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Written submission from Evelyn Gigantes

Exposé oral

Mémoire d' Evelyn Gigantes

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

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Canada

Submission to CNSC concerning the licensing application by CNL for construction of an NSDF at Chalk River.

Evelyn Gigantes March 28, 2022

I first became aware of the Near Surface Disposal Facility (NSDF) proposal in late 2016. I reviewed the early materials concerning the proposal and submitted a response for the CNSC's consideration in 2017. Since that time I have attempted to absorb all new materials generated by the proponent (CNL), by the CNSC, and by other informed sources.

As the proposal is being reviewed under the Environmental Assessment Act (2012), it seems fair to assume that the CNSC's emphasis will be on the effects of the NSDF concerning the environment – on humans, animals, plants, water, air and so on.

Unfortunately, the more I have followed the Commission's approach to assessing the proposal, the more I question the capacity of the CNSC to provide rigorous assessment on that score. I also realize now that the existing nuclear waste situation at the Chalk River Laboratories site is much, much worse than I had earlier assumed, and that the CNL "Vision" for future developments at that site will make conditions even more dangerous to the environment.

Section 1: Indigenous Involvement

My comments begin with a subject I believe to be existentially important – the significance of the NSDF decision-making process for the way the Canadian nation operates. While the current federal government has adopted UNDRIP principles and committed our nation to ceasing previous colonial policies viz-a-viz Indigenous peoples, the continuation of those colonial practices by bodies such as the CNSC illustrates how little things have changed.

A policy requirement of the CNSC is that the <u>proponent</u> of a Canadian nuclear development must open its development policy framework to input from First Nation peoples. Back in 2018 when I made my first submission to the CNSC about the proposed NSDF, I outlined the CNL failure to follow this rule, and noted that, because of this CNL failure, the CNSC itself was taking on major responsibility for integrating Indigenous views into the judgements to be made about whether and how the NSDF project might proceed.

I also noted that when the CNSC staff became responsible for informing, meeting, consulting and responding to the views of affected First Nations peoples, it would be highly unlikely that these CNSC efforts would be judged a failure by the CNSC itself.

This tangle of responsibilities has produced the result that could have been expected and is demonstrated by Sections 9.0-9.4 in the CNSC staff recommendations to the Commission dated January 2022. For 35 pages CNSC staff report all contacts since 2016, funding, meetings, discussions, and attempts to persuade those First Nations having a direct interest in the proposal to build the NSDF.

To do justice to that extended staff report, it does not attempt to hide the fact that CNSC staff encountered serious resistance to their efforts to reassure local First Nations. But the report also describes First Nations responses as displaying "hesitancy" about accepting the adequacy of NSDF information provided by CNL and CNSC representatives, and about the problem created by First Nations associating a "potential increased stigma" with changes to the Chalk River area lands associated with CNL activities, both current and planned.(p. 279) On p. 134 the report alludes to "perceived psycho-social impacts such as fear and avoidance and their effects on health, well-being and AOPFN rights practices" as a concern of the AOPFN. Not surprising, given that the Algonquins of Pikwakanagan First Nation, the AOPFN also "perceives" a very tangible current problem: "the importation of radioactive wastes from off-site without AOPFN approval."

Given all the above, it is also not surprising that on January 31 Chief Lance Haymond of the Kebaowek First Nation, wrote to the CNSC Chair formally requesting that the next steps in the CNL proposal to build the NSDF be halted. Neither CNL nor the CNSC has established a framework agreement with either the KFN or the AOPFN (with which the KFN is affiliated).

Chief Haymond noted in his letter to Chair Velshi that the current NSDF process compares badly to another process in which local First Nations are working with a different Government agency:

"*As a comparison Kebaowek, Wolf Lake and Temiskaming First Nations are currently engaged in an environmental assessment under CEAA 2012 at the Temiskaming Dam Complex on the Ottawa River. Here the Federal proponent Public Services and Procurement Canada (PSPC) and the communities have developed a consultation framework agreement in advance of carrying out the assessment. Furthermore, UNDRIP principles are incorporated in the review as part of this rights based environmental assessment. It appears that the TDQRP Federal Consultation is much more robust on Indigenous consultation and engagement than the CNSC regulatory scheme. It is for these reasons that for some time KFN has been seeking to provide some structure to the exercise of the NSDF consultation requesting the CNSC funding of an overarching Consultation Framework Agreement.*"

Such a Framework Agreement should also cover Kebaowek First Nation consideration of the proposal by CNL to develop one or more small nuclear reactors on the CRL properties.

Finally, when we turn to the January 2022 CNSC Environmental Assessment Report CMD 22 H-7 in **Section 6.0 "Conclusion and recommendations"** concerning Indigenous responses to the CNL Environmental Assessment Report NSDF proposal we can read 4.5 pages of summation of CNSC staff responses to the expressed views of the Algonquins of Pikwakanagan First Nation which includes the following statements printed in a special block on page 296:

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"*AOPFN concluded moderate to high severity adverse impacts on AOPFN governance and stewardship rights, related to lack of adherence to AOPFN's stated nuclear principles, 'Willing Host" principle and right to free, prior and informed consent.*

CNSC's Views

CNSC staff cannot make a conclusion on this impact as it is outside of the mandate of the CNSC. The CNSC as an independent regulator does not have the authority or the mandate to dictate the location of where nuclear projects are proposed and therefore, does not have the authority to weigh in on AOPFN's request for the 'Willing Host' principle.

