Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 22-H7.64A

File / dossier : 6.01.07
Date: 2022-05-16
Edocs: 6772400

Supplementary Information

Presentation from William Turner

Renseignements supplémentaires

Présentation 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 30 to June 3, 2022

30 mai au 3 juin 2022

Canada

Characterization and Decision Making

A Presentation to the Commission Hearing, Part Two

(Pembroke, Ontario)

May/June, 2022

by

W. Turner
(AECL Retiree and Deep River Resident)

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Purpose

- **To outline the relationship between characterization and decision making.**
- **To assess whether CNL's decision was based on adequate characterization.**

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Outline

- **Two Definitions:**
  - Characterization
  - Decision Making
- **The link between the two.**
- **Their application to the two issues:**
  - Site Selection; and
  - Non-radiological contaminants.
- **Uncertainties in measuring and modelling.**
- **Conclusions.**

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Two Definitions

- **Characterization**
  - The act of describing distinctive characteristics or essential features.
- **Decision Making**
  - The process of acting upon the best information available (i.e. essential characteristics) in order to determine the most appropriate course of action.

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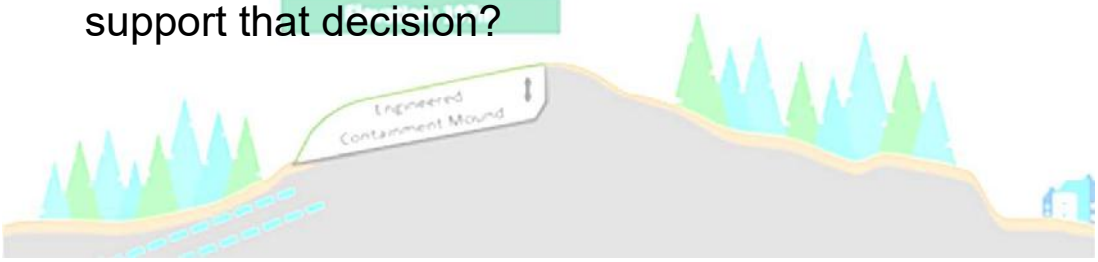
The Link Between Characterization and Decision Making

- **To determine the most appropriate course of action you need to answer two questions.**
  - What is the decision?
  - What are the essential characteristics required to support that decision?



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CNL's "Decision" Statement

- ***"The purpose of the NSDF Project is to provide the permanent disposal of current and future low-level waste at the CRL site …in a manner that is protective of both the public and the environment."***
  - CNL, *Environmental Impact Statement for the NSDF Project, Volume 1, Executive Summary*; 232-509220-REPT-004, Revision 3, May 2021

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CNL's "Decision" Statement (Cont'd)

- **What is meant by "…*permanent disposal*…?**
  - From the CNSC's Glossary, the definition of disposal is:
    - "*The placement of radioactive waste without the intention of retrieval.*"
  - Thus, "permanent disposal" means "abandonment".
- **Where on the CRL site is there a location suitable for abandoning the wastes?**
  - Is the East Mattawa Road location suitable?
- **What is meant by "*…low-level waste*…?**
  - Does LLW include non-radiological contaminants?
- **What are the essential characteristics required to demonstrate the project is "…*protective of both the public and the environment*"?**
  - Is there an inventory of the non-radiological contaminants?
- **When does CNL intend to abandon the wastes?**
  - Is this 100 or 300 years from now? Or can these wastes ever be abandoned?

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The Missing Information Required by Legislation

- **From Paragraph 11 of the "*Prescribed Information for the Description of a Designated Project Regulations*":**
  - "*A description of the anticipated phases of and the schedule for the project's construction, operation, decommissioning and abandonment.*"
- **From Paragraph 14(2)(d) of the "*Class I Nuclear Facilities Regulations*":**
  - Records of "*the nature and amount of radiation, nuclear substances and hazardous substances within the nuclear facility*"
- **From Paragraph 3(1)(j) of the "*General Nuclear Safety and Control Regulations*":**
  - Information including "*the name, origin, quantity, form, and volume of any … hazardous waste that may result from the activity to be licensed*"
- **Although having this information would make it easier to evaluate CNL's decision, an assessment can be done based on the information CNL provided.**

NOTE: These two regulations specifically address the information required to develop the waste inventory.

