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Supplementary Information

Presentation from the Concerned Citizens of Renfrew County and Area

In the Matter of the

Canadian Nuclear Laboratories (CNL)

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

Commission Public Hearing
Part 2

May 30 to June 3, 2022

Renseignements supplémentaires

Présentation des Concerned Citizens of Renfrew County and Area

À l'égard des

Laboratoires Nucléaires Canadiens (LNC)

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

Audience publique de la Commission
Partie 2

30 mai au 3 juin 2022

Canada

Facilities awaiting decommissioning at CRL include the Plutonium Recovery Laboratory (the white building at left) and the shut-down NRX and NRU reactors (the brick buildings beside the twin stacks). Some facilities are heavily contaminated with long-lived radioactive wastes such as plutonium-239, with a 24,000-year half-life. The International Atomic Energy Agency (IAEA) says that such wastes should go in a geological repository – underground, in stable rock where no earthquakes occur, and where groundwater cannot contact the wastes.

The CRL property is right next to the Ottawa River, on a fault line with frequent earthquakes, fractured bedrock, and rapid groundwater movement – an unsuitable location for disposal of radioactive wastes.

The decision to build a mound at CRL was made in haste. The environmental assessment of the NSDF project should have been based on credible existing information sources on federal wastes at Chalk River and other AECL properties. The main one is the 2014 C*omprehensive Preliminary Decommissioning Plan*. Why was this document not referenced in the EIS or in the CNSC Staff EA Report? Suppression of key information sources is a serious concern in an environmental assessment.

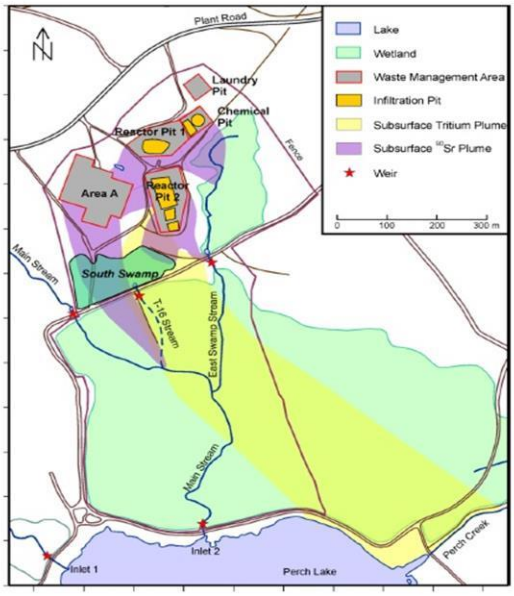


Figure B-1 Subsurface Plumes from WMA A and the LDA

Waste Management Area A

- **direct disposal of solids and liquids to excavated trenches into the sand overburden.**
- **<u>the NRX accident generated large quantities of radioactive waste:</u> 4,500 m^3 of aqueous waste containing mixed fission products was poured into excavated trenches, and the original NRX reactor core is buried in the sand at WMA A**

Liquid Dispersal Area (Reactor Pits, Chemical Pit, Laundry Pit)

- **established to receive active liquids via pipeline from the NRX Rod Bays**
- **Dispersals included mainly ^{90}Sr, along with a wide variety of other fission products.**
- **Between 1956 and 1998, the pit was backfilled with solid materials that included contaminated equipment and vehicles**

Source: *Comprehensive Preliminary Decommissioning Plan*, March 2014 CPDP-508300-PDP-001 Revision 2

This figure from the 2014 *Comprehensive Preliminary Decommissioning Plan* shows contaminant plumes from Waste Management Area A and the Liquid Dispersal Area. The proposed location of the NSDF would be under the legend box for the figure.

The yellow plume contains tritium, the radioactive form of hydrogen. This tritium plume discharges directly into Perch Lake. The purple plumes contain strontium-90, one of the major products generated by fission of the uranium-235 isotope in a nuclear reactor. These strontium-90 plumes discharge into streams that flow into Perch Lake.

In Waste Management Area A, radioactive wastes were dumped into unlined sand trenches. The serious accident that occurred in the NRX reactor in 1952 generated large quantities of both liquid and solid radioactive waste. Contaminated water was pumped uphill through a hastily constructed pipeline and discharged in the Liquid Dispersal Area. The highly contaminated original NRX reactor core is buried in the sand at Waste Management Area A. The pipeline continued in use until around 2000. After this practice was stopped, the pit was filled with radioactively contaminated equipment and vehicles.

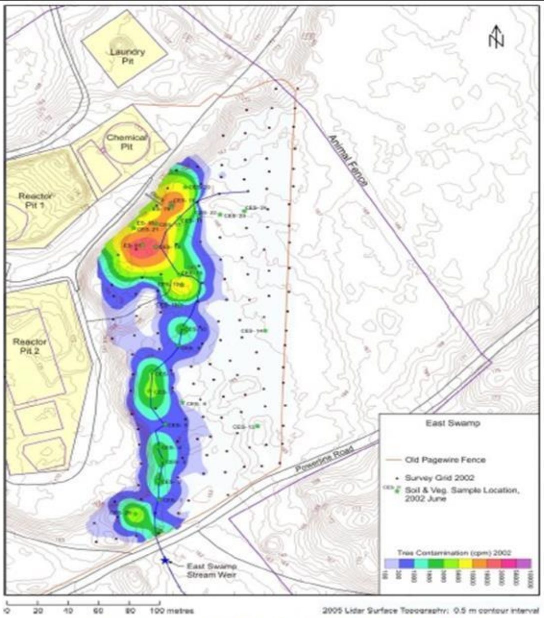


Figure 19 Vegetation Contamination in East Swamp in 2002 June

Radiological Contamination in the East Swamp, 2002 to 2012, 3611-121250-REPT-006, Revision 0, March 2015

- **Doses from exposure to surface water were measured at East Swamp Weir. The dose rate to snails, calculated to be 458 uGy.hr-1, exceeds the ecological benchmark of 400 uGy.hr-1 for protection of aquatic biota**
- **The dose rate to vegetation (alder) within the wetland from bioaccumulation of ^{90}Sr in the trees was 49 uGy.hr-1, less than the benchmark of 100 uGy.hr-1 for terrestrial species.**

This figure shows radiation levels in vegetation – mostly alders – downslope from the Liquid Dispersal Area in the East Swamp wetland, where a so-called “exfiltration gallery” would discharge partially treated leachate from the NSDF mound.

When measurements were made in 2002, radiation counts in alders growing in the orange and red zones exceeded ten thousand per minute. Radioactivity in the alders largely represents strontium-90 disintegrations.

Radiation doses to snails, measured in the green zone where the East Swamp Stream crosses the Powerline Road at the East Swamp Weir, exceeded the benchmark for protection of aquatic life.

Radiological Contamination in the South Swamp, 1997 to ***2011*** 3611-121250-REPT-005, Revision 0, January 2015

- **The dose rate to snails measured at South Swamp Weir was 704 uGy.hr-1, “slightly” exceeding the ecological benchmark of 400 uGy.hr-1 for protection of aquatic biota.**
- **The dose rate to vegetation (alder) within the most contaminated area of the wetland was 292 uGy.hr-1, “slightly” exceeding the benchmark of 100 uGy.hr-1 for terrestrial biota.**

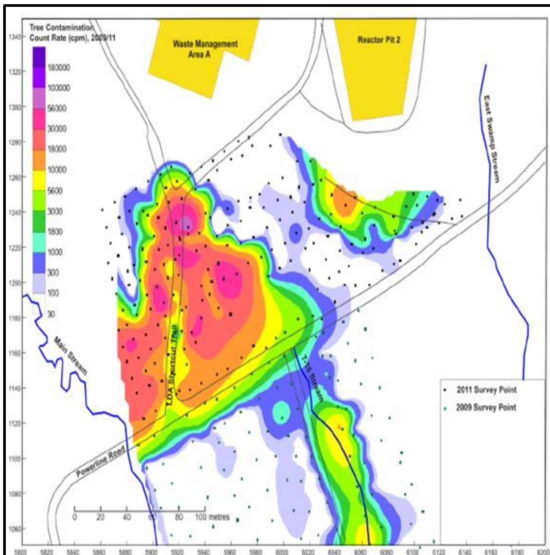


Figure 37 Measured Vegetation Contamination Count Rates (cpm) in the South Swamp, 2009 and 2011.