CNSC concluded low and AOPFN concluded moderate severity impacts on AOPFN governance and stewardship rights, related to the temporal, effectively permanent extension of the current inability to manage this portion of its unceded lands in a manner agreeable to AOPFN."

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What can it possibly mean for the CNSC to take the position that it does not have the authority or mandate to "dictate" where nuclear projects are proposed and therefore has no authority to require the proponent - CNL - to adopt a "Willing Host" principle? Working within the framework of the Environmental Assessment Act 2012 it is clear that the CNSC has the authority and mandate to decide if the proponent has adequately investigated all reasonable locations and all reasonable sites for the project the proponent, CNL, is proposing.

In any case the CNSC hearing of February 22, 2022 heard from the Chair that she considered it "premature" to adjourn the license application hearings without a review of the consultation process that had taken place. She said further that the decision, when it is made, will be placed

on the CNSC website - a statement that might well be considered dismissive. The decision, when it came, was to reject the Kebaowek First nation request for a halt to the licensing of construction application.

Section 2: Siting the NSDF

The next subject I would like to address is the manner in which the siting of the NSDF has been considered, first by CNL and then by staff of the CNSC.

As the CNL plans for a new "Vision" for their operations at the Chalk River Lands (CRL), it has become necessary to actually deal with the "legacy" waste situation there. As the CNL website puts it: "CNL is cleaning up the past to make way for a bright future." Unfortunately, legacy wastes are still accumulating because CNL will continue to import flows of wastes from other federally-initiated nuclear reactor sites: Douglas Point (the original CANDU reactor in Ontario), Whiteshell in Manitoba**, a**nd Gentilly in Quebec. In addition, Chalk River Lands will continue to receive wastes from commercial operations that produce nuclear waste in Canada, and wastes generated abroad using Canadian commercial technologies and repatriated for disposal.

The CNL proposal to create an NSDF at Chalk River flows from the Corporation's wish to develop major new operations which would be housed in new facilities at Chalk River Lands, and to rid the CRL of old structures and old wastes. The Environmental Assessment Act of 2012 requires an examination of alternatives for the siting of a development that generates significant environmental risks, such as the proposed NSDF.

The CNL submission of January 24, 2022 notes that a primary attraction of the CRL site has been the fact that it is already owned by the Canadian government and it already contains large amounts of nuclear waste, mostly (by volume), Low-Level waste.

The CNL consideration of other locations for the siting of a waste disposal facility for federally-generated nuclear wastes has been cursory. Even the exact location of the proposed NSDF within the spacious 4000 hectares of the Chalk River Lands, appears to be more a question of putting the Facility (occupying 37 hectares within the already-developed area of CNL operations) close to where the AECL wastes are currently located.

Undoubtedly this is convenient. The wastes to be placed in the proposed facility will hardly need to be moved. The hazards of whatever waste-packaging must be done will be confined to an area already accommodating wastes of High, Intermediate and Low-levels.

Convenience, of course, reflects costs to CNL, to AECL and, ultimately, to the Canadian government's taxpayers. The building costs for the Facility are projected to be $475m, the operations costs over a total of 80 years are estimated at $275m.

But the convenience and cost-containment of the location places the NSDF 1.1km from the Ottawa River.

In the February 22, 2022 hearing by the CNSC questions were asked by Comissioners about the siting process. In the discussion which followed Joesph McBrearty, President of CNL, explained that other locations on the CRL property had been considered – including the location of the de-commissioned NPD reactor (Rolphton) and other locations further inland from the current CNL operations. However, the Rolphton location and the Whiteshell, Manitoba site of a decommissioned AECL reactor and CNL laboratories had been judged unsuitable for a "mound", meaning a Near Surface Disposal Facility. Meggan Vickerd, CNL General Manager of Waste Services at CRL, explained "We only looked at AECL land" (which is managed by CNL as the private-sector operator for AECL). So the public, and the Commissioners, have been clearly told that

. because most of the waste to be dealt with is aleady located on the CRL property,

. because it is deemed advisable to deal with the waste in a "mound" – the NSDF, and

. because choosing the immediate site and surrounds of the Canadian Nuclear Laboratories operations would entail the least movement of existing and projected new nuclear waste volumes

therefore there should be an NSDF, and it should be located in the same area as CNL operations at Chalk River. No CNL witness suggested that the recommended site and the recommended disposal method would also be the cheapest, and no Commission member raised that reality.

Both the CNL and CNSC are clear about the fact that this location entails special environmental (nuclear) hazards that require special "mitigation" measures.

