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Written submission from Northwatch

Mémoire de Northwatch

In the Matter of the

À l'égard de

Canadian Nuclear Laboratories, Douglas Point Waste Facility

Les Laboratoires Nucléaires Canadiens, installation de gestion des déchets de Douglas Point

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Application to amend the waste facility decommissioning licence for the Douglas Point Waste Facility

Demande de modification du permis de déclassement de l'installation de gestion des déchets de Douglas Point

Commission Public Hearing

Audience publique de la Commission

November 25-26, 2020

25 et 26 novembre 2020

Canada

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NORTHWATCH

October 26, 2020

Canadian Nuclear Safety Commission
280 Slater St., P.O. Box 1046
Ottawa, Ontario K1P 5S9

Email: cnsc.interventions.ccsn@canada.ca

Ref. 2020-H-04

Dear Members of the Commission:

Re. **Application to Amend the Decommissioning Licence for the Douglas Point Reactor**

On February 6, 2020 the Canadian Nuclear Safety Commission (CNSC) issued a notice that it would hold a public hearing on June 17 and 18, 2020 to consider an application from Canadian Nuclear Laboratories Limited (CNL) to amend its waste facility decommissioning licence for the Douglas Point Waste Facility (DPWF). The hearing was later rescheduled to August, and then to November 2020.

The Canadian Nuclear Energy Alliance (CNAE), operating under the name of the Canadian Nuclear Laboratories Limited (CNL), has applied to amend the waste facility decommissioning licence for what is referred to in the application and other documents as the Douglas Point Waste Facility (DPWF). The DPWF is comprised of the former 200 MW Douglas Point Power Reactor – a permanently shut down, partially-decommissioned prototype CANDU (CANada Deuterium Uranium) reactor - and associated buildings, structures, and ancillaries. The DPWF has been in Storage with Surveillance (SWS) for more than three decades.

The Douglas Point Reactor / Waste Facility is located on the Bruce Power site in Tiverton, Ontario, occupying 5.5 hectares within the 923 hectare Bruce nuclear site complex located within the Municipality of Kincardine, on the eastern shore of Lake Huron. The nuclear complex includes the Bruce Nuclear Generating Station (four reactors at each of Bruce A and Bruce B), Ontario Power Generation's Western Waste Management Facility, an additional Radioactive Waste Storage Area, and the Douglas Point Reactor which was shut down in 1984. Two heavy water plants were also on the site, but have been decommissioned. The Douglas Point Reactor was located immediately adjacent to the eastern shore of Lake Huron, as is the "waste facility" currently subject of the decommissioning application amendment request.

The Douglas Point reactor was permanently shut down in 1984 and has been in Phase 2 of decommissioning – storage with surveillance – since 1988. CNL is now requesting a licence amendment to authorize Phase 3 of the DPWF decommissioning project, which would include the active decommissioning and demolition of remaining facilities. The Douglas Point facility is owned by Atomic Energy of Canada Limited (AECL), a federal Crown corporation, and was operated by Ontario Hydro (now operating as Ontario Power Generation (OPG). The facility remains the property and liability of the federal government.

Since 2015, CNL has been managing the DPWF site under a Government–Owned, Contractor-Operated (GoCo) model under agreement with AECL who retains ownership of the site and its associated liabilities on behalf of the Government of Canada[1] Under the GoCo arrangement CNL was created and CNEA was awarded the contract, initially for six years and now extended by an additional four years until 2025.[2] As Northwatch has previously raised with the Commission, the arrangement raises questions about the respective roles and responsibilities of AECL, CNL and CNEA, including who the licensee is, i.e. AECL or CNAE, who the licensee is, i.e. AECL or CNL, and who should be authorized to prepare and submit license applications, i.e CNL or CNEA. Throughout, it is unclear and unstated whether certain players are performing as CNL or CNAE.

Despite the questionable propriety of doing so, for the sake of brevity and consistency with the terminology used by CNSC staff, Northwatch will refer to the licensee and applicant as CNL, as if CNL was the actual and appropriate licensee and the application was made by CNL.

Northwatch's Interest

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario. Founded in 1988 to provide a representative regional voice in environmental decision-making and to address regional concerns with respect to energy, waste, mining and forestry related activities and initiatives, we have a long term and consistent interest in the nuclear chain, and its serial effects and potential effects with respect to northeastern Ontario, including issues related to uranium mineral exploration and mining, uranium refining and nuclear power generation, including on the Bruce region, and various nuclear waste management initiatives and proposals.

