Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 22-H7.64

File / dossier : 6.01.07
Date: 2022-04-09
Edocs: 6757738

Oral presentation

Written submission from William Turner

Exposé oral

Mémoire de William Turner

In the Matter of the

À l'égard des

Canadian Nuclear Laboratories (CNL)

Laboratoires Nucléaires Canadiens (LNC)

Application from the CNL to amend its Chalk River Laboratories site licence to authorize the construction of a near surface disposal facility

Demande des LNC visant à modifier le permis du site des Laboratoires de Chalk River pour autoriser la construction d'une installation de gestion des déchets près de la surface

Commission Public Hearing
Part 2

Audience publique de la Commission
Partie 2

May and June 2022

Mai et juin 2022

Canada

Two Evaluations of CNL's Proposed Radioactive Waste Disposal Facility
By W. Turner (AECL Retiree and Resident of Deep River)

Summary and Conclusions

Since CNL announced its proposal for a radioactive waste disposal facility to be located on the Chalk River Laboratories site in 2016, many individuals and groups have raised concerns about this undertaking.

Although the table of consolidated comments is about 500 pages long [1], this intervention addresses these two issues:

- "CNL's selection of the East Mattawa Road site", and
- "The disposal of non-radiological contaminants in CNL's mound"

The two documents, included as parts to this intervention, address each of these issues. Below is a summary of these two parts.

1 Part One: CNL's Site Selection, An Evaluation

Part One of this intervention specifically addresses the CNSC staff's evaluation of CNL's selection of the East Mattawa Road site as described in CMD22-H7, Section 3.1, *Site Selection Evaluation* [2]. The last paragraph of that section includes a reference to Appendix I, "*Siting of Near Surface Disposal Facilities*" of the IAEA Specific Safety Guide, SSG-29. To quote from that appendix:

> *"I.1. Siting is a fundamentally important activity in the disposal of radioactive waste…"* [3]

As a fundamental activity, the choice of location will impact all subsequent activities related to the facility. For example, choosing to locate the facility on the side of a hill, in an area surrounded by wetlands, beside a creek or lake, or on a bedrock outcropping, will affect the preparation of the site, its construction, operation, and decommissioning, and its eventual abandonment.

In other words, the decision as to where to locate a disposal facility is crucial to everything about the facility, including its long-term safety.

Although it is likely that CNL identified their preferred site before they conducted their site selection process, the evidence for this is circumstantial. If we ignore this anecdotal evidence, we are left with this question: "Did the process CNL used to determine the location for its disposal facility consider the fundamentals?"

To answer this question, the scope of Part One was divided into three parts corresponding to the three features of the advice from real estate agents; "Location", "Location", "Location".

1. Issue 1: IAEA Specific Safety Guidance and CNL's Site Selection,
2. Issue 2: Addressing Public Comments on CNL's Site Selection, and
3. Issue 3: The Safety Control Area (SCA), "Emergency Management and Fire Protection" and Site Selection.

To address Issue 1, CNL's *Site Selection Report* [4] was compared to the two IAEA specific safety guidance documents that the CNSC staff assert were used in their review of CNL's licence application. These are the IAEA Specific Safety Guide, SSG-29 [3] quoted above, and IAEA Specific Safety Guide, SSG 23 [5].

To address Issue 2, CNL's site selection process was examined to determine whether it gave due consideration to the public's comments submitted in accordance with CEAA 2012. This section addresses CNL's disposition to this author's comments on their choice of the East Mattawa Road site. That disposition itself raises several questions about CNL's selection of this location.

Lastly, to address Issue 3, the fact that the planned relocation of Emergency Road 3 (ER3) has yet to occur even after about 6 years, raises questions as to how the CNSC's rating of "Satisfactory" for the "Emergency Management" Safety and Control Area (SCA) is justified.

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[1] CNSC, *CNL Table: Consolidated Public and Indigenous Groups' Comments on the Near Surface Disposal Facility Project Draft EIS,* 2021-07-02, Downloadable from https://www.ceaa-acee.gc.ca/050/documents/p80122/139599E.pdf

[2] CNSC, *Commission Member Document, CMD22-H7*, January 24, 2022

[3] IAEA, SSG-29 *Near Surface Disposal Facilities for Radioactive Waste*, Vienna, 2014

[4] CNL, *Near Surface Disposal Facility Site Selection Report,* 232-10300-TN-001, Revision 2, October 2016

[5] IAEA, SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, Vienna, 2012

The details of this evaluation are provided in "*Part One: CNL's Site Selection, An Evaluation*" of this intervention.

2 Part Two: The Disposal of Non-radiological Contaminants in CNL's Mound

Every process generates wastes. Clearly, we need to manage those wastes to minimize the risks to future generations and the environment.

Consider this quote from Section 3.1.1 of CNL's Project Description:

> *"The **NSDF project will provide a safe, permanent solution for the disposal of LLW** and other suitable waste streams that meet the WAC."* [6] [emphasis added]

If one applies CNSC's definition of disposal, "*The placement of radioactive waste without the intention of retrieval*" [7], to the concept of "permanent disposal", then the wastes will never be retrieved. Thus, eventually the wastes will be abandoned.

The scope of this part of the intervention is to determine whether CNL's proposed solution minimizes the risk to future generations and to the environment from the wastes to be emplaced, and whether that solution is permanent. Essentially, can non-radiological content in the wastes in CNL's proposed mound ever be abandoned?

Since neither the CNSC's CMD [2], nor CNL's CMD [8] address the potential effects to the biosphere resulting from the inclusion of non-radiological contaminants in the wastes, this intervention focuses on these contaminants. To address this scope, the following five questions were considered:

1. Does CNL have the information about the non-radiological hazards as required by legislation?
2. Does the definition of Low-Level wastes include non-radiological hazardous substances?
3. What are the safety and environmental effects of including the non-radiological contaminants in the wastes?
4. Are there any issues with CNL's safety analyses?
5. Does "permanent disposal" mean "abandonment"?

With respect to the first question, a search was done to determine whether the information required by two regulations, the *General Nuclear Safety and Control Regulations* [9] and the *Class 1 Nuclear Facility Regulations* [10], could be found. Six documents were examined. Although some of the information was found, it was based on CNL's *Non-Radiological Inventory of Constituents of **Potential** Concern* report [11] [emphasis added]. What is missing is any verification that these "potentials" represented "actuals". Thus, all the data about the quantity of the non-radiological contaminants are, at best, speculative. This lack of quantitative data suggests that CNL is out of compliance with these two regulations, and the CNSC staff have enforcement issues. Furthermore, since all of CNL's safety analysis documentation is based on these hypothetical quantities, any conclusions from these reports are essentially guesstimates.

To answer the second question, another document search was conducted, this time to determine whether the definitions of LLW included the non-radiological hazards. The documents searched included the GoCo contract, three of CNL's documents, and four of the CNSC's REGDOCs. What was found was surprising. Although inconsistencies among CNL's documents were expected, what I did not expect to find was the significant discrepancies among the CNSC's own REGDOCs. These inconsistencies raise the question: "*Which definition does the CNSC staff use in their review of the safety of a licensee's radioactive waste management program*?"

In answering the third question, several additional issues were identified that were not addressed in any of CNL's or the CNSC's documentation. These additional issues relate to the quantity and concentration of non-radiological contaminants that CNL identified as components in their waste inventory. Suffice to say, that the concentration of two toxic metals, copper and lead exceed *Canadian Soil Quality Guidelines*. Furthermore, the scrap value of four metals in the inventory is $33,000,000, making scavenging the mound for these metals

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[6] CNL, *Project Description: Near Surface Disposal Facility At Chalk River Laboratories*, Revision 1, 232-509200-ENA-001, September 2016

[7] CNSC, *Glossary of CNSC Terminology*, REGDOC-3.6, April 2021.

[8] CNL, CMD22-H7-1, February 22, 2022

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

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

]11] *CNL, Near Surface Disposal Facility (NSDF) Non-Radiological Inventory of Constituents of Potential Concern, (COPC*), Revision 3, 232-508600-TN-007, 2019 August

irresistible. The total scrap value raises the issue of CNL's failure to implement even the basics of a segregation program to prevent inclusion of valuable scrap in the wastes. As such, the scrap value is a significant contributor to the problem of intrusion by scavengers.

When evaluating the answer to the previous question, several issues with CNL's safety documentation were identified. These issues resulted in the fourth question. The issues include: the length of time between the announcement in 2015 of a facility that the proponent asserted was safe and the dates of CNL's safety assessment documentation; and the confusion over the end-state of the proposed disposal facility. What was found, is astonishing. In its safety case document [12], CNL asserted that three paragraphs of the *Class 1 Nuclear Facility Regulations* (specifically; 7, 8 and 14) are not applicable to their proposed disposal mound.

To answer the fifth question, two issues need to be addressed. Given the quantity of toxic metals in CNL's proposed waste inventory, land-use restrictions will need to be maintained long-past the time the radioactive contaminants decay to a safe level. At that time, the CNSC is no longer responsible for maintaining those restrictions, and those responsibilities need to be transferred to another regulator to ensure safety to persons and the environment is maintained.

This transfer is related to a lack of defined end-state for the proposed facility. Suffice to say, the owner of the site is not prepared to abandon the facility. If it is not abandoned, then it is a long-term storage facility and land-use restrictions will be required in perpetuity. As such, all of CNL's and the CNSC's safety documentation will need to be revised to consider the safety issues surrounding waste retrieval and land-use restrictions.

The details of this evaluation are provided in "*Part Two: The Disposal of Non-radiological Contaminants in CNL's Mound*" of this intervention.

3 Conclusions

With respect to Part One, CNL's Site Selection, from the evidence provided, CNL's selection of the EMR location for their mound disposal facility failed to address:

- the IAEA Specific Safety Guides the CNSC staff used to evaluate the location for CNL's proposed facility,
- the public's comments received in accordance with CEAA 2012, 19(1)(c), and
- the recommendation from their Emergency Preparedness Program to relocate Emergency Road 3, even after 6 years.

With respect to Part Two, the evaluation of the long-term consequences of including non-radiological contaminants, the evidence provided indicates that CNL failed to address:

- the hundreds to thousands of tonnes of non-radiological contaminants;
- several non-compliances with nuclear regulations and CNSC guidance;
- the absence of any consideration of the safety implications of including those non-radiological contaminants in the wastes;
- the gaps in their safety analysis reports; and
- the lack of a defined end-state for the disposal facility.

Therefore, if the purpose of CNL's proposed landfill facility is to "*…provide a safe, permanent solution for the disposal of LLW and other suitable waste streams that meet the WAC…"* [6], then it cannot be licenced in its present location and as currently designed.

[12] CNL, *Near Surface Disposal Facility Safety Case*, Revision 2, 232-03610-SAR-001, January 2021

Part One: CNL's Site Selection, An Evaluation

By W. Turner (AECL Retiree and Resident of Deep River)

Executive Summary

What are the three critical aspects of real estate? "Location", "Location", "Location". Since disposal is forever, the choice of a site for a disposal facility will have long-term consequences to the biosphere. Thus, the importance that the process for locating the disposal site address those long-term safety aspects, cannot be underestimated.

This part of the intervention specifically addresses the CNSC staff's evaluation of CNL's selection of the East Mattawa Road site as described in CMD22-H7, Section 3.1, *Site Selection Evaluation* [1]

Consider this quote from Appendix I, "*Siting of Near Surface Disposal Facilities*" of the IAEA Specific Safety Guide, SSG-29:

> *"I.1. Siting is a fundamentally important activity in the disposal of radioactive waste…"* [2]

As a fundamental activity, the choice of location will impact all subsequent activities related to the facility. For example, choosing to locate the facility on the side of a hill, in an area surrounded by wetlands, beside a creek or lake, or on a bedrock outcropping, will affect the preparation of the site, its construction, operation, and decommissioning, and its eventual abandonment.

In other words, the decision as to where to locate a disposal facility is crucial everything about the facility, including its long-term safety.

Although it is likely that CNL identified their preferred site before they conducted their site selection process, the evidence for this is circumstantial. If we ignore this anecdotal evidence, we are left with this question: "Did the process CNL use to determine the location for its disposal facility consider the fundamentals?"

To answer this question, the scope of this evaluation is divided into three parts corresponding to the three features of the advice from real estate agents; "Location", "Location", "Location".

- Issue 1: IAEA Specific Safety Guidance and CNL's Site Selection,
- Issue 2: Addressing Public Comments on CNL's Site Selection, and
- Issue 3: The SCA, *"Emergency Management and Fire Protection"* and Site Selection

In Issue 1, CNL's *Site Selection Report* [3] is compared to the two IAEA specific safety guidance documents that the CNSC staff assert were used in their review of CNL's licence application. These are the IAEA Specific Safety Guide, SSG-29 [2] quoted above, and IAEA Specific Safety Guide, SSG 23 [4].

In Issue 2, the answer to the question as to whether CNL's site selection gave due consideration to the public's comments submitted in accordance with CEAA 2012 is discussed. This section addresses CNL's disposition to this author's comments on their choice of the East Mattawa Road site. That disposition itself raises several questions about CNL's selection of this location.

Lastly, in Issue 3, the fact that the planned relocation of Emergency Road 3 (ER3) has yet to occur even after about 6 years, raises questions as to how the CNSC's rating of "Satisfactory" for the "Emergency Management" Safety and Control Area (SCA) is justified.

From the evidence provided, CNL's selection of the EMR location for their mound disposal facility failed to address the critical aspects of "Location", "Location" and "Location".

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[1] CNSC, *Commission Member Document, CMD22-H7*, January 24, 2022

[2] IAEA, SSG-29 *Near Surface Disposal Facilities for Radioactive Waste*, Vienna, 2014

[3] CNL, *Near Surface Disposal Facility Site Selection Report,* 232-10300-TN-001, Revision 2, October 2016

[4] IAEA, SSG-23, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, Vienna, 2012

Part One: CNL's Site Selection, An Evaluation

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1 Introduction

"Location", "Location", "Location".

1.1 The Importance of Site Selection

The choice of a location for a disposal facility is critical to determine its long-term safety. As a fundamental activity, the choice of location will impact all subsequent activities related to the facility. For example, choosing to locate the facility on the side of a hill, in an area surrounded by wetlands, beside a creek or lake, or on a bedrock outcropping, will affect the preparation of the site, its construction, operation, and decommissioning, and its eventual abandonment.

Consider this quote from the IAEA Specific Safety Guide, SSG, SSG-29, Appendix I, "*Siting of Near Surface Disposal Facilities*" [2],

> *"I.1.* ***Siting is a fundamentally important activity in the disposal of radioactive waste****…"* [emphasis added]

The focus on this evaluation is to determine whether the process CNL used to determine the location for its disposal facility included a considered of safety aspects of the site itself.

1.2 When did CNL Select Their Preferred Site?

From the public record, this question cannot be answered directly. However, there are dated documents that suggest that CNL had selected their site before their Site Selection Report was released.

CNL released their first revision of the Project Description document on March 30, 2016 [5]. Subsequently, they released three revisions of their Site Selection Report, with the last one dated October 26, 2016 [3].

With three revisions of their site selection report released after CNL had selected their site, suggest that CNL's Site Selection process was designed to specifically support their preferred location for their landfill type mound disposal facility. Since there is no direct publicly available evidence to support this conclusion, it remains speculative.