Section 3: Design of the NSDF

Perch Lake is part of the existing nuclear waste management arrangement on the CNL site. The design proposed for the NSDF would have the Facility drain on a downward slope into Perch Lake, but the water table in the proposed location is high enough to require the excavation and blasting of bedrock so that NSDF waste water treatment would outlet towards Perch Lake.

We are asked to trust that the blasting can be controlled sufficiently, and will not generate fissures in the bedrock , and movement that could jeopardize the overall design of the Facility. The CNL estimate is that 170,000 cubic meters of bedrock rock will be blasted out during construction. We are also asked to trust that the current design proposal of the waste mound –

the “floor”, the “cover”, and the “sides” will be sufficient to be able to avoid the “bathtub scenario” of flooding that could overcome containment.

Assessing the capacity of the current design to prevent or withstand extreme geo-physical assaults is clearly both critical and extremely difficult. The assumptions that the berm perimeter will be able to safely handle severe weather and/or severe earthquake are not suited to faint engineering hearts.

The berm perimeter is critical to whether the sides of the waste mound will survive extreme geo-physical assault.

The engineering studies provided by CNL and endorsed by CNSC staff are divided into assessments of

. how well the mound would sustain its integrity against extreme weather, and

. how well mound integrity would be maintained in a major seismic event.

When I review the assumptions underlying the engineering studies they seem to me to be less than the maximum assumptions which should be examined. The extreme storm contemplated is the once in one- hundred- year event, the extreme seismic event is assumed to occur, if at all, only once in 10,000 years.

Living as we do today, with the clear evidence that weather patterns are beginning to reflect new extremes on a regular basis, it does not seem reasonable to propose that the worst storm will exhibit 2 consecutive days of 24-hour heavy rain during the 500-550 years the proposed NSDF needs to maintain its integrity.

And in spite of the calculation/guess/bet by CNL that an earthquake of a magnitude sufficient to damage the integrity of the NSDF will not happen soon enough to interrupt the operation of the NSDF, or breech the closed NSDF, to the point of releasing dangerous radioactivity, there remains at least one reasonable, unanswered possibility.

The Ottawa River is a southerly extension of the Timiskaming watershed which is dammed upstream of Chalk River. Because the watershed sits within the West Quebec Seismic Zone, one of North America’s larger seismic faults, it is vulnerable to major earthquakes. In 1935 an earthquake of magnitude 6.2 on the Richter scale and 7 on the Modified Mercalli Scale was named the Timiskaming Quake. In my youth I met people in the Pembroke area who remembered that quake with genuine fear.

The Timiskaming watershed has many dams, as does the section of the Ottawa River north of Chalk River. A major quake in the West Quebec Seismic Zone has the potential to damage one or more of these dams, releasing a torrent of water downstream.

And in 2015 we had a foretaste of the surprises that, even without a seismic event, the Timiskaming watershed can unleash:

High water level expected on Lake Timiskaming - Flood warning

For immediate release

TÉMISCAMING, Quebec, December 24, 2015 – Public Works and Government Services Canada (PWGSC) wishes to advise the public that as a result of significant rainfall over the last week in the northern portion of the Ottawa River basin, water levels along the Ottawa River and on Lake Timiskaming have increased significantly. Also, due to more rain expected in the next week, the water level on Lake Timiskaming may rise above normal operating conditions. The Timiskaming Dam Complex is currently passing its maximum discharge capacity being limited to the Quebec portion of the dam because of construction on the Ontario portion of the dam.

Residents of the watershed are reminded that current runoff flows are cold and fast-moving. Streams and lakes should be avoided.

PWGSC will continue to monitor weather forecasts, river flows and water levels.

This message will remain in effect until conditions change.

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I continue to believe that neither CNL, nor the staff of the CNSC, have taken the seismic surrounds of Chalk River into proper consideration. I also fear their willingness to accept low estimates of heavy storms or tornadoes that could severely damage the NSDF are unwarranted

. first, because I think those estimates won't be accurate given the new climate patterns we can expect, and

. second, because I am not convinced the measures designed to protect the integrity of the Engineered Containment Mound would withstand large storms, water invasions triggered by seismic events, or ground shifts triggered at the site by a seismic event.

The greatest vulnerability of the ECM is likely not its bottom or top, but its sides. Recognizing this, CNL is now planning to extend a sloped "perimeter" around the ECM where the mound rises 15 -18 meters above the ground.

CNL Environmental Impact Statement, May 2021, p.183

"The perimeter berm side slopes will be 3 horizontal (H) to 1 vertical (V) with a 7m width at the top. Heights of the perimeter berm will vary from 2m to 15m. The perimeter berm height is the height of compacted free-draining fill, and not the ECM perimeter sidewall height that contains the waste. Depending on the location around the ECM, the ECM perimeter sidewall consists of free-draining fill (compacted), bedrock, or a combination of the two."

Although this extended perimeter may shed heavy amounts of water away from the elevated sides of the ECM, it may not be sufficient to prevent that water from below-surface penetration of the sides of the mound.