Northwatch has a longstanding interest in the management of nuclear waste, as well as other environmental and social impacts of using nuclear power for the purpose of electricity generation. Our interests are primarily with respect to the impacts and potential impacts of the nuclear chain on the lands, water, and people of northeastern Ontario. Our interest in nuclear waste was initiated by proposals dating back to the 1970's to site nuclear waste "disposal" projects in northern Ontario. There have been numerous proposals over the last several decades, including proposals for the import and burial of high level waste in the 1970s and 1980s and for low level waste in the 1990s. Currently there are two municipalities who remain engaged with the Nuclear Waste Management Organization in a siting process for a proposed deep geological repository for high level nuclear fuel waste, one in southwestern Ontario and one in northwestern Ontario. The Revell Lake area in northwestern Ontario, between Ignace and Dryden, continues to be associated by the NWMO with the municipality of Ignace, despite its considerable distance outside the municipal boundaries of Ignace.[3]

The decommissioning of the Douglas Point reactor and associated facilities is of interest because of its close proximity to Lake Huron and the subsequent potential for adverse effects on the North Channel and North Shore of Lake Huron, Manitoulin Island, and the broader Great Lakes ecosystem, and because the decommissioning of the reactor will result in the generation of low and intermediate level radioactive waste and required the disposition of low, intermediate and high level nuclear waste.

Status of the Site and Site Decommissioning

According to CNL's submissions, during the licensing period of 2014-20191, several Non-nuclear buildings and structures were removed after securing CNSC staff acceptance of their respective Detailed Decommissioning Plans (DDPs) to reduce AECL's overall liability and cost incurred to maintain the DPWF site and to prepare the site for final (Phase 3) decommissioning,. Those buildings included Guardhouse, Plate Shop, Machine Shop, Tool Crib, Emergency Coolant Injection System (ECIS) Tank, and the ECIS Bunker. The waste generated due to the removal of these Non-nuclear buildings and structures was predominantly Clean Waste (~99%), as stated by CNL.

CNL also states that "hazard reduction campaigns" including decontamination and removal of clean, hazardous, and radioactive wastes are ongoing at the DPWF. During 2014-2019, the waste removed as a result of hazard reduction campaigns was also largely Clean Waste (~91%).

During the 2014-2019 licensing period, CNL made reportedly made 13 shipments of the spent exchange resins i.e. Intermediate Level Waste (ILW) and 21 shipments of LLW to CRL and other licensed facilities.

At present the stored waste at DPWF includes 0.02 metric tons (MT) Hazardous Waste, 22,256 spent fuel bundles (High Level Waste, HLW) in 46 canisters, 6 m3 of solid ILW, and 103 m3 of solid Low Level Waste (LLW). These stored wastes and future decommissioning wastes will be handled and disposed in accordance with the provincial and federal regulations and guidelines. CNL's strategic plan is to relocate all of the DPWF's radioactive waste (i.e. stored waste and future decommissioning waste) to CRL except the spent fuel which will transfer to Nuclear Waste Management Organization's high level waste disposal facility. During proposed licensing period (2020-2034), CNL anticipates a total of approximately 20 shipments of LLW (with a total waste of ~200 m3) and 1 shipment of ILW (with a total waste of ~6 m3) from DPWF to CRL.[4]

All of the above is as reported by CNL and has not been verified by Northwatch.

On 2019 February 13, CNL informed CNSC staff of its intention to proceed with the physical decommissioning of the DPWF. Later on 2019 July 18, pursuant to the *Nuclear Safety and Control Act* and associated regulations, CNL submitted an application to the CNSC Secretariat to amend the current Waste Facility Decommissioning Licence of DPWF without changing the expiration date of December 2034 and authorize CNL to proceed with final decommissioning. CNL has requested to receive an amended licence with expiration date of December 2034 (i.e. 14 year licence) to align with the current license. CNL has also indicated that "a standard 10 year licence with expiration date of December 2030, would also align well with CNL's decommissioning timeline of the first three planning envelopes".[5]

High Level Nuclear Waste and its Management

According to CNL's CMD, the stored waste at DPWF includes 0.02 metric tons (MT) Hazardous Waste, 22,256 spent fuel bundles (High Level Waste, HLW) in 46 canisters, 6 m3 of solid ILW, and 103 m3 of solid Low Level Waste (LLW). CNL states that "these stored wastes and future decommissioning wastes will be handled and disposed in accordance with the provincial and federal regulations and guidelines.[6]

CNL states that their "strategic plan" is to relocate all of the DPWF's radioactive waste (i.e. stored waste and future decommissioning waste) to the Chalk River Laboratory site "except the spent fuel". During proposed licensing period (2020-2034), CNL anticipates a total of approximately 20 shipments of LLW (with a total waste of ~200 m3) and 1 shipment of ILW (with a total waste of ~6 m3) from DPWF to CRL.[7]

Northwatch relies upon and adopts the submissions of the Concerned Citizens of Renfrew County and Area and the expert report of Dr. Hartmut Krugman with respect to the proposed shipments to the Chalk River site.