The South Swamp wetland receives discharges from Waste Management Area A, just to the west of the Liquid Dispersal Area. Here, the orange and red zones (with radiation counts in alders exceeding ten thousand per minute) are much larger. Both alders and snails in the South Swamp receive radiation doses that exceed benchmarks for protection of living organisms.

A groundwater treatment system was installed in 2013 to remove strontium-90 from the plume originating from Waste Management Area A. However, until action is taken to address the “source terms” in Waste Management Area A – the wastes themselves – radioactivity will continue to leak into the South Swamp.

Although the NSDF EIS says that Canadian Nuclear Laboratories intends “to remediate various waste management areas at the Chalk River Laboratories property,” the EIS provides no details about these remediation activities. For example, it is unclear whether the wastes themselves, or only the soils and vegetation contaminated by radionuclides leaking from the wastes, would be put in the mound. There is a great deal of uncertainty about exactly what wastes are in these areas.

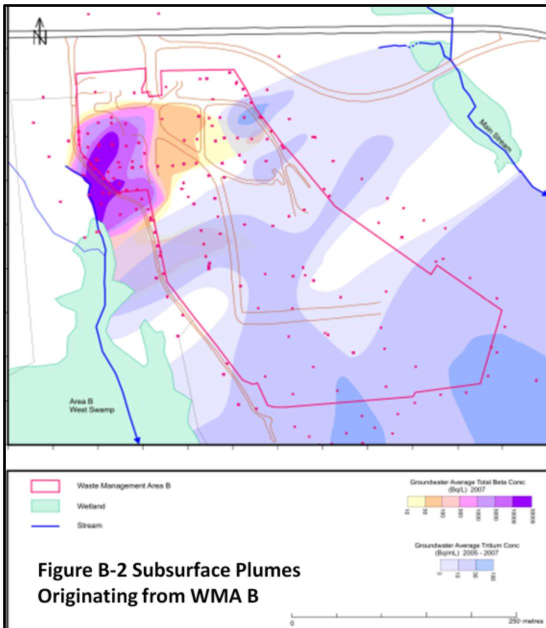


Figure B-2 Subsurface Plumes Originating from WMA B

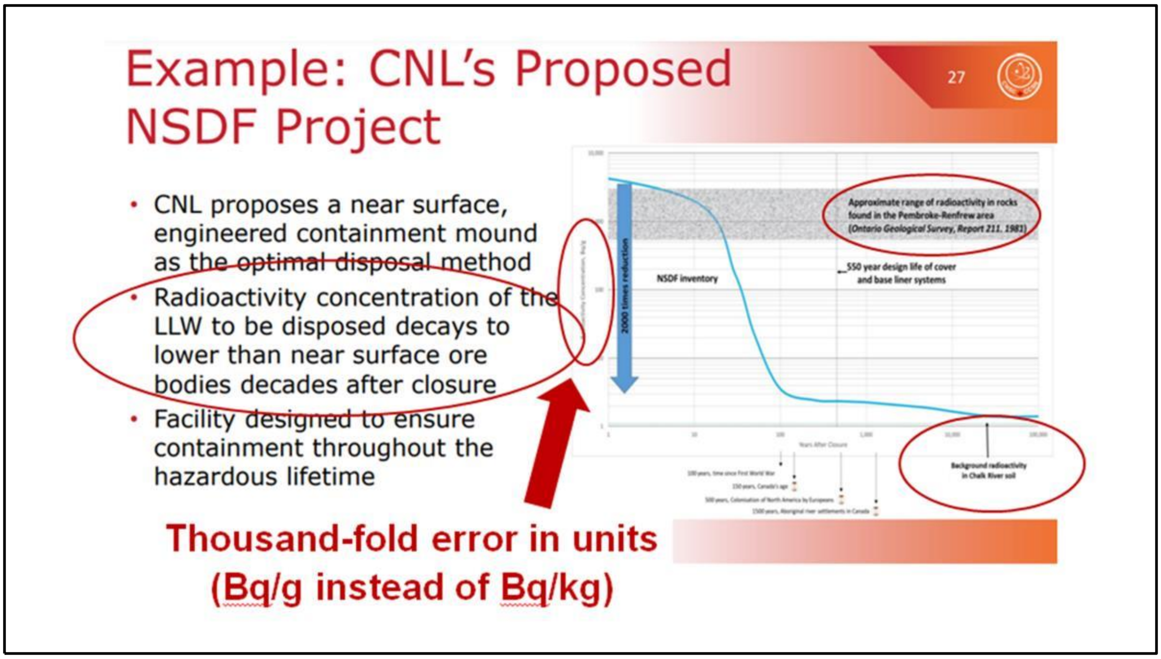
Waste Management Area B

- Early waste storage practices for LLW were consistent with those used in WMA A, namely **emplacement in unlined trenches**
- Additionally, there were numerous **"special burials"** of components and materials, sometimes in concrete containers or **directly in sand (e.g., the first NRU and the second NRX calandrias).**
- **High-level wastes are also stored in WMA B, in engineered facilities known as Tile Holes.** Tile Holes are used to store radioactive material that requires more shielding than can be provided in concrete bunkers.

Source: *Comprehensive Preliminary Decommissioning Plan*, March 2014 CPDP-508300-PDP-001 Revision 2

In Waste Management Area B, like Waste Management Area A, radioactive wastes were dumped directly into unlined trenches in the sand. This figure shows tritium plumes in blue, and strontium-90 plumes in purple, from Waste Management Area B. As with the plumes from Waste Management Area A, these plumes discharge into streams that flow into Perch Lake.

So-called "special burials" in this area included the second NRX reactor core and the first NRU reactor core. There are many concrete tile holes at Waste Management Area B, some containing high-level spent fuel wastes. Water has gotten into some of the tile holes. A fuel repackaging project has retrieved some of the affected high-level wastes, dried them, and put them in more secure above-ground storage.



The CNSC Staff PowerPoint for the part 1 hearing on February 22nd (CMD 22-H7.A) has a slide that purports to show that within decades after closure of the mound, its radioactivity would decay to levels less than the range of radioactivity in rocks in the Pembroke-Renfrew area. But the gray band showing that range is misplaced by orders of magnitude. CNSC Staff apparently made a thousand-fold error in the units for radioactivity in rocks. In actuality, many of the rock samples in the Ontario Geological Survey report cited had radioactivity levels similar to local soil.

Are CSNC Staff willing to discuss this error? It is also found in the *Safety* Case, where a comparison of "radiotoxicity" of rocks and materials to be put in mound was used to build a case for NSDF approval.

A Geologic Waste Management Facility:

- would provide increased barriers for potential releases to the environment in the long-term;
- is considered to be robust and technically feasible;
- provided suitable geology is available, there are no practical limitations on the size of the repository;
- would provide additional barriers against potential groundwater transport;
- would not be prone to infiltration of precipitation through the waste during emplacement; and
- human intrusion is less likely… BUT…