CNL intends to deposit waste in 10 cells, each cell to contain roughly 10% of the total waste. Keep in mind that though waste is being deposited one "cell" at a time within the ECM, and CNL proposes to cover each cell as it is filled and to "compact" the waste placement with fill, including on the side of the waste that is on the edge of the interior wall and that the interior wall has no other real support but carefully chosen and well-packed fill and clay. I don't doubt the statements by CNL and SNSC representatives that the superior-quality geo-membrane liners proposed for placement in the "sideslope lining system" are better protection from earthquake vibrations than concrete or steel. But I do doubt the wisdom of siting this NSDF in a well-documented earthquake hazard zone, 1.1 kilometer from the Ottawa River.

Table 8.4 of CNSC staff's Environmental Assessment Report (Jan 2022), page 117, contains the following:

"The ECM is designed to retain its containment under a strong earthquake with an annual probability of 1:10000. However seismic analysis of the ECM has shown that sandy soil below the ECM footprint could potentially liquefy under a 1:10000 earthquake. As a mitigation measure, CNL has proposed to remove the sandy soil under the berms down to the bedrock and replace it with compacted fill. During the pre-closure period, any damage to the ECM due to seismic activity will be responded to."

That's supposed to be reassuring?

The same section of Table 8.4 continues:

"During the post-closure period, the impact to human health and the environment from a beyond-design basis earthquake is shown to meet acceptable criteria under several scenarios, which consider failure of the berm and a series of landslides."

Surely that will depend on whether the waste that could be landsliding is still radioactive?

Section 4: What goes Into the NSDF?

If we examine what little information is provided on the exact amount of radioactivity is expected to outlast the operations stage of the ECM, as noted earlier, the most detailed information is provided in the third draft of CNL's Environmental Assessment dated May 2021.

In Table 3.3.1-2: CNL presents the **NSDF Reference Inventory and Licensed Inventory.** The table lists 31 Radionuclides, with half-lives ranging from 5 years to 14,000,000,000 years. It identifies the Predominant Decay Emission for each and provides a Total Reference Activity in Becquerels/gram at Emplacement, and a Total Activity (B/q) at Closure of the NSDF. Finally it provides for each a Licensed Inventory which is the Maximum Activity (B/q) at Placement, and a Maximum Activity (Bq) at Closure. (some underlining added)

The introduction to Table 3.3.1-2 includes the following information: p 3-26

"An estimation of the total inventory is required for the safety assessments in which the inventory is tested against selected scenarios to determine the long-term consequences of the proposed facility. It also informs design criteria for NSDF Project components such as the WWTP. [Waste Water Treatment Plant]

The reference inventory (Table 3.3.1-2) establishes a representative radionuclide inventory by considering waste already in storage and waste forecasts from environmental remediation and decommissioning projects data to predict an assumed total volume of waste at the NSDF at time of closure. The NSDF Reference Inventory has been used to inform the design and safety analyses.

In the third iteration of the Post-Closure Safety Assessment (Arcadis and Quintessa, 2020), a recommendation was made to lower the maximum radioactivity of two radionuclides listed in the reference inventory, to support the claim that future public doses in the post-closure phase will be well below the long-term dose acceptance criteria. The Licensed Inventory is a modified reference inventory, and represents a maximum radiological inventory limit for the NSDF. The Licensed Inventory is part of the NSDF safety and licensing basis, and represents a maximum radiological inventory limit for the NSDF. In the Licensed Inventory, the radioactivity of both I-129 and Pu-239/Pu240 were reduced to 58% of the reference inventory values. All LLW that is expected to be generated has been meticulously described, or "characterized", before its generation to ensure the cumulative total inventory of the NSDF is tracked against the licensed inventory (Table 3.3.1-2)"

So, by May 2021, CNL had decided to lower the amounts of 2 elements in the "Licensed Inventory" for the NSDF. Iodine -129 has a half-life 15,700,000 and Plutonium 239-240 has a half-life of 6,650 - 24,100 years. There is no explanation of why only those two were selected. Is it because otherwise the amounts of these particular radionuclides deposited in the NSDF would be extremely large? Or because they would be most easily identified in the "unseparated" mix of Low-Level and Intermediate- Level waste and /or most easily separated? There is no further CNL commentary on the matter of how the "Licensed Inventory" of particular elements was established or marked for change. Further, I could find no reference to the way in which the Licensed Inventory was determined in the CMD 22-H7, the CNSC staff Environmental Assessment document prepared for the Feb 22, 2022 hearing.

About the overall design that is being proposed for the NSDF, it seems fair to say that it is meant to accommodate waste on a site that is far less than ideal.

It is certainly proposed to contain waste that is less than ideal for a Near Surface Disposal Facility as is indicated by the SCOPE section of the IAEA Specific Safety Guide No. SSG-29, Near Surface Disposal Facilities for Radioactive Waste, 2014, p.p.4-5

"SCOPE 1.11. The term 'near surface disposal' is used in this Safety Guide to refer to a range of disposal methods, including the emplacement of solid radioactive waste in earthen trenches, above ground engineered structures, engineered structures just below the ground surface and rock caverns, silos and tunnels excavated at depths of up to a few tens of metres underground. This Safety Guide provides general guidance for the development, operation and closure of facilities of this in INTERNATIONAL ATOMIC ENERGY AGENCY, Siting of Near Surface Disposal Facilities, Safety Series No. 111-G-3.1, IAEA, Vienna (1994).