CNL also states that their "strategic plan" is that the high level waste (spent fuel) "will transfer to Nuclear Waste Management Organization's high level waste disposal facility". [8]

According to the CNL CMD:

> "*Decommissioning of the Spent Fuel Canister Area (i.e. PE-D) can only be carried out after the spent fuel has been removed. As with all of Canada's spent nuclear fuel, Douglas Point's fuel will eventually be emplaced in the Nuclear Waste Management Organization's high level waste disposal facility. Once the selected site is announced - scheduled for 2023 - a decision will be made on whether to continue interim storage of the fuel at the Douglas Point site or to transfer it to central interim storage at the CRL site*.[9]

<u>Adequacy of Information Provided</u>

The General Nuclear Safety and Control Regulation Requirement (herein "General Regulations") sets out in Section 3 that:

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

Northwatch reviewed the application for this information, and found that instead of providing the required information in the application itself, CNL provided a reference to another document.

The following is found on pages 6 and 7 of the application:[10]

Requirement	*CNL Response*
(j) the name, quantity,form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored,managed, processed and disposed of at the site of the activity to be licensed.	*Specific information on radioactive waste and hazardous waste is presented in the Program Overview DDP Volume 1 (A-4) and the 2018 Annual Compliance Monitoring Report (A-13)*

Northwatch subsequently reviewed the referenced document, *Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview*.[11]

The referenced document contained several general descriptions of highly radioactive irradiated fuel waste but did not include an actual inventory or an adequate characterization of the high level waste or its condition or the condition of its current storage system.

The following information with respect to the volume and state of high-level waste was included in the *Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview*:

- all spent fuel was removed from the reactor and transferred to the fuel bay and after the construction of dry irradiated fuel storage facility at the Douglas Point site, in 1987 all spent fuel from "wet storage" in the fuel bays were transferred to dry storage[12]
- The spent fuel canister area, approximately 67 m by 56 m in size, is located to the east of the Turbine Building. A 0.6 m thick reinforced concrete slab, 43 m x 16 m, lies within this area and serves as a foundation for the storage structures that house the spent fuel. These storage structures consist of 47 poured-in-place concrete silos, or "canisters", arranged in three rows of 12 and one of 11; rhe canisters are cylindrical in shape with an outside diameter of 2.59 m and a height of 6.16 m. Out of the 47 canisters, 46 contain spent fuel and the other one was constructed to provide storage contingency.[13]
- the canisters have been kept under continuous security surveillance and subjected to periodic inspection and maintenance. It is expected that spent fuel will remain in the canisters until a suitable long-term disposal solution is developed.[14]
- there were repeated incidents of defective fuel resulting in radioactive releases, including: In 1969, fourteen confirmed defective fuel channels were detected and they resulted in radiological release; in 1970,duel sheath failures (similar to the incidents noted above) at a rate of one to two a month resulted in chronic fission product contamination of the heat transport system and bay water; in 1981 and 1982 a "considerable number" of fuel failures occurred resulting in significant increases in radiation levels and Fifty defect or suspected defect fuel bundles were removed from the reactor[15]