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Two Issues Related to CNL's Permanent Waste Disposal Decision

- **Issue 1 – Site Selection**
- **Issue 2 – The Non-rad Inventory**

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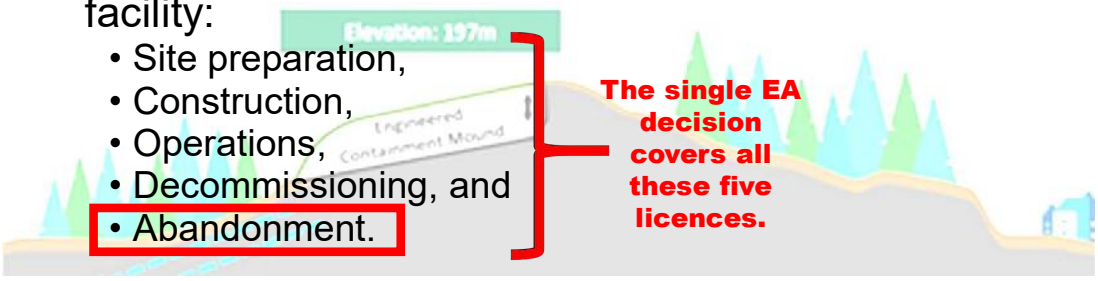
Issue 1 - Site Selection

- **Deciding on the location for a disposal facility:**
  - is critical to determine its long-term safety; and
  - will impact all subsequent activities related to the facility:
    - Site preparation,
    - Construction,
    - Operations,
    - Decommissioning, and
    - Abandonment.



The single EA decision covers all these five licences.

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Issue 1 - Site Selection
(Cont'd)

- **Consider these three criteria CNL used evaluate the various locations for siting their facility:**
  - Technical feasibility;
  - Economic feasibility; and
  - Safety.
- **If a location under consideration was not technically or economically feasible, or safe, the project could not proceed.**
  - Thus, in selecting a site, these criteria are irrelevant.

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Issue 1 - Site Selection
(Cont'd)

- **Consider this more relevant criterion:**
  - Section 1, Appendix I from IAEA *"Siting of Near Surface Disposal Facilities",* Specific Safety Guide, SSG-29:
    - "*Site selected should display favourable natural containment and isolation characteristics.*"
- **Does CNL's chosen site display these two characteristics?**
  - No. There is nothing natural about:
    - an "Engineered Containment Mound", or
    - maintaining "isolation" (i.e. Institutional Controls) for as long as there are risks to the biosphere.
- **NOTE: "*Favourable natural containment and isolation characteristics*" increase from virtually zero for an above surface landfill, through a near surface facility located 10's of metres below surface, to a maximum for a deep geological facility.**
  - There is no evidence that CNL applied this criterion in its evaluation of "alternative means".

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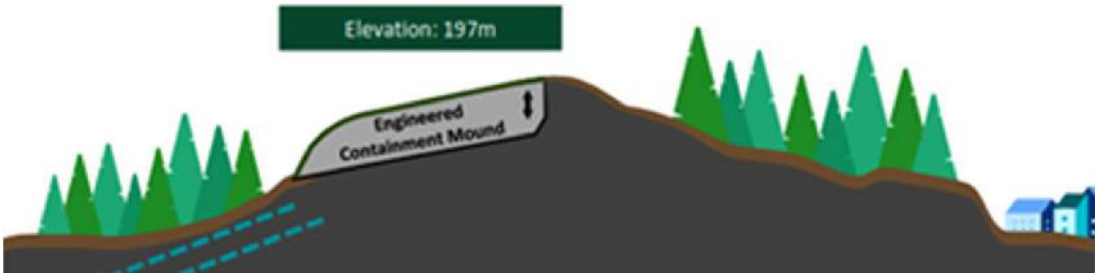
Issue 1 - Site Selection
(Cont'd)