2 The term 'development' covers all stages before operation of a near surface disposal facility. It includes siting, design, construction and commissioning.10 5 type that are suitable for the

disposal of VLLW and LLW [8]. This Safety Guide does not apply to intermediate level waste (ILW) that will not decay to safe levels over a period of a few hundred years or to high level waste (HLW), as both are unsuitable for near surface disposal.

The reference above to Section 8 is a section of this Specific Safety Document (pp-80-82) which describes the painful steps required to be performed if an existing NSDF is found not to have the features now identified as necessary to meet IAEA requirements.

The CNL proposal for the Chalk River NSDF began in 2016 as one that would contain Low Level and Intermediate Level Nuclear Waste, and now proposes to contain only Low Level Waste along with waste which would, by itself, be categorized as Intermediate or even High-Level Waste, except that it will be so co-mingled with Low Level waste that it is not "practical" to propose separation. This co-mingled waste would be packaged before it is deposited in a cell of the ECM.

CNL's calculation is that this specially-packaged waste will make up 134,000 cubic meters of the 1 million cubic meters to be placed in the ECM. That 13% of the planned waste content of the ECM contains some long-lived and dangerous radioactivity. CNL projects that only 2 of 5 of these radionuclides - Cobalt-60 and "Gross Beta" -whatever that is supposed to signify- would require special "treatment" in order meet the "effluent discharge limit" CNL proposes.

Many of the Beta-emitting radionuclides that will be placed in the NSDF are long, long-lived. Their hazardous radioactive power will certainly outlive the operations phase of the NSDF (550 years). This means that if the waste system of the ECM is disturbed, either during the construction phase, the operations phase, or the closed phase, prompt and effective mitigation measures would be required.

Section 5: Mitigation of Potential Problems

The link *https://www.nuclearsafety.gc.ca/eng/the-commission/hearings/cmd/pdf/CMD22/CMD22-H7.pdf*

Contains two documents – first the CNSC staff's document for members of the Commission, and second the staff's January 2022 Environmental Assessment Report, which begins at p.182 of the link. Beginning on page 55 of this EA Report there is a **Table 6.1** – *"a summary of the maximum predicted wastewater [contaminant] concentration for surface water quality from either of 2 model scenarios".*

Those scenarios are:

1. *50% discharge to East Swamp Wetland via exfiltration gallery and 50% discharge to Perch Lake concentration before treatment as well as the maximum range of modelled results, or*
2. *100% discharge to Perch Lake."*

Table 6.1 also presents a "target" level for effluent discharge and a "maximum range of modeling for surface water quality (after treatment)", as well as a prediction about where any over-target effluent might find its ultimate resting place.

Table 6.1 thus provides some key information about the CNSC staff judgement about the efficacy of the available treatment /mitigation efforts. A review of two sections of Table 6.1, starting at page 55 and running to page 57, indicates eleven contaminants, and one condition(hardness), which will exceed "effluent discharge targets" of "Water quality modeling results" for discharges in the two discharge scenarios:

. **Scenario 1**: 50% discharge to East Swamp Wetland via exfiltration gallery and 50% discharge to Perch Lake

. **Scenario 2**: 100% discharge to Perch Lake

Those eleven COPCs (or Constituents of Potential Concern) in the first part of Table 6.1 are

Aluminum, Barium, Chromium, Copper, (Hardness,) Iron, Lead, Nitrite, Phosphorus, Selenium, Silver, and Sulphate. Their "Maximum range of modeling results for surface water quality, <u>after treatment</u> are indicated in **bold** numbers. Five of these elements would be above the "target"limit and are predicted to pass through the Perch Creek and Perch Lake settlement stages and reach even the Ottawa River – those five are Aluminum, Copper, Iron, Lead and Phosphorous.

Radionuclides that are above the "Maximum range of modelling results for surface water quality" (before treatment) and(after treatment) are reported on page 57 of the same table. The indication that effluent "discharge limit is exceeded" is not shown in the same manner (**bolding**) as was the case for non-radiological contaminants, but by a *.

Both Cobalt-60 and "Gross beta" have asterisks for "Maximum predicted wastewater concentration" (before treatment). And for each the "Maximum range of modelling results for surface water quality (after treatment)" is shown to cover a wide range.

Cobalt 60 , which was predicted to have a wastewater concentration of 1300 Bq/L before treatment, with an "Effluent discharge target" of 40 Bq/L, is expected to have a range of 0.038

– 14.572 Bq/L after treatment. In other words, the expected result of treatment puts the Cobalt 60 radioactivity well within the "target" level.

