations will not take responsibility for the inherited waste, and it rests on a limited imagination with respect to how the nuclear waste management industry may evolve over the next 500+ years. At a minimum, CNL's final EIS should incorporate the notion of reversibility in its evaluation of alternatives. Critical questions remain about, for example, whether an above-ground concrete vault would allow for greater retrievability of the nuclear waste for generations to come.

[61] CNL's Final EIS at p 108.
[62] Nuclear Energy Agency and Organization for Economic Cooperation and Development. (2012). Reversibility of Decisions and Retrievability of Radioactive Waste: Considerations for National Geological Disposal Programmes.
[63] CNL's 2020 Response Table at pp 9, 17.

CNL asserts that for the NSDF, waste retrieval is not intended nor required and thus is not assessed; however, CNL acknowledges the potential need for waste retrieval, and it notes that a safety assessment for waste retrieval would be required prior to retrieval activities. The public must be assured that the contents of the NSDF, which will be organized according to ten (active and closed) disposal cells, will be retrievable if necessary.

CNL's failure to devote appropriate attention to retrievability in the design of the project is a critical flaw, especially considering the long-lived nature of the radionuclides destined for the mound and the potential for environmental contamination. CNL's final EIS must incorporate a discussion about how the NSDF's disposal cell system will be designed to ensure that present and future generations will be able to retrieve the waste. This discussion must devote attention to a range of accidents and malfunctions and environmental impacts related to the key components of the NSDF design, notably the engineered containment mound and its passive safety features (base liner system, final cover system, and perimeter berm).

D. Long-Term Monitoring Plans

CELA's 2017 submission provided a brief explanation of the concept of rolling stewardship as an appropriate concept to incorporate in planning for the long-term monitoring of nuclear waste facilities. We submitted the following related Information Request:

- Provide a description of how the concept of rolling stewardship will be applied in all phases of monitoring for the NSDF.

CELA again submits that CNL's failure to incorporate the concept of rolling stewardship in its consideration of long-term monitoring for the NSDF in its final EIS is a critical deficiency in its evaluation of sustainability and environmental impacts.

CNL's final EIS notes that the closure phase (2070 – 2100) of the project will involve ongoing, long-term performance monitoring and inspection activities to meet performance requirements. During the post-closure period (2100 – 2400), institutional controls will be implemented to limit access to or uses of land and facilities, to protect cultural and natural resources, to maintain the physical security of facilities, and to prevent or limit inadvertent human and environmental exposure to residual contaminants.

CNL asserts that these institutional controls will include methods to preserve knowledge and to inform current and future generations of potential hazards, risks and appropriate land uses, including administrative and legal controls (e.g., land use designations to control and restrict land use) to reduce the potential for human exposure to contamination. These methods relate to the notion of rolling stewardship in nuclear waste management.

CELA submits that the concept of rolling stewardship should be defined more broadly to include:

- Plans for the accurate transmission of information from one generation to the next,
- Plans for the transfer of responsibility from one generation to the next,
- Plans for the recharacterization of the waste when necessary,
- Plans to rapidly detect and correct any leakages or other problems,
- Plans for the retrieval of waste as appropriate, and
- Plans for continual adaptive management and monitoring.[64]

The Nuclear Energy Agency ("NEA") and Organisation for Economic Co-operation and Development ("OECD") support the preservation of records, knowledge, and memory across generations as an integral part of responsible radioactive waste management in line with a prudent approach to safety and a conscious attitude to ethics.[65] They recommend that management should address such preservation actions during the early stages of nuclear waste management planning.

One key aspect of the preservation of records, knowledge and memory across generations is planning for the maintenance of a set of essential records, selected during the lifetime of a nuclear waste management facility, for permanent preservation.[66] CNL notes that its monitoring plans will keep detailed notes of changes in facility performance and mitigation measures applied, but it does not situate these plans in an explicit framework and procedure for knowledge transfer across generations.

CNL's failure to devote appropriate attention to the transmission of information from one generation to the next rests in part on its inadequate project timeframe (2070 – 2400) and lack of planning for the post-institutional control period. As the Concerned Citizens of Renfrew County and Area assert, at maximum permitted limits the long-lived radionuclides proposed for the mound would not decay for thousands to millions of years.[67] Removal from institutional control would not be possible for millennia. As such, CELA **recommends** that CNL must develop a transparent, justifiable, and traceable procedure to select and manage a set of essential records for future generations.

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[64] *See* Canadian Coalition for Nuclear Responsibility, online: http://www.ccnr.org/Rolling_Stewardship.pdf at p 1.
[65] Nuclear Energy Agency & Organisation for Economic Co-operation and Development, "Preservation of Records, Knowledge, and Memory (RKM) Across Generations: Compiling a Set of Essential Records for a Radioactive Waste Repository" (2019) Nuclear Energy Agency & Organisation for Economic Co-operation and Development [**NEA & OECD 2019**].
[66] *See* NEA and OECD 2019.
[67] CCRCA 2022 at p 4.

E. Summary and Recommendations

The critical deficiencies in CNL's final EIS reveal CNL's failure to adequately consider sustainability throughout planning and assessment; therefore, they render the NSDF project unacceptable to the public, and they must be addressed. As such, the intervenor makes the following recommendations:

Recommendation No. 13: CNL must adopt a comprehensive set of sustainability evaluation criteria and context-specific sustainability concerns throughout assessment and planning. CNL's three evaluation criteria (technical feasibility, economic feasibility, likely environmental effects) do not constitute a full suite of generic sustainability issues rooted in possible project impacts. Notably, CNL must adopt evaluation criteria that adequately capture the intergenerational and intragenerational justice concerns surrounding the distribution of economic, health and safety, and environmental costs, risks, and burdens of the project over its lifetime.

Recommendation No. 14: CNL must undertake a transparent comparison of all alternatives with the aim to identify the best option. CNL identifies the preferred NSDF option using a flawed evaluation method that allows for the systematic elimination of facility type and facility design options based on one criterion or two criteria, as opposed to a comparative evaluation of options based on a comprehensive set of sustainability criteria, weighing the relative costs and risks of all options in this light. This stepwise, criteria-based process of eliminating options to select the preferred option does not constitute a full comparative analysis and it is unacceptable.

Recommendation No. 15: CNL's failure to devote appropriate attention to retrievability in the design of the project is a critical flaw. CNL's final EIS must incorporate a discussion about how the NSDF's disposal cell system will be designed to ensure that present and future generations will be able to retrieve the waste. This discussion must devote attention to a range of accidents and malfunctions and environmental impacts related to the key components of the NSDF design, notably the engineered containment mound and its passive safety features (base liner system, final cover system, and perimeter berm).

Recommendation No. 16: CNL must devote appropriate attention to the preservation of records, knowledge, and memory across generations to transfer vital information from one generation to the next. This failure rests in part on CNL's inadequate project timeframe and lack of planning for the post-institutional control period. CNL must develop a transparent, justifiable, and traceable procedure to select and manage a set of essential records for future generations.

VI. HUMAN HEALTH AND SAFETY (EXPERT REPORT BY DR. FAIRLIE)

This chapter provides comments on the human health and safety implications of the proposed NSDF project, and highlights critical omissions in CNL's final EIS, CNSC staff's EA Report and associated documents related to these matters as reviewed and written by Dr. Ian Fairlie.

A. Outstanding Concerns Related to Human Health and Safety

Although CNL's final EIS is changed from its 2017 version, many of CELA's comments on CNL's first draft still have not been addressed. In addition, many of the questions raised by CELA at that time have not been answered in the final version. Accordingly, relevant parts of CELA's comments in 2017 are again set out below (for ease of inspection, they are indented, in bold). Aspects of our prior comments which have been responded to have been omitted from the below text.

CELA again requests the CNSC require answers to these questions from CNL, and that CNL provide unredacted versions of certain documents. CELA submits that until these information requirements are fulfilled, the CNSC does not have the information it needs in order to fully assess the project, its impacts, and whether it will cause significant adverse environmental effects.