- **Conclusion**
  - CNL's chosen location (East Mattawa Road) does not "…*display favourable natural containment and isolation characteristics.*"



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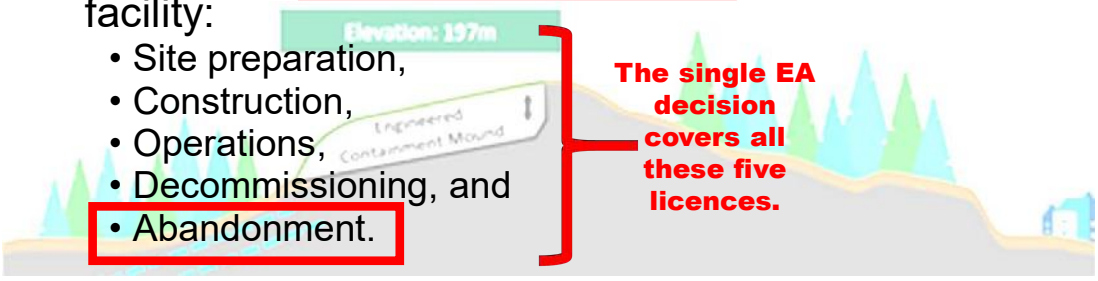
Issue 2 – Non-Rad Contaminants

- **Deciding on what goes into the proposed disposal facility:**
  - is critical to determine its long-term safety; and
  - will impact all subsequent activities related to the facility:
    - Site preparation,
    - Construction,
    - Operations,
    - Decommissioning, and
    - Abandonment.



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Issue 2 – Non-Rad Contaminants
(Cont'd)

- **What other criteria need to be addressed to support CNL's radioactive waste disposal facility "Decision"?**
  1. A clearly defined end-state.
  2. A clear definition of LLW that includes the non-radiological contaminants.
  3. A waste inventory that is both clearly defined and does not result in any significant adverse environmental effects.
  4. A clear description of the characterization process used to verify the inventory.
  5. A systematic approach to address uncertainty from any characterization process.

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Issue 2 – Non-Rad Contaminants Criterion 1

- **A clearly defined end-state**
  - CNL states the purpose of their proposed facility is:
    - To provide the permanent disposal of low-level waste at the CRL site.
  - Permanent disposal with no intention of retrieval means:
    - The wastes will eventually be abandoned.
- **Nowhere in CNL's or the CNSC's documentation is "abandonment" addressed.**
  - Furthermore, AECL, the owner of the site, states:
    - "*There are no current plans for the abandonment of the facility.*"
- **Conclusion**
  - There is no clearly defined end-state for CNL's radioactive waste disposal facility.

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Issue 2 – Non-Rad Contaminants Criterion 2

- **A clear definition of LLW that includes the non-radiological contaminants.**
  - For a summary of 9 definitions of LLW see the next slide.

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

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Issue 2 – Non-Rad Contaminants Criterion 2
(Cont'd)

- **Conclusion**
  - Except for excluding shielding, no definition of LLW includes the non-radiological contaminants.

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Issue 2 – Non-Rad Contaminants Criterion 3

- **A waste inventory that is both clearly defined and does not result in any significant adverse environmental effects.**
  - As discussed in the written intervention, the inventory of the non-radiological contaminants is not clearly defined.
  - The concentration of copper and lead in the mound exceed the Canadian Soil Quality Criteria for Agricultural Land Use by several times.
  - The scrap value of the metallic inventory represents an irresistible attraction for scavengers.
  - See the next two slides.