1.3 The Scope of the Evaluation

Ignoring the circumstantial evidence discussed in Section 1.2 above, this evaluation is divided into three parts, each addressing different aspects of publicly available evidence. These are:

- "Issue 1: IAEA Specific Safety Guidance and CNL's Site Selection" is an evaluation of CNL's Site Selection Process [3] against two applicable IAEA standards, the IAEA Specific Safety Guide, SSG-23, *The Safety Case and Safety Assessment of Disposal of Radioactive Waste* [4] and the IAEA Specific Safety Guide, SSG-29, *Near Surface Disposal Facilities for Radioactive Waste* [2].
- "Issue 2: Addressing Public Comments on CNL's Site Selection" is a review of the dispositions to comments received in accordance with CEAA 2012, specifically, a supplementary comment submitted by this author [6], and CNL's dispositions to that comment [7].
- "Issue 3: The SCA, *"Emergency Management and Fire Protection"* and Site Selection" is a short review of the CNSC staff's evaluation of the impact to this SCA caused by CNL's selection of the EMR site for their proposed mound.

As discussed in Section 2 below (Issue 1), the two IAEA safety guidance documents selected for this evaluation were identified in the CNSC staff's Commission Member Document (CMD22-H7) [1] and Slide 17 of CMD22-7A [8] in their review of CNL's Environmental Impact Statement and the supporting documentation. To quote from Section 2.3, third paragraph of CMD22-H7

> *"****CNSC staff considered all applicable IAEA safety standards and guidance documents in the review of CNL's application****, including: …*
>
> *2. IAEA SSG-23, The Safety Case and Safety Assessment of Disposal of Radioactive Waste …,*
>
> *3. IAEA SSG-29, Near Surface Disposal Facilities for Radioactive Waste..."* [emphasis added]

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[5] CNL, Project Description: Near Surface Disposal Facility At Chalk River Laboratories, 232-509200-ENA-001, Revision 0, March 30, 2016

[6] W. Turner, *From W. Turner (Supplementary Submission) to The Canadian Nuclear Safety Commission re: Comments on the Environmental Impact Statement for the Near Surface Disposal Facility*, August 7, 2017. (Downloadable from https://www.ceaa-acee.gc.ca/050/documents/p80122/119717E.pdf)

[7] CNSC, *CNL Table: Consolidated Public and Indigenous Groups' Comments on the Near Surface Disposal Facility Project Draft EIS,* 2021-07-02, Downloadable from https://www.ceaa-acee.gc.ca/050/documents/p80122/139599E.pdf

[8] CNSC Staff Presentation, *Commission Member Document, CMD22-H7A*, February 22, 2022

As discussed in Section 3 below (Issue 2), consider this quote from Step 9 in Section A.2 *Key steps for an environmental assessment under CEAA 2012*, REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*. [9]

> *"CNSC staff prepare a document summarizing the EA report's conclusions and recommendations, and outlining the EA-related decisions that the Commission needs to make. This document and the EA report are submitted to the Commission,* ***along with any public comments received (including how the CNSC staff addressed the comments****). The Commission uses this information to inform its decision."* [emphasis added]

Since the CNSC published the Comment Disposition Table [7] that includes CNL's dispositions to the public indigenous groups' comments, it is assumed that these dispositions represent *"…how the CNSC staff addressed the comments…",* thus fulfilling this REGDOC requirement.

In Section 4 below (Issue 3), I raise the question as to why the CNSC staff rated CNL's performance against the Safety and Control Area (SCA) *Emergency Management and Fire Protection* as "Satisfactory" when the planned re-routing of the Emergency Route 3 (ER3), has yet to occur.

2 Issue 1: IAEA Specific Safety Guidance and CNL's Site Selection

2.1 "Location" and IAEA Specific Safety Guide SSG-23

Consider this quote from Section 4.8 of the IAEA Specific Safety Guide SSG-23 [4]:

> *"4.8.* ***Development of the safety case should commence at the inception of the project*** *and should be continued through all steps in the development and operation of the facility through to its closure and licence termination.* ***The safety case should also be used throughout all steps to guide the site selection process****, the facility design, excavation and construction activities, operation of the facility and its closure …"* [emphasis added]

Two hits were found in a search of CNL's safety analysis report [10] for any reference to the IAEA Specific Safety Guide, SSG-23 document.

The results of this search were not unexpected since, as discussed Section 1.3 above, the site was likely selected before CNL's safety analysis report was available, making it impossible for their site selection process to address the specifics of the IAEA Specific Safety Guide, SSG-23 as quoted above.

In other words, the overall safety of the site could NOT have been considered when CNL selected the East Mattawa Road location to construct their mound.

2.1.1 Is Safety Addressed in CNL's Site Selection Report?

Figure 1 "*Criteria for evaluating alternatives*", has two rows that address "Health and Safety". Figure 2 also addresses site selection and includes "Health and Safety" which is highlighted.

So, the answer to the question is "yes", with caveats. For example, all safety criteria in these figures address the short-term worker safety, not the long-term safety of a proposed disposal facility.

Since disposal is forever, and not a short-term issue, omitting consideration of the long-term safety when siting a disposal facility does not meet the provisions of the IAEA Specific Safety Guide, SSG-23 quoted in Section 2.1 above.

Note: Factor 2.2 in Figure 2 identifies the "*Proximity to Evacuation and Travel Routes (so as to not interfere with)*" as one of the exclusion factors. The concern with respect to a specific evacuation route, Emergency Road 3 (ER3), is discussed in Section 3 below.

Consider the highlighted area in Figure 3. Apparently, the areas whose slope exceeded 25% were excluded from further consideration as a possible location. However, consider this quote from Page 4-3 [3]:

> *"For the NSDF, almost all of the same exclusion criteria that had been used for the VLLW siting were applied because they apply, by default, to all siting initiatives at CRL. These criteria are listed in Table 4-1 below.* ***Note that the slope restriction was relaxed from 10% to 25% for the NSDF site selection*** *…"* [emphasis added].

Apparently, CNL decided to relax an exclusion criterion that was suitable for "*…all siting initiatives at CRL…*" specifically to allow for the siting of their proposed disposal mound on the side of a hill.

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[9] CNSC, *REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures,* Version 1.1, April 2017

[10] CNL, *Near Surface Disposal Facility Safety Analysis Report*, 232-508770-SAR-002 , Revision 2, October 2020

Siting a landfill-type disposal facility on the side of a hill, then relaxing the slope criteria, suggests CNL is not concerned with long-term safety. See also Section 2.2.2 below.

Table 3-1
Table 3-1: Criteria for Evaluating Alternatives

Criteria		Definitions
Technical Feasibility		Does the alternative meet the project purpose? Does the alternative meet the project schedule (i.e., operational in 2020 to enable planned decommissioning and site restoration activities)?
Economic Feasibility		How do the construction and operations costs of each alternative compare in relation to each other?
Environmental Effects	Biophysical	How do the likely environmental effects compare (e.g., effects on wildlife habitat, species at risk, air quality)?
	Socio-economic	How do the socio-economic effects compare (e.g., effects on heritage sites, public roads, and highways)?
	Public Health & Safety	Can it be constructed/operated in a manner that protects public health?
	Worker Health & Safety	Can it be constructed/operated in a manner that protects worker health?

Figure 1: Table 3-1 - Criteria for Evaluation Alternatives [3]

2.1.2 Issues with CNL's Site Selection Criteria

2.1.2.1 Technical and Economic Feasibility

Consider the first two criteria listed in Figure 1, "Technical Feasibility" and "Economic Feasibility". If the site was not feasible either technically or economically, then the project cannot proceed. By definition then, the site has to be both technically and economically feasible.

Similarly, unless the facility can *"…be constructed/operated in a* [safe] *manner…"*, there is no project.

Since no-one would design a project that is neither technically nor economically feasible and is not safe, the criteria listed in Figure 1 cannot be applied to the site selection process.

These are **NOT** site selection criteria.

2.1.2.2 CNL's Weighting Factors

Figure 2 provides a list of weighting factors that would be applied to the Site Selection Criteria listed in Figure 1. Again, we run into issues with respect to the project. For example, the criteria "Cost", "Functionality", and "Constructability" are all related to whether the project exists, not the site. To quote from Executive Summary for CNL's Environmental Impact Statement:

> *"**The purpose of the NSDF Project is to provide the permanent disposal of** current and future **low-level waste at the CRL site**, as well as a small percentage of waste volume from off-site locations, **in a manner that is protective of both the public and the environment**."* [11] [emphasis added]

If the purpose of this project is to dispose of wastes *"…in a manner that is protective of both the public and the environment…*", then one has to ask why the criterion Safety is given a weighting of 20%?

This is further proof that CNL's site selection criteria were not based on safety (see Section 2.1.1 above).

[11] CNL, *Environmental Impact Statement for the NSDF Project, Volume 1, Executive Summary*; 232-509220-REPT-004, Revision 3, May 2021

Appendix C

Comparison Criteria Description and Weighting Factors Scorecard

Comparison Criteria	Section	Factors
COST (20% weighting)	1.1	Site Preparation - clearing, excavation, demolition, decommissioning, foundation shore-up costs, and availability of overburden
	1.2	Provision of Services to the Site - access roads, electrical power, water
	1.3	Operational Costs for provision of Nuclear Support Systems - e.g., dosimetry, security, and waste. i.e., is it close to these services
	1.4	Operational Costs for provision of Non-Nuclear Support Systems - e.g., fire, maintenance. i.e., is it close to these services
HEALTH and SAFETY (20% weighting)	2.1	Impact on Public Health (relative proximity to public beyond CRL site boundaries)
	2.2	Proximity to Evacuation and Travel Routes (so as to not interfere with)
	2.3	Impact on Areas of Known Contamination - location of known plumes, impact on workers (working in the area), ability to mitigate or remediate
ENVIRONMENT (25% weighting)	3.1	The discharge point of any potential untreated effluent from the site to the Ottawa River (> minimizes the risk of contamination)
	3.2	Distance from other watercourses, wetlands, groundwater, and drainage systems (> minimizes risk including site erosion risks)
	3.3	Located in an existing contaminated drainage basin (e.g., Perch Lake Basin, Maskinonge Lake Basin)
	3.4	Impact on socio-economic factors (e.g., local ski/bike/walking trails, etc.)
	3.5	Impact on valued plant or forest resources (e.g., research plantations, high value forest stands, tree, plant or animal Species of Concern (COSEWIC) or Species at Risk (SARA)
	3.6	Fuel consumption requirements for waste vehicles (greenhouse gas emissions) i.e., reduced distance from waste source will decrease fuel consumption and emissions
SITE FUNCTIONALITY (20% weighting)	4.1	Visual Impact and scale of structure relative to location
	4.2	Road access: condition, ease of access and safety during operations, intersections with Plant Road
	4.3	Expandability of site (including overburden thickness of 2 m which equates to less fill required)
	4.4	Consistency with site planning principles vision for site development (minimizes expansion of area that will not be free released)
CONSTRUCTABILITY (15% weighting)	5.1	Relocation of structures or major infrastructure modifications (e.g., new/upgraded roads required, interference by hydro lines requiring relocation)
	5.2	Grade - minor or major excavation required
	5.3	Adequacy and accessibility of construction lay down areas or trailer sites; adequacy and ease of access; ability to provide/enable a dedicated construction access route and point(s) capable of supporting heavy volumes

Figure 2: Appendix C-Comparison Criteria Description and Weighting Factors Scorecard [3]

2.1.3 Does the Site Selection Report Include the Site Selection Evaluation Results?

Figure 3 contains the list of exclusion criteria that were applied during the site selection process. According to the following quote from CMD44-H7, *Appendix F - Environmental Assessment Report*, Section 4.2*, "Alternative means to carry out the project*", subsection Site Selection (see Page 226 of 590)

> *"A total of 15 potential sites within CRL were identified for initial screening for the proposed NSDF Project site selection …".* [1]

Yet, there is no evidence in CNL's Site Selection Report [3] that 15 alternative sites were identified, and evaluated, resulting in the exclusion of 13.

CNL's report considers only two sites, the *East Mattawa Road* and the *Alternate* sites. Since the report contains no results from an evaluation against the complete set of criteria listed in Figure 1 and Figure 2, there is no evidence as to why the other 13 sites were excluded [3].

NOTE 1: By identifying one of the sites as "Alternate", one already knew that, from the beginning (see CNL's *Project Description* [5]), the site selection process was biased in order to prove that the EMR site was the preferred location.

NOTE 2: Section 2.5.5, *Site Selection* of CNL's EIS report [12] includes Table 2.5.5-1: *Potential Sites for the Project Considered by CNL*. This table summarizes the results of the evaluation of the 15 sites. With respect to this section of CNL's EIS report, there is only one reference to any document that could contain the results of an evaluation. That document is CNL's Site Selection Report [3]. As noted above, there are several issues with the report and CNL's evaluation criteria.

NOTE 3: Although it is beyond the scope of this evaluation, one example from Table 2.5.5-1 proves the point. For the sites (5, 6, 7, 8, 9, 10, 11, and 12), all eight were excluded because their "*Area is less than 14 ha and not considered large enough to accommodate the NSDF Project.*" [12]. To include these sites and then exclude them because they were not "large enough" suggests that these sites were included specifically to increase the number of sites evaluated.

Table 4-1
Exclusion Criteria Applied in the NSDF Siting Process

Ottawa River Floodplain • Areas that are below the 1 in 100 year Ottawa River flood elevation of 115 m above sea level (ASL); and • Areas that are below the flood elevation of 130 m ASL which would result from a hypothetical failure of the Des Joachims Main Dam and McConnell Lake Control Dam.
Areas of Steep Slope • Areas with a slope in excess of 25% shall be excluded. Areas with a slope of less than 10% are desirable.
Distance from Plant Road must be at least 50 m. The three key reasons for this requirement are: • Radiological protection of non-Nuclear Energy Workers on Plant Road during waste emplacement; • Inherent benefits in supporting the NSDF safety case; and • To limit visibility of structures from Plant Road.
Geotechnical Characteristics • Areas with outcrops and organics >20% of the proposed siting area; and • Areas with liquefaction potential and active fault lines.
Species at Risk • Known or proposed critical habitats for species listed under the Federal Species at Risk Act (SARA) or listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) shall be excluded or used such that the habitats shall have mitigation measures put in place to safeguard the species, as per guidance from the Environmental Protection (EnvP) Program.
Wetlands • Seasonally or permanently inundated wet areas; and • 30 m setback from a watercourse and 240 m from a wetland used by the Blanding's Turtle shall be utilized if no mitigation strategies are applied.
Cultural Heritage • Areas that are located on or adjacent to recorded Class I significant archaeological settings (e.g., gravesites).
CRL Property Boundary: • Minimum 100 m from existing CRL site boundaries.
Sites of existing or previously sited facilities.
Areas protected for low radiation background purposes.

Figure 3: Table 4-1 Exclusion Criteria Applied in the NSDF Siting Process [3]

2.2 "Location" and IAEA Specific Safety Guide SSG-29

Consider this quote from the last paragraph of Section 3.1 *Site Selection*, CMD22-H7:

> *"CNSC staff assessed the site selection and site evaluation of the proposed site and location of the NSDF against applicable standards, specifically Appendix I of the IAEA SSG-29 …"* [1]

What is included in "…*Appendix I of the IAEA SSG-29…"*? Consider this quote from Appendix I of the IAEA Specific Safety Guide, SSG-29, [2]:

> *"I.1. Siting is a fundamentally important activity in the disposal of radioactive waste ….*
>
> *… Sociopolitical factors are an important consideration in any site selection process (e.g. demographic conditions, transport infrastructure and existing land use). Decision making in* ***the site selection process may involve various levels of involvement of the public and local communities, including the use of veto and volunteerism****.*
> *…During the initial stages of site selection, site specific information (e.g. geological and hydrogeological information) may be sparse or lacking. Nevertheless, such data that are available and expert judgement should be used in support of a decision to select one or more locations as a prospective near surface disposal site.* ***A promising site should display evidence of favourable natural containment and isolation characteristics for the waste types under consideration*** *and should provide indications that all necessary engineered barriers to prevent or to retard the movement of radionuclides from the disposal system to the accessible environment can be effected.* ***This evidence needs to be tested in subsequent detailed site effected, characterization and associated safety assessment modelling****.* [emphasis added]

The following sections address two statements from Appendix I quoted above, public involvement, and favourable natural characteristics.