But "Gross Beta" is different. During the "Existing baseline water quality data ranges for all assessment nodes between 2010 to 2018" , the Gross Beta waste category was found to have a range of 9 to 293 Bq/L . Looking to the NSDF projected wastewater concentrations for effluent discharge, the target for Gross Beta radionuclides is set at 5 Bq/L. After treatment, the range of "results for surface water quality" for Gross Beta is estimated to be in a range of 0.046-293 Bq/L following treatment. This appears not to be a very dependable treatment at all!

In no case of radionuclides examined in Table 6.1 is there a prediction of the "Waterbody where effluent discharge limit is exceeded". (N/A) In other words, we have no prediction about whether a treated and "safe" level of Gross Beta will end up in the Ottawa River and no prediction about whether unsafe levels of Gross Beta will become deposited in the Ottawa River.

The lumping of elements as "Gross Beta" is not defensible. As noted, there also appears to be a major mistake in the presentation of "before" and "after" treatment estimates for Gross Beta.

Further, because most of the non-radiological COPCs (Constituents of Potential Concern) were predicted to meet wastewater concentrations below "target", most would not require treatment. But those with concentrations higher than target would show "treatment of these constituents prior to discharge is required".

But *"Where the maximum range of modelled surface water concentration results exceed effluent discharge targets, any incremental change in concentration to the Perch Creek and Perch Lake watershed from the NSF are not expected to be measurable in the Ottawa River and the downstream environment. All recorded exceedances of the effluent discharge limit in the Ottawa River were reflective of the baseline concentration already being higher than the effluent discharge limit. Regardless, CNL has indicated the effluent will be treated and tested prior to release into the environment."* (CNSC Environmental Assessment Report, pp. 57-58)

Why does this leave the impression that it's very nice of CNL to take these "over-target" contamination figures seriously when, in reality, over-target effluent figures measured in the Ottawa River reached "baseline concentrations already being higher than the effluent discharge limit" ?

Also "COPCs from the effluent are not expected to be measurable beyond existing baseline conditions in the Ottawa River after the Perch Creek confluence. Aquatic life and drinking water sources are not likely to be affected by treated effluent from the WWTP."(underlining added)

Pardon me if I find this kind of analysis rather disturbing. Overall I find it to be loose and not reassuring. I am therefore not impressed that the CNSC staff deemed "all environmental assessment and licensing documents acceptable", July 2021.

Section 6: What if the NSDF suffers "short-term" leaks?

I was an observer of the February 22, 2022 meeting of the Commission as it heard from CNL (and CNSC staff). Commission members asked about the possibility of Environmental Containment Mound or ECM leaks.

They were assured that leaks would be detected and that waste water treatment can be varied and adjusted. They were told leaks in the lower level of the drainage systems would be detected and corrected. If leaks created COPCs in the Perch Creek-Perch Lake systems it would take 8-10 years for any such COPCs to travel to the Ottawa River.

But what of leaks involving "Gross Beta" radioactivity? The result of leaks would surely be determined by what the leaking radionuclides actually are, and what the half-life of radioactivity associated with each might be at the time the leaks occurred. Not all leaks would offer the same level of threat.

We know that the material to be placed in the ECM is not only Low-Level waste. Some of it will also be Intermediate and even High– Level and intermingled with L-L waste in a manner that is not "practical" to separate. Some of it will be dangerous for a long time. (See p. 69 0f 170 pages prepared by CNL Staff ,"Commission Member Document for Licensing Decision" CMD22 H-7.1)

"Radiologic Content

The NSDF will contain only low-level radioactive waste. Low-level radioactive waste contains primarily short-lived radionuclides (i.e., half-life ≤30 years) and restricts the number of long lived radionuclides (i.e., half-life > 30 years); thus, isolation and containment are only required for periods of time up to a few hundred years. Long-lived radionuclides are included in the NSDF inventory as they are intrinsically part of the radiological fingerprints of waste streams at CRL and other CNL sites, and are listed in Table 5. It is not practical, technical, or economical to separate the long-lived radionuclides from the waste streams, especially since many of the waste streams are in the form of soil and building debris. However, the concentrations of long-lived radionuclides that are proposed in the NSDF inventory are limited, consistent with CSA N292.0 General principles for the management of radioactive waste and irradiated fuel [49] and IAEA GSG-1 Classification of Radioactive Waste [4] guidance."

This is followed by ***Table 5: Proposed Radionuclides in CNL's NSDF*** *(p. 70)*

Table 5 lists 31 radionuclides. Among these, Cobalt 60, has been identified as the element with the lowest half-life (5 years). As has already been noted (see page 11 above in this submission) only "Gross Beta" radionuclides have been identified as being "above target", even after "treatment", by the CNSC staff Environmental Assessment Report. Among the thirty other radionuclides the half-lives identified in Table 5 range from 12 years (Tritium) to 14 billion (Thorium- 232) .