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Issue 2 – Criterion 3
Concentrations Exceed Benchmarks

Contaminated Material Type	Calculated Mass in the Facility at Closure (kg)	Concentration in Mound	Canadian Soil Quality Guidelines	
			Agricultural	
		(kg/kg)	(mg/kg)	Ratio
Aluminum	33,000	34		
Copper	3,520,000	3,678	63	58.4
Iron (waste plus package material)	10,442,000	10,911		
Lead	178,000	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			
Engineered Containment Mound total waste mass of 9.57E+08 kg.	957,000,000			

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Issue 2 – Criterion 3
Intrusion by Scavengers

Contaminated Material Type	Calculated Mass in the Facility at Closure (kg)	$ per Kg	Value of Scrap
Aluminum	33,000	$1.98	$65,000.00
Copper	3,520,000	$4.75	$16,720,000.00
Iron (waste plus package material)	10,442,000	$1.50	$15,663,000.00
Lead	178,000	$3.96	$704,000.00
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
Engineered Containment Mound total waste mass of 9.57E+08 kg.	957,000,000		

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Issue 2 – Non-Rad Contaminants Criterion 3
(Cont'd)

- **Conclusion**
  - The inclusion of copper and lead (and other non-rad contaminants) in the waste inventory is likely to result in significant adverse environmental effects.

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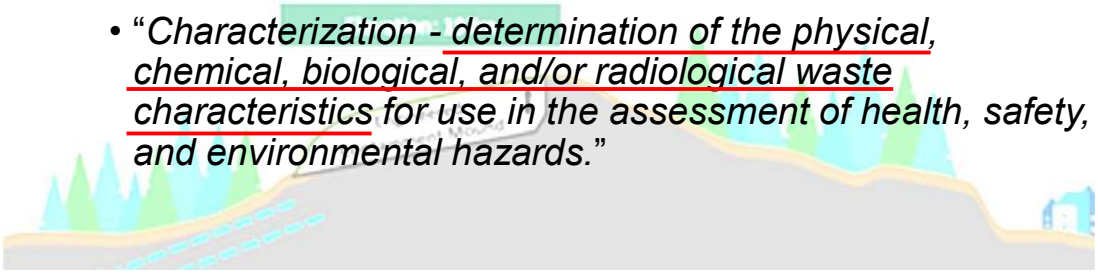
Issue 2 – Non-Rad Contaminants Criterion 4

- **A clear description of the characterization process used to verify the inventory.**
  - 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.*"



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Issue 2 – Non-Rad Contaminants Criterion 4
(Cont'd)

- **The four steps in the decision tree given in CNL's *Integrated Waste Strategy*:**
  - Reduce
  - Re-Use
  - Recycle
  - Disposal

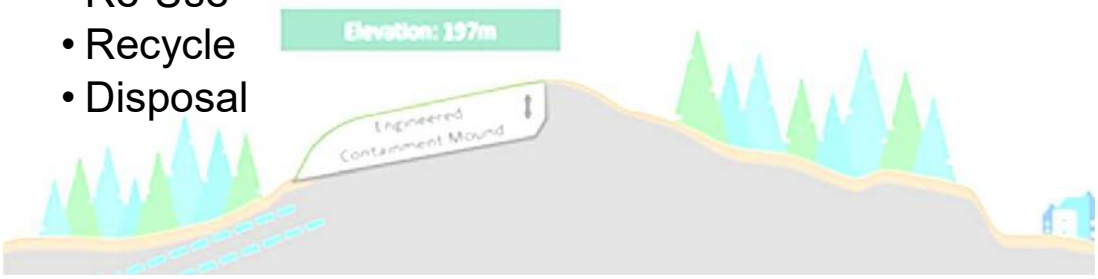

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Figure 2-2 The Waste Hierarchy

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Issue 2 – Non-Rad Contaminants Criterion 4
(Cont'd)

- **Conclusion**
  - The wastes were not characterized in a manner that would support any of the four decisions as one proceeds down the decision tree.
  - See the next slide

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

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Issue 2 – Non-Rad Contaminants Criterion 5

- **A systematic approach to address uncertainty from the characterization process.**
  - By their very nature, both measuring and modelling are uncertain.
    - One cannot know everything.
  - Without that absolute knowledge, how can one make the best decision?
    - One must specify up front the acceptable levels of potential decision errors that will be used to establish the quality and quantity of data required to support that decision.
    - One must choose a model whose results can be used to support the decision.