2.2.1 Did CNL's Site Selection included an Appropriate Level of Public Involvement?

With respect to the phrase from IAEA Guide SSG-29, quoted above: *"…the site selection process may involve various levels of involvement of the public and local communities, including the use of veto and volunteerism …"* consider the "*Site Selection Team Members"* listed in Figure 4. All "Site Selection Team Members" represented some aspect of CNL's internal management.

Appendix B

Site Selection Team Members

Stakeholder	Interest
Cost Estimating	Cost Analyses
Decommissioning and Waste Management	Compliance with Waste Management Program and Decommissioning Activities
Decommissioning and Waste Management Safety and Licensing	Compliance for Safety and Licensing Activities
Engineering	Compliance with Engineering Program
Environmental Protection Program	Compliance with Environmental Protection Program
Environmental Technologies Branch	Environmental Subject Matter Expertise
Fire Protection Program	Compliance with Fire Protection Program
Radiation Protection Program	Compliance with Radiation Protection Program
Security Program	Compliance with Security Program Authority
Site Landlord	Utilities Provider and Future Building Owner
Site Planning and Property Management	Compliance with Integrated Site Master Plan
Technical Planning and Assessment	Co-ordinating Waste Management Requirements
Waste Management Operation	Compliance with Facility Authorization

Figure 4: Appendix B-Site Selection Team Members [3]

The answer to this question is, "**NO**". All site selection team members were CNL employees.

2.2.2 Did CNL's Site Selection Process Include Consideration of the Site's Natural Characteristics?

Consider this phrase from IAEA Specific Safety Guide SSG-29 quoted above: "*A promising site should display evidence of favourable natural containment and isolation characteristics for the waste types under consideration…"* [4].

This leads to an obvious question, can an above ground municipal type landfill, such as the Carp landfill site just outside of Ottawa, display any *"…evidence of natural containment and isolation…*"? Regretfully, the answer to this is "**NO**". It is a dump".

NOTE: The term "dump" occurs 3 times in Revision 3 of CNL's EIS [12]; two associated with figures depicting the layout of the facility, and once in a reference. Whereas, in Revision 0 of their EIS report [13], it occurs 33 times; 16 times as "dump road", 11 times as "dumping"; 3 times as "dump truck"; twice as "dump trucks" and once as "dump ramp". Without any significant change to the design of CNL's proposed mound in the five years between the first and fourth revision of their EIS report, this reduction in the number of hits for the term "dump", suggests a deliberate attempt to mislead.

Consider Figure 5, copied from CNL's slide deck for the Part One hearing [14]. It depicts the cross-section and the hillside location of CNL's proposed mound. While it is unlikely to be to scale (given the height of the trees), it is indicative of these issues with CNL's Site Selection process. As one can see, there is no "*…evidence of natural containment and isolation…*".

As shown, CNL's proposed facility is located on the side of hill which means providing much in the way of natural containment is unlikely. Then there is the additional issue that CNL actually reduced any existing natural containment capabilities by relaxing the slope restriction from 10% to 25% (see Section 2.1.1 above).

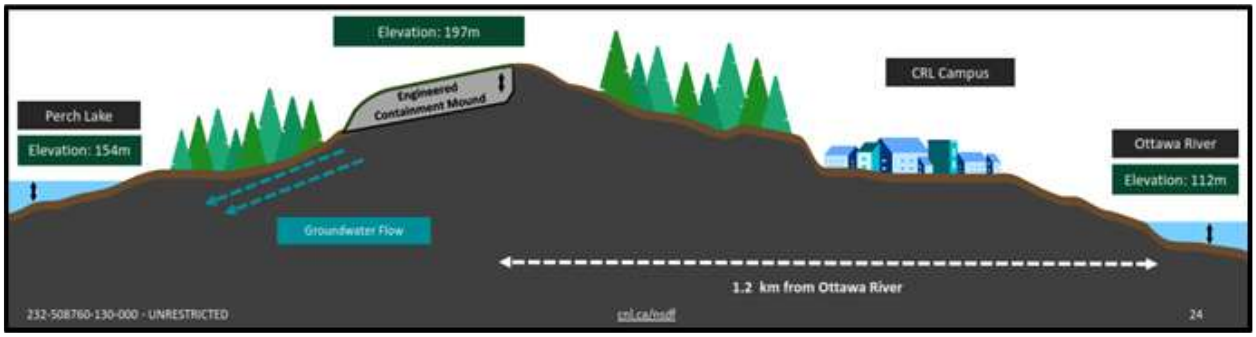

Figure 5: Cross-Section of CNL's Mound [14]

As to whether this location provides any natural isolation capabilities, that too is doubtful. Since Figure 5 depicts trees at the bottom of the hill, this figure is deliberately deceptive. We know from all other depictions of their mound, at this location, the mound is surrounded by wetlands, not trees. As shown in Figure 6, those wetlands are in fact about 30 metres from the fence line at the bottom of the hill. Thirty metres does not provide much in the way of natural isolation.

Comparing trees in this figure with Figure 6, the only possible area in which trees can be found is upgradient of the mound, that is, on the other side of the hill: not the wetlands.

Of course, through engineering and design, one can compensate for the lack of these natural containment and isolation characteristics. However, that totally ignores the IAEA safety guidance. If CNL chose a location for their mound that addressed these natural characteristics, then the requirement to compensate for their lack through engineering and/or design would be reduced. This would result in a lower cost for the construction, operation and eventual abandonment for the facility while enhancing its overall safety.

Figure 5 confirms the fact that CNL's site selection criteria did not address any natural containment and isolation features that could address the safe disposal of radioactive wastes in their proposed mound

2.3 Conclusion: CNL's Site Selection Process Failed to Address Applicable IAEA Guidance

As discussed in Section 2.1.1 above, there is no evidence that CNL's Site Selection report [3] addressed the long-term aspects of safety as recommended by the IAEA Specific Safety Guide, SSG-23 [4].

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[12] CNL, *Near Surface Disposal, Environmental Impact Statement*, Volume 2, Revision 3, 232-509220-REPT-004, May 2021

[13] CNL, *Near Surface Disposal, Environmental Impact Statement*, Volume 1, Revision 0, 232-509220-REPT-004, March 2017

[14] See Slide 24 in CNL's presentation, CMD22-H7.1A

As to whether CNL's process address the two recommendations from the IAEA Specific Safety Guide, SSG-29 [2], again the answer is "No".

First, there is no evidence that CNL made any attempt to involve the public in the decision process (see Section 2.2.1 above).

Second, there is no evidence that CNL included any consideration of the site's natural characteristics with respect to containment and isolation in their site selection (see Section 2.2.2 above). In fact, as quoted in Section 2.1.1 above, they relaxed their slope restriction from 10% to 25% [3].

Therefore, CNL's site selection process did not address the applicable Appendix I of the IAEA Specific Safety Guide SSG-29 [4].

3 Issue 2: Addressing Public Comments on CNL's Site Selection

Consider Step 9, Section A.2 Key steps for an environmental assessment under CEAA 2012, REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures. [9] To quote:

> *"CNSC staff prepare a document summarizing the EA report's conclusions and recommendations, and outlining the EA-related decisions that the Commission needs to make. This document and the EA report are submitted to the Commission, **along with any public comments received (including how the CNSC staff addressed the comments**). The Commission uses this information to inform its decision." [emphasis added]*

Since the CNSC published the Comment Disposition Table [7] that includes CNL's dispositions to the public indigenous groups' comments, it is safe to assume that the CNSC staff accepted all CNL's dispositions without further comment.

3.1 The Author's Comments on the "Locating the Mound" on the EMR site.

The following is a summary of my comments on the selection of the East Mattawa Road (EMR) site as described in CNL's EIS Report [13]. For details I refer the reader to my supplementary submission to the CNSC in accordance with CEAA 2012 [6].

In my submission I point out that the selected site straddles the East Mattawa Road which is designated as Emergency Road #3 (ER3), one of three emergency site evacuation routes. During the clearing of the location, the construction, operation, and closure of the facility, this route will not be available. By not including this fact in the site selection criteria suggested those criteria were just not credible.

I also pointed out, that in Section 2.5.5.1.1 of their 2017 EIS report [13], CNL stated that ER3 will be "*… re-routed as part of a previously planned upgrade to this road*". While that may be true, there would be no requirement to re-route this road if the mound did not straddle the road.

3.2 CNL's Dispositions to the Author's Comments on the EMR site.

The following is quoted from the CNSC document [7], specifically #CNL-ND87.

> *"The upgrade/re-route of emergency route 3 (ER3) was recommended by the Emergency Preparedness program based on changes to the Chalk River Laboratories (CRL) site parking, roads and intersections and results from site evaluation drills. The ER3 project will result in improved emergency egress for employees in the event of an evacuation requirement. The ER3 project is not part of the Near Surface Disposal Facility (NSDF) Project. "*

Consider two aspects of this response:

- The upgrades to ER3 were planned, and
- The ER3 project is not part of the disposal project.

These are discussed below

3.2.1 The Planned Upgrades to ER3

If changes to this road were planned before the EMR site was selected in 2016, where is the evidence that these plans were implemented before CNL chose this site?

Consider this statement from CNL's response: "***The ER3 project will result*** *in improved emergency egress …"*. Apparently, this project has yet to happen, whereas the EMR site was selected without the implementation of the plan.

NOTE 1: Since their Emergency Preparedness Program is a requirement under the site licence, did CNL approach the CNSC staff with their plans to re-route the ER3?

NOTE 2: Since these plans have yet to be implemented, they are "reasonably foreseeable". As such, under CEAA 2102, the environmental effects of this re-routing project must be considered in the assessment of the cumulative effects for the proposed Mound.

3.2.2 The Designated Project Includes East Mattawa Road

Regretfully, CNL has provided no evidence that changes to the East Mattawa Road are part of the project. What is much more problematic, is that in their 2021 EIS [12], they provide evidence to the contrary.

Consider Figure 6, copied from their 2021 EIS report. As depicted in this figure, this road provides both the entrance and the exit (that is, the north and south gates) to CNL's proposed mound facility. Since there is no other road depicted (such as the "new" ER3, which according to their 2017 EIS report [13]. were planned at least five years ago, see Section 3.2.1 above), it is safe to assume that the road identified as the "East Mound Road" is the ER3 road. If so, it circles the east side of the facility within the boundaries of the mound facility site as shown in this figure.

Whether or not this "East Mound Road" is the ER3 road does not matter, since CEAA 2012 defines a designated project as:

> *"… one or more physical activities that … includes* ***any physical activity that is incidental*** *to those physical activities."* [emphasis added]

As depicted in Figure 6, the East Mattawa Road provides both the entrance and an exit to the mound. Thus, this road is incidental to the "designated project" and must be included in the environmental assessment for CNL's proposed disposal project. Yet, neither CNL's latest EIS report [12] nor the CNSC's EA summary report [1] include any consideration of the environmental effects related to the location of the East Mattawa Road, and the re-routing of ER3.

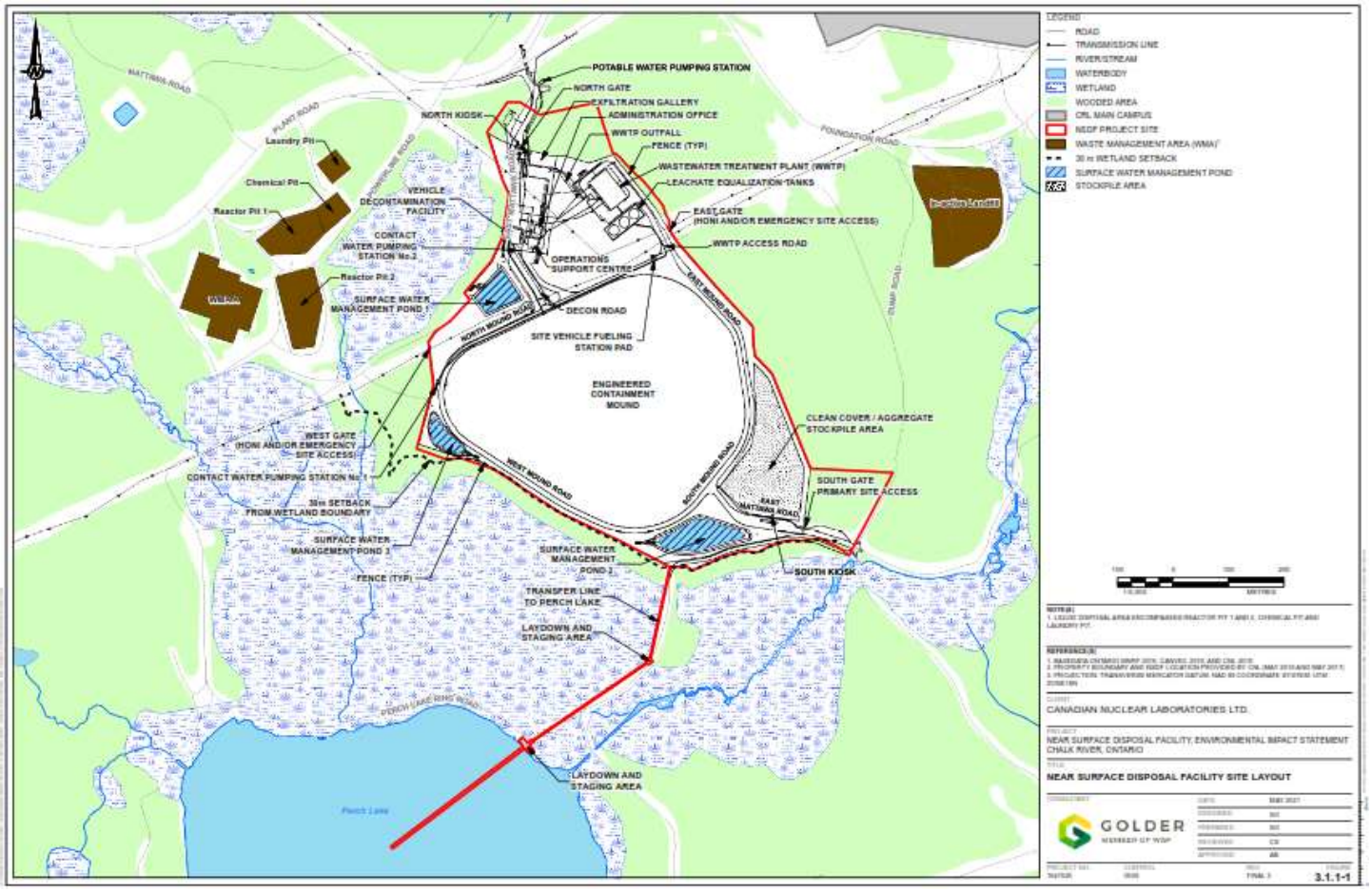

Figure 6: Facility Site Layout as Depicted in the CMD22-H7 Figures 2 and 10 [1]

3.3 Conclusion: CNL's Disposition to Public Comments on the EMR Location

As discussed in Sections 3.2 above, CNL's disposition to this author's comment on the EMR location for their mound disposal facility raises many more questions that have yet to be addressed. For example;

- Where is the re-located ER3?
- Why, after 5 or so years, has that re-routing not occurred?
- Why has both CNL and the CNSC staff ignored including East Mattawa Road in their assessments of the potential environmental effects of the designated project?