> **HUMAN HEALTH AND SAFETY**
>
> **This chapter will set out omissions and questionable matters on human health and safety matters, contained in two draft CNL documents issued on March 17, 2017 as follows:**
>
> - **CNL Near Surface Disposal Facility Project EIS. Report 232-509220-Rept-004 (hereafter "Draft EIS") as amended**
> - **CNL Performance Assessment for Near Surface Disposal Facility to support the Environmental Impact Statement. Report 232-509240-ASD-001 (hereafter "PA")**
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> **1. Oversights and Issues with the Draft EIS**
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> **1.1 Public Availability of Documents**
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> **Several important CNL documents are not yet available for public examination, including unredacted versions of CNL's Waste Acceptance Criteria (WAC) report, its Safety Analysis Report (SAR), and its Criticality Safety Analysis (CSAR) report.**
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> **CELA's requests for these documents were denied because they were marked "security sensitive." CELA's inability to obtain these reports, even in part, reflects a process which is neither transparent nor conducive to public review. CELA notes that**

this submission is not an endorsement of this review process, nor its ability to facilitate meaningful public engagement.

Furthermore, these reports are likely to contain information pertinent to the overall project, particularly CNL's report on criticality. Relatively large amounts of fissile nuclides, including U-235 and Pu-239, are proposed for the facility. Unless it can be demonstrated beyond reasonable doubt that the probability of a criticality incident (ie. an uncontrolled chain reaction such as that which occurs in a nuclear bomb) involving these nuclides at the proposed facility is extremely remote, the project should not proceed.

1.2 Waste Categories

The CNL documents contain several definitions of LLW and ILW (to be stored at the proposed site) in an attempt to differentiate such radioactive wastes from HLW (not to be stored at the proposed site). These definitions are unsatisfactory.

On the other hand, the IAEA's Specific Safety Guide for near surface disposal facilities (SSG-29, *Near Surface Disposal Facilities for Radioactive Waste*) makes clear that:

- **Neither ILW (ie. lasting more than a few hundred years) nor HLW should be placed in these facilities**
- **Near-surface disposal is an appropriate disposal option only for very low-level wastes, and**
- **ILW and HLW, which contain larger quantities of long-lived radionuclides should not be stored in surface or near surface facilities.[68]**

Despite this international guidance, the Draft EIS is proposing that the NSDF should contain some ILW (ie. less than 1% by volume). Since the volume of wastes is 1,380,000[69] cubic metres, this still means that 13,800 cubic metres of ILW is proposed to be placed in the NSF. This is a large amount and is expected to contain the heat-generating wastes.

[68] International Atomic Energy Agency, IAEA Safety Standard, SSG-29, *Near Surface Disposal Facilities for Radioactive Waste* (2014).
[69] Canadian Nuclear Laboratories, "Performance Assessment for Near Surface Disposal Facility to Support the Environmental Impact Statement – Report 232-509240-ASD-001" at amended Table 4-2.

1.2.1 Heat-Generating Wastes

The reports also state that heat–generating HLW, such as spent nuclear fuel and reprocessing wastes, will not be disposed of at the site, but large amounts and concentrations of heat-generating nuclides, including Cs-137, Sr-90 and several actinides are proposed to be stored on site, as shown in table 4.2 of the PA report.

The presence of these heat-generating wastes acts to blur the CNL's waste definitions. In CELA's view, the question - should the wastes to be stored at the proposed facility be properly categorised as HLW as well as LLW and ILW? - needs to be addressed.

1.3 Possible High Temperatures

On page 3-11, the draft EIS states "…waste shall have a thermal power rate below 2 kilowatts per cubic metre (kW/m^3) for LLW in accordance with CSA Standard N292.0-14 *General Principles for the Management of Radioactive Waste and Irradiated Fuel*."

However, CELA questions whether the CSA's proposed 2 kW per m^3 restriction is adequate. When the proposed facility is full (ie. containing 1.38 million cubic metres of wastes), the facility in theory could be generating more than 2 GW of heat. This is a huge amount of heat as it is approximately equivalent to the heat output of a large operating Pressurised Water Reactor (PWR).

The IAEA's General Safety Guide (GSG – 1) Classification of Radioactive Waste states in para 2.33 that "Management of decay heat should be considered if the thermal power of waste packages reaches several watts per cubic metre."[70] This is ~1,000 times more restrictive than CNL's 2 kW per cu metre. Para 2.33 adds that "More restrictive values may apply, particularly in the case of waste containing long-lived radionuclides", as is the case here.

The following questions must therefore be answered:

- **What are the estimated heat production rates (kW per m^3) when the facility starts (ie. with 450,000 m^3 in place) and ends (ie with 1,380,000 m^3 in place)?**
- **What is the maximum temperature envisaged within the engineered containment mound (ECM)?**
- **What is the safe temperature limit?**

[70] International Atomic Energy Agency, IAEA Safety Standards Series No. GSG-1, *Classification of Radioactive Waste* (2009), available online: http://www-pub.iaea.org/books/iaeabooks/8154/Classification-of-Radioactive-Waste

- **What controls are in place to ensure that temperatures within the facility do not exceed the safe limit?**
- **What provisions are made for cooling and ventilation?**
- **What specific fire risks are envisaged?**
- **What specific provisions are made for fire prevention and fire control?**

Unless sufficient assurances can be given on heat rates, maximum temperatures and fire risks within the waste facility, the proposed project should not proceed.

1.4 No 'Justification' of Radiation Exposures Provided

The International Commission on Radiological Protection (ICRP) has established three principles for all practices involving radiation exposures to the public: justification, optimisation and limitation. Justification, according to the ICRP, requires that collective doses arising from the practice have to be evaluated and compared with any benefits accruing from the facility.

No attempt has been made in the draft CNL documents to "justify" the radiation exposures to people living nearby from the routine emissions from the proposed facility, for instance, from the proposed annual tritium emissions of 6.5 TBq.

1.5 No Discussion of Chalk River Nuclear Accidents in 1952 and 1958

The CNL reports reviewed do not mention the two major nuclear accidents which occurred at Chalk River in the 1950s and their ensuing wastes. CELA reminds the Commission of the partial meltdown which occurred in 1952 at the National Research Experimental reactor operated by Atomic Emergency of Canada Limited (AECL) and of the second event in 1958, involving a fuel rupture and fire in the National Research Universal (NRU) reactor building.

It is likely that highly radioactive debris from these accidents still exist given the long half-lives of the nuclides involved. CELA asks that information on the nuclear wastes from these accidents be given in the Draft EIS.

1.8 Organically Bound Tritium

Exposures to workers and local people from organically-bound tritium (OBT) are not mentioned in the documents. These are serious omissions.

1.9 No Collective Dose Estimates

The CNL reports do not contain estimates of collective doses, that is population doses, arising from the facility for the people living in or near Chalk River, Ontario.

2. Technical Matters

2.2 Lax Limit for Tritium in Drinking Water

Section 4.2 of the PA report states that a drinking water limit of 7,000 Bq per litre is used in the assessment. This is extremely lax given the current recommendation of the Ontario Drinking Water Advisory Council (ODWAC) of 20 Bq per litre.[71] CELA considers that the safer recommended tritium limit of 20 Bq per litre should be used throughout the proposals.

The following table demonstrates various drinking water limits in use.

Table 2. Tritium in drinking water limits

Agency	Tritium limit (Bq per litre)
CNL	7,000
US EPA	740
European Union	100
Ontario Government's ACES in 1994	20
Ontario Government's ODWAC in 2009	20
US State of Colorado	18
US State of California	15

CONCLUSION

CELA has sought to identify the gaps and omissions in the existing Draft EIS as regards to (a) its consideration of the purposes of CEAA and (b) the project's impacts on human health and safety. CELA requests that all recommendations and information requests) be provided before the CNL's proposal for the near surface facility is allowed to proceed.

[71] Ontario Drinking Water Advisory Council, *Report and Advice on the Ontario Drinking Water Quality Standard for Tritium* (2009), available online: http://meteopolitique.com/Fiches/nucleaire/documentation/01/Nucleaire_eau-potable-Ontario-Tritium.pdf.