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Issue 2 – Non-Rad Contaminants Criterion 5 - Measurement

- **The following are several steps in a systematic approach to developing a plan to obtain the quality and quantity of measurement data that is required to support a decision.**
  - Specify how the information will be used.
  - Specify the information required.
  - Specify the acceptable uncertainty in the required information.
  - Define the analytical approach.
  - Develop the plan to obtain the information.
  - Execute the plan.
  - Depending on the results, repeat to ensure the decision is based on the best information available.
    - See US EPA, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, February 2006

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Issue 2 – Non-Rad Contaminants Criterion 5 - Modelling

- **CNL has produced the following three safety assessment documents all of which based on modelling:**
  - "Near Surface Disposal Facility Safety Analysis Report"
  - "Post-Closure Safety Assessment 3rd Iteration to the NSDF Project"
  - "Near Surface Disposal Facility Safety Case"
- **Two issues with CNL's use of models:**
  - The input data required for modelling is uncertain (see previous slide).
  - None of the models address the decision to abandon the wastes on the Chalk River site.
- **Thus, there is no link between CNL's characterization and its decision.**

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Issue 2 – Non-Rad Contaminants Criterion 5 - Uncertainties

- **CNL's Waste Characterization document omits any discussion of:**
  - A systematic approach to obtain the best available information required for input into safety assessment models; and
  - The choice which model (or models) would best support the decision to abandon the wastes at the Chalk River site.
- **Conclusion**
  - The uncertainty in the results of CNL's modelling cannot support the conclusion that CNL's proposed undertaking "… *is protective of both the public and the environment."*

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Overall Conclusion

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Overall Conclusion
(Cont'd)

- **There is little to no evidence that CNL's decision was based on the following essential characteristics:**
  1. A location that displays natural containment and isolation characteristics;
  2. A clearly defined end-state. that is, abandonment;
  3. A clear definition of LLW that includes the non-radiological contaminants;
  4. A waste inventory of the non-radiological contaminants that is both clearly defined and does not result in any significant adverse environmental effects;
  5. A clear description of the characterization process used to verify the inventory; and
  6. A systematic approach to address the uncertainties in both their modelling and the input data required for that modelling.
- **Therefore, CNL's decision cannot be supported and their proposed facility is not "*the right solution*".**

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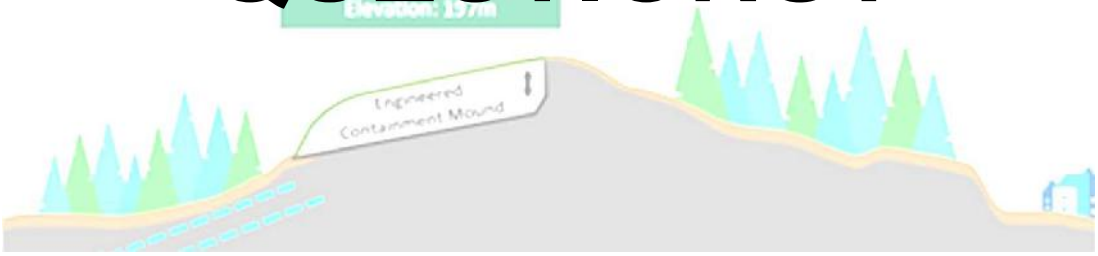
QUESTIONS?



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Thank You

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