CNL suggests that the radioactivity of these elements within the ECM will decrease about 2,000 times in the first 100 years of the NSDF operations and will "begin to approach background [radioactivity] concentrations of the local soils". (p. 70)

The Engineered Containment Mound design life of 550 years has been established to meet the required time period to allow for radioactive decay of the waste inventory, as illustrated in Figure 18. The radioactivity concentration in the Engineered Containment Mound decreases by about 2,000 times in the first 100 years and begins to approach background levels of concentration shortly thereafter. After the initial rapid decay of the shorter-lived radionuclides, the radioactivity concentration begins to approach the natural background concentrations of the local soils. By the time the facility begins to experience degradation of barriers, the radioactivity concentration will have decayed even closer to background levels. In fact, at the time the engineered barriers no longer provide significant physical containment, 99.991% of the disposed inventory will have decayed and only 0.005% is available to be released from the Engineered Containment Mound. This negligible environmental release is the reason the radiological consequences to both human health and the environment are acceptable[y] low, as presented in Section 5.5. (p.p. 70-71, CNL Commission Member Doc CND22 H-7.1)

But is a radioactivity concentration "closer to background levels of concentration" shortly after the first 100 years" an acceptable design target?

The members of the Commission should know by now that serious questions have been raised about the accuracy of the CNL (and subsequently the CNSC) estimation of the "background concentrations of the local soils" at the CNL location. But beyond that issue, the description of the Waste Acceptance Criteria for the NSDF as providing *a "limit of 400Bq <u>on average</u> for long-lived alpha-emitting radionuclides"* and *"Similarly, for long-lived beta and/or gamma emitting radionuclides, the <u>allowable average activity concentration</u> is 10,000Bq/g."* (P.72 ,CNL Commission Member Doc, <u>underline added</u>)

This makes no sense. Averaged over what? A cell-placement, the whole NSDF?

I next turn again to Section 6.2.1.of the CNSC Environmental Report Jan 2022, p.53, and read consecutively through p.59.

Once again I draw attention to Table 6.1. There are many non-radiological substances that, even after treatment, will be in excess of "target" levels of effluent contamination. And there

also appears to be unspecified “Gross Beta” radionuclides which will continue to exceed target even after treatment.

It’s all very well to do projections of the insignificance of the mix of Gross Beta elements and how they will have dramatically diminished after the NSDF has operated for 550 years, but what about after 25 years, and 60 years, or another reactor problem (an SMR) at the site?

The Indigenous Peoples of Canada beg us to consider what effects we produce in our Environment for 7 generations, but that is just a portion of the time some of these elements must be prevented from afflicting life.

It’s clear that CNSC staff are extremely sensitive to the possibilities for NSDF damage to the environment from construction activities through to closure. (pp 72-73 CNSC staff Environmental Assessment Report Jan 2022)

“Without mitigation, NSDF Project activities have the potential to alter soil quantity, quality, and distribution as well as geomorphology as a result of construction and closure activities. Blasting activities, site grading, excavating, and emissions of air contaminants could change soil quality during construction. The construction of the NSDF Project will physically alter groundwater levels and flows and surface drainage. During operations, discharge of treated effluent could cause changes to groundwater quality, levels, and flows. During the post-closure phase, without mitigation, leakage of leachate could cause changes to groundwater quality. Examples of design features and mitigation implemented to limit these potential effects to geology and hydrogeology include the following:

- *Physical changes to the bedrock from blasting will be limited to the local area within the Engineered Containment Mound footprint.*
- *The base liner design includes both primary and secondary liner systems that are designed to have redundancy in case of premature failure and are designed to be suitable for the disposal of low-level radioactive waste.*
- *The Surface Water Management Plan developed for the NSDF Project, which includes appropriate management techniques for erosion and sediment control, will be implemented.”*

CNL addresses geological issues, but….

"The residual effects of the NSDF Project on geology are related to changes in soil quantity, soil quality, and geomorphology as a result of construction of the NSDF Project and changes to soil quality from blasting activities and air emissions. Mitigation and environmental design features implemented for the NSDF Project include existing practices at the CRL site and those used at similar facilities. Consequently, changes in geology are not expected to result in significant adverse effects to other valued components (e.g., terrestrial environment). " CMD 22-H7.1 CNL presentation document for Commission Members p.91.

Their Environmental Assessment Report of Jan 2022 indicates CNSC staff are serious about the need to address both geology and groundwater quality, but their conclusion is that final judgement will be based on whether CNL's "commitments" are carried out effectively:

"6.4.2 Changes in groundwater quality Proponent's assessment of potential changes to the environment, mitigation, and monitoring:

The GWMP at the CRL site includes annual and semi-annual water level measurements, sampling and analysis from 180 monitoring wells and boreholes at 32 locations on the CRL site. The proposed NSDF Project site has not previously been used for storage of waste and other materials, and as a result, there is no long-term groundwater quality data for the footprint directly beneath the proposed location of the ECM[[Engineered Containment Mound]. However, monitoring wells in and adjacent to the NSDF SSA [Site Study Area] were included in the GWMP.[Ground Water Momitoring Program]

Bedrock groundwater quality throughout the CRL site demonstrates consistent variations with groundwater depth. Shallow groundwater, to depths of 100 metres, is dominated by sodium and bicarbonate, with pH values between 7.0 and 8.0. Deeper groundwater, between depths of 100 metres and 900 metres, is consistently alkaline with a pH value of approximately 9.0.