B. CNL's Assessment of Human Health Effects is Flawed

Section 5 of CNL's final EIS contains a lengthy discussion of the likely health effects arising from the proposed NSDF. In most aspects, the final EIS concludes that the estimated radiation doses to workers are low and to the public are very low, and within acceptable limits. The final EIS also concludes the NSDF will safely contain and isolate the wastes from the surrounding environment over its expected lifetime of a few hundred years.[72]

However, the intervenor submits serious problems exist with the EIS human health analysis and its conclusions on radiation doses and risks. These problems are in addition to those cited in CELA's 2017 comments above.

An important matter is that they are **not transparent**. That is, the models and assumptions used by CNL to derive its estimated radiation risks are neither listed nor discussed. This means it is impossible to assess or critique the cited doses and risks.

An associated problem is that **large uncertainties** are involved with CNL's estimates of radiation doses and risks. This is particularly the case for risks arising from postulated exposures centuries ahead, well into the future. The EIS admits the existence of such uncertainties but downplays their size and significance.[73] The arguments used against uncertainty being an issue, for example, are often tautological[74] and circular.

A major omission is the **lack of explanation about why such dose and risk uncertainties** arise in the first place. This is often poorly understood by scientists and not at all by the public. For the sake of transparency and clarity, a brief explanation is given in **Figure 1** below.

Figure 1. How radiation risks are estimated

To estimate the radiation risks to (say) a member of the public from radioactive emissions to air and discharges to water from the NSDF requires the use of at least 5 computer models, in simple terms. The first model is to estimate the amounts of radioactivity escaping from the NSDF over various time periods. The second to model their transport through the environment (including weather and geophysical models). The third is to model their uptakes and retentions by humans. The fourth is to convert the becquerels inside humans to radiation doses in millisieverts. And the fifth is to estimate the risks (e.g., cancer deaths) from these radiation doses.

The central result from each model is plugged into the consecutive model, and its central result is plugged into the next, and so on through the 5 models.

[72] CNL's Final EIS at p 1-1.
[73] CNL's Final EIS at pp 5-717 to 5-722.
[74] Tautology is the use of different words to say the same thing twice in the same statement.

However, each result is just one number (often the mean, median or mode) of the range of results arising from each model. In other words, uncertainties will arise from each of the above models. And these uncertainties have to be multiplied together to obtain an overall uncertainty. The report of the UK Government's CERRIE Committee found that these uncertainties could be very large, ranging over several orders of magnitude, i.e., by factors of a hundred or a thousand above the final estimate.[75]

In particular, the CERRIE report found that the estimation of radiation doses from internal exposures is fraught with large, sometimes very large, uncertainties. This large source of uncertainty is not discussed in the EIS, even though almost all the radiation exposures from the NSDF will be internal ones, certainly for members of the public.

The overall conclusion is that the doses and risks cited in the EIS are unreliable for use in decisions, especially on issuing licenses.

Another issue not discussed in the EIS is the **new evidence that radiation risks are greater** than currently acknowledged. This new evidence is from the International Nuclear Workers' Study (INWORKS) which comprises a number of meta studies of nuclear workers in the US, UK and France. These meta studies are very large (>300,000 participants) which lends considerable authority to their findings.

In more detail, in late 2015 and in subsequent years, the INWORKS studies examined associations between low dose-rate radiation and **leukemia/lymphoma**[76], **solid cancers**[77], and **circulatory**

[75] CERRIE, "Report of the Committee Examining Radiation Risks of Internal Emitters" (2004), online: https://www.researchgate.net/publication/259763240_Report_of_the_Committee_Examining_Radiation_Risks_of_Internal_Emitters_CERRIE

[76] *See* Leuraud K, Richardson DB, Cardis E, Daniels RD, Gillies M, O'Hagan JA, Hamra GB, Haylock R, Laurier D, Moissonnier M, Schubauer-Berigan MK, Thierry-Chef I, Kesminiene A, "Ionising radiation and risk of death from leukaemia and lymphoma in radiation-monitored workers" (2015) 2:7 (INWORKS): An International Cohort Study Lancet Haematol at pp 276-281, online: https://www.thelancet.com/journals/lanhae/article/PIIS2352-3026(15)00094-0/fulltext; Leuraud K, Richardson DB, Cardis E, Daniels RD, Gillies M, Haylock R, Moissonnier M, Schubauer-Berigan MK, Thierry-Chef I, Kesminiene A, Laurier D, "Risk of cancer associated with low-dose radiation exposure: comparison of results between the INWORKS nuclear workers study and the A-bomb survivors' study" (2021) 60:1 Radiat Environ Biophys at pp 23-39, online: https://link.springer.com/article/10.1007/s00411-020-00890-7.

[77] Richardson DB, Cardis E, Daniels RD, Gillies M, Haylock R, Leuraud K, Laurier D, Moissonnier M, Schubauer-Berigan MK, Thierry-Chef I, Kesminiene A, "Site-specific Solid Cancer Mortality After Exposure to Ionizing Radiation: A Cohort Study of Workers" (2018) 29:1 (INWORKS) Epidemiology at pp 31-40, online: https://journals.lww.com/epidem/Abstract/2018/01000/Site_specific_Solid_Cancer_Mortality_After.5.aspx.

disease[78]. Their radiation risk estimates were higher than current risk estimates[79]. For example, in the solid cancer study, the observed increase was 0.47/0.32 = 1.47, ie a 47% increase - a significant amount. But for leukemia the increase was much greater. The more recent study on leukemia risks (Leurad et al, 2021) found the increase in point estimates was 5.8 fold or 580%. This large increase was driven mainly by the 11-fold increase in chronic myelogenous leukemia[80] ("CML") in older workers[81]. The study on cardiovascular risks somewhat surprisingly reported brand new risks of heart disease and strokes. These new risks and increased risks are not taken into account in official risk estimates by regulatory agencies including the CNSC but they should be.

The INWORKS radiation studies remain pertinent as to whether a license should be given to CNL for a number of other reasons, as follows. They:

a. provide **strong evidence** of a dose-response relationship between cumulative, chronic, low-dose, exposures to radiation and leukemia.
b. confirm that radiation risks exist even **at very low dose rates** (average = 1·1 mGy per year).
c. **observe** risks at low dose rates rather than extrapolating them from high dose rates. (eg as in the LSS study of Japanese bomb survivors)
d. found that risks **do not depend on dose rate** thus contradicting the ICRP's use of a Dose and Dose Rate Effectiveness Factor (DDREF) (which acts to reduce by half its published radiation risks).
e. found radiogenic leukemia risks decline **linearly** with dose, contradicting earlier studies suggesting a lower, linear-quadratic relationship for leukemia.
f. **strengthen** the Linear No-Threshold (LNT) model of radiogenic risks, as it now applies to leukemias as well as to solid cancers.
g. found **no evidence of a threshold** below which no effects are seen, and
h. found a trend of **increasing risk of solid cancer by attained age.**

Because the INWORK findings are far-reaching in their implications, it is necessary to double-check their findings. This was carried out by recent exhaustive review (Hauptmann et al, 2020) of

[78] Gillies M, Richardson DB, Cardis E, Daniels RD, O'Hagan JA, Haylock R, Laurier D, Leuraud K, Moissonnier M, Schubauer-Berigan MK, Thierry-Chef I, Kesminiene A, "Mortality from Circulatory Diseases and other Non-Cancer Outcomes among Nuclear Workers in France, the United Kingdom and the United States" (2017) 188:3 (INWORKS) Radiat Res at pp 276-290, online: https://meridian.allenpress.com/radiation-research/article/188/3/276/192902/Mortality-from-Circulatory-Diseases-and-other-Non.
[79] Derived from Japanese bomb survivors' studies.
[80] In myeloid leukemia, the cancers occur in cells that form red blood cells, some other types of white cells, and platelets.
[81] Comparing relative risks between different populations (ie Japanese and US/UK/French) must be handled carefully. However, the magnitude of the differences are such – especially for leukemia- that it is valid to state qualitatively that perceived risks have definitely increased.

the INWORKS studies which examined possible sources of bias[82] and confounding[83]. It concluded that these epidemiological studies directly support the conclusion of increased cancer risks from low doses of ionising radiation, with little evidence of bias and confounding. This is similar to the findings of yet another study[84] which also reviewed the INWORKS studies using specialist statistical and epidemiological methods to look for evidence of bias. It found none.