Thus, one can safely conclude that CNL's site selection process was inadequate.

4 Issue 3: The SCA, *"Emergency Management and Fire Protection"* and Site Selection

Appendix D, of Part One of CMD44-H7 [1] defines the Safety and Control Area (SCA), *Emergency Management and Fire Protection* as:

> *"Covers emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions.* ***This also includes any results of exercise participation.****"* [emphasis added]

As quoted Section 3.2 above, the re-routing of ER3 *"… was recommended by the Emergency Preparedness program based on …* ***results from site evaluation drills****.* ***The ER3 project will result in improved emergency egress*** *for employees in the event of an evacuation requirement."* [emphasis added]

However, as depicted in Figure 6, the re-routing of ER3 has yet to occur. As of this writing, the straddling the ER3, the location of CNL's proposed mound will seriously impacts the SCA for the site.

To quote from Section 4.10.4 of Part One of CMD44-H7 [1]:

> *"Based on CNSC staff's assessment of CNL's licence application and supporting documents for the construction of the NSDF and past performance at the CRL site, CNSC staff conclude that CNL continues to maintain and implement effective emergency management and fire protection programs in compliance with regulatory requirements.* ***CNSC staff are satisfied that potential emergencies at the NSDF facility can be successfully incorporated into CNL's existing emergency management and fire protection programs.****"* [emphasis added]

By selectively focusing on the construction of the proposed facility alone, in their assessment of CNL's application, the CNSC staff appears to ignore the implication that CNL's selection of the EMR site will negatively impact this SCA for the site as a whole.

Table 6: CRL Site Performance Rating (2018 to 2020)

SAFETY AND CONTROL AREAS	2018	2019	2020
Management system	SA	SA	SA
Human performance management	SA	SA	SA
Operating performance	SA	SA	SA
Safety analysis	SA	SA	SA
Physical design	SA	SA	SA
Fitness for service	SA	SA	SA
Radiation protection	SA	SA	SA
Conventional health and safety	SA	SA	SA
Environmental protection	SA	SA	SA
Emergency management and fire protection	SA	SA	SA
Waste management	SA	SA	SA
Security	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA
Packaging and transport	SA	SA	SA

SA = satisfactory

Figure 7: Table 6: CRL Site Performance Rating (2018 to 2020) [1]

4.1 The CNSC's Evaluation of Emergency Management SCA

According to the table depicted in Figure 7 above [1], the CNSC staff rated CRL's performance with respect to this SCA (over three years, 2017-2020, as "Satisfactory". However, this seems to contradict the fact that the re-routing of ER3 has yet to occur even after "*The upgrade/re-route of emergency route 3 (ER3) was recommended by the Emergency Preparedness program…*" before CNL chose the site for its mound, (see Comment 3.2 above). Surely as a critical safety concern, inaction by CNL on the Emergency Protection Program recommendations over the last seven years (2015-2022) is NOT appropriate. Thus, the rating of "Satisfactory" suggests that the CNSC staff either were unaware of these recommendations, or have done nothing to ensure actions have been taken to implement them.

4.2 Conclusion: CNSC's Performance Rating for the Emergency SCA Cannot be Supported

As discussed in Section 4.1 above, the fact that the recommended re-routing of ER3 has yet to occur, raises questions as to the CNSC's rating of "Satisfactory" for the Emergency SCA.

5 Conclusions

"Location". "Location". "Location".

To quote from Section 1.1 above:

> *"The choice of a location for a disposal facility is critical to determine its long-term safety."*

One question that remains unresolved is the timing of CNL's announcement of their preferred site, and the release of their three site selection reports (see Section 1.2 above).

As discussed in Section 1.3 above, two IAEA Specific Safety Guides, SSG-23 [4] and SSG-29 [2], were chosen as evaluation criteria. The choice of these guides was based on the CNSC's CMD22-H7 document in which it is stated that the "*CNSC staff considered all applicable IAEA safety standards and guidance documents in the review of CNL's application*." [1]

As discussed in Section 2.1.1 above, the results of the evaluation of CNL's site selection process against the IAEA Specific Safety Guide, SSG-23. While safety was included as criteria, only short-term operational health and safety issues are identified in CNL's process. Thus, CNL's site selection process did not meet the provisions of SSG-23, in which the safety case covers all aspects of the project.

With respect to the level of public involvement (the IAEA Specific Safety Guide, SSG-29 [2]), as discussed in Section 2.2.1 above, there is no evidence that CNL's process included public involvement. As depicted in Figure 4, all the members of the Site Selection Team represented CNL's internal management.

Section 2.2.2 above includes a review of whether CNL's site selection process considered the natural containment and isolation characteristics as recommended by the IAEA Specific Safety Guide, SSG-29 [2]. As discussed in this section, there is no evidence these characteristics were considered. Even more disconcerting is the fact that CNL relaxed one of their own criteria to allow for the siting of their mound on the side of a hill. By not addressing these IAEA requirements, the overall costs for the facility will increase, and its overall safety will decrease.

In 2017, the author provided comments raising issues with respect to the fact that CNL's preferred location for their proposed mound straddled Emergency Road #3 (ER3) [6]. The question raised by this author was why CNL's site selection process did not include a criterion specifically addressing ER3, which at the time represented a significant "Emergency Preparedness Program" issue.

In 2021, the CNSC posted CNL's dispositions to public comments [7]. A review of CNL's dispositions, specifically as they related to planned re-routing of ER3, concluded that both CNL's EIS, and the CNSC's EA ignored both the re-routing and the East Mattawa Road issues. As discussed in Section 3 above, the East Mattawa Road must be included an assessment of the potential adverse environmental effects as required by CEAA 2012.

Then there is the issue of the CNSC staff evaluation of the Safety and Control Area (SCA), "Emergency Management and Fire Protection" (see Section 4 above). Apparently, the lack of progress on the re-routing of ER3 as recommended by CNL's Emergency Preparedness Program after at least 5 years was not of concern to the CNSC's staff when they assigned "Satisfactory" to the performance rating for this SCA.

In summary, by almost any measure, CNL's site selection process was flawed. Recall that disposal is forever. Without a robust site selection process that addresses long-term safety, then the safety of all the other activities associated with the mound (such as, construction, operations, decommissioning, and closure) are in jeopardy.

Part Two: The Disposal of Non-radiological Contaminants in CNL's Mound

By W. Turner (AECL Retiree and Resident of Deep River)

Executive Summary

Every process generates wastes. Clearly, we need to manage those wastes to minimize the risks to future generations and the environment.

Consider our own wastes. If we chose to store it, we have this idea that we will find a use for it sometime in the future. Think of what is in that closet, basement, attic, or garage. Some of us even pay to have a storage locker.

If we decide to dispose of it, then we have no use for it now or in the future, and we abandon it.

Note the link between "disposal" and "abandon". When "disposal" is related to wastes that present a hazard to the health and safety of future generations, and/or to the environment, the term "abandon" changes the framing of what "disposal" really means. This is why municipalities have hazardous waste programs designed specifically to separate what is appropriate for disposal in a municipal waste landfill from the hazardous substances that present a risk to safety, both short-term and long-term, such that site access restrictions can be removed and the landfill can be abandoned safely.

Consider this quote from Section 3.1.1 of CNL's Project Description:

> *"The **NSDF project will provide a safe, permanent solution for the disposal of LLW** and other suitable waste streams that meet the WAC."* [1] [emphasis added]

If one applies CNSC's definition of disposal, "*The placement of radioactive waste without the intention of retrieval*" [2], to the concept of "permanent disposal" then the wastes will never be retrieved. Thus, eventually the wastes will be abandoned.

The scope of this part of the intervention is to determine whether CNL's proposed solution minimizes the risk to future generations and to the environment from the wastes to be emplaced, and whether that solution is permanent. Essentially, can the wastes in CNL's proposed mound be abandoned?

Since neither the CNSC's CMD [3], nor CNL's CMD [4] address the potential effects to the biosphere resulting from the inclusion of non-radiological contaminants in the wastes destined for disposal in CNL's proposed mound, this evaluation focuses on these contaminants. To address this scope, the following five questions were considered:

1. Does CNL have the information about the non-radiological hazards as required by legislation?
2. Does the definition of Low-Level wastes include non-radiological hazardous substances?
3. What are the safety and environmental effects of including the non-radiological contaminants in the wastes?
4. Are there any issues with CNL's safety analyses?
5. Does "permanent disposal" mean "abandonment"?

To answer the first question, a search was done to determine whether the information required by two regulations, the *General Nuclear Safety and Control Regulations* and the *Class 1 Nuclear Facility Regulations*, could be found in available documentation. Six documents were examined. Although some of the information was found, that data was incomplete. This suggests that CNL is out of compliance with these two regulations, and the CNSC staff have enforcement issues.

To answer the second question, another document search was conducted, this time to determine whether the definitions of LLW included the non-radiological hazards. The documents searched included the GoCo contract, three of CNL's documents, and four of the CNSC's REGDOCs. What was found was surprising. Although inconsistencies among CNL's documents were expected, what I did not expect to find was that there are significant discrepancies among the CNSC's own REGDOCs. These inconsistencies raise the question, "*Which definition does the CNSC staff use in their review of the safety of a licensee's radioactive waste management program*?"

In answering the third question, several issues were identified that were not addressed in any of CNL's and the CNSC's documentation. The two main issues relate to the quantity and concentration of non-radiological contaminants

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[1] CNL, *Project Description: Near Surface Disposal Facility At Chalk River Laboratories*, Revision 1, 232-509200-ENA-001, September 2016

[2] CNSC, *Glossary of CNSC Terminology*, REGDOC-3.6, April 2021.

[3] CNSC, CMD22-H7, January 24, 2022

[4] CNL, CMD22-H7-1, February 22, 2022

that CNL identified as components in their waste inventory. Suffice to say that the concentration of two toxic metals, copper and lead, exceed *Canadian Soil Quality Guidelines*. Further, the scrap value of four metals in the inventory is about $33 million, making scavenging the mound for these metals irresistible. The total scrap value raised the issue of CNL's failure to implement even the basics of a segregation program to prevent inclusion of valuable scrap in the wastes. As such, the scrap value is a significant contributor to the problem of intrusion by scavengers.

When evaluating the answer to the previous question three issues with CNL's safety documentation were identified. These concerns resulted in a fourth question. The issues include: the length of time between the announcement in 2016 of a facility that the proponent asserted was safe and the dates of CNL's safety assessment documentation; the confusion over the end-state of the proposed disposal facility, and the fact that in its safety case document [5], CNL asserted that three paragraphs of the *Class 1 Nuclear Facility Regulations* (specifically; 7, 8 and 14) do not apply to their proposed disposal mound.

The fifth question was easy to answer. If permanent disposal does not mean abandonment, then CNL's proposed mound must allow for waste retrieval, and the facility must be designed for long-term radioactive waste storage. Since nowhere in CNL's or the CNSC's safety documentation is retrieval considered, all that documentation (including the Environmental Assessment) will require major revision to address the safety issues surrounding waste retrieval.

By considering the answers to all five evaluation questions, with respect to the inclusion of non-radiological contaminants, the evidence provided indicates CNL failed to address:

- the hundreds to thousands of tonnes of non-radiological contaminants;
- several non-compliances with nuclear regulations and CNSC guidance;
- the absence of any consideration of the safety implications of including those non-radiological contaminants in the wastes;
- the gaps in the safety analysis reports; and
- the lack of a defined end-state for the deposal facility.

Therefore, CNL's proposed waste landfill cannot be licenced as presently designed.

[5] CNL, *Near Surface Disposal Facility Safety Case*, Revision 2, 232-03610-SAR-001, January 2021

Part Two: The Disposal of Non-radiological Contaminants in CNL's Mound

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1 Introduction

Every process generates wastes. The question is, what do we do about those wastes?

To answer this question, we need to know what is in that waste. With that knowledge we can determine the optimal program to manage those wastes. For example, "Can the wastes be prevented, reduced, re-used, or recycled?" Or "Are we left with the least favoured option, disposal?"

As is stated in from Section 3.1.1 of CNL's Project Description, CNL has chosen the last option. To quote:

> *"The purpose of the NSDF Project is* ***to provide the permanent disposal of current and future low-level waste*** *at the CRL site …"* [6] [emphasis added]

Assuming this is the best choice, then, as stated above, we still need to know what is in that waste. This raises two questions. Will the contaminants in the wastes meet the criteria for low-level waste (LLW)? Can those contaminants be safely abandoned sometime in the future?

This evaluation focuses on the non-radiological hazards that both the CNSC and CNL failed to address in their CMD reports (References 3 and 4, respectively). As discussed below, these substances form about 10% of the total mass of the wastes destined for permanent disposal in CNL's mound facility.

The scope of this evaluation is to determine whether these contaminants in the wastes pose an unacceptable risk to future generations and the environment. To address this scope, the following five questions were considered:

1. What information about the non-radiological hazards in the wastes are required by legislation?
2. Does the definition of Low-Level wastes include the non-radiological hazardous substances?
3. What are the safety and environmental effects of including the non-radiological hazards in the wastes destined for CNL's proposed mound?
4. Are there any issues with CNL's safety analyses?
5. Does "permanent disposal" mean "abandonment"?

Section 2 below addresses the legislated requirement about the contaminants in the waste that CNL's licence application must address. The two regulations applicable to this study are: the *General Nuclear Safety and Control Regulations* [7] and the *Class I Nuclear Facilities Regulations* [8].

The definition of LLW and whether it includes non-radiological hazards is addressed in Section 3 below. Suffice to say that there is no single definition of LLW. For CNL/AECL there are 4 different definitions. Even the CNSC has four separate definitions.

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[6] CNL, *Environmental Impact Statement for the NSDF Project, Volume 1, Executive Summary*; 232-509220-REPT-004, Revision 3, May 2021

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

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

With respect to the safety and environmental effects of the non-radiological contaminants in CNL's proposed disposal facility (addressed in Section 4 below), the CMD22-H7 is virtually silent [3]. One explanation for this silence may be provided by this quote from this Section 4.11.2, *CNSC Staff Assessment* in the CMD:

> CNL's *"… waste management program ensures the safe management of low, intermediate and high-level radioactive wastes, and hazardous wastes. Of note, the proposed NSDF will accept only solid low-level waste…".*

Since this quote suggests that hazardous wastes will not be accepted, then obliviously there is no need to assess their effects on safety and the environment. However, that is not the only issue. The scrap value of the large quantity of metals, estimated to be $33 million at recent prices, presents an irresistible attraction to scavengers. Thus, both the short and long-term safety analyses of the repository must address the risks to this receptor.

When attempting to answer the third question above, several issues with CNL's safety documentation were identified which became the fourth question listed above. These are discussed in Section 5 below, and include:

- When were the documents produced?
- Why are there no safety analyses for abandonment?
- Why does CNL assert that three paragraphs in the Class 1 Regulations are "not applicable" to their proposed mound?