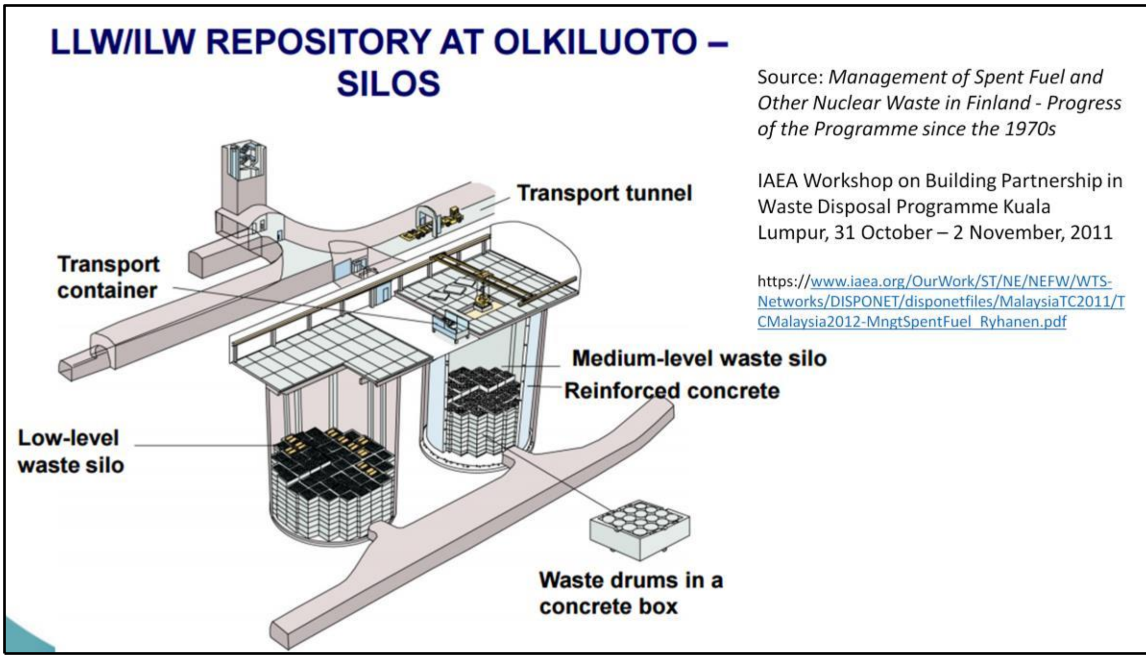
- would result in a construction start date later than 2020; and
- does have substantially higher lifecycle costs, which are potentially an order of magnitude higher than for an NSDF.

Source: 2017 Draft *EIS,* Section 2.5.2.2, pages 2-19 to 2-26

CNL's 2017 draft *Environmental Impact Statement* (EIS) for the mound describes a number of advantages of a geological facility for managing radioactive waste. These include increased barriers against releases to the environment, increased barriers against groundwater contamination, and lack of infiltration of precipitation into the waste during emplacement.

Perhaps the most important advantage of a geological facility is the greatly decreased likelihood of future human intrusion into the wastes. The IAEA recommends that long-lived radionuclides be put in a geological facility, because risks of human intrusion remain for many thousands of years, long after information about the wastes and the facility itself will have been lost.

Nonetheless, the geological facility alternative was rejected, largely because it would take longer to build and cost more – while noting that the cost estimates are very poorly documented by CNL and completely ignored in CNSC's EA report.



Other countries with similar geology to Canada have moved ahead with geological facilities for their low-and intermediate-level radioactive wastes. This figure shows a facility in Finland that conforms to IAEA safety requirements.

A Modular Above-Ground Storage (MAGS) Unit at CRL

Modular Above-Ground Storage (MAGS) units and shielded units (SMAGS), were built by AECL prior to the advent of the GoCo model at CRL. These provide good shorter-term nuclear waste storage. However, above-ground concrete structures cannot last long enough to contain and isolate radioactive substances with half-lives of thousands of years for the duration of their radiological hazard.

Better ways for the federal government to deal with its nuclear waste liabilities

- Construct additional “modular above-ground storage” (MAGS) units
- Upgrade the CRL groundwater treatment facilities to more fully capture the plumes from the leaking waste management areas
- Transfer buried radioactive wastes that are the source terms for the plumes to MAGS units (or “shielded” MAGS units)
- Halt the transport of wastes from other federal nuclear sites to CRL
- Initiate a siting process for a geological repository or in-ground vault that conforms to IAEA safety requirements for long-lived radioactive wastes
- Only proceed with reactor decommissioning, and with decommissioning of other high-hazard facilities such as the Plutonium Recovery Laboratory, when a geological repository is available

Noting that serious existing federal nuclear waste problems – particularly those at Chalk River - are in urgent need of attention, our group is often asked what we would propose to do to address them. This slide has our answers.

Appendix A – Questions

The 2.7E+10 Becquerels of thorium-232 in the Licensed Inventory are equivalent to a mass of 6.59 tonnes (based on its specific activity of 4100 Bq/g) and constitute the largest amount (mass) of any single radionuclide. Why was thorium-232 not included in the waste inventory in the 2017 draft environmental impact statement? What are the origins of the thorium-232 waste that would go in the NSDF? Specifically, what quantities of thorium-232 would be removed from the Thorium Pit and from Waste Management Area F and put in the NSDF? What are the clean-up criteria for residual amounts and concentrations of thorium-232 after remediation of these areas?

Little attention has been paid to the NSDF sideslope liner. The EIS says “the sideslope lining system will be subjected to freeze-thaw action,” but adds that “the sideslope HDPE geomembrane liner component of the sideslope lining system will not be adversely affected by freeze-thaw cycles, whereas the geosynthetic and compacted clay liner components of the sideslope lining system could undergo an increase in hydraulic conductivity prior to placement of the wastes on the sideslopes. “ However, research done at the University of Ottawa shows that the shear strength at the interface between a compacted clay liner and high-density polyethylene (HDPE) geomembrane decreases with increasing numbers of freeze-thaw cycles. What is the basis for the conclusion that the NSDF sideslope liner will not be adversely affected by freeze-thaw cycles? What are the implications of decreasing shear strength? Following closure, would there be a gap between the top cover and the slideslope liner through which water could enter or gases could escape containment? If not, how would the bottom/sideslope liner and the top cover be joined?

How many samples were analyzed to develop the activity values for radionuclides in the Liquid Dispersal Area (LDA) shown in Table E-6 of the *Near Surface Disposal Facility Reference Inventory Report*? What was the range of values? What were the maximum values?

How was the figure of 58,469 m3 for the volume of contaminated material in the LDA determined? Why is the estimate of 2.5E+11 Bq of radioactivity for three main beta/gamma emitters (Cs-137, Co-60, Sr-90) in the LDA 3,720 times lower than the estimate of 9.30E+14 Bq in the *Comprehensive Preliminary Decommissioning Plan*?

The *Comprehensive Preliminary Decommissioning Plan* shows a waste volume of approximately 380,000 m^3 in Waste Management Area F, including 5.15E+11 Bq of radium-226. Table E-8 of the *Reference Inventory Report* presents results of a spring 2018 sampling of this area, showing 60,500 m^3 of volume and 4.57E+10 Bq of radium-226. What explains this discrepancy?

Table E-8 of the *Reference Inventory Report* indicates that quantities of thorium-230, uranium-235 and uranium-234 (in 60,500 m^3 of material from Waste Management Area F) would exceed limits in the NSDF Licensed Inventory by 23.21-fold, 3.39-fold and 1.34-fold, respectively. Is the NSDF Safety Case based on limits in the Licensed Inventory? If long-lived radionuclides in a only a portion of the material in Waste Management Area F would exceed these limits, does CNL still intend to put that material in the facility? Does this not indicate a need for a different facility location and design?

Why were geometric means rather than arithmetic means used to estimate total activity in the Liquid Dispersal Area and in Waste Management Areas A and F in the *Reference Inventory Report*?

Given that waste packages have been generated at Chalk River for nearly 70 years, but the Waste Inventory Program III (WIP-III) data are only for packages stored during the 20-year period 1995-2015, what is the evidence that 20 years of data can be extrapolated to the full 70 years? Could waste packages from the first 50 years at Chalk River contain higher quantities of long-lived fission and activation products than those from the past 20 years? Why is calcium-41, a significant product of neutron activation of concrete, not included in the Licensed Inventory?

Part 1 of CMD 22-H7 says the NSDF site will require “slope depressurization”, and that “horizontal drains will be drilled in the rock mass to lower the water table” prior to rock blasting. The *EA Report* section of CMD 22-H7 says “data collected between October 2016 and June 2018 shows that the average depths of the groundwater table ranged from 0.06 metres below ground surface to 15.95 metres below ground surface, with an average of 4.81 meters.” Why is lowering of the water table, and its potential environmental impacts, not assessed in the *Environmental Impact Statement* or in the *EA Report*? What is the likelihood that the ground water table would rise above the base of the NSDF during construction and operation activities? What would be the impact of lowering the water table beneath the mound footprint on the water table of adjacent wetland areas? Could drying of adjacent wetland areas alter their vegetation cover, speed oxidation of their organic soils, and mobilize their contaminant plumes?