C. Proposed High Doses to Workers

The final EIS estimates that the maximum dose to NSDF workers during the construction and operating phases at the ECM would be 10.4 mSv per year. CNSC staff found (see CNSC doc CMD 22-H7 page 90 et seq) that CNL had demonstrated that this dose estimate was below the "legal" limit of 50 mSv per annum and that the Project was not likely to cause significant adverse environmental effects on human health, including Indigenous peoples' health.

There are several misconceptions here. *First*, although the CNSC's own limit for workers is 50 mSv/a, the IAEA limit which applies in the rest of the world is 20 mSv/year, averaged over 5 years (i.e., a limit of 100 mSv in 5 years) "with the further provision that in any single year the effective dose should not exceed 50 mSv".[85]

This definition is quite different and more protective than the CNSC's formula. Therefore, from a safety viewpoint, the maximum estimated dose for workers should be compared with 20 mSv/a, not 50 mSv/a.

Second, CNL's estimate of 10.4 mSv/a is actually quite high. If workers were to be employed for say 20 years (which is not uncommon), their dose would then be over 200 mSv, a seriously high level which would significantly increase their risks of cancer, birth defects (if they are women) and cardiovascular disease.

D. Problems with Proposed NSDF Inventory

The radiation from the decay of radioactive nuclides to be contained in the NSDF is mutagenic, carcinogenic and teratogenic. However, the amounts of radioactivity which are being proposed to

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[82] Statistical bias occurs when a model or statistic is unrepresentative of the population being studied: several sources of bias can occur (e.g. selection bias).
[83] Confounding occurs when an extraneous factor causes inaccuracy in the estimated measure of an association (e.g. smoking in a lung cancer study).
[84] Berrington de Gonzalez A, Daniels RD, Cardis E, Cullings HM, Gilbert E, Hauptmann M, Kendall G, Laurier D, Linet MS, Little MP, Lubin JH, Preston DL, Richardson DB, Stram D, Thierry-Chef I, Schubauer-Berigan MK, "Epidemiological studies of low-dose ionizing radiation and cancer: rationale and framework for the monograph and overview of eligible studies" (2020) 56 J Natl Cancer Inst Monogr at pp 97–113, online: https://academic.oup.com/jncimono/article/2020/56/97/5869935.
[85] *See* https://www-ns.iaea.org/tech-areas/communication-networks/orpnet/documents/2.2.BSS-occup-dose-limits-WEB.pdf

be placed in the NSDF are extremely large (over 10^{16} becquerels = 10,000,000,000,000,000 Bq), therefore, close attention needs to be paid to the proposed inventory of radioactive species.

The two main pathways for radioactive nuclides to reach workers and members of the public are via (a) air emissions and (b) discharges to ground water aquifers and rivers. Comments on (b) and on hydrogeology generally are dealt with separately.

The disposal of nuclear waste is governed by the General Regulations. Section 3 of the General Regulations states:

> **3 (1)** An application for a licence shall contain the following information:
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> […]
>
> **(j)** the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.[86]

However, CNL's documents, including the final EIS itself and NSDF waste inventory document, do not provide this required information, especially their names, forms, and origins of many of the wastes.

For example, no information is contained in the CNL documents as to precisely what "packaged" wastes actually contain, i.e., their names, origins and forms. For example, as regards the requirement to state "origin", none of the wastes is stated to originate from the reprocessing of spent nuclear fuels. Or from the two nuclear disasters at Chalk River in 1952 and 1958. Or from the disposal of cobalt-60 irradiators and cesium-137 irradiators.

In addition to these regulations, advisory codes of practice from agencies such as the IAEA and CSA do exist. An example is the IAEA recommendation (see below) that the maximum concentration of beta/gamma-emitting nuclides in LLW should not exceed a "few tens of kBq per kg", otherwise it would be classified as ILW. This recommendation is reiterated in the Canadian CSA's guidance, but this is not legally enforceable. As discussed below, several radionuclides do exceed this limit.

In addition**,** legal provisions exist which permit the disposal of very low amounts of radioactive materials including wastes. These are set out in section 5.1 of the *Nuclear Substances and Radiation Devices Regulations, 2000* as follows:

[86] General Regulations at s 3(1)(j).

> **5.1 (1)** A person may, without a licence, abandon or dispose of a radioactive nuclear substance if the activity or the activity concentration of the substance does not exceed
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> **(a)** its exemption quantity;
>
> **(b)** its conditional clearance level; or
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> **(c)** its unconditional clearance level.[87]

This section means that anyone who wishes to dispose of radioactive material may do so without a licence as long as the radioactivity (Bq) amounts or concentrations (Bq/kg) are **below** certain numerical thresholds. Below these levels, the radioactive materials are considered "safe[88]" enough to be disposed without a licence.

Above these thresholds, a licence is required, and this is very much the case in the present application. CNL's EIS freely admits that the LLW to be disposed in the proposed NSDF will NOT meet these levels. It defines LLW as "radioactive solid waste …above established clearance levels and exemption quantities…"

However, what is not explained is that the radionuclides proposed to be disposed of are, in almost all cases, not merely "above" but are much higher than the exemption amounts. Indeed, many are millions of times larger than the "safe" thresholds listed in the above Regulations. **Table 1** below lists the proposed NSDF Licensed Inventory quantities (Bq) for nuclides which exceed the exemption amounts by very large factors. **Table 2** shows a fuller list.

Table 1. Proposed Nuclide Inventory quantities at closure which are much higher than exemption amounts[89]

Nuclide	NSDF inventory quantities at closure - Bq	Regulatory Exemption Threshold -Bq	Times greater than exemption amount
cobalt-60	1.47E+16	E+05	0.15 trillion
uranium-238	7.57E+10	E+04	7.5 million
uranium-234	6.88E+10	E+04	6.9 million
plutonium 239/240	5.06E+10	E+04/E+03	5.1 million
radium-226	3.61E+10	E+04	3.6 million
strontium-90	3.35E+12	E+04	3.4 million
cesium-137	3.17E+12	E+04	3.2 million

[87] *Nuclear Substances and Radiation Devices Regulations, 2000*, SOR/2000-207.
[88] It should be kept in mind that according to the Linear No Threshold model for radiation risks, there is no level of radiation exposure below which there are no effects.
[89] Prepared by CELA based on data in CNL's Final EIS.

thorium-232	2.70E+10	E+04	2.7 million
thorium-230	5.30E+09	E+04	0.53 million
uranium-235	2.96E+09	E+04	0.3 million
hydrogen-3	2.79E+14	E+09	0.28 million
iodine-129	1.75E+10	E+05	0.18 million
carbon-14	1.70E+12	E+07	0.17 million

(The notation system used here is as follows. The letter "E" is an abbreviation for "exponential". Therefore E+04 denotes 10 to the power of 4, i.e., 10,000. Thus, 7.57E+09 Bq means 7.57 times 10 to the power 9, i.e., 7,570,000,000 Bq.)