The overall water quality at the two monitoring wells east of the NSDF Project site (i.e., FR-3 and GD-42) is classified as diluted calcium/sodium bicarbonate, with sulphate and chloride as other dominant anions. Groundwater samples from these two monitoring wells show the consistent presence of tritium, but gross alpha and beta activity have consistently remained low (either below detection limit or less than 1 counting standard deviation above detection limit since 2007). Long-term groundwater quality to the west of the proposed ECM footprint has been characterized through both the GWMP [Ground Water Monitoring Program] and a series of detailed evaluations of subsurface contaminant distributions for facilities such as the chemical pit, WMA [Waste Management Area] A, and reactor pit 2. Downgradient of the chemical pit (a legacy fluid dispersal area), slightly elevated concentrations of mercury, lead and uranium have been observed in groundwater. No elevated concentrations of mercury or other heavy metals have been detected downgradient of WMA [Waste Management Area] A or reactor pit 2. Based

on results of routine groundwater monitoring conducted since 1997, as well as detailed plume monitoring, it can be concluded that these facilities do not make a considerable contribution to inorganic parameter concentrations in the groundwater, and contaminants in the groundwater are not likely to impact ecological receptors as there is negligible direct exposure and rapid dilution in the receiving water (East Swamp).

During the operations phase of the NSDF Project, changes in groundwater quality could be caused by discharge of treated wastewater to the ground and East Swamp via the exfiltration gallery. However, these effects are expected to be negligible, as effluent will be monitored to verify that discharge targets are being met.

Leakage of leachate from the ECM during the post-closure phase of the proposed NSDF Project could result in changes to groundwater contaminant concentrations. During the post-closure phase of the NSDF Project, the final cover, leachate collection system, and water treatment systems will no longer be maintained. During this phase, rain may infiltrate though the final cover into the waste and then enter the groundwater flow through a breach in the base liner.

CNL has proposed several mitigation measures to reduce the effects of the NSDF Project on groundwater quality throughout all project phases. These measures, as listed in CNL's commitments report, include:

• provincial guidelines and are protective of the environment and human health

• treated effluent will be sampled to confirm that it meets the effluent discharge targets before release to the environment

• exfiltration gallery will promote the exfiltration of treated water into the local groundwater regime, where further retention of radioactivity by the geosphere is anticipated

• the waste acceptance criteria developed for the NSDF Project will limit the level of contamination and types of waste to be disposed in the ECM and therefore limit the magnitude of potential changes to surface water and groundwater quality

• limitation of the level of contamination and types of waste to be disposed in the ECM, which in turn will limit the magnitude of potential changes to surface water and groundwater quality

• all runoff will be directed to collection ditches for treatment prior to discharge

• implementation of procedures to identify spill occurrences and initiate emergency responses

• construction of final cover system will promote shedding of surface water (or the runoff of water from the surface of the mound) to mitigate infiltration into the mound. Proposed follow-

up monitoring program measures for effects on groundwater quality, also listed in CNL's commitments report, include:

• groundwater elevation measurements to determine groundwater flow directions and gradient

• sampling to confirm groundwater quality to detect potential impact of leachate from the ECM [Engineered Containment Mound]

• groundwater monitoring to occur through all phases of the project and to be adjusted (parameters, location, frequency) as required based on annual review of monitoring data. A GWMP [Ground Water Monitoring Program] specific to the NSDF Project will be developed by CNL to monitor groundwater hydraulics and quality in both vertical and horizontal orientations along the critical flow pathway, with an emphasis on locations downgradient from the ECM. The GWMP will be compliant with Canadian Standards Association (CSA) N288.7-15 Groundwater Protection Programs at Class 1 nuclear facilities and uranium mines and mills, and integrated into the overall CNL groundwater monitoring program. Groundwater monitoring will continue through operation, closure, and post-closure phases." p.p.72-73 Environmental Assessment Report, CNSC, Jan 2022.

Section 7 : The License Application

To sum up: CNSC staff are telling the Commission to approve the <u>construction</u> of the NSDF and count on CNSC staff to make sure CNL carries out all the monitoring it has promised and successful remediation of whatever problems are revealed.

It is my strong belief some problems that could arise may not be possible to "remediate".

I disagree with the position CNSC staff have taken in recommending construction when remediation may not be possible. I also believe once the NSDF is built at a cost of $345 million and operating (if the project licensing actually gets that far) that CNSC staff will find it near-impossible to recommend the NSDF be closed.

I do believe that the "legacy" wastes at the CRL must be dealt with. I also firmly believe no more nuclear waste should be generated or received at the CNL site. Adding the proposed new "hot cell" laboratories or new SMR waste is both insupportable and downright foolish.

We need a whole new approach to the awful nuclear waste problem at Chalk River. The current CNL application for a license to construct the NSDF should be denied.