Why has the adjacent Department of National Defence property not been examined for potential sites suitable for a radioactive waste disposal facility?

Given that the July 2016 *CNL-CNSC NSDF Administrative Protocol* and the June 2017 *Appendix A to the Protocol* provided for a dedicated Commission hearing on the environmental assessment for the NSDF, and a public comment period specific to the *EA Report*, how and why was the decision made to drop these provisions?

Why is the loss of 30 hectares of high-quality forest habitat for endangered bats and at-risk bird species not considered a significant adverse environmental impact of the NSDF project?

What provision, if any, has been made to compensate for greenhouse gas emissions associated with removal of 30 hectares of mature forest and disturbance of adjacent wetlands, and the loss of future carbon storage capacity in the 37-hectare "footprint" of the NSDF?

Why does the *EA Report* contain no mention of the origins and characteristics of the commercial wastes that CNL plans to put in the NSDF? Why is there no mention of "disused sources"? What proportion of the radioactivity in the NSDF at the time of emplacement would "disused sources" represent?

What volume and activity of commercial waste has been transferred to government ownership at Chalk River Laboratories, and what proportion would go in the NSDF?

Would commercial wastes imported from foreign countries be put in the NSDF? If not, what would be done with foreign imported wastes? Is country of origin tracked in the CRL waste inventory?

Why is there no reference to shielded wastes, or the particular hazards associated with them (such as a loss-of-shielding accident) in the *EA Report*? Noting that the CNSC Glossary defines "intermediate-level waste" as "Radioactive solid waste that typically exhibits levels of penetrating radiation sufficient to require shielding during handling and interim storage," why does the *EA Report* state that "only low-level" radioactive waste would go in the NSDF?

What would be the maximum quantity of cobalt-60 in any package (e.g., a "disused source") put in the NSDF?

A September 2016 internal CNL memo, *Critical Review of the Canadian Nuclear Laboratories Very Low Level Waste Strategy,* describes a pilot test between 2013 and 2015 to segregate very low level waste (VLLW) from low level waste (LLW) at CRL, so as to explore the feasibility of a VLLW disposal facility. The memo says this pilot test was discontinued in November 2015 "due to the change in strategy to accelerate the development of the NSDF, which will be a surface disposal facility similar to the proposed VLLW disposal facility." The memo adds that both facilities would be "engineered landfills," and that "there should be little discernable difference" in either construction costs or waste characterization costs. How could a facility originally designed for acceptance of only very low level waste be deemed acceptable for all forms of low level waste? How could low level waste that is not considered "very low level" be put in such a facility without additional waste characterization? Was cost the only consideration in choosing to recast a possible VLLW facility as a facility for all LLW?

Senior managers at CNL are appointed by the "Canadian National Energy Alliance". Most are from foreign countries and often stay only a year or two in Canada. What level of senior management turnover is deemed acceptable under the Management System Safety and Control Area?

Given that section 19(1)(g) of *CEAA 2012* refers to "alternative means of carrying out the designated project that are technically and economically feasible," why does CNSC's EA Report not examine economic feasibility of alternative means?

Why were long-term population health impacts of increased radiation exposures to downstream residents using Ottawa River water not examined in the NSDF EA?

How would compliance with the 856 mitigation measures in the 105-page "Consolidated Commitment Lists" be enforced? Would compliance with each of these measures be reviewed in the annual Regulatory Oversight Reports for CNL sites?

What quantity (volume, activity) of expired gaseous tritium light sources would be put in the NSDF?

What is the inventory of radionuclides and their activity in the intermodal shipping containers stacked at Waste Management Area H?

How would specific alpha-emitting radionuclides be measured in decommissioning wastes destined for the NSDF? How would they be measured in soil? What are the limitations of using gross alpha measurements to estimate specific radionuclides?

Have environmental remediation plans been prepared for Waste Management Areas A, B, C, and F? If so, what proportion of their contents would be put in the NSDF?

Why was no effort made to quantify potential "cumulative" environmental impacts associated with remediation of the Waste Management Areas, such as plume mobilization, dust generation from increased exposure of contaminated soil, and worker exposures associated with handling and waste segregation?

Have decommissioning plans been prepared for the Plutonium Recovery Facility, the NRX Reactor, the NRU Reactor, the MAPLE Reactors, and the Molybedum-99 Production Facility? If so, what proportion of their decommissioning wastes would be put in the NSDF?

Why is the *Comprehensive Preliminary Decommissioning Plan* not publicly available? Why is this document not referenced in the CNSC's *EA Report* or in CNL's *Environmental Impact Statement*?

How much lead and depleted uranium (e.g., for shielding higher-activity waste) is in the CRL waste inventory, and what proportion of each would go in the NSDF?

How much cesium-137 in the form of disused sources (volume and radioactivity) is in the CRL waste and what proportion would go in the NSDF? What quantities of other radionuclides are contained in disused sources stored at CRL?

Why were estimates of radon doses excluded from certain post-closure scenarios? If radon doses had been included, how much would dose estimates have increased? Why is radon not included in the NSDF Licensed Inventory?

What proportion of the natural uranium and natural thorium that would go in the NSDF would be accompanied by their radioactive progeny? Why are no radioactive progeny of thorium-232, and no progeny of uranium-238 with mass less than radium-226, included in the NSDF Licensed Inventory?

What is the basis for stating in the *EA Report* that the NSDF siting process was in alignment with IAEA Safety Guide SSG-29, *Near Surface Disposal Facilities for Radioactive Waste*?

Why were radiation exposures resulting from scavenging for iron, copper, aluminum, etc. during the post-closure period not considered in the EA?

A September 2017 CNSC *NSDF Waste Characterization Process Compliance Inspection Report* found areas of non-compliance, resulting in six action notices and fourteen recommendations for CNL to address. Asked about the capacity of the CNL waste characterization program to do the job internally, "CNL indicated that an assessment of the path forward has still not been confirmed and it should be a business decision between using the internal capabilities and/or the supply chain." Has a decision since been made as to whether CNL has the capabilities to do waste characterization internally?

The 2017 *Inspection Report "*determined that the waste inventory for the NSDF was based on the existing CRL waste inventory database, with no independent verification." Has an independent verification of the CFL waste inventory database been done since September 2017?

At that time CNL "indicated that the NSDF Waste Characterization program/process is at its early implementation state and undergoing programmatic improvements.

Once the improvements have been completed, the program will be fully implemented and adhered to company wide." Has the NSDF Waste Characterization program since been fully implemented?

During the 2017 inspection, CNSC staff reviewed of the *Building 228 Waste Water Evaporator Characterization Report* and noted that the "number of samples taken to characterize a building area was often less than three, especially for intrusive sampling, which made it difficult to adequately quantify the variability in Cs-137 activity in these materials." Specifically, "In one instance, the cement dust Cs-137 activity ranged from 6.57 to 11200 Bq/g," leading CNSC to issue an action notice that "CNL shall collect at a minimum three samples per waste type/area when measuring radiological and non-radiological contamination in order to adequately quantify the variability in concentration/activity estimates in a given waste." How is "waste type/area" defined? What are examples of waste type/area? Has the action notice been fully addressed?

Noting the limits in Table 4 of the NSDF *Waste Acceptance Criteria* of 1,000 Bq/g Cs-137 in bulk waste and 10,000 Bq/g in "Leachate Controlled Packaged Waste", would cement dust from the Waste Water Evaporator be considered intermediate-level waste, or low-level waste that could be put in the NSDF? Would CNL base that decision on maximum or average level of Cs-137 in a sample? Would a geometric or an arithmetic mean be used to calculate that average? Is the maximum value, the arithmetic mean, or the geometric mean used if Cs-137 is employed as a "scaling factor" to estimate other radionuclides?

Revision 1 of the *NSDF Reference Inventory Report* (not publicly available) noted that long-lived beta/gamma emitters include "hard-to-detect radionuclides important to NSDF" such as technetium-99 and carbon-14 for which "gross beta measurements are essentially useless for quantification." How are their quantities estimated? How would the resultant uncertainty in the quantities of these radionuclides be accounted for in a waste inventory, or in deciding whether particular wastes could go in the NSDF?