Table 2. Proposed NSDF nuclides which at closure exceed limits for disposal without a licence in the Nuclear Substances and Radiation Devices Regulations[90]

Nuclide	Half Life (years)	Maximum activity* (Bq) at closure	Exemption Quantity** (Bq)	Times exceeded
Ag-108m	438	2.62E+10	E+05	2.6E+05
Am-241	433	9.74E+10	E+04	9.7E+06
Am-243	7,360	5.24E+07	E+03	5.2E+04
C-14	5,700	1.70E+12	E+07	1.7E+05
Cl-36	301,000	3.97E+09	E+06	4.0E+03
Co-60	5	1.47E+16	E+05	1.5E+11
Cs-135	2,300,000	5.19E+08	E+07	5.2E+01
Cs-137	30	3.17E+12	E+04	3.2E+06
H-3	12	2.79E+14	E+09	2.8E+05
I-129	15,700,000	1.75E+10	E+05	1.8E+05
Mo-93	4,000	1.47E+05	E+08	1.5E+03
Nb-94	20,300	2.34E+10	E+06	2.3E+04
Ni-59	76,000	1.21E+09	E+08	1.2E+01
Ni-63	101	2.59E+11	E+08	2.6E+03
Np-237	2,140,000	1.74E+07	E+03	1.7E+04
Pu-239/240	24,100	5.06E+10	E+04/E+03	5.1E+06
Pu-241	6,560	5.84E+11	E+06	5.8E+05
Pu-242	14	6.32E+07	E+04	6.3E+03
Ra-226	1,600	3.61E+10	E+04	3.6E+06
Se-79	327,000	9.26E+07	E+07	9.3E+0
Sn-126	230,000	1.24E+08	E+05	1.2E+03
Sr-90/Y-90	29	3.35E+12	E+04	3.4E+06
Tc-99	230,000	3.16E+11	E+07	3.2E+04

[90] Prepared by CELA based on data in CNL's Final EIS.

Th-230	211,000	5.30E+09	E+04	5.3E+05
Th-232	75,400	2.70E+10	E+04	2.7E+06
U-233	14,000,000,000	2.74E+08	E+04	2.7E+04
U-234	159,000	6.88E+10	E+04	6.9E+06
U-235	246,000	2.96E+09	E+04	3.0E+03
U-238	704,000,000	7.57E+10	E+04	7.6E+06
Zr-93	4,470,000,000	4.92E+11	E+07	4.9E+04

* Table 3.3.1-2: NSDF Reference Inventory and Licensed Inventory, page 3-26, final EIS
**Column 3, Schedule 1, *Nuclear Substances and Radiation Devices Regulations.*

E. Large Amounts of Long-Lived Nuclides in Proposed NSDF Inventory

A major problem with the proposed NSDF Inventory is that large amounts of long-lived nuclides are envisaged in the NSDF. For example, it can be seen in table 2 that most (17 in sum) **nuclides** have half-lives longer than 10,000 years, and that their proposed quantities are very large.

Such long-lived nuclides are normally classified (eg, by the IAEA) as Intermediate Level Waste ("ILW") rather than Low Level Waste ("LLW"), but the EIS uses ambiguous language to describe what it thinks is LLW, thus blurring this distinction. For example, the final EIS states that "[…] LLW contains primarily short-lived radionuclides and restricts the amount of long-lived radionuclides […]".[91]

However, this is unsatisfactory as it contains imprecise language and undefined parameters. For example, the words "primarily", "short-lived", "restricts", and "long-lived", in the above paragraph are not defined.

In addition, CNL's final EIS also states:

> "Long-lived radionuclides are included in the NSDF inventory as they are intrinsically part of the radiological fingerprints of waste streams at CRL and other CNL sites. It is not practical, technical, or economical, to separate the long-lived radionuclides from the waste streams, especially since many of the waste streams are in the form of soil and building debris."[92]

The assertions in this paragraph require considerable discussion. The first sentence asserts that because several long-lived nuclides are found in some radioactive wastes, therefore they can be put into the NSDF.

[91] CNL's Final EIS at p 3-24, para 3.3.1.3.
[92] *Ibid.*

With respect, it is submitted that, from the standpoint of public safety, this is the incorrect way of looking at the matter. To give a trivial example, the speed limit on the highway is not set at how fast cars can go, but set at an external limit, ie 100 kph.

What is needed is a comparison of the numerical concentrations of the various long-lived nuclides in the wastes with the limits recommended by the international and national agencies (eg. the IAEA and CSA). This means that long-lived nuclides should be separately assessed and, if necessary, placed in a suitable repository designed to prevent their escape for much longer periods of time. For example, see the alternatives discussed below.

The next sentence asserts "[i]t is not practical, technical, or economical, to separate the long-lived radionuclides from the waste streams".[93] However, this assertion is neither explained nor justified, not even in a technical document. Essentially, the CNL's EIS states we are going to deal with long-lived nuclides by putting them in the NSDF essentially designed for short-lived wastes. This is considered an unacceptable approach for an EIS.

Para 3.3.3.1 also asserts "… thus, isolation and containment are only required for periods of time up to a few hundred years." However, many (17 in number) nuclides listed in table 2 above have half-lives considerably longer than a few hundred years. This phrase is also unsatisfactory as it glibly assumes that institutional control of some kind will exist for that long. If we consider the EIS means, say, three hundred years (a benchmark often used as this constitutes 10 half-lives of Cs-137), then neither Canada nor the US has existed for that long.

F. Large Amounts of Cobalt-60 to be Disposed

Based on **Table 1** above, it can be seen that the proposed amount of cobalt-60 to be disposed of in the NSDF is extremely large, ie 1.47×10^{16} Bq. This is thousands of times greater than most other nuclides. This large amount is not explained in the EIS; however, it is surmised that this is due to the planned disposal of disused cobalt irradiation devices currently being stored at Chalk River. An example of such a device is pictured below.

[93] CNL's Final EIS at p 3-24.

These and other similar devices were (and continue to be) shipped world-wide for cancer treatment purposes. After the end of their useful life (about 20 years as the half-life of Co-60 is 5 years) they are required to be returned to Chalk River. When new, they contain approximately 900 TBq[94] of Co-60. It is not explained in the EIS whether these large devices would be placed whole into the NSDF or only a part or parts of them.

If it is reasonably assumed that all the cobalt-60 to be disposed of is from the disused (ie returned) Co-60 sources in these gamma irradiators and if we assume they are on average 20 years old, ie that 4 Co-60 half-lives have occurred, then each unit would still contain, on average, about 100 TBq of Co-60.

CNL is initially proposing to dispose 9 x 10^{16} Bq = 90,000 TBq of Co-60 in the NSDF. Therefore, this would mean 90,000/100 = about 900 units. This is an approximate estimate with no accuracy implied. However, it gives a rough idea of the likely numbers of Co-60 irradiators involved. Note that if we were to reduce the average Co-60 amount down to, say, 50 TBq, the number to be disposed would increase to 1,800 units.

[94] *See* slide 10 of https://www1.cgmh.org.tw/intr/intr2/c3s000/corelab/RadiationBiology/doc/%E9%8A%AB137%E7%85%A7%E5%B0%84%E5%84%80.pdf

In CELA's view, the contents of this large number of potentially dangerous[95] Co-60 irradiators should not be placed in what CNL itself admits is essentially a landfill site. Instead, they should be placed in a much more robust containment such as those listed in the section below on the alternatives to a NSDF.

G. Alternatives to a NSDF

Because of the existence of these very long-lived nuclides, more thought needs to be given to alternatives. For example, instead of placing long-lived nuclides in an NSDF primarily designed for short-lived nuclides, it would be better to construct a more permanent facility for ILW and to put the LLW in along with it. This would apply to Co-60 and Cs-137 irradiation devices as well.

Figure 2 below (from the same consultants which drafted CNL's EIS) provides indicative costs per unit volume of waste for the following six potential long-term solutions:

- Engineered Containment Mound (ECM)
- Concrete Vault (CV)
- Shallow Rock Cavern (SRC)
- Deep Geological Repository (DGR)
- Deep Borehole (DB)
- Rolling Stewardship (RS)

The cost estimates were developed in accordance with the Association for the Advancement of Cost Engineering ("AACE") cost estimating guidelines and recommended practices for a Class 5 cost estimate. A preliminary design basis and cost basis were established for each option based on publicly available information and input from Hatch Consultants subject matter experts in nuclear and non-nuclear industries. The results of this cost estimate are shown graphically below. It is emphasized that this report was prepared for the relative cost comparison of different waste disposal options on a per-unit- volume basis and should not be used for the absolute cost estimate of individual options.