The fifth question is easy to answer. If the permanent low-level waste disposal facility will not be abandoned in the foreseeable future, then the wastes contained in the mound are subject to retrieval. Thus, CNL's proposed mound is a long-term radioactive waste storage facility. Since neither the CNL's nor the CNSC's safety documentation address retrieval, all that safety documentation will require major revision to address the issues surrounding waste retrieval.

1.1 Disclaimer

All comments are those of the author and do not constitute legal opinions.

2 Applicable Legislation

If, in their safety analyses documents, CNL ignored considering the clearance criteria for the radiological contaminants as defined in Schedule 2 of the *Nuclear Substances and Radiation Devices Regulations* [9] (see Section 5 below), then it is extremely likely CNL also ignored the non-radiological contaminants.

The following discussion focuses on requirements for the non-radiological contaminants defined in the *Class I Nuclear Facilities Regulations* [8], and the *General Nuclear Safety and Control Regulations* [7]. Both these regulations include the requirement to identify and quantify the non-radiological contaminants.

2.1 The "Class I Nuclear Facilities Regulations"

To quote from Paragraph 14(2)(d):

> *"(2) Every licensee who operates a Class I nuclear facility shall keep a record of …*
>
> *(d) the nature and amount of radiation, nuclear substances and* ***hazardous substances*** *within the nuclear facility …*" [8] [emphasis added]

Table E.1.2 - *Class I Nuclear Facilities Regulations* of CMD22-H7 [3], includes a reference to this section of the Regulation. According to the table, under the column "*CNL submission addressing the Regulatory Requirements*" the following three documents are identified.:

- Waste inventory
- Safety Analysis Report
- Safety Case

The problem with this list is that these reports are NOT records, although they could include summaries of the required records. However, if they were summaries then one would expect to find a short description of the required information to address paragraph 14(2)(d) [8]. However, that is not the case. Consider the first bullet, CNL's Waste Inventory document [10]. In a review of that document, no data on the non-radiological contaminants could be found.

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[9] *Nuclear Substances and Radiation Devices Regulations*, SOR/2000-207

[10] CNL, *NSDF Reference Inventory Report*, 232-508600-REPT-003, Revision 2, 2019 September

NOTE: As discussed in Section 2.3 below, CNL appears to be out of compliance with Paragraph 14(2)(d) of the *Class I Nuclear Facilities Regulations* [8].

2.2 The "General Nuclear Safety and Control Regulations"

To quote from CMD22-H7 [3], page 146 of 590:

> *"It is a requirement of the General Nuclear Safety and Control Regulations under paragraph 3(1)(j) that an application for a licence include the name, origin, quantity, form, 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."*

Since the *Class I Nuclear Facilities Regulations* [8] requires records of the nature and the quantity of hazardous substances be kept, it should have been relatively easy to search those records or their summaries and find the information required by this regulatory requirement. However, as discussed in Section 2.1 above, those records appear to be missing.

2.3 A Search for the Information Required by Legislation

Five documents were searched to determine "…*the name, origin, quantity, form, and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed*..." These are:

- The licence application [11]
- COPC Inventory report [12]
- The Reference Inventory Report [10]
- The EIS report [13]
- The CMD22-H7 [3]

While some information required to comply with Section 3(1)(j) of the *General Nuclear Safety and Control Regulations* [7] can be found in several of the documents searched, even if all of the information found in these reports was combined, the complete information required by Paragraph 3(1)(j) is missing. Without this information (specifically the quantities), assessing the consequences resulting from the disposal of the non-radiological contaminants in CNL's proposed mound is virtually impossible.

All is not lost however. Thus, this evaluation attempts the impossible by relying on CNL's extrapolation of its own incomplete inventory information to obtain an estimate of the quantities required by the two regulations (see Section 2.3.1 below).

However, conclusions based on estimates alone cannot be relied upon, especially when used to predict the long-term effects to the biosphere.

2.3.1 Constituents of Actual Concern

Consider the title of CNL's report, "*Near Surface Disposal Facility (NSDF) Non-Radiological Inventory of Constituents of **Potential** Concern, (COPC*)" [emphasis added], and the use of the term "*Constituents of Potential Concern"* or COPC. If CNL was concerned about impact to the long-term safety resulting from any contaminants in the wastes destined for disposal in their proposed mound, then CNL must be concerned with "actuals" not "potentials".

To verify the "potentials" identified in this report represent the "actuals" in the wastes, one would expect to find answers to the following two questions.

- Is there a source for the potential contaminant?
- Have these chemicals been found in either the wastes generated or the effluent and groundwater monitoring data?

The first question should be an easy one to answer. Unless the specific chemical is used in a process somewhere on Chalk River site, it cannot appear in the wastes. Without a source, it will not be found in the process wastes.

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[11] CNL letter, J.M. Hammell (CNL) to J. LeClair (CNSC), *Subject: Application for Approval of a Modification to the Waste Management Areas at Chalk River Laboratories: Construction of the Near Surface Disposal Facility*, March 31, 2017

]12] *CNL, Near Surface Disposal Facility (NSDF) Non-Radiological Inventory of Constituents of Potential Concern, (COPC*), Revision 3, 232-508600-TN-007, 2019 August

[13] CNL, *Environmental Impact Statement for the NSDF Project*; 232-509220-REPT-004, Revision 3, May 2021

The second question is even easier. Unless the chemical was found in in the monitoring data, again it will not appear in the wastes. That said, to be on the safe site, the soils, debris, and other bulk materials could be subjected to the Toxicity Characteristic Leachate Procedure (TCLP) as defined in Ontario Regulations 347 [14] to confirm whether it can be found in the wastes.

However, just because a contaminant is not found in the effluents and/or the groundwater, does not mean it is not in the wastes. As discussed in Section 2.3.2 below, there are many factors that control the movement of contaminants through the mound. Since the TCLP is designed to determine whether the bulk material is classified as a hazardous waste under Ontario Regulation 347, it does not address these controlling factors. Therefore, the TCLP results cannot be the only evidence for deciding whether the contaminant is present in the wastes. Without the evidence provided by an examination of the chemicals used on the Chalk River site and the monitoring results, one cannot determine potential impacts to the biosphere if any of these materials end up in the wastes destined for CNL's mound.

Since there is no evidence in this or any other of CNL's reports that these simple checks were done, all the following reports, that are based on CNL's COPC report [12], amount to pure speculation:

- The WAC [15]
- The Safety Case [5]
- The Safety Analysis Report [16]
- The Post-Closure Safety Assessment Report [17]
- The Waste Characterization Report [18]

2.3.2 Factors Controlling the Movement of Contaminants in the Mound

The movement of both the radiological and non-radiological contaminants through the mound is controlled by the interaction of following factors:

- their chemical properties,
- the chemical and physical nature of the soils,
- the size of the soil particles,
- the ionic potential of the water,
- the partitioning between the mobile and stationary phases,
- the pH,
- the microbial interactions, and
- whether or not the media is aerobic or anaerobic.

The above list is not intended to be complete. For example, if there are non-aqueous phase liquids (NAPLs) present then there is an added complexity to the movement of the contaminants. To characterize the movement of the contaminants all these factors (and many others) must be considered, or, if there is sufficient justified, eliminated from further consideration.

NOTE: Several NAPLs are listed in Table 1. Obvious examples are the solvents: benzene, carbon tetrachloride, and chloroform, to name just three. While their total quantity may be low (e.g. several hundred litres), their effects will likely be highly localized. Most of the other organic halocarbon contaminants listed in Table 1 will be dissolved in these solvents. Thus, the availability of these chemicals for leaching and treatment in the Waste Water Treatment Facility (WWTF) will be limited.

Since neither CNL nor the CNSC provide any information about the chemical and physical characteristics of the mound, any modelling of the movement of the contaminants through the mound ending with an exposure to the receiver is incomplete.

Furthermore, since concentration of the contaminants in the leachate is questionable, then the results of CNL's safety analyses based on the potential releases from CNL's WWTF are likely irrelevant.

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[14] Ontario Regulation 347, *General – Waste Management*, Revised Regulations of Ontario, 1990,

[15] CNL, *Near Surface Disposal Facility Waste Acceptance Criteria*, 232-508600-WAC-003. Revision 4, November 2020.

[16] CNL, *Near Surface Disposal Facility Safety Analysis Report,* Revision 2, 232-508770-SAR-002, October 2020

[17] CNL, *Postclosure Safety Assessment – Iteration 3*, Revision 1, 232-509240-ASD-004, October 2020

[18] CNL, *Waste Characterization*, 232-508600-REPT-002, Revision 4, 2020 February

Part Two: The Disposal of Non-radiological Contaminants in CNL's Mound

2.4 The Non-Radiological Inventory – Information Found

If there is one of the reports listed in Section 2.3 above that should include the non-radiological inventory it would be CNL's Reference Inventory Report. [10]. Except that it does not.

As discussed in Section 2.3.1 above, CNL has no information about the contaminants of actual concern. All is not lost, however. We can still assess the safety of CNL's proposed undertaking using the data from CNL's COPC report [12].

Consider Table 1 below. It summarizes the non-radiological contaminant information found in CNL's reports. As noted in Section 2.3.1 above, four of CNL's reports refer to CNL's COPC inventory report [12], thus contain essentially the same information. Therefore, only two columns in Table 1 contain any quantity information. The fourth column lists the quantities for four metals found in Table 3.3.2-3 of CNL's EIS report [13].

Table 1: List of Non-radiological Contaminants

#	Chemical Name	From CNL's WAC Report, Table 3	From CNL's COPC inventory, Table 3-2	From CNL's EIS, Table 3.3.1-3 (see also Table 3 below)
		Chemical Abstracts Service (CAS) Number	NSDF Non-Radiological Inventory (kg)	Calculated Mass in the Facility at Closure (kg)
1.	1,1,2,2-Tetrachloroethane	79-34-5	120	
2.	1,1,2-Trichloroethane	79-00-5	120	
3.	1,4-Dichlorobenzene	106-46-7	120	
4.	Acetone	67-64-1	3,200	
5.	Aluminum	7429-90-5		33,000
6.	Anthracene	120-12-7	68	
7.	Antimony	7440-36-0	23	
8.	Arsenic	7440-38-2	100	
9.	Barium	7440-39-3	2,000	
10.	Benzene	71-43-2	200	
11.	Benzo[a]pyrene	50-32-8	68	
12.	Beryllium	7440-41-7	24	
13.	Bis(2-ethylhexyl)phthalate	117-81-7	560	
14.	Boron	7440-42-8	10,000	
15.	Cadmium	7440-43-9	10	
16.	Carbon tetrachloride	56-23-5	120	
17.	Chlorobenzene	108-90-7	160	
18.	Chloroform	67-66-3	200	
19.	Chromium (Total)	7440-47-3	100	
20.	Chromium VI (same as total)	18540-29-9		
21.	Chrysene	218-01-9	68	
22.	Cobalt	7440-48-4	6,000	
23.	Copper	7440-50-8	6,000	3,520,000
24.	Dioxin (Toxic Equivalency)	9014-42-0	3.0E-05	
25.	Ethylene dibromide	106-93-4	300	
26.	Fluoranthene	206-44-0	68	
27.	Fluorene	86-73-7	68	
28.	Fluoride (aqueous)	16984-48-8	360	
29.	Furan (Toxic Equivalency)	110-00-9	3.0E-05	
30.	Iron	7439-89-6		10,442,000
31.	Lead	7439-92-1	100	178,000
32.	Mercury	7439-97-6	2	
33.	Methylene Chloride	75-09-2	600	
34.	Molybdenum	7439-98-7	800	
35.	Nickel	7440-02-0	20,000	
36.	Nitrate	14797-55-8	800	
37.	Nitrite	14797-65-00	220	
38.	Phenol	108-95-2	120	
39.	Phenolic compounds, nonchlorinated		200	
40.	Phosphate (Phosphorus)	14265-44-2		

#	Chemical Name	From CNL's WAC Report, Table 3	From CNL's COPC inventory, Table 3-2	From CNL's EIS, Table 3.3.1-3 (see also Table 3 below)
		Chemical Abstracts Service (CAS) Number	NSDF Non-Radiological Inventory (kg)	Calculated Mass in the Facility at Closure (kg)
41.	Polychlorinated Biphenyls (PCB)	1336-36-3	6	
42.	Selenium	7782-49-2	110	
43.	Silver	7440-22-4	100	
44.	Sodium	7440-23-5		
45.	Tetrachloroethylene	127-18-4	120	
46.	Thallium	7440-28-0	4	
47.	Tin	7440-31-5	6,000	
48.	Vanadium	7440-62-2	2,600	
49.	Zinc	7440-66-6	7,200	

As one can see there is a large discrepancy between the metal inventory that is based on speculation (Column 3) and an actual estimate given in CNL's EIS report (Column 4). See also Section 2.3.1 above.

2.4.1 The WAC and the Non-Radiological Inventory

To repeat this quote from WAC Section 4.2, *Key Constituents of Potential Concern* [15]:

> *"Key Constituents of Potential Concern (COPC) are chemicals of interest* ***if CNL were to emplace the constituent at its maximum leachable concentration****… The COPC were used for NSDF leachate modelling purposes and the total quantity of COPCs in the waste must be tracked; therefore, when the Key COPC listed in Table 3 are present in the waste and/or are part of the waste container, the concentration or quantity and the uncertainty shall be reported."* [emphasis added]

Both CNL and the CNSC staff need to explain how anyone can determine *"… when the Key COPC listed in Table 3 are present in the waste …*", if there is no process to establish the presence of a "Key COPC". (See Section 2.4.2 below.) Apparently, for the non-radiological contaminants, CNL's WAC are an illusion.

However, as discussed in Section 2.4.1.1 below, even if CNL's WAC are illusionary, they do preclude the inclusion of these components in the wastes destined for the mound.

2.4.1.1 CNL's WAC Preclude the Disposal of Mixed Wastes in the Mound

Consider this quote from WAC Section 4.1 *Hazardous Waste*:

> *"Waste that, notwithstanding of its radioactive component, is classified as hazardous waste is not permitted for disposal in the NSDF*." [15]

CSA N292.0:19 defines mixed waste as:

> *"radioactive waste that also contains hazardous substances."* [19]

According to both the WAC statement and the CSA definition quoted above, all the constituents listed in Table 1 cannot be disposed of in CNL's proposed mound. Thus, in order to exclude the hazardous components from the radiological components of the mixed wastes, CNL will need to invest in a rigorous waste segregation program.

Further, CSA N292.0:19 defines "Waste Segregation" as:

> *"… the separation of wastes based on physical, chemical, biological, or radiological properties …"* [19]

Neither CNL's WAC, their Waste Characterization nor their EIS reports provide any description of a waste segregation program. Thus, virtually all the wastes classified in CNL's six waste types (see also Section 4.1 below) would be excluded from disposal in the proposed mound.

NOTE: A mixed waste segregation program has significant implications for worker safety. Thus, CNL's safety case [5], safety assessment [16], their EIS [6] and the CMD [3] need to address the potential adverse effects to worker safety and to the environment that may result from the activities associated with a segregation program. None of these reports address any impacts associated with such a segregation program. The reason for this may be as simple as, "There is no program". See also Figure 2 and Figure 3 below.

[19] CSA, *General principles for the management of radioactive waste and irradiated fuel,* CSA N292.0:19, March 2019.