Has the draft *Licensing Regulatory Actions Licensing Phase: Construction* document under Licence Condition G.7 been made publicly available for this hearing? Will the public have an opportunity to review these regulatory actions during the hearing?

Will Commissioners discuss them prior to "prescribing" them? Is it acceptable that key NSDF documents such as the *Safety Analysis Report*, the *Waste Acceptance Criteria*, and the *Post-Closure Safety Assessment* have not been finalized? Is it premature to consider licensing of the NSDF? Would the Commission be acting reasonably were it to "prescribe" regulatory actions that it may not even have seen?

Will Commissioners discuss and review the 856 mitigation measures in the 105-page *Consolidated Commitment Lists* under Licence Condition G.8 prior to prescribing them?

Why is the NSDF being put through a CNSC licensing process when other new Class 1b facilities at Chalk River, such as the Intermediate Level Waste Storage Area, are not?

Why is there no inventory of the non-radioactive hazardous wastes that would go in the NSDF? How is that compatible with section 3(1)(j) of the *General Nuclear Safety and Control Regulations*?

Why does Table B-1 of the *Safety Case* state that section 14(2)(d) of the *Class I Nuclear Facilities Regulations* (that "Every licensee who operates a Class I nuclear facility shall keep a record of... the nature and amount of radiation, nuclear substances and hazardous substances within the nuclear facility") is "**Not applicable to the NSDF Project**?"

Why have the Cask Facility Project, the Intermediate Level Waste Storage Area, the Bulk Storage Laydown Area, the Material Pit Expansion Project, the Access Road Upgrade, the Building Demolition Project, the Waste Management Area Modification Project, the Effluent Monitoring Stations Upgrade Project, and the Multi-Purpose Waste Handling Facility not been included in a cumulative assessment of the NSDF Project?

Appendix B – Supporting Materials for Questions

B.1 Problems with the NSDF Environmental Assessment

The Project Description and Scoping Phase

The scoping phase of the NSDF EA was done in a confusing and hurried manner.

Following the release of the project description in May 2016, and a 30-day public comment period, CNL apparently decided that both intermediate level waste as well as low level waste would be included in the NSDF. This triggered a second 30-day public comment period that ended November 18, 2016.

According to the timeline in *Appendix A to the CNL-CNSC Administrative Protocol for the Near Surface Disposal Facility Project at Chalk River Laboratories, Revision 6, January 2022*, (https://iaac-aeic.gc.ca/050/documents/p80122/141157E.pdf), an *Environmental Impact Statement* was submitted by CNL to the CNSC on October 3, 2016. This was over a month before the end of the second public comment period.

How could the public comments (many of them highly critical) on the NSDF project description have been taken into account in the original *Environmental Impact Statement* if a draft was already under internal review by the CNSC and a federal-provincial review team, before the public comment period had ended?

The "public hearing" on the scope of the environmental assessment was held without public notice on March 7, 2017, over five months after submission of the first *Environmental Impact Statement.* It could not possibly have influenced the preparation of this *Environmental Impact Statement,* considering that a new draft was submitted to CNSC on March 17, 2017, ten days after the scoping decision.

This draft *Environmental Impact Statement* was released to the public for a 60-day comment period on May 17, 2017. Quebec-based groups asked for a French version, and the comment period was extended until August 16, 2017.

Lack of Subsequent Opportunities for Public Participation

Since August 2017 there have been no formal opportunities for public participation in the NSDF EA. After CNL announced on October 26, 2017 that only low-level waste (not intermediate-level waste) would go in the NSDF, a ***Public Notice*** - "Near Surface Disposal Facility - Recharacterization of Waste" was posted on the Impact Assessment Registry.

This was not accompanied by additional opportunities for public comment. Members of the public wondered "What is the plan for the intermediate-level waste that was to have gone in the NSDF?" The *Public Notice* merely said "Intermediate-level waste will continue to be managed in interim storage at Chalk River

Laboratories until a long-term disposal solution for this category of radioactive waste is developed and approved."

All six versions of the NSDF *CNL-CNSC Administrative Protocol* have timelines for the EA process. The original version, dated July 2016 (not available on line) provided for a dedicated Commission hearing on the NSDF EA. This provision was retained when the timeline was revised in a June 2017 *Appendix A to the Protocol*. It was dropped from the third *Version* of the timeline in October 2018, which called for a "Commission Hearing (EA and licensing decision)." Versions four, five and six make no reference at all to an EA portion of a Commission Hearing. The provision for a dedicated public comment period on the CNSC's EA Report was also dropped.

This progressive diminishing of opportunities for public participation in the NSDF EA carried through into the *Part 2 Hearing Agenda*. It assigns a single day (May 30th) to "environmental assessment and environmental protection," with only a few interveners selected by the CNSC to participate in that day's discussion.

Inadequate Consideration of Cumulative Effects

Paragraph 19(1)(a) of *CEAA 2012* states that the environmental assessment of a designated project must take into account "any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out."

CNSC REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*, says that the approach and methods should be consistent with *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*. Some examples of guidance in this document include:

- Present-day environmental conditions reflect the cumulative environmental effects of many past and existing physical activities.
- Information on existing physical activities should cover their full lifecycle, particularly if decommissioning is certain or reasonably foreseeable.
- Baseline information serves as a point of reference – before a project is developed – against which cumulative effects can be predicted and assessed.

In the CNSC's *EA report*, Table 8.5: Past, existing, and future projects included in the cumulative effects assessment (p. 303 of 590) has a short list of activities. Two of these -- decommissioning and environmental remediation -- would interact with the NSDF Project in profound and direct ways.

The *EA Report* does not adequately assess these interactions. For "infrastructure decommissioning" it only lists "Emission of dust, GHG, and indicator compounds," ignoring the risks to groundwater and surface water when contaminated building materials and their footprints are exposed to the elements.

In regard of the "environmental remediation" projects potentially associated with the NSDF, the *EA Report* refers to "possible emission of contaminants within lands being remediated and "possible resuspension or release of contaminants to aquatic receiving environment." It then asserts (p. 306 of 590) that "CNSC staff have found that cumulative effects on surface water quality are expected to be negligible in magnitude." No justification is provided for this assertion.

This seems an inadequate assessment of the cumulative effects of the NSDF Project.

CNL has recently approved a series of additional projects that are likely to interact with the NSDF in various ways but that have been omitted from the cumulative effects assessment. These include:

Canadian Nuclear Laboratories Cask Facility Project
Canadian Nuclear Laboratories Intermediate Level Waste Storage Area
Canadian Nuclear Laboratories Bulk Storage Laydown Area
Canadian Nuclear Laboratories Material Pit Expansion Project
Canadian Nuclear Laboratories Access Road Upgrade
Canadian Nuclear Laboratories Building Demolition Project
Canadian Nuclear Laboratories Waste Management Area Modification Project
Canadian Nuclear Laboratories Effluent Monitoring Stations Upgrade Project
Canadian Nuclear Laboratories Multi-Purpose Waste Handling Facility

Available descriptions of these projects are insufficiently detailed to assess their potential cumulative effects in association with the NSDF project.

B.2 Wrong Plan, Wrong Place

IAEA Safety Guide SSG-29, Appendix 1, *Siting of Near Surface Disposal Facilities*, says siting is a "fundamentally important activity in the disposal of radioactive waste."

SSG-29 says the first two stages in the siting process are a "conceptual and planning stage," during which "projected waste volumes and activities should be quantified," and an "area survey stage," involving "regional mapping or investigation."

The NSDF facility type and site were selected without quantifying volumes and activities of federal wastes awaiting disposal, and without a regional investigation.

Proximity to contaminated structures being demolished at the Chalk River Laboratories — not safety or environmental protection — appears to have been the priority is choosing the site of the NSDF. No serious consideration was given to sites other than AECL's 3700-ha Chalk River property,

Alternative sites should be sought to avoid rapid discharge of radioactive and hazardous substances to a major water body and to avoid placing wastes in an area with a high water table (Ref: *CMD 22-H7*, Section 3.2, Design Options Evaluation).