- In 1984 all spent fuel was transferred from the reactor to the fuel bays and in 1987 the spent fuel was transferred from wet storage in the reactor pool to dry storage in the dry storage facility[16]
- Purportedly there is an inventory updated annually and reported in the Annual Compliance Monitoring Report (previously known as Annual Compliance Report), but that inventory is not available to Northwatch [17]
- the spent fuel bundles were loaded into stainless steel fuel baskets, dried, seal welded and then transferred to dry, criticality-safe concrete canisters for storage[18]
- The Spent Fuel Canister Area (SFCA), is a dry-storage facility consisting of 47 poured-in-place concrete silos or canisters. Out of the 47 canisters, 46 contain spent fuel bundles and the other one served to provide storage as required, or potentially required, during routine/emergency fuel transfer operations.
- It is expected that the SFCA is to function effectively over the required period of a minimum of 50 years [5-28]. Since the completion of the spent fuel bundles loading in 1988, the canisters have been under a continuous surveillance and routine inspection and maintenance program. These surveillance, inspection, and maintenance activities for the SFCA, will continue to such time when spent fuel bundles are transferred to another suitable facility for long term storage and the SFCA is fully decommissioned.
- The main radiation hazard present in the SFCA, is due to the inventory of the radionuclides associated with 22,256 spent fuel bundles that were transferred from the Fuel Storage Bay in 1987 and stored in 46 canisters. Each canister contains nine fuel baskets with each basket having a maximum storage capacity of 54 fuel bundles. Each fuel bundle is a Zircalloy clad natural UO2, 19 element design weighing 16.7 kg, of which 15.3 kg is due to UO2.The dose rates, decay heat generation and radiological inventories with decay times for a typical spent fuel bundle with an average burn-up (i.e. 185 MWh/kgU), were calculated for 3-year and 10-year decay periods by using the ORIGIN code[19]
- At present, after 35 years into the SWS state, the total activity of the spent fuel bundles has decreased by decay to 15.56% of its original activity and will further reduce to 12.05% by 2025. Therefore, the fission products inventory and radiation levels of the spent fuel bundles have significantly reduced over the decay period.[20]

We note that while the DDP states that inventory is updated annually and reported in the Annual Compliance Monitoring Report (5-2), the DDP also states that "*A detailed waste breakdown for the Spent Fuel Canister Facility (i.e. Planning Envelope D) is currently not attempted. The spent fuel will be managed in the long term in a Deep Geological Repository, to be designed and built in a suitable location in Canada*." P 7-5 While it is possible that both of these things are true, they can only be true if the inventory is incomplete and does not include a detailed waste breakdown / characterization of the wastes that are placed in the Spent Fuel Canister Facility at Douglas Point.

What is not clear from the DDP is the degree to which CNL has characterized the irradiated fuel waste and – if this has been undertaken – the quality of that waste characterization. Generally,

Northwatch is left with the very strong impression that the irradiated fuel waste has not been characterized and that the CNL inventory of the irradiated fuel is more along the lines of a count-up rather than a characterization. And while it is certainly of interest to know the number, array, and general location of this waste (all of which is included above) this falls far short of the kind of characterization of these wastes required and expected at this point of time, when the licensee is proposing to move to "final" decommissioning.

The DDP does communicate important information about irradiated fuel waste and its current condition:

- The storage facility is comprised of a 47 poured concrete structures placed on a concrete slab
- During operation there were a large number of fuel failures and defects
- The various fuel failures, incidents and defects were the cause of significant radiological releases
- While the DDP describes the spent fuel bundles as having been loaded into stainless steel fuel baskets, dried, seal welded it is unclear as to what kind of containment was provided for the defective fuel bundles

What is does not communicate includes:

- How has the defective fuel been managed differently, i.e. what additional containment was applied to the defective fuel?
- What is the condition of the concrete structures, and have they performed and aged as predicted?
- What is the condition of the stainless steel fuel baskets, and have they performed as predicted?
- How has the current condition of the irradiated fuel and the stainless steel and concrete containers been established? For example, what observation, sampling, testing or other data collection has been undertaken?

CNSC staff have previously acknowledged that fuel defects are a precursor to public dose.[21]

Changes that alter the physical structure and mechanical properties of a fuel bundle can cause damage. For example, oxidation of the cladding weakens its mechanical properties and decreases its thermal conductivity. In-reactor corrosion can also lead to embrittlement. Any of the just described phenomena can lead to damage or even failure of the fuel bundle.[22]

Over longer periods of time, even micro-defects in fuel bundles – which effectively become waste containers after removal from the reactor core – have increasingly more significant potential consequences. Long term storage – either dry storage on site or some form of centralized storage – rely on a multiple barrier approach. The weakening of the first barrier by any means – corrosion, dryout, temperature fluctuations – can potentially lead to failure. This, in turn, may lead to or hasten the release of radioactive materials into the storage container and then, ultimately, into the environment.

REQUEST: CNL should provide a stand-alone report which is made publicly available on the condition of the irradiated fuel and the status, condition and performance to date of the storage containers and facility. This should be a detailed and referenced report and should clearly identify those aspects of the report are based on observation, testing and measurement and which aspects are based on predictions, estimated or modelling.

Long Term Containment of Irradiated Fuel Waste

A central element of decommissioning planning for a nuclear reactor is with respect to its most hazardous component: the irradiated fuel, also referred to by CNL as spent fuel and as high level waste.

CNL variously describes their plans for long term management of the irradiated fuel as follows:

> *The removal and relocation of the spent fuel from the DPWF for long