2.4.2 Waste Characterization and the Non-Radiological Inventory

Consider this quote from Section 6.3 *Non-Radiological Inventory* of CNL's *Waste Characterization* report, [18]:

> *"The non-radiological waste constituents are associated with low-level waste that contains both radionuclides and regulated nonradioactive materials. The non-radiological inventory is based on the assumption that no more than 2% of the NSDF waste volume, or 20,000 m^3, represents the estimated total leachable mass of the contaminants at their regulatory concentration limits.* ***Based on the limiting concentrations and the assumed volume of 20,000 m^3, the inventories of individual constituents are calculated****"*

and

> *"…**The leachable inventory estimates in Table 7 are considered conservatively high because they are based on the maximum leachable concentrations or maximum untreated concentrations allowed by Ontario Regulation 347** … They are also based on the maximum projected waste volume of 20,000 m^3"* [emphasis added]

From the quote above, it is obvious that CNL has no actual analytical data on which to base their projected non-radiological inventory. Apparently the inventory is "… *based* [on] *the maximum leachable concentrations … allowed by Ontario Regulation 347,,*," See also Section 2.4.2 above.

NOTE 1: From an examination of chemicals listed in Table 1, one can identify several liquids, which according to Section 3.5 of CNL's WAC *"…are not permitted in NSDF waste (i.e., equal to or greater than 1% free standing liquids by volume)…"* [15]. Since no source is given for these liquids, we do not know whether they "…*are suspect to contain free liquids*…" This section lists these two test methods that will confirm whether the wastes "…*contain free liquids*…":

- the US EPA SW-846 Test Method 9095B, and
- the slump test defined in Ontario Regulation 347.

NOTE 2: Given that both these tests are included in CNL's WAC [15], one would expect to see specific references to these tests in CNL's Waste Characterization report [18]. Since neither test method is included in this report, there is a significant gap in the process to characterize the physical nature of the wastes destined for CNL's proposed mound.

NOTE 3: For reference, this is the definition of "characterization" given in the CSA N292.0:19 standard:

> *"Characterization -* ***determination of the physical****, chemical, biological, and/or radiological waste characteristics for use in the assessment of health, safety, and environmental hazards"* [19] [emphasis added]

2.4.3 The EIS and the Non-radiological Inventory

Table 3 below is a modification of Table 3.3.1-3 of CNL's EIS [13] that specifically addresses the metals listed in the last column of Table 1. The source of the metals is discussed in Section 4.1 below. The safety consequences resulting from the disposal of the hundreds to thousands of tonnes of these metals is discussed in Section 4.3 below.

Suffice to say, neither CNL nor the CNSC address these safety consequences.

2.4.4 CMD22-H7 and the Non-radiological inventory

The only list in the CMD [3] that should contain the non-radiological inventory is Table 6.1, "*Water quality modeling results"*. As the title of this table indicates, it does not. It lists the results of modelling, and contains no information as to the actual inventory or the assumptions on which the modelling was based.

Models need to be verified against actual measurement. Without evidence of that verification, all the results reported in this table are questionable.

Furthermore, the results focus on water quality, essentially a single pathway from the source of the contaminant in the mound to the recipient. Regretfully, for an entity whose responsibilities include ensuring safety above all else, this focus is unacceptably restrictive (see also Figure 4).

NOTE: A search of the CMD on the term "verification" gave 83 hits. Of those "compliance verification" occurred 31 times, "geological verification", nine times, "effluent verification" eight times, "waste verification", six times, "design verification", twice, "model verification" none, and so on. What is disturbing is that this search confirmed that the CMD did not include any discussion of the results of any verification activities that CNL may have conducted to support the results of the various models used to:

- estimate the quantities of the contaminants in their inventory,
- project the implications to long-term safety resulting from the inclusion of those contaminants in the waste inventory.

2.5 Summary: The Non-Radiological Inventory Information is Inadequate

To summarize Section 2.3.2 above, the inventory of non-radiological contaminants does not meet the requirements of the two applicable regulations: the *Class I Nuclear Facilities Regulations* and the *General Nuclear Safety and Control Regulations*. This strongly suggests that CNL is out of compliance with these two regulations.

Even without details of the non-radiological inventory required by these regulations, and considering only the huge quantities of toxic metals (see Table 3), Section 52(2) of CEAA 2012 will require that EA decision be referred to the Governor in Council (see Section 4.5 below).

3 Does the Definition of Low-Level Waste Include Non-Rads?

During the Part One Hearing, both CNL and CNSC staff made statements to the effect that "*Only Low-Level wastes will be disposed of in CNL's NSDF facility*". Since neither CNL nor CNSC staff defined what they meant by low-level waste, we need to ask: "*Does low-level waste include non-radiological contaminants?*"

To address this question, we immediately run into a problem with the various definitions of Low-Level Waste (LLW). Below is a discussion of several definitions of LLW which are applicable to CNL's proposed mound.

The discussion starts at the beginning with the GoCo contract, since that is the document by which CNL is given the direction and permission to develop their proposed disposal facility. A review of several definitions given in CNL's own documentation follows. Lastly, the definitions given in several REGDOCs are quoted.

3.1 The GoCo Contract

Consider the Government-Owned-Contractor-Operated (GoCo) contract between AECL and the Consortium managing "Canadian Nuclear Laboratories". This contract includes three agreements covering the "Site Operating Company" (SOC), Nuclear Power Demonstration site (NPD) and the Whiteshell site. For the purposes of this discussion, I will focus on the SOC agreement.

From the "SOC Agreement - Schedule A - SOC Statement of Work" [20], LLW is defined as:

> *"Low Level Waste (LLW) -Waste, as per IAEA safety standards, with radionuclide content above established clearance levels and exemption quantities, but that generally has limited amounts of long-lived activity. LLW requires isolation and containment for periods of up to a few hundred years.* ***LLW does not require significant shielding during handling and transportation****."* [emphasis added]

Also of note, is this definition of VLLW

> *Very Low Level Waste (VLLW) - Low level waste (LLW) that does not need a high level of containment and isolation and therefore is suitable for disposal in near surface landfill-type facilities, with limited control. Typical VLLW includes bulk material such as low activity soil and rubble as well as some uranium wastes.*

3.2 CNL's Definitions

CNL has more than one definition of LLW. These are discussed below.

3.2.1 CNL's Environmental Impact Statement

The definition of LLW given in *Table 14.1: Glossary of Terms* of CNL's EIS report is:

> *"Low Level Waste*
>
> *Radioactive solid waste that contains material with radionuclide content above established clearance levels and exemption quantities, but that generally has limited amounts of long-lived activity*." [13].

3.2.2 CNL's Integrated Waste Strategy

To quote from Section 2.1, *Classification of Waste* from CNL's *Integrated Waste Strategy* [21]:

> *The classification of waste are described in Table 2-1 and are adopted from CNL's Waste Management (WM) Program definitions.*

[20] SOC Agreement - Schedule A - SOC Statement of Work, Page 3

[21] CNL, *Integrated Waste Strategy*, CW-508600-PLA-002. Revision 1, March 2019.

This is the definition of LLW given in Table 2-1:

> *Low Level Waste (LLW) - Waste with radionuclide content above established clearance levels and exemption quantities, but that generally has limited amounts of long-lived activity. LLW requires isolation and containment for periods of up to a few hundred years.* ***LLW does not require significant shielding during handling and transportation****."* [emphasis added]

NOTE: Except for the reference to the IAEA, this definition is word-for-word copy of the definition given in the GoCo contract (see Section 3.1 above).

3.2.1 CNL's Waste Acceptance Criteria

To quote from Section 1 of CNL's Waste Acceptance Criteria

> *All waste that will be placed for disposal in the NSDF will be Low-Level Waste (LLW) as defined by the Canadian Standard Association (CSA) N292.0:19 …*

However, there is a problem with this reference. The CSA N292.0:19 does not include any definitions for the various waste classes [19].

3.2.2 CNL's COPC Inventory Report

To quote from Section 1.3.2, *Definitions* from CNL's COPC Inventory report [12], LLW is defined as:

> *"The CSA standard N292.0:19 defines LLW as waste that contains material that has radionuclide content above established clearance levels and exemption quantities and has generally limited amounts of long-lived radioactivity.* ***Low-Level Radioactive Waste generally does not require significant shielding during handling and interim storage****. Low-Level Radioactive Waste requires isolation and containment for up to a few hundred years."* [emphasis added]

3.3 CNSC REGDOCs

As discussed in the four subsections below, the CNSC's definitions of LLW and ILW given in their REGDOCs are inconsistent.

3.3.1 REGDOC-3.6

With respect to the REGDOCs, the definition of LLW as given in *Glossary of CNSC Terminology* [2] is:

> *"Radioactive solid waste that contains material with radionuclide content above established clearance levels and exemption quantities, but that generally has limited amounts of long-lived activity."*

However, this definition is incomplete, since it does not address Intermediate Level Waste (ILW). From *Glossary of CNSC Terminology* ILW is defined as:

> *"Radioactive solid waste* ***that typically exhibits levels of penetrating radiation sufficient to require shielding during handling and interim storage****."* [emphasis added]

3.3.2 REGDOC-2.11.1, Volume I

To quote from Section 7.1, Waste classification of 2.3.2 REGDOC-2.11.1, Volume I [22]:

> *"Low-level radioactive waste (LLW) contains material with radionuclide content above established unconditional clearance levels and exemption quantities (set out in the Nuclear Substances and Radiation Devices Regulations), but generally has limited amounts of long-lived radionuclides. LLW requires isolation and containment for periods of up to a few hundred years and is suitable for disposal in near surface facilities …"*

And

> *"Intermediate-level radioactive waste (ILW) generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years. ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal. Due to its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near surface repositories."*

NOTE: This latter definition of ILW does not include a requirement for shielding.

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[22] CNSC, *Waste Management, Volume I: Management of Radioactive Waste*, REGDOC-2.11.1, Volume I, January 2021

3.3.1 REGDOC-2.11.1, Volume III

Consider the following quote from Section B.5.1 General, REGDOC-2.11.1, Volume III [23]:

> *"Low-level radioactive waste (LLW) contains material with radionuclide content above established clearance levels and exemption quantities, but generally has limited amounts of long-lived activity. … LLW requires isolation and containment for periods of up to a few hundred years.* ***LLW does not generally require significant shielding during handling and interim storage.***" [emphasis added]

3.3.1 REGDOC-2.11.1, Volume III, Version 2

To quote from Section 1.1 of REGDOC-2.11.1, Volume III, Version 2 [24]:

> *"The purpose of this document is to provide requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment activities pertaining to* ***the disposal of all classes of radioactive waste.****"* [emphasis added]

What is most disconcerting about this REGDOC is that it provides no definitions for any of the "… *classes of radioactive waste"* that the safety case is supposed to address. Therefore, it lacks any guidance for selecting the type of disposal facility required to contain and isolate the various waste classes, for example, very low-level waste (VLLW), low-level waste (LLW), intermediate-level waste (ILW), and high-level fuel waste (HLW).

3.3.2 The CNSC's Inconsistency in Defining LLW is Unacceptable

For the regulator to issue documents with inconsistencies in the definitions of LLW and ILW discussed above is unacceptable. Which of these definitions does a licensee use when applying for licencing approval for a radioactive waste management and/or disposal facility?

This inconsistency among the REGDOCs raises the question as to whether use of the terms "REGDOC" and "regulatory document" should even apply to these CNSC documents. These terms give the documents an air of authority, which due to their inconsistency, they cannot have. Apparently the CNSC staff can chose whatever definition they wish to apply when reviewing a proponent's proposal for a radioactive waste management facility.

3.4 Does LLW Exclude Shielding and/or Include Non-Radiological Hazards?

Table 2 summarizes whether the various definitions of LLW discussed above exclude and/or include non-radiological hazards. Of course, definitions alone provide no guidance as to what should or should not be included in the waste inventory destined for CNL's mound.

Table 2: Definitions of LLW and the Non-Radiological Hazards

Definition Source	*Does the Definition Exclude Shielding?*	*Does the Definition Include Non-Radiological Hazards?*
GoCo Contract	*Yes*	*No*
CNL's EIS	*No*	*No*
CNL's IWS	*Yes*	*No*
CNL's WAC	*Unknown*	*Unknown*
CNL's COPC Inventory	*Yes*	*No*
CNSC's Glossary	*Yes (shielding is required for ILW)*	*No*
CNSC's REGDOC-2.11.1 Vol I	*No*	*No*

[23] CNSC, *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management,* REGDOC-2.11.1, Volume III, May 2018

[24] CNSC, *Waste Management, Volume III: Safety Case for the Disposal of Radioactive Waste, Version 2*, REGDOC-2.11.1, Volume III, Version 2, January 2021

Definition Source	*Does the Definition Exclude Shielding?*	*Does the Definition Include Non-Radiological Hazards?*
CNSC's REGDOC-2.11.1 Vol III	*Yes*	*No*
CNSC's REGDOC-2.11.1 Vol III Version 2	*Unknown*	*Unknown*

Since disposal is forever, and the non-radiological hazards will not decay, we have no other alternative but to err on the side of long-term safety. Thus, any wastes that require shielding or include significant quantities of non-radiological hazards must be excluded from CNL's proposed mound; for example, the metals listed in the last column of Table 1.

4 The Safety and Environmental Effects of the Non-Radiological Contaminants

Table 3 is a modification of Table 3.3.1-3 from CNL's EIS report [13]. Five columns, B through F were added to the original table.

NOTE: The quantity of metals in Table 3-24, *Estimated Quantity of Metals in NSDF at Closure*, from CNL's Safety Case report [5] is essentially the same quantities listed in Table 3.3.1-3 of the EIS report.

Compared to the list of non-radiological contaminants in Table 1, there are only four metals listed. Thus, the list of metals cannot be seen as addressing all the non-radiological hazards as required by regulatory requirements discussed in Section 2 above. That said, it does include thousands of kg of the 5 contaminants, two of which are known toxics; copper and lead.

Also included in Table 3, is an estimate of the value of scrap for the four metals, based on April 8 prices [25], and a comparison of the concentration of the two metals against their respective benchmarks given in the Canadian Soil Quality Guidelines (CSQG) [26].

Table 3: Modification of Table 3.3.1-3: NSDF Non-radiological Inventory at the Time of Closure [13]

Contaminated Material Type	*Calculated Mass in the Facility at Closure (kg)*	*$/kg [25]*	*Value of Scrap ($)*	*Concentration in Mound (mg/kg)*	*Canadian Soil Quality Guidelines [26]*	
					Agricultural Land Use	
					(mg/kg)	*Ratio*
Column	**A**	**B**	**C = AxB**	**D = A/Total Mass**	**E**	**F = D/E**
Aluminum	33,000	$1.98	65,000.00	34		
Copper	3,520,000	$4.75	16,720,000.00	3,678	63	58.4
Iron (waste plus package material)	10,442,000	$1.50	15,663,000.00	10,911		
Lead	178,000	$3.96	704,000.00	186	70	2.7
Organics (wood and dry radioactive waste, which includes cotton-based materials like mop heads and clothing)	80,339,000					
Totals	**94,512,000**		33,152,000.00			
Total mass of the Mound [27]	957,000,000					

4.1 The Source of the Contaminated Materials Listed in Table 3

As depicted in Table 3, the five materials listed make up about 10% of the total mass of the mound. Since the purpose of the facility is to dispose of radioactive wastes, the fact that 10% of the mass consists of non-radiological contaminants, some of which have significant long-term safety implications, seems excessive. Thus, one has to ask; "What is the source for all that waste?".

[25] Scrap Metal Pricer, prices as of March 7, 2022, link - https://www.scrapmetalpricer.ca/

[26] *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (2007)

[27] Footnote to Table 12, from Reference [10].