Flat, sandy portions of the 30,770-ha Department of National Defence Garrison Petawawa property, adjacent to the Chalk River Laboratories, would accommodate a larger, less expensive, and safer in-ground concrete vault facility. Vegetation was removed from extensive portions of this property to create a parachute training zone for the Canadian Airborne Regiment, which was disbanded in 1995.

A regional investigation of crown land for geological formations suitable for a shallow rock cavern facility should also be conducted.

IAEA Safety Requirement SSR-5, *Disposal of Radioactive Waste*, indicates that an in-ground concrete vault or a shallow rock cavern could contain a wider range of waste types than an above ground, landfill-type facility such as the NSDF.

The southern portion of the site chosen for the NSDF is underlain by a feature categorized in 1994 as a "high-probability" fracture zone," ten meters wide and over a kilometer long – a potential groundwater flow pathway with "permeability values several orders of magnitude greater than bulk rock mass." (*EIS*, p. 5-109) This feature should have eliminated the proposed site from further consideration.

Original site selection criteria announced by the proponent would have excluded any site with more than a 10% slope. This criterion was changed to 25% to allow CNL's desired site (Ref: *Near Surface Disposal Facility Site Selection Report* 232-10300-TN-001 Revision 2. Oct. 2016). The NSDF site is on a hillside, over fractured rock, with a high water table, surrounded on three sides by wetlands that drain into Perch Lake 50 metres from the base of the hill. Perch Creek flows from Perch Lake into the Ottawa River, one kilometre away.

The site selection criteria were also supposed to exclude "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)."

However, construction of the NSDF would destroy 30 hectares of mature and semi-mature forest that provides high-quality maternity roosting habitat for three endangered bat species (Little Brown Myotis, Northern Myotis and Tri-colored Bat) and nesting habitat for six at-risk bird species (Canada Warbler, Golden-winged Warbler, Wood Thrush, Eastern Wood Pewee, Whip-poor-will, Wood Thrush). It would also have adverse impacts on at-risk aquatic species such as the Blanding's Turtle.

Chalk River Laboratories, with its proximity to the Ottawa River, high groundwater table, uneven terrain, and fractured bedrock is a terrible place for permanent radioactive waste disposal. The NSDF would destroy habitat for many at-risk species. Given that volumes and activities of federal wastes were not quantified prior to selection of a landfill-type disposal facility, there is no certainty that the NSDF could safely accommodate a significant portion of these wastes.

This is why concerned citizens say this is the "Wrong Plan" in the "Wrong Place".

B.3 The NSDF Inventory – Ignoring International and Domestic Requirements
The NSDF project was launched in the absence of information on specific radionuclides and amounts of radioactivity in waste resulting from past practices at federal nuclear facilities.

Canada has agreed to provide this information in accordance with the provisions of Article 30 of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, overseen by the International Atomic Energy Agency (IAEA).

Canada submits a national report to each review meeting of Contracting Parties to the *Joint Convention*. But the Government of Canada's *Report* for the Seventh Review Meeting (in June 2022) lacks information on specific radionuclides and radioactivity in federal nuclear wastes. This information is required so that other IAEA member states can review Canada's radioactive waste management plans.

Figure 1 in IAEA General Safety Guide GSG-1, *Classification of Radioactive Waste*, relies upon two axes -- activity content and half-life – to apportion waste into four classes. Only very low level waste with short half-lives is suitable for landfill disposal (the NSDF resembles a municipal landfill). Low level waste is suitable for near surface disposal. Higher activity, longer-lived Intermediate level waste requires intermediate depth disposal. High level waste requires deep geological disposal.

Without information on specific radionuclides, their half-lives, and their activity, it is impossible to design a facility that can safely accommodate a given waste inventory.

The proposed waste inventory for the NSDF is a fantasy inventory. It is divorced from real data.

Data that do exist in the *Comprehensive Preliminary Decommissioning Plan* for the Chalk River Laboratories (CRL) are being ignored. Indeed, given that this *Plan* can be found nowhere on CNL's website, it is no exaggeration to say that data are being suppressed. The *Plan* shows that the amounts of radioactivity in waste that CNL intends to put in the NSDF exceed the proposed NSDF "Licensed Inventory" by many orders of magnitude. Yet, the safety case for the NSDF is based on this "Licensed Inventory" – a fantasy inventory.

Real data are needed to prepare a real inventory – not a fantasy inventory – that can be used to start the conceptual and planning stage for a disposal facility.

As explained in Appendix 1 of IAEA Specific Safety Guide SSG-29, *Near Surface Disposal Facilities for Radioactive Waste*:

> At the start of the conceptual and planning stage, key decision points should be defined on the basis of the needs and timing for the disposal facility. The types and quantities of waste to be emplaced in the disposal facility should be specified and characterized. The projected waste volumes and activities should be quantified. Using this information, the generic disposal facility design concept should be developed.

One will search in vain for any evidence of a conceptual and planning stage for the NSDF. No solid, quantitative information on projected waste volumes and activities was compiled before the decision was made to build a radioactive waste mound at CRL. Nonetheless, Canadian Nuclear Safety Commission (CNSC) staff members recommend project approval.

The likelihood is that the CNSC's appointed Commission will approve the project and it will proceed. The CNSC has no capacity to monitor waste emplacements. Waste with long-lived radionuclides will be put in the mound with little or no prior characterization. The "Licensed Inventory" will simply be ignored.

It is impossible to say if future radiation exposures to the public would be "reasonable" even if the "Licensed Inventory" were adhered to, wastes were scrupulously characterized, and the mound were to "evolve" as predicted after closure. Radiation dose estimates for the NSDF are not transparent. Complex models, not available to the public, containing many assumptions, were used to make these estimates.

Long-term health consequences of exposing a very large number of people for a very long time to small but measurable increases in man-made radionuclides in the Ottawa River have not been assessed.

Protecting human health is more important than cost savings. A mound is not suitable for most of the waste at CRL. Better locations and safer technical alternatives exist for permanent waste disposal.

In the unlikely event that waste is well characterized, the NSDF will be a financial boondoggle. The $750 million cost estimate for the NSDF is likely grossly understated. Furthermore, the federal nuclear liability recorded in Canada's *Public Accounts* is far greater: "The undiscounted future expenditures, adjusted for inflation, for the planned projects comprising the liability are $16,074 million."

It is highly likely that costs will escalate, poorly characterized waste will go in the NSDF, it will be an environmental disaster, and future generations will inherit a mess.

We conclude that the NSDF Licensed Inventory (the "maximum radiological inventory limit for the NSDF" (in Table 5-19 of the *Safety Case*) has no factual basis. The *Safety Case* is invalid. The CNSC staff recommendations in *CMD 22-H7* must be rejected.

B.4 How Likely is it that the NSDF Licensed Inventory Would Be Exceeded?
The Radionuclide Concentration Limits (Table 5-18 of the *Safety Case*) would be used to screen wastes deposited in the NSDF. These would allow the Licensed Inventory limits (Table 5-19 of the *Safety Case*) to be **exceeded by many orders of magnitude**.

The dose calculations in the *Post-Closure Safety Assessment* were based on the Licensed Inventory limits in Table 5-19 of the *Safety Case*, not the Radionuclide Concentration Limits in Table 5-18. The NSDF proponent **would not track the individual radionuclides shown in the Licensed Inventory.** CNL would only perform "gross alpha and gross beta/gamma screening" prior to disposal of packaged and bulk waste in the mound, according to *CMD 22-H7* (p. 101 of 590).

For long-lived beta/gamma emitters, Table 5-18 of the *Safety Case* shows a 10,000 Bq/g limit for leachate-controlled packaged waste and a 1,000 Bq/g limit for bulk waste. Assuming 13% of the mound (130 billion grams) would be packaged waste and 87% (870 billion grams) would be bulk waste, the radionuclide concentration limits would allow up to 2.17 quadrillion Becquerels of beta/gamma emitters in the

NSDF. This is roughly three orders of magnitude more than the Licensed Inventory limits, summing up all the long-lived (> 1500-year half-life) beta/gamma emitters.