[95] *See for example*: The 1987 Goiana incident, online: https://en.wikipedia.org/wiki/Goi%C3%A2nia_accident

Figure 2. Cost of Long-Term Management Options[96]

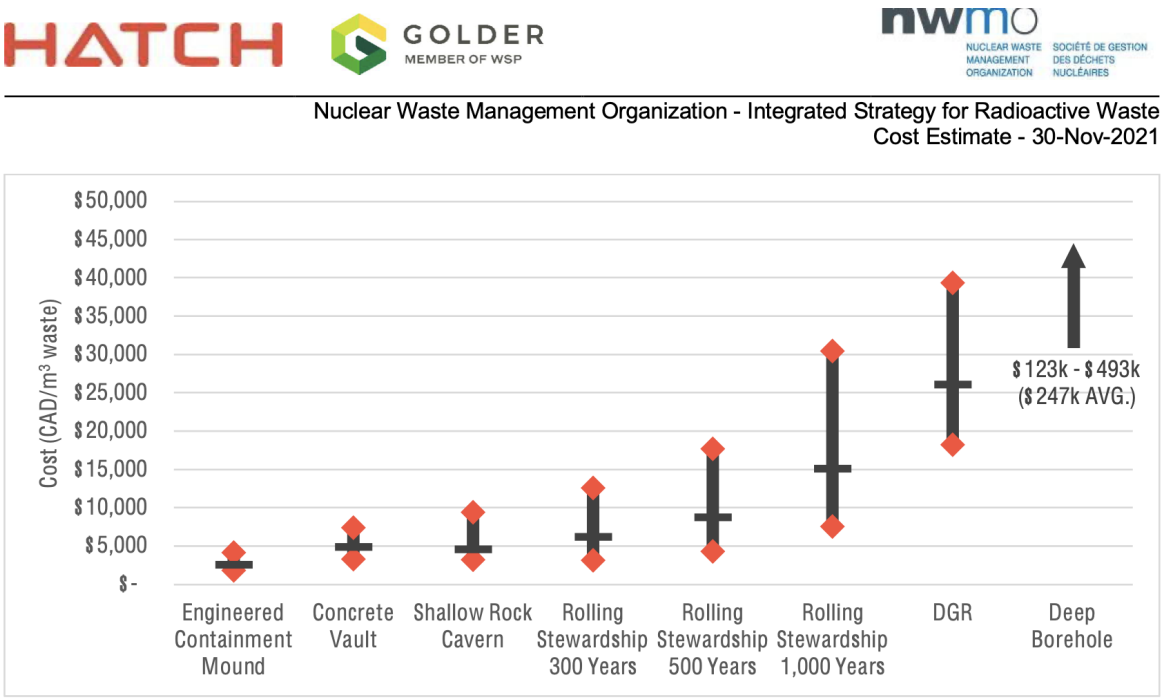


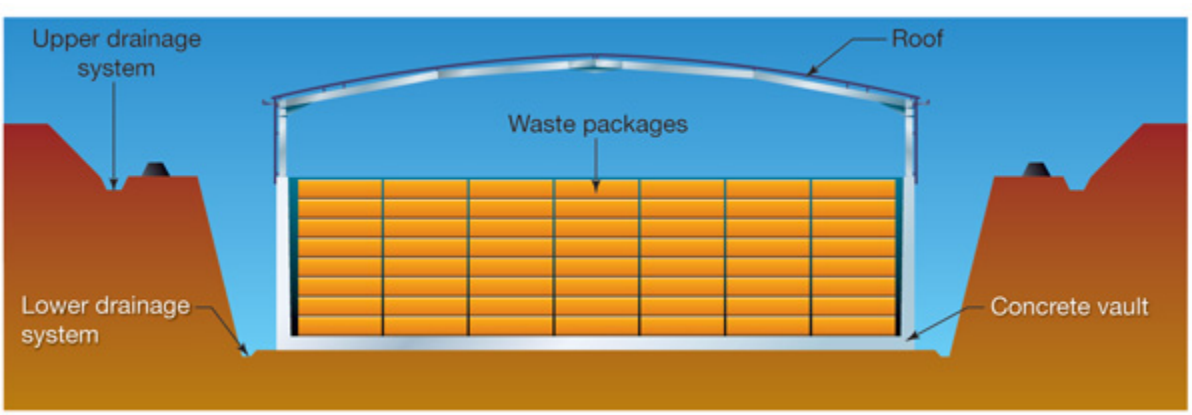
Figure ES-1: Cost Summary Graph of Each Long-Term Management Option, Including Accuracy Range

It can be seen in **Figure 2** above that the ECM is the cheapest option per m^3 of waste. In CELA's view, the cheapest option is certainly inadequate for the radioactive wastes which CNL proposes to dispose of.

To provide but one example of the alternatives listed in the figure above, a concrete vault (the second least expensive option) already exists at Dounreay in Scotland - see diagram below.[97] While CELA is not tasked with assessing the suitability of the various alternatives, and although the Dounreay facility is much smaller (43,000 m^3 = £110 million) and limited to LLW (maximum concentration =12 GBq of beta/gammas per tonne = 12 kBq per g), this slightly less inexpensive option clearly appears more robust and thus more suitable than an engineered landfill – i.e. the NSDF.

This example and the graph above both beg the question why the apparently cheapest option is being proposed? In particular, it suggests that more suitable alternatives were discarded due to a lack of focus on very long-term containment and protection of the environment and human health.

[96] Hatch and Golder Associates, "Nuclear Waste Management Organization – Integrated Strategy for Radioactive Waste Initial Plan Development – Characterization and Options – Cost Estimate" (2021), online: https://radwasteplanning.ca/sites/default/files/h365930-00000-200-066-0002_0_v1.pdf at p iii.
[97] Online: https://www.neimagazine.com/features/featurebuilding-dounreays-llw-vaults-4435386/



H. Conclusion and Recommendations

Based on the above analysis, CELA submits the proposed NSDF at Chalk River is unfit for the following reasons (apart from the objections listed in CELA's submissions in 2017). At closure, it would contain:

(a) many (17) nuclides whose half-lives are very long, far exceeding the proposed lifetime of the ECM
(b) many nuclides whose amounts would considerably exceed the 'safe' quantities laid down by the Nuclear Substances and Radiation Devices Regulations 2000 for the unrestricted disposal of radioactive wastes.
(c) nuclear wastes whose names, origins, and forms are unidentified,
(d) the contents of approximately 900 Co-60 irradiation devices, and possible Cs-137 irradiation devices

It would also result in high cumulative radiation doses to nuclear workers who would construct and operate the NSDF.

As such, CELA finds the CNSC cannot find the project will not result in significant adverse environmental effects. As the EA is a precondition to the issuance of the licence amendment, CELA subsequently finds the CNSC does not have the requisite basis to grant a licence amendment to CNL in order to construct and operate its proposed NSDF at Chalk River, which would permit the proposed unrestricted disposal of the radionuclides (listed in **Table 2**) at its NSDF at Chalk River.

Recommendation No. 17: CNL should be required to address CELA's comments on CNL's first draft, which are listed in Part VI.A. above. These comments are still relevant, but have not been answered in CNL's final EIS.

Recommendation No. 18: CNL's EIS should address the large uncertainties involved in CNL's estimates of radiation doses and risks, including an explanation of why these uncertainties arise in the first place.

Recommendation No. 19: CNL's EIS should take into account the findings of the INWORKS studies, which provided strong evidence, inter alia, that radiation risks exist even at very low dose rates, and that the risks of leukemia/lymphoma, solid cancers and circulatory disease are higher than current risk estimates.

Recommendation No. 20: The CNSC should set a lower and more protective maximum dose limit that is in line with the IAEA's guidance of 20 mSv/year, averaged over 5 years (i.e., a limit of 100 mSv in 5 years). The CNSC should furthermore set a lifetime dose limit to ensure that workers do not end up receiving an overly high dose over the course of a long career in the nuclear industry.

Recommendation No. 21: With many of the radionuclides proposed to be disposed of being millions of times larger than the "safe" regulatory thresholds, it is imperative that CNL's documents, including the final EIS itself and NSDF waste inventory document, provide detailed information about the wastes, especially their names, forms, and origins.