The answer may be CNL's definitions of Waste Types given in their EIS report [13]. To quote from Section 3.3.1.1 of that report, four of the six waste types are:

> ***"Type 3 – Non-Soil-Like Waste:*** *Type 3 waste includes materials that can be excavated and handled as bulk materials but do not have the physical characteristics of soil and soil-like materials. These include process wastes, highly organic wastes, highly compressible wastes, flowing wastes and similar waste types.*
>
> ***Type 4 – Decommissioning and Demolition Waste:*** *Type 4 wastes include typical materials used in construction such as: concrete, asphalt, brick, lumber, structural steel, process equipment, piping, wood and other building materials produced by decommissioning and demolition activities.*
>
> ***Type 5 – Packaged Waste:*** *Type 5 waste refers to wastes contained in rigid packages. There are two types of rigid waste packages: Non-Leachate Controlled Waste Packages and Leachate Controlled Waste Packages. Liners and soft-sided waste packages are not considered Type 5 Waste. Non-Leachate Controlled Waste Packages include intermodal containers (e.g., 20-foot ISO container), steel waste boxes (e.g., B-25 boxes) and drums (e.g., 205 L drum). Leachate Controlled Waste Packages provide containment of the waste during the time the disposal cell is not covered with the final cover. Containment can also be provided using approved overpacks or waste processing methods.*
>
> ***Type 6 – Oversize Debris:*** *Type 6 waste includes waste that does not fall within the definition of waste Types 1 through 5, primarily by its size or shape. "*

4.2 The Organic Content

Consider the over 80 million kg of organics. To quote from the third bullet on Page 3 of CNL's *Waste Characterization* report [18]:

> *"…the ECM will have a reducing chemical environment, due to the presence of organic matter (wood) and iron …"*

As those familiar with municipal landfills know, as organic wastes decompose under anaerobic conditions, they produce methane, a landfill gas and a significant contributor to greenhouse gas emissions. The installation of a cover over their mound to prevent water ingress, in order to minimize the quantity of the leachate requiring treatment, will ensure that the reducing environment will extend throughout the mound.

In other words, CNL is proposing to create the chemical conditions that will ensure the maximum production of landfill gas (methane) from the decomposition of the waste organics.

4.2.1 The Source of the Organics and What Could Have Been Done

Ignoring the soil and soil like wastes (which as any soil chemist knows contains organics) the main source for organics are Waste Types 3 and 4 (see Section 4.1 above).

From CNL's description of these two types, one can postulate that with a rigorous upfront segregation program, such as the three "R's" depicted in Figure 1, most of the organics could be processed, decontaminated and/or removed before emplacement in the mound. If CNL implemented a waste reduction program similar to that used by

Figure 1: Copy of Figure from CNL's IWS [21]

municipalities, they could significantly reduce the quantity of organics destined for their mound, thus reducing (although not eliminating) the production of landfill gas.

However, as depicted in the two photos to the left side of Figure 2, CNL has made no attempt to "prevent, reduce, re-use, or recycle" the organics; "*…lumber, …wood and other building materials produced by decommissioning and demolition activities*", that are included in the Type 4 wastes (see Section 4.1 above).

Recall from Section 2.4.1.1 above, that CSA N292.0:19 defines "Waste Segregation" as:

> *"… the separation of wastes based on physical, chemical, biological, or radiological properties*
>
> *Note: **Waste segregation increases the efficiency of most waste processing technologies and reduces the overall cost of waste management**."* [19] [emphasis added]

As depicted in both Figure 2 and Figure 3, there is no evidence that CNL did any waste segregation to minimize the quantity of organics destined for their proposed mound.

Figure 2: Slide 28 - CNL Presentation, L'Isle-aux-Allumettes, 2017 August 3

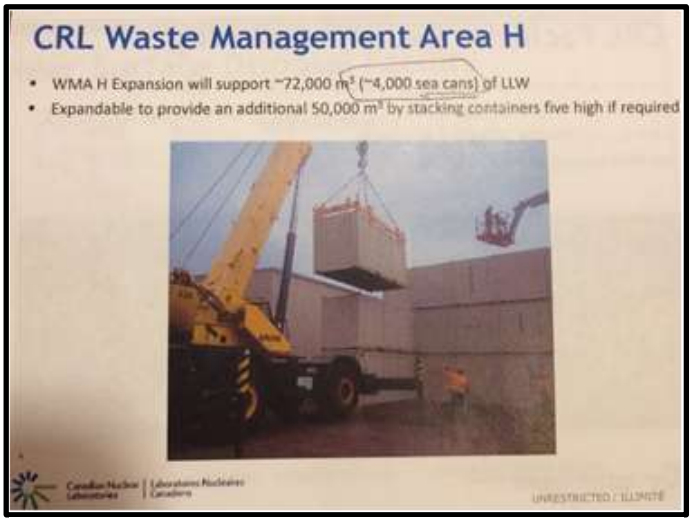

Figure 3: Waste Containers Destined for Disposal in the Mound

4.3 The Metallic Wastes

4.3.1 The Long-term Safety

Consider Table 3 in Section 4 above. In order to compare the concentration of the metals in the mound with the most restrictive Canadian Soil Quality Criteria (CSQC), those for agricultural land use [26], Columns D, E and F were added to the original table. For two metals, aluminum and iron, there are no CSQC.

As one can see, under Column F, the concentrations of both copper and lead exceed the CSQC benchmarks by 58 and 2.7 times respectively.

Although they may oxidize, dissolve, etc., metals are not subject to radioactive decay, thus they will remain in the mound as a hazard forever. However, the chemistry in the mound is not static. The metals will be subject to chemical reactions, which, depending on the chemistry of the mound, may result in a more toxic form and/or an increase in their mobility (see Section 2.3.2 above). Consequently, the mound can never be released for unconditional land use.

However, that conclusion may not be true, since all four metals have significant value as scrap (see Table 3, Column C). Given the value of these metals as scrap, as discussed in Section 4.3.3 below, intrusion by scavengers will happen.

4.3.2 The Source of the Metals and What Could Have Been Done

As described in Section 4.1 above, the three waste types, 4, 5, and 6, include metallic waste. A check of Figure 2 and Figure 3 shows several sources for these metals (such as demolition, and waste packaging) that would account for the thousands of kilograms of the four metals listed in Table 3.

As shown in the two figures, CNL has made no attempt to "prevent, reduce, re-use, or recycle" the metals such as "*…structural steel, process equipment, piping, … and other building materials produced by decommissioning and demolition activities*", that are included in the Type 4 wastes. Furthermore, there was no attempt to reduce the Type 5 wastes such as the "…*rigid packages …* [including] *intermodal containers (e.g., 20-foot ISO container), steel waste boxes (e.g., B-25 boxes) and drums (e.g., 205 L drum)*." See also Section 4.1 above.

As to packaged wastes, there is no mention of the lead shielding required for waste radionuclides, such as Co-60.

4.3.3 Intrusion into the Mound by Scavengers

Column B in Table 3 lists the scrap value of the four metals obtained from the website, Scrap Metal Pricer [25]. As shown in Column C, on March 12th 2022, the total scrap value of these metals is about $33 million.

These prices make it extremely attractive for scavengers to break into the mound to recover these metals. If scavenging were to occur, that scavenger is very likely to be exposed to an unacceptable radiation dose. Recall that much of the radioactive waste is packaged in either lead or iron, making this risk of exposure virtually certain.

Of course, as time goes on, and the radioactivity decays, the risk from a radiation exposure is also reduced. However, there is no reduction in risk from the non-rad metals.

With respect to any intrusion by scavengers, given the three Waste Types, 4, 5 and 6, as discussed in Section 4.3.2 above, the metals can never be evenly dispersed throughout the mound. Thus, the concentrations listed in Table 3 are a significant underestimation of the actual risk resulting from exposure to these metals.

Of greater concern is that these scavengers will be exposed to the radiological contaminants in the various waste packages such as those described for the Type 5 wastes (see Section 4.1 above).

While these concentrations present a risk to the scavengers, they also present a risk to that postulated resident farmer living on the mound. That farmer will also encounter these packages, especially when drilling that "shallow well". To quote from the subsection *"What if" Scenarios*, on Page 47 of 590 of the CMD:

> *"Two of these* [what if scenarios] *are variants of the human intrusion scenario (i.e., mass excavation and farming and shallow well) …"* [3]

4.4 The Non-Radiological Wastes and the Safety Analyses.

4.4.1 The Safety Analysis as Described in the CMD

A search of Appendix F of CNSC's CMD22-H7 on the term "farmer" returned two hits. To quote from the last sentence of the second paragraph on Page 277 of 590:

> *"The enhanced erosion case results in an annual dose of 0.114 mSv, 7,650 years post-closure resulting from a resident farmer consuming locally grown foodstuffs …."*

First, the idea that there would be a farmer resident on the mound 7,650 years from now is problematic at best. Consider what this area was like only one hundred years ago, let alone 7,650 years ago. There is no way anyone can predict that the mound will even exist that long. In other words, this 7,000-year time assumption renders the whole post-closure assessment meaningless.

Second, there is no reference to the non-radiological contaminants which, as listed in Table 3, will remain above the CSQC benchmarks for agricultural land use forever (unless, of course, the metals are removed by scavengers. See Section 4.3.3 above).

A search of the complete CMD22-H7 on the term "farmer" (ignoring the hit for the colonial farmer) returns four hits. To quote from Page 48 of 590 of the CMD Part One, bullet 3, which includes the two hits that are not discussed above:

> *"…it is not expected that a farmer will be living on top of the ECM; yet it is assumed that the critical receptor most affected by the facility is a farmer family who lives 100% of their time on the NSDF site, with a house and garden located on top of the ECM, and raises cattle that grazes in Perch Lake Swamp …"*

Apparently, it is assumed that this farmer will not be living on the top of the mound, and yet the family's house and garden will be located on the top of the mound, with their cattle grazing in the Perch Lake Swamp.

The inconsistency in timing between these two sections of the CMD raises significant questions about the CNSC staff's review of CNL's safety documentation.

4.4.2 CNL's Safety Analyses

Figure 4 depicts the scenarios assessed in CNL's safety analysis. Figure 5 provides some additional pathways from the source to the receptors depicted in Figure 4.

Aside from the fact that the assumption that one can predict the lifestyle of any future resident, indigenous group or cottager 100 years into the future is unreasonable, we can identify issues with the pathways as depicted in Figure 4.

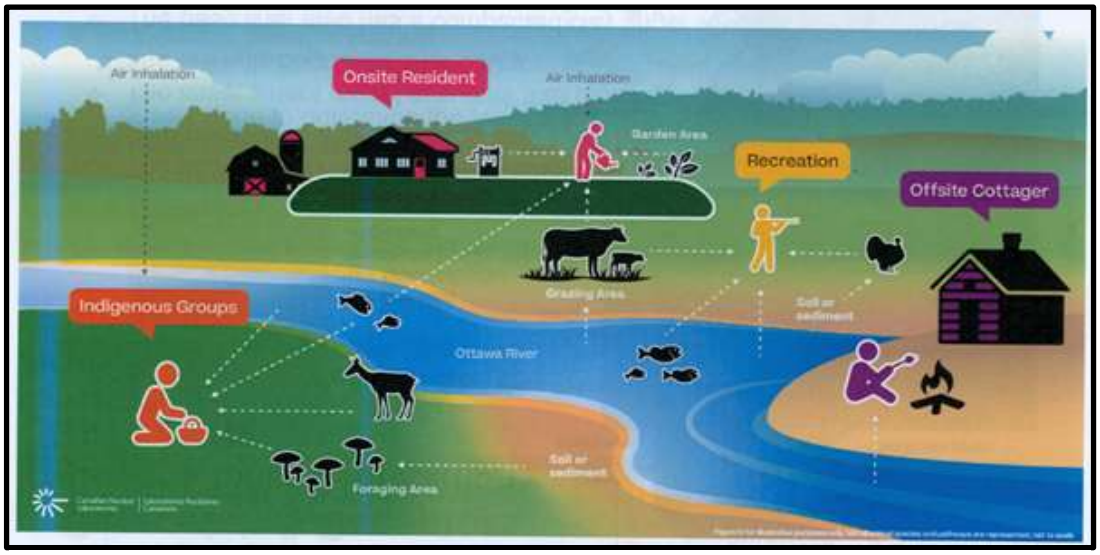

Figure 4: A Depiction of CNL's Safety Assessment Scenarios

For example, CNL's mound is missing. That said, the only receptor directly impacted is the resident. Given that the mound is located more than 1 km from the Ottawa River, all other receptors are considerably further away from CNL's proposed disposal facility. Thus, the pathway from the source (i.e. the mound) to these receptors will result in a

considerable reduction in the risk of exposure. What prevents these receptors (i.e. indigenous groups, recreational group or the cottager) from residing on the mound?

Also missing is one critical receptor, the scavenger. As discussed in Section 4.3.3 above, given the value of scrap for the huge quantities of metals in CNL's mound, intrusion by scavengers to recover these metals is certain.

Let us now turn to Figure 5. The obvious omission is that the non-radiological contaminants that we know are in the wastes discussed in Section 2.3.2 above are not identified.

When comparing Figure 5 with Figure 4, several discrepancies become obvious. For example, Figure 4 shows an arrow between the receptor and a well located next to the resident, whereas in Figure 5, there is no well. Given that any well located anywhere on the mound will have to penetrate both the cover layer, the wastes, and likely the bottom layer, this omission is unacceptable. This well is a direct exposure pathway from contaminants to the receptor.

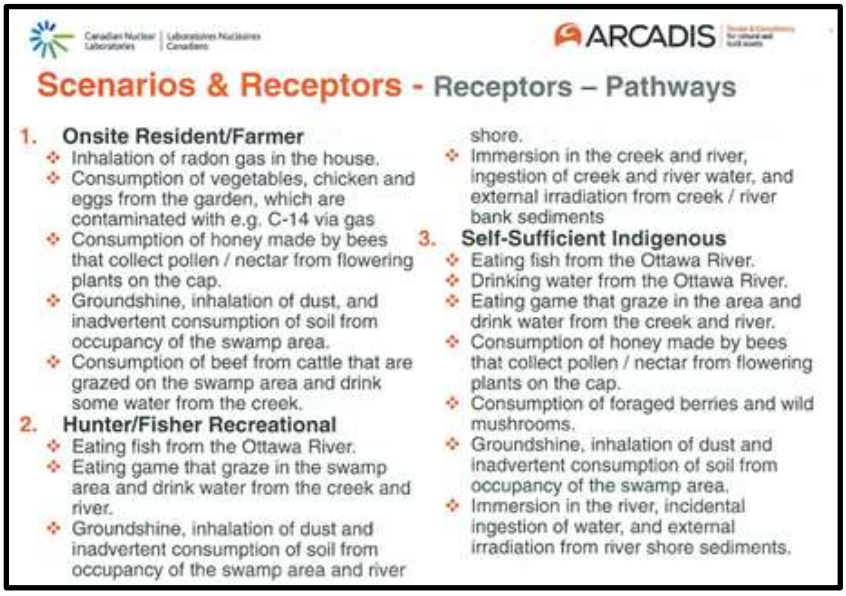

Figure 5: The Description of the Receptors Depicted in Figure 4

Under *Post-closure Phase* of Section 5.8.6.1.1.3, *Receptor Selection*, of CNL's EIS report [13] identifies the following "*,,, potential exposure groups for the Normal Evolution Scenario*":

- Resident/farmer
- Hunting/Recreational

Missing from this list is the "scavenger", which, as discussed in Section 4.3.3 above, is an intentional intruder.