Most of the carbon-14 -- the radionuclide with the highest Licensed Inventory limit among the long-lived beta-gamma emitters -- would likely NOT be detected with a gross beta/gamma screening. This creates the potential for an even greater exceedance of the Licensed Inventory limit for this radionuclide class.

Given the large amounts of packaged and bulk wastes to be deposited in the mound, the large amounts of carbon-14, and the very crude measurement proposed for the beta/gamma activity of these wastes, the potential exceedance of the Licensed Inventory limit for the mound's radioactivity of long-lived beta/gamma emitters at time of closure would be still higher, on the order of 10,000-fold.

For long-lived alpha emitters, a similar calculation based on the 400 Bq/g limit for packaged wastes and 100 Bq/g limit for bulk wastes yields a value of 139 trillion Becquerels. This represents nearly a 1000-fold exceedance of the Licensed Inventory limits, summing up the main long-lived alpha emitters Pu-239/240, Th-232, U-234, and U-238. Importantly, bulk waste – not packaged waste - would constitute the majority of this potential thousand-fold exceedance.

CMD 22-H7 gives only hints of the critical role of the Licensed Inventory in developing the NSDF *Safety Case*. It does not contain the term "Licensed Inventory", instead referring to "waste inventory":

- CNSC staff assessed the changes made for each sensitivity analysis scenario (such as an increase in the waste inventory by a factor of 10…) (p. 46)
- CNL's main safety arguments put forth in the safety case can be classified in three main classes: 1. Those related to the waste inventory and waste characteristics… (p.51)
- Uncertainty in the waste inventory and near-field sorption coefficients directly influences the calculated dose rate and environmental impact results (p. 56)

In Table B-1 of the *Safety Case* *(*p. 569) CNL claims that section 14(2)(d) of the *Class I Nuclear Facilities Regulations* that "Every licensee who operates a Class I nuclear facility shall keep a record of... the nature and amount of radiation, nuclear substances and hazardous substances within the nuclear facility" is "**Not applicable to the NSDF Project**."

The enormous discrepancy between the Table 5-18 Radionuclide Concentration Limits and the Table 5-19 Licensed Inventory in the *Safety Case*, and the proponent's stated intent not to record amounts of radiation and nuclear substances in the NSDF, render invalid the staff recommendations in *CMD 22-H7*.

B.5 The NSDF Was Never Checked for Conformity with International Safety Requirements

IAEA SSG-29, *Near Surface Disposal Facilities for Radioactive Waste*, is a Specific Safety Guide that provides guidance for near surface disposal facilities. This guidance relates to each of 26 specific safety requirements in IAEA SSR-5, *Disposal of Radioactive Waste.*

CNL did NOT check for compliance with these 26 IAEA requirements before it decided to proceed with the NSDF. Had it done so, guidance such as the following in *SSG-29*, related to *SSR-5* requirement 20 on "Waste Acceptance", would have ruled out putting long lived waste in an above-ground mound:

> 6.32. In the development of the waste acceptance criteria, emphasis should be given to the fact that near surface disposal is intended for short lived radioactive waste containing only limited amounts of long lived radionuclides and that, generally, longer lived waste needs greater levels of containment and isolation that cannot be provided by near surface disposal. **The national policy for radioactive waste management should ensure that these limitations on long lived radionuclides are respected** and that waste with higher concentrations of long lived radionuclides is disposed of in facilities designed to accept such waste. [emphasis added]

This is a strong argument for NOT proceeding with ANY radioactive waste disposal projects until a national policy is in place.

Pages 584-615 of CNL's *Safety Case* -- written long after CNL and its corporate owners decided on an above-ground mound design -- contains Table B-3, Concordance Table for Disposal of Radioactive Waste, SSR-5. This 32-page table copies the 26 requirements from *SSR-5* and lists a huge number of CNL documents against each. It does **not** show that these documents contain information demonstrating conformity with *SSR-5*.

CNSC Staff, in *CMD 22-H7*, boiled Table B-3 down to a 10-page table called "Mapping of NSDF Technical documentation to the IAEA SSR-5." CNSC's 10-page table is just as devoid of substance as CNL's 32-page table in the *Safety Case*.

IAEA *SSR-5* radioactive waste disposal requirements have been in place since 2011. The Government of Canada should have followed these requirements in developing a facility for its radioactive waste. Instead, in 2015 the Government contracted private companies. They immediately announced their "solution" would be an above-ground mound. Ever since then they have been trying to justify the unjustifiable, spending hundreds of millions of dollars in the process.

The private companies – and now, Canada's nuclear regulator – are trying to make the case for Commission approval of the NSDF with bogus "concordance tables" that hide the reality that the NSDF does not conform to international safety requirements and standards.

B.6 The NSDF - Publicly Subsidized Commercial Waste Disposal?

If the license to build it is approved, large quantities of cobalt-60 and tritium from commercial sources will likely be disposed of in the NSDF.

Significant quantities of cobalt-60 and tritium are imported as **radioactive wastes from other countries**. These two substances would give off nearly all the initial radioactivity in the NSDF. The "Licensed Inventory" for the NSDF (Table 5-18 in the *Safety Case*) includes 90.6 Terabecquerels of cobalt-60 and 0.891 Terabecqurels of tritium.

Chalk River Laboratories, a publicly owned research facility, is Canada's main commercial radioactive waste **storage** facility.

Many companies ship their wastes to Chalk River. A partial list for the period 2014 to 2018 obtained through an Access to Information request to Atomic Energy of Canada Limited (AECL) includes ABB Inc., ALARA Consultants, Bunge Canada, BWXT Nuclear Energy Canada, DFF Recyclex, Energy Solutions Canada, Kinetrics, MDS Nordion, Noremtech Inc., Nuclear Services Canada, Overwatch, Permafix NW, Shield Source, Spencer Manufacturing, SRB Technologies, Stuart Hunt, Uni-Vert, and Voith.

Large quantities of cobalt-60 and cesium-137 'disused sources' are in storage at Chalk River, mainly imported by Ottawa-based companies Nordion and Best Theratronics. The *Transcript* of the 2019 licensing hearing for Best Theratronics says

> "In 2014, we had a resident inventory of disused sources at Nordion. All of that has now been disposed of at CNL… So I can report that all those legacy sources, which is over 500 sources, cobalt and cesium, have been successfully removed from our license."

Amounts of cesium-137 in storage at CRL are likely to be roughly 100,000 times the "Licensed Inventory" limit for the NSDF. CNL may have initially planned to put stored cesium-137 waste in the NSDF, but backed off because it is classified as intermediate level waste (ILW) in Annex III, Origin and Types of Radioactive Waste, in IAEA General Safety Guide GSG-1, *Classification of Radioactive Waste*. The IAEA also considers higher activity cobalt-60 waste to be ILW.

SRB Technologies (based in Pembroke, Ontario) imports large quantities of waste 'light sources' filled with tritium (the radioactive form of hydrogen) from the U.S. It regularly receives truckloads of expired tritium exit signs, dismantles them, puts the tritium-filled 'glow in the dark' glass tubes in packages, and ships them to Chalk River for storage. Nuclear regulations in the U.S. do not allow expired tritium exit signs to be dumped in municipal landfills. Canada has a special exemption in its nuclear regulations to allow this, but as far as we can tell, SRB only sends small quantities of its tritium wastes to the Ottawa Valley Waste Recovery Center. All of SRB's radioactive waste imports are sent to Chalk River.

Commercial wastes become the responsibility of the Government of Canada when they are sent to Chalk River. Canadian citizens and taxpayers become owners of radioactive waste shipped from around Canada and around the world. Technically speaking, the federal crown corporation Atomic Energy of Canada Limited (AECL) becomes the waste owner and is responsible for its long-term management.

This has been going on for many years. Canadian Nuclear Laboratories, contracted by AECL to deal as quickly and cheaply as possible with AECL's 70+ years of accumulated waste, appears to be planning to put into the NSDF as much as possible of the (former) commercial waste now in storage at Chalk River.