Recommendation No. 22: The CNL should provide a comparison of the numerical concentrations of the various long-lived nuclides in the wastes with the limits recommended by the international and national agencies e.g., the IAEA and CSA. Long-lived nuclides should be separately assessed and, if necessary, placed in a suitable repository designed to prevent their escape for much longer periods of time than the NSDF.

Recommendation No. 23: The extremely large quantity of Co-60 should not be placed in what CNL itself admits is essentially a landfill site. The form and origin of the Co-60 should also be described.

Recommendation No. 24: More thought should be given to the consideration of alternatives. While the NSDF may be the cheapest solution, a more permanent facility would be better suited to ensure the long-term containment of the included ILW. The proposed NSDF suggests that more suitable alternatives were discarded due to a lack of focus on very long-term containment and protection of the environment and human health.

VII. ORDER REQUESTED

For the foregoing reasons provided in this intervention, CELA seeks an order:

(1) Granting CELA the status of intervenor;

(2) Granting CELA the opportunity to make an oral presentation at the May 2022 hearing;

(3) Finding CNL's EIS is inadequate and there is not the requisite information to find the project will not cause significant adverse environmental effects;

(4) Prohibiting "any act or thing in connection with the carrying out" of the NSDF at Chalk River by virtue of not having an EA decision statement finding the project will not likely cause significant adverse environmental effects;

(5) Denying CNL's request to amend the nuclear research and test establishment operating licence for the Chalk River Laboratories ; and

(6) An order to the proponent remitting the licence application with direction that all deficiencies noted in this submission be remedied and the information demonstrating fulfillment of all statutory preconditions and regulatory requirements be clearly set out prior to moving forward with a licence amendment request.

Sincerely,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Morten Siersbaek
Legal Counsel

Krystal-Anne Roussel
Legal Counsel

APPENDIX A – SUMMARY OF RECOMMENDATIONS

Recommendation No. 1: Given the significant lack of a detailed inventory, the CNSC cannot make a finding under section 7 of the CEAA 2012 that the NSDF is not likely to cause significant adverse environmental effects. CNL should be required to provide a detailed inventory of the wastes in question given the stated interest of the public in this project and its impact on findings of adverse environmental effects.

Recommendation No. 2: The final EIS should explain why long-lived radionuclides cannot be separated from the waste stream, including why a more suitable design was not chosen in order to reduce the risk of significant adverse environmental effects in the centuries to come.

Recommendation No. 3: CNL should be required to explain the significant amount of Cobalt-60 in the NSDF waste inventory, as well as how the NSDF is expected to contain this to avoid significant adverse environmental effects.

Recommendation No. 4: To ensure adherence to the purposes set out in sections 4(1)(b) and 4(2) of CEAA 2012, greater attention must be paid to the precautionary principle, including by incorporating the notion of reversibility into the consideration of alternatives and by ensuring that future retrievability of the waste is possible no matter what design is chosen.

Recommendation No. 5: To reflect the purpose set out in section 4(1)(h) of CEAA 2012, CNL's sustainability evaluation criteria must be broadened to make it clear that appropriate attention has been devoted to the NSDF project's potential intergenerational and intragenerational distributive justice impacts, including economic risks and burdens.

Recommendation No. 6: CNL should be required to provide a detailed explanation of the models it is relying on, as well as the large uncertainties in its radiation doses and risks. Furthermore, given the uncertainty and the estimated high doses to workers, the CNSC cannot conclude that adequate protection of human health is ensured per the NSCA, and thus cannot grant a licence amendment to CNL.

Recommendation No. 7: All comments in this submission should be addressed to ensure the EA process reflects the requirements in sections 4(1)(e) of CEAA 2012, which requires opportunities be provided for "meaningful public participation during an environmental assessment", and 19(1)(c), which requires an EA to account for comments received from the public.

Recommendation No. 8: CNL's final EIS fails to undertake a transparent comparison of all alternatives with the aim of identifying the best option. As such, CNL's consideration of alternative means does not live up to the requirement set out in section 19(1)(g) of CEAA 2012 and further explained in the CNSC's RegDoc 2.9.1 and Generic Guidelines. CNL should be required to

provide a more fulsome comparison of alternatives, in line with expectations set out in these legislative and policy documents.

Recommendation No. 9: In accordance with the international law principle of justification, CNL must be required to justify the radiation exposures to people living nearby from the routine emissions of the proposed facility. The CNSC must also ensure it considers in its own decision-making whether the benefits of the proposed facility to individuals and society outweigh the risks posed by increased radiation exposures from the facility.

Recommendation No. 10: The CNSC must ensure its decision-making aligns with the precautionary principle and thus, only licence CNL's activities to the extent they are carried out in a way which ensures protection of the environment and human health and safety.

Recommendation No. 11: The CNSC cannot grant the licence amendment until the licence application contains all information required by section 3 of the *General Nuclear Safety and Control Regulations*.

Recommendation No. 12: The CNSC should not grant the licence amendment until the information which demonstrates compliance with section 3 of the *Class I Nuclear Facilities Regulations* is provided by CNL.

Recommendation No. 13: CNL must adopt a comprehensive set of sustainability evaluation criteria and context-specific sustainability concerns throughout assessment and planning. CNL's three evaluation criteria (technical feasibility, economic feasibility, likely environmental effects) do not constitute a full suite of generic sustainability issues rooted in possible project impacts. Notably, CNL must adopt evaluation criteria that adequately capture the intergenerational and intragenerational justice concerns surrounding the distribution of economic, health and safety, and environmental costs, risks, and burdens of the project over its lifetime.

Recommendation No. 14: CNL must undertake a transparent comparison of all alternatives with the aim to identify the best option. CNL identifies the preferred NSDF option using a flawed evaluation method that allows for the systematic elimination of facility type and facility design options based on one criterion or two criteria, as opposed to a comparative evaluation of options based on a comprehensive set of sustainability criteria, weighing the relative costs and risks of all options in this light. This stepwise, criteria-based process of eliminating options to select the preferred option does not constitute a full comparative analysis and it is unacceptable.

Recommendation No. 15: CNL's failure to devote appropriate attention to retrievability in the design of the project is a critical flaw. CNL's final EIS must incorporate a discussion about how the NSDF's disposal cell system will be designed to ensure that present and future generations will

be able to retrieve the waste. This discussion must devote attention to a range of accidents and malfunctions and environmental impacts related to the key components of the NSDF design, notably the engineered containment mound and its passive safety features (base liner system, final cover system, and perimeter berm).

Recommendation No. 16: CNL must devote appropriate attention to the preservation of records, knowledge, and memory across generations to transfer vital information from one generation to the next. This failure rests in part on CNL's inadequate project timeframe and lack of planning for the post-institutional control period. CNL must develop a transparent, justifiable, and traceable procedure to select and manage a set of essential records for future generations.

Recommendation No. 17: CNL should be required to address CELA's comments on CNL's first draft, which are listed in Part VI.A. above. These comments are still relevant, but have not been answered in CNL's final EIS.

Recommendation No. 18: CNL's EIS should address the large uncertainties involved in CNL's estimates of radiation doses and risks, including an explanation of why these uncertainties arise in the first place.

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APPENDIX B – LETTER TO PRESIDENT VELSHI RE: NSDF ENVIRONMENTAL ASSESSMENT AND LICENCING HEARING PROCEDURAL DIRECTIONS

December 16, 2021

President Rumina Velshi
Canadian Nuclear Safety Commission
280 Slater Street,
P.O. Box 1046, Station B
Ottawa, ON K1P 5S9

IAA Reference Number 80122

Re: Near Surface Disposal Facility Project
Environmental Assessment and Licensing Hearing Procedural Directions

Dear President Velshi:

We write jointly on behalf of the following groups: Canadian Environmental Law Association, Northwatch, Concerned Citizens of Renfrew County and Area, Old Fort William Cottagers' Association and Nuclear Waste Watch. In anticipation of the Commission issuing draft procedural directions for comment in respect of the above-noted proceeding, we make these submissions as a means of providing our early input into draft hearing procedures. These submissions have been discussed and agreed to by the potential Participants listed below.

We make the following submissions as to the manner of the Panel's public hearing regarding the Near Surface Disposal Facility Environmental Assessment and Licensing Hearing and related Procedural Directions.

We are of the view that these provisions are necessary to ensure a fair hearing with equitable access for those wishing to participate; to ensure that the Hearing Panel has the best possible evidence and information on which to base its decision in the matter; and to ensure transparency in the proceeding. Our initial guidance is that the Panel procedures should achieve the following:

1. Provide early notice of the hearing schedule, including which days focus on the environmental assessment decision versus which days focus on licensing issues;

2. Clearly set out timelines for future licensing stages, should the EA be granted;

3. Establish an Interrogatory Response process specific to this hearing and disclosure of all responses to Information Requests before the close of comments to the public;

4. Provide a right of members of the public to request standing as Participants in the hearing with a right of oral submission, or a right to choose to provide written submissions only, regardless of whether or not those members or organizations have been funded through the Funding Program;

5. Provide participants the options of making an Oral Intervention (30 minutes, supported by a written submission), an Oral Statement (10 minutes, may be in a regular session or community session), or a Written submission only;

6. Provide a right to Participants making an Oral Intervention to make opening and closing oral and written submissions and to reply to closing submissions of other parties / participants;

7. Allocate at least 90 days after final presentation of any evidence in the hearing in order to make final submissions;

8. Provide a requirement for those presenting evidence on the part of the applicant / proponent to be under oath or affirm their evidence;

9. Provide a right of Participants making an Oral Intervention to question the applicant / proponent and CNSC staff on the evidence and information provided by them to the Hearing Panel;

10. Provide a right of Participants making an Oral Intervention to ask questions of others presenting evidence and information;

11. Provide the ability of Participants to submit list of witnesses to be called by the Hearing Panel and topics regarding same; including the right of participants to request the Hearing Panel to summon government witnesses;

12. Provide the ability of Participants to submit lists of documents relevant to the subject matter of the proceeding to be requested by the Hearing Panel to be introduced into the Record of the Panel and ability of participants to ask questions of relevant witnesses regarding same;

13. Provide an ability of Participants and their advisors to provide expert opinion evidence to the Hearing Panel;

14. Provide a minimum of 30 minute per Participant making an Oral Intervention for their presentation to the Hearing Panel on each of the Environmental Assessment and the Licensing Application In the case of Participants who have retained multiple experts on different subject areas, provide a minimum of a 30 minute presentation per subject area;

15. Make provision to ensure that all sessions are fully accessible to the public, both physically and electronically, and in both official languages with simultaneous translation;

16. Make provision to allow for presentations from individuals and experts in remote locations or in other jurisdictions such as by teleconference, video link or webinar technology;

17. Make provision for "public days" where members of the public who are otherwise not engaged in the hearing may hear a summary of the evidence and ask questions or express their views including during non-weekday hours;

18. Provide permanent archiving of all hearing sessions including opening and closing statements and evidence of all parties and participants, on-line on the CNSC / CEAA (IAA) websites;

19. Ensure the preparation of transcripts of the hearing, electronic accessibility to those transcripts by the participants, one-day turnaround of said transcripts, and posting of transcripts on-line on the CNSC and CEAA websites;

20. Ensure the translation of all proceedings, evidence, submissions and documents adduced in the Record of the Hearing Panel into both English and French; including full translation of all Parties', Governments; Participants; and public submissions into both official languages as the case may be; and

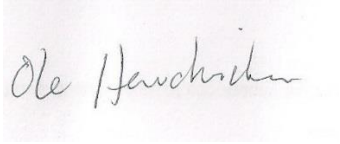
21. Ensure the provision by the Hearing Panel of a final decision document which includes a full outline of all information on which it has relied and thorough reasons for its decision.

We look forward to the Panel's response to the foregoing submission.

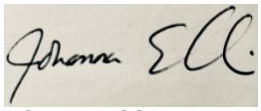
Yours very truly,

Theresa McClenaghan Executive Director
CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Brennain Lloyd
NORTHWATCH



Ole Hendrickson, Researcher
Concerned Citizens of Renfrew County and Area



Johann Echlin
Old Fort William Cottagers' Association

John Jackson
Nuclear Waste Watch

c. Marc Leblanc, Commission Secretary
Denis Samure, Incoming Commission Secretary

APPENDIX C – CNSC RESPONSE RE: PROCEDURAL GUIDANCE FOR CNSC PUBLIC HEARING – CNL'S APPLICATION TO AMEND LICENCE TO AUTHORIZE THE CONSTRUCTION OF NSDF FOR LOW-LEVEL WASTE

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Commission Registry
Greffe de la Commission

February 17, 2022

e-Docs # 6739999 Word
e-Docs # 6740014 PDF

Sent by email

Canadian Environmental Law Association et al.
c/o Theresa McClenaghan Executive Director,
55 University Avenue, Suite 1500
cela.ca
Toronto, Ontario
M5J 2H7
Canada

SUBJECT: Procedural Guidance for CNSC Public Hearing – CNL's application to amend licence to authorize the construction of NSDF for low-level radioactive waste

Dear Ms. McClenaghan:

As you know, on February 16th, 2022, the CNSC published a *Revised Notice of Public Hearing including Procedural Guidance for Intervenors*. Hopefully, you will recognize that the revised procedures incorporate or build upon some of the recommendations contained in your letter of December 16, 2021. Of course, being mindful of the regulatory framework and timelines already in place for this project, the changes might appear modest to some, but we nonetheless think that they demonstrate our willingness, openness and flexibility to consider change while ensuring that the Panel members receive the best evidence "as informally and expeditiously as the circumstances and the considerations of fairness permit" (s. 3 Canadian Nuclear Safety Commission Rules of Procedure) to discharge their mandate and obligations. We recognize that the revised procedural guidance for the NSDF proceeding will not address all of the participants expectations, but we are confident and hopeful that the changes will contribute to improved transparency, facilitate public participation and assist the Commission in obtaining all of the information it requires.

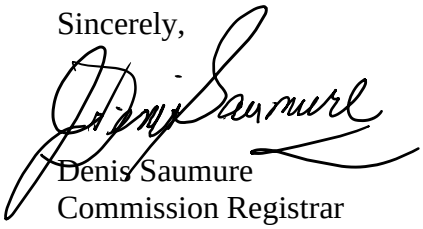
By structuring the interventions by topics, it will allow for more focused presentations and exchanges of information in an effective and efficient manner. The Registry will be able to set out timelines in advance for each topic, including the topic dealing with the consideration of environmental assessment and environmental protection. Once all interventions are received (deadline for interventions is April 11, 2022) the Registry will be able to prepare such an agenda. We anticipate that the EA topic will be the first one to be presented. Time allowing, intervenors may be invited to present during more than one topic-based session. Participants

have the opportunity to submit written submissions only or request to intervene by way of an oral presentation regardless of whether or not they have received Participant Funding. Participants making an oral presentation wishing to ask questions of CNSC staff or CNL will have the opportunity to ask questions via the President who may redirect the question as appropriate. We have also modified the procedures to allow participants to make final submissions up to 30 days following the final session of Part 2 of the hearing, before the record is closed. Participants can file as part of their submission, any document that is relevant and within the scope of the subject matter of the proceeding. All CMDs and transcripts are available on the CNSC website. Draft transcripts will, to the extent possible, be available within a one-day turnaround. With regard to interpretation services, and translation of documents, the CNSC complies with the requirements of the Official Languages Act and the CNSC provides simultaneous interpretation services for its public proceedings.

I understand that this does not address all of your submission but as stated in my previous letter, we remain committed to re-start the work on modernizing the Commission processes: it is one of our strategic objectives. I look forward to our future interactions on this endeavour.

Should you have any further comments or questions, please do not hesitate to contact me.

Sincerely,



Denis Saumure
Commission Registrar

Cc (by email)

Brennain Lloyd, NORTHWATCH

Ole Hendrickson, Concerned Citizens of Renfrew County and Area

Johann Echlin, Old Fort William Cottagers' Association

John Jackson, Nuclear Waste Watch