Consider the first bullet, the *Resident/Farmer*. From Table 3 Column F, we know that this farmer will be exposed to concentrations of at least 58 times the CSQC for copper, and 2.7 times the CSQC for lead in the soils in which they will be growing their crops. Since both these metals are part of the packaging of some wastes, and/or the decommission debris (Waste Types, 4, 5 and 6 described in Section 4 above), this critical group is likely to experience much higher concentrations than those shown in Table 3 Column D.

4.5 The EA Decision Requires Referral to the Governor in Council

As discussed in Section 4.3.3 above, since the activities of a scavenger include the excavation and the direct handling of the contaminated metals and waste packaging, they will be exposed to much higher levels of radioactivity and hazardous substances than the resident farmer.

Furthermore, neither CNL's EIS report nor the CNSC's CMD describe any mitigation measures for these potential exposures to the farmer or to the scavenger. For these receptors, given this evidence, under Section 52(1) of CEAA 2012, the EA decision must be:

"…the designated project

…(b) ***is likely to cause significant adverse environmental effects*** *referred to in subsection 5(2). …"* [emphasis added]

This requires the decision maker to refer the project to "… *the Governor in Council the matter of whether those effects are justified in the circumstances.*" (Section 52(2) of CEAA 2012),

5 Issues With CNL's Safety Documentation

CNL has produced three documents all of which address the safety of their proposed mound. These are listed in Table 4. Included in this table is the revision number, and the date of release for each report. What is of interest is that all of the documents have been revised, even though the proposed facility's site has yet to be prepared, and the facility is awaiting the approval for a licence to construct.

Table 4: CNL's Safety Assessment Documentation

Title	*Revision*	*Reference*	*Date*
Near Surface Disposal Facility Safety Analysis Report	Rev 2	[16]	Oct 2020
Post-Closure Safety Assessment 3rd Iteration to the NSDF Project	Rev 1	[17]	Oct 2020
Near Surface Disposal Facility Safety Case	Rev 2	[5]	Jan 2021

5.1 "After-the-fact" Bias

In their Project Description CNL asserted:

"The NSDF project will provide a safe, permanent solution for the disposal of LLW …" [1]

If, at the time CNL issued its Project Description (2016) [1], they knew their proposal would "…*provide a safe … solution…*", then they must have had sufficient evidence to support this assertion. If that evidence existed, there would be no need to do any safety analyses. That said, revising that documentation as a more detailed design for the facility was developed is acceptable. However, if in 2016 CNL did not have the evidence to support this assertion, then it had a gap that had to be filled. Apparently, CNL wrote these documents in order to gather sufficient evidence to support their initial "safe" assertion. In other words, these assessments can only be seen as providing "after the fact" evidence, thus they are biased.

5.2 Addressing the Long-Term Safety

Only one of the three documents listed in Table 4 above addresses the abandonment of the facility at the end of the Institutional Control period, that is, *Near Surface Disposal Facility Safety Case* [5]. However, the report contains a contradiction. Consider this quote from Table 8-1, *Conservatisms in the PostSA Modelling* under the column "*Modelled in the PostSA*", Row 2:

"The land-use restriction on the Facility (and all other Institutional Controls) are assumed to be lost at 300 years post-closure."

If all controls are lost after 300 years, then why extend the project timeline beyond the end of the IC period?

One answer to this question is that, by depicting the "Post-Institutional Controls" as a blue arrow in Figure 6, these restrictions will be required in perpetuity since, as discussed in Sections 2.4 and 4.4 above, the non-radiological constituents remain hazardous forever.

Therefore, both CNL and the CNSC need to provide a description of the facility at the end of the 300 years. That description needs to address any postulated receptors and identify any remaining hazards. Since the quantity and nature of those non-radiological hazards are currently based on guesstimates (see Section 2.3.1 above), these cannot be used to assess the potential consequences to the biosphere after the 300 years.

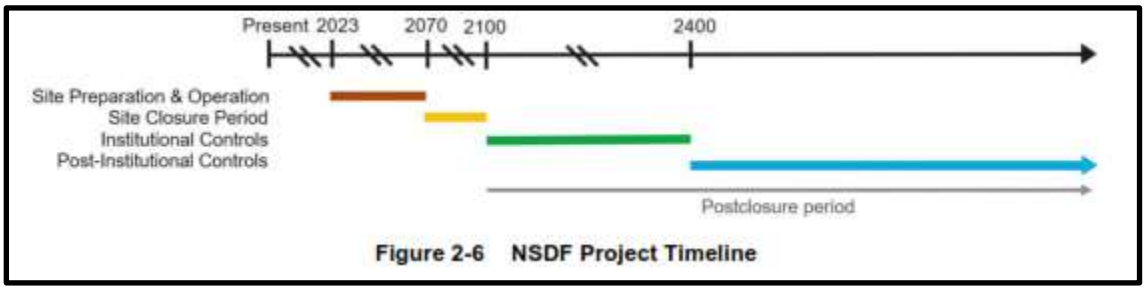

Figure 6: Project Timeline - Copied from Reference [17]

5.3 CNL's Safety Case Asserts that Three Paragraphs of the Class 1 Regulations are Not Applicable

According to CNL's Safety Case [5], Appendix B, Table B-1*. Concordance Table for Class I Nuclear Facilities Regulations*, CNL asserts that Paragraphs 7, 8 and 14 from this regulation are "***Not applicable to the NSDF Project***" [emphasis added]. Since CNL's proposed undertaking covers all five NSCA licences, site preparation, construction, operation, decommissioning and abandonment, this is somewhat surprising.

For reference, the paragraphs in this regulation that CNL states are not applicable to their disposal project are:

- Paragraph 7 addresses "Decommissioning",
- Paragraph 8 addresses "Abandonment", and
- Paragraph 14 addresses "Records".

In other words, by excluding these paragraphs from the *Class I Nuclear Facilities Regulations,* CNL's proposal appears to be out of compliance with this regulation.

6 Permanent Disposal means Abandonment

The CNSC defines "disposal" as "*The placement of radioactive waste without the intention of retrieval*". [2]

Consider this quote from the Executive Summary for CNL's Environmental Impact Statement:

> *"**The purpose of the NSDF Project is to provide the permanent disposal of** current and future **low-level waste at the CRL site**, as well as a small percentage of waste volume from off-site locations, in a manner that is protective of both the public and the environment."* [28] [emphasis added]

If CNL's proposed facility is designed, constructed, operated, and decommissioned for the purpose of "…*the permanent disposal of… low-level waste…*", then according to the CNSC definition of disposal, those wastes will remain in place forever. In other words, the end-state for the facility is abandonment. Otherwise, it cannot be "…*permanent disposal*…".

The following documents were searched for a description of the end-state for CNL's proposed facility:

- CNL's EIS report [13]
- NSDF Safety Analysis Report [16]
- Post Closure Safety Assessment [17]
- The CMD22-H7 [3]

Although one would expect to find an end-state description in the Post Closure Safety Assessment, that was not the case. The only document that included a description of the end-state was the *NSDF Safety Analysis Report*. To quote from the last paragraph in Section 16.4 *Planned End State* from that document:

> *"As the enduring Federal entity, and owner of the assets and liabilities of CNL, AECL is committed to controlling and restricting the land use of the NSDF footprint for as long as necessary. While other areas of the CRL site may be re-used, **the NSDF footprint will be restricted as a waste disposal Facility**."* [16] [emphasis added]

[28] CNL, *Environmental Impact Statement for the NSDF Project, Volume 1, Executive Summary*; 232-509220-REPT-004, Revision 3, May 2021

This is confirmed by CNL's response to Comment Numbers CNL-ND322 and CNL-ND323 [29]. To quote:

> "***<u>There are no current plans for the abandonment of the facility.</u>*** *Atomic Energy Canada Limited (a federal Crown corporation and the owner of the land) is committed to enforcing land-use restrictions on the site for as long as necessary. This includes passive controls such as restrictions placed on the property-deed, and could extend to ensuring that monitoring and maintenance continue for as long as necessary.*" [emphasis added]

However, nowhere in any documentation reviewed does AECL, CNL, and the CNSC define "*…as long as necessary…"* Nevertheless, Figure 7 [30] does provide an indication of what the CNSC may indicate their definition for "*… as long as necessary…*", which is 300 years (see Figure 6 and Figure 7).

6.1 Maintaining Land-Use Restrictions beyond the 300-year IC Period

While the 300-year IC period depicted in the two figures address the requirement to maintain restrictions until the radiological contaminants decay to levels that allow for a licence to abandon, that length of time does not address the non-radiological contaminants that will require land-use restrictions in perpetuity (see Section 5.2 above).

The obvious question is: "If the CNSC issues a licence to abandon at the end of the IC period, which other regulator whose responsibly includes regulating the non-radiological hazards will replace the CNSC as the regulator in order to maintain the land-use restrictions?"

<u>NOTE:</u> Both Figure 6 and Figure 7 assume that over the 300-year IC period depicted, there will be

- a site owner whose responsibility is to maintain the ICs, and
- a regulator, whose responsibility is to ensure those ICs are maintained.

Given that the current owner has a history of about 75 years, and the current regulator has a history of a little over 20 years, this assumption is tenuous at best.

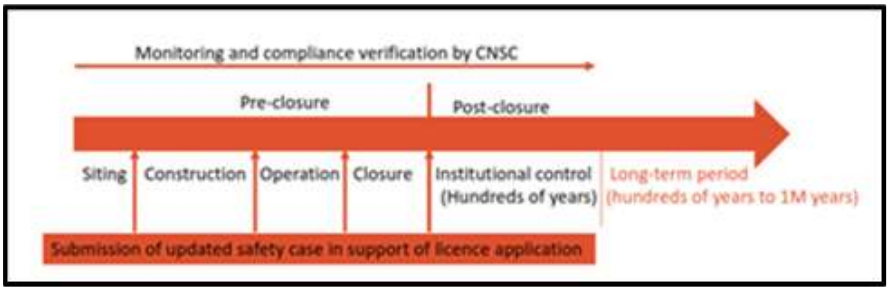

Figure 7: Project Timeline - Copied from Slide 24, CNSC Webinar, October 20, 2021 [30]

6.2 Permanent Disposal vs Long-term Storage

As discussed above, there is a disagreement between the owner of the site, and the regulator with respect to "abandonment"

If the owner states there are no plans for the "permanent disposal" of AECL's low-level radioactive waste, then we must conclude that CNL's proposed mound is really a long-term storage facility. Therefore, both CNL's documentation and CNSC's CMD will require revision to address the facility owner's preferred end-state, a long-term radioactive waste storage facility.

7 <u>Conclusions</u>

The objective of this evaluation was to determine whether the inclusion of non-radiological contaminants in CNL's proposed mound would present an unacceptable risk to the biosphere. To address the scope of this evaluation, the answers to the following questions were considered:

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[29] CNSC, *CNL Table: Consolidated Public and Indigenous Groups' Comments on the Near Surface Disposal Facility Project Draft EIS,* 2021-07-02, Downloadable from https://www.ceaa-acee.gc.ca/050/documents/p80122/139599E.pdf

[30] This figure was copied from Slide 24 of the CNSC staff's October 20, 2021 webinar, CNSC, *NSDF/ISD Fall Series #2: Long-term Safety of Disposal Facilities and In Situ Decommissioning, Regulatory Framework,* October 20, 2021

- What information about the non-radiological hazards in the wastes are required by legislation (I,e, *General Nuclear Safety and Control Regulations*)?
- Does the definition of Low-Level wastes include the non-radiological hazardous substances?
- Are there issues with CNL's safety assessment as they relate to the non-radiological hazards?
- What are the safety and environmental effects of including the non-radiological hazards in the wastes destined for CNL's proposed mound?
- Does "permanent disposal" mean "abandonment"?

Let us consider the answers to each question in turn,

7.1 Applicable Legislation

As discussed in Section 2 above, there are two regulations that apply; the *Class1 Nuclear Facilities Regulations* and the *General Nuclear Safety and Control Regulations.* Both these regulations require the licensee to have records of both the amount, and nature of nuclear and hazardous substances.

As discussed, in a search of both CNL's and the CNSC's documents, although considerable information was found, that data was insufficient to meet the requirements of these two regulations. With respect to the non-radiological contaminants, the required information was practically non-existent.

7.2 Does the Definition of LLW include the Non-rads?

Answering this question presented a significant problem (see Section 3 above). Both CNL and the CNSC have several contradictory definitions of LLW. Some excluded shielding and other did not. None specifically address the non-rad hazards. Since both CNL and the CNSC identify non-rads in the wastes destined for the mound, we were left with the default. An assessment of the non-radiological contaminants is required to demonstrate the long-term safety of CNL's proposed mound.

7.3 Issues with CNL's Safety Documentation

As discussed in Section 5 above, there are several issues with CNL's documentation. Suffice to say, there is significant confusion as to the end-state of the facility, and whether it would ever be safe to abandon. Why it takes over 5,000 pages to prove that the facility would be safe to abandon is problematic to say the least. However, ignoring abandonment as the end-state is even more troubling.

7.4 The Safety and Environmental Effects of the Non-Radiological Contaminants

As discussed in Section 4 above, the main issue is the huge quantity of non-radiological components that CNL identified as part of their waste inventory, upwards of 94,000 tonnes, representing almost 10% of the total mass of the wastes destined for CNL's proposed mound (see Table 3). Of that total, 80,000 tonnes are organics, which, given the reducing nature of the wastes, will likely be a major source of the land-fill gas, methane (see Section 4.2 above). Of the four metals listed in Table 3, the concentration of two known toxic metals, copper and lead, exceeds the Canadian Soil Quality Guidelines for agricultural land use. The CSQG benchmarks for assessing these concentrations were chosen because they are the most restrictive, and, in CNL's safety analyses, one of the critical receptors is a farmer residing on the mound.

Also discussed is the source of these contaminants. With respect to those sources, as shown it Figure 2 and Figure 3, CNL did not address their own "Waste Hierarchy" as depicted in Figure 1.

Also problematic is CNL's selection of the various scenarios that form the basis for their safety assessments (see Section 4.4.2 above). The discrepancies between Figure 4 and Figure 5 do not provide confidence that CNL's analyses are adequate. Furthermore, any potential exposure to a scavenger is completely ignored.

Suffice to say, CNL's safety analyses provide sufficient evidence to prove that

> *"…the designated project*
>
> *…(b)* ***is likely to cause significant adverse environmental effects*** *referred to in subsection 5(2). …"* [emphasis added]

This requires the decision maker to refer the project to "… *the Governor in Council the matter of whether those effects are justified in the circumstances.*" (Section 52(2) of CEAA 2012),

7.5 Permanent Disposal means Abandonment.

As discussed in Section 5 above, there is no evidence that CNL/AECL have any plans for the "permanent disposal" of low-level radioactive wastes on the Chalk River site. Thus, the true purpose of CNL's proposed undertaking is for constructing, operating and decommissioning a "long-term radioactive waste storage facility".

Regretfully, this will require that virtually all supporting documentation be reviewed to determine whether revisions are needed to address CNL's original purpose, that is, long-term waste storage.

7.6 Overall Conclusion

In conclusion, by including the large quantity of non-radiological contaminants, with no provision to remove them from the wastes by upfront segregation, then under CEAA 2012, the EA decision must be referred to the Governor in Council. Even if that decision was "…*that the significant adverse environmental effects that the designated project is unlikely to cause are justified in the circumstances*", given the safety issues discussed above, CNL's proposed waste landfill cannot be licenced under the NSCA as presently designed.erro