Information from Canada's recent *Seventh National Report to the Joint Convention* confirms that wastes are being imported from other countries. Table D.5 lists facilities in Canada that manage non-spent fuel radioactive waste, including intermediate level waste (ILW) and low level waste (LLW). These include Best Theratronics Manufacturing Facility, Kanata, Ontario that engages in "Storage of disused sealed sources and depleted uranium shielding (LLW and ILW);" and Nordion Manufacturing Facility in Kanata that also engages in "Storage of disused sealed sources (ILW)."

Table D.8 in the *Report* has an inventory of low and intermediate level radioactive waste in storage in Canada as of December 31, 2019. It shows that Best Theratronics had 71 Terabecquerels of "Disused cobalt-60 sealed sources, disused cesium-137 sealed sources, depleted uranium shielding components;" and Nordion had 4,126 Terabecquerels of "Disused cobalt-60 sealed sources; disused cesium-137 sealed sources." A Terabecquerel (TBq) is the radioactivity of the quantity of a radioactive substance that undergoes one thousand trillion radioactive disintegrations every second.

Section J of the *Report* says that "the CNSC has received more than 2,820 applications to export Category 1 and 2 radioactive sealed sources to 100 countries and has controlled the export of more than 20.4 million TBq," adding that "Canada remains a global leader in the production and export of Category 1 cobalt-60 radioactive sealed sources, supplying approximately 95 percent of the global demand."

Section J of the *Report*, Disused sealed sources, quotes the *Joint Convention* as saying that "A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources." Section J adds that "For long-term management, radioactive sealed sources may be returned to the manufacturer in Canada," and that disused sources may be sent to a licensed waste management facility "such as the facility operated by CNL in Chalk River, Ontario."

B.7 It's Time for Parliament to Take Responsibility for Canada's Nuclear Waste

Parliament's Standing Committee on Environment and Sustainable Development has been studying *Nuclear Waste Governance in Canada*, following a motion by Vice Chair Bloc Québécois MP Monique Pauzé.

As shown in Figure 2 of a national radioactive waste *Inventory* released in January 2022 by Natural Resources Canada (NRCan), Parliament is ultimately responsible for managing radioactive waste.

A September 2019 *Review* by the International Atomic Energy Agency (IAEA) found that Canada's nuclear safety framework lacks a detailed governmental policy on radioactive waste and decommissioning, and has no accompanying strategy. The IAEA recommended that Canada's current 143-word radioactive waste *Policy Framework* be enhanced, and that an associated strategy be established.

The current *Policy Framework*, established by NRCan in 1996, says that owners and generators of radioactive waste will deal with it "in accordance with approved waste disposal plans." But not one single permanent disposal plan has been approved since then.

NRCan's radioactive waste *Inventory* provides data on waste volume and mass, but not radioactivity, for four waste classes. Canada has over 2.5 million cubic meters of "low-level" waste, and 385 million tonnes of uranium mill tailings and waste rock.

These pose population-level health risks, particularly if inhaled (e.g., radon gas) or ingested (radium), and must be contained and isolated from human contact.

"Intermediate" and "high" level wastes are present in smaller volumes but contain far greater amounts of radioactivity, making them very difficult to handle safely.

IAEA Nuclear Energy Series NW-G-1.1, *Policies and Strategies for Radioactive Waste Management*, says that national policy should identify "arrangements for the management of the main types of radioactive waste." But the *Draft Policy* released by NRCan in February 2022 does not. It merely states that nuclear waste owners and generators will "develop and maintain an integrated strategy for radioactive waste management and decommissioning activities".

The federal government, through its crown corporation Atomic Energy of Canada Limited (AECL), is the owner of over 90% of Canada's 2.5 million cubic meters of radioactive waste. The 2019 NRCan *Inventory* projects that future work at AECL sites will generate another 888 million cubic meters of federal radioactive waste by 2100.

As the owner of so much of Canada's radioactive waste, one might assume that the Government would step up and develop a national strategy to accompany its new policy. But former NRCan Minister Seamus O'Regan assigned the task of developing a national strategy to the industry-owned Nuclear Waste Management Organization (NWMO) when he launched a policy review in November 2020.

NRCan Assistant Deputy Minister Mollie Johnson is charge of the group leading the policy review. The *Transcript* of a January 27^{th} Canadian Nuclear Safety Commission (CNSC) meeting quotes her as saying "a number of projects we know that are in the cue [sic]… will continue to move forward and the review itself will continue. So we want to make sure that there's certainty for the work that is ongoing."

Ms. Johnson confirmed that the NSDF project can proceed unimpeded by sober consideration of matters such as an acceptable national waste policy or strategy.

AECL is advancing the Chalk River mound under a 10-year, multi-billion-dollar contract it awarded to a multinational consortium (currently SNC-Lavalin and Texasbased Fluor and Jacobs) during the fall 2015 federal election period. This was the final act of the Harper government's "restructuring " of AECL.

The Chalk River mound project -- as Canada's first-ever permanent disposal facility for nuclear reactor wastes -- would set a disastrous precedent. Leaving long-lived radioactive waste above ground would expose countless generations of Canadians to radiation leaks into the Ottawa River, not to mention radiation exposures to human scavengers seeking to exploit the thousands of tonnes of radioactively contaminated iron, copper, aluminum and lead in the mound.

There has been no independent review of the $750 million cost of this project, and no estimate of what part of AECL's $16,074 million (undiscounted) waste liability it could accommodate. Every indication is that it would not conform to IAEA safety standards.

But the project does conform to nuclear industry plans to dot the Canadian landscape with mounds of radioactive waste. In commenting on a draft CNSC radioactive waste management document in 2019, Canadian Nuclear Laboratories, Bruce Power, the Canadian Nuclear Association, New Brunswick Power, Ontario Power Generation, and the NWMO all said "There are current plans to place ILW [intermediate-level radioactive waste] in aboveground mounds."

All have made formal submissions to the CNSC in support of the NSDF.

The NWMO's August 2021 *Characterization and Options Project Report* for an "integrated" national radioactive waste strategy excludes high-level radioactive waste, uranium mine tailings and waste rock, and 90% of low- and intermediate-level radioactive waste. It assumes that the NWMO itself has "solved" the problem of what to do with high-level waste, and CNL's NSDF has "solved" the problem of what to do with federal low-level waste. The *Report* appears to be making a case for putting as much as possible of the remaining 10% of low- and intermediate-level waste in above-ground mounds.

The CNSC appears keen to approve the precedent-setting NSDF mound project under the Harper government's 2012 version of the *Canadian Environmental*

Assessment Act. *CMD 22-H7* says the project "is not likely to cause significant adverse environmental effects." Under *CEAA 2012* a CNSC approval decision is final and cannot be overturned by Cabinet.

CNSC's *EA Report* does **not** adequately assess the effects of CNL's "renewal" of the CRL site (demolition of unused buildings) or CNL's "environmental remediation" of historic waste management areas. This is one of the most serious flaws in the *EA Report*. This is a direct violation of section 19 (1) (a) of *CEAA 2012*:

> "The environmental assessment of a designated project must take into account … any **cumulative environmental effects** that are likely to result from the designated project **in combination with other physical activities that have been or will be carried out"** [emphasis added]

The *EA Report*, prepared by CNSC staff and released on January 25th for the part 1 hearing on February 22nd, will be the specific topic of day 1 (May 30th) of the week-long NSDF hearing. It will also likely come up repeatedly during the following four days. The *EA Report* is noteworthy for its lack of scientific credibility (it has **no** references, not even a reference list at the end). Hence, none of the statements in the *EA Report* are supported.

One would want a clear demonstration of significant **positive** impacts of the NSDF prior to approval: that the quality of surface water and the terrestrial environment at will be improved, and Indigenous interests will be fully respected.

That demonstration is lacking in CNL's *Environmental Impact Statement* and in CNSC's *EA Report*. To the contrary, there is abundant evidence that things would get worse: more wastes imported to CRL, more tritium in surface water, loss of over 30 hectares of high-quality terrestrial habitat, and a permanent nuclear waste facility on unceded Indigenous land with no free, prior informed consent of Indigenous communities.

An independent, publicly-owned body, accountable to Parliament, is needed to deal with Canada's radioactive waste. As indicated in NRCan's latest radioactive waste *Inventory*, Parliament is - or should be - the ultimate arbiter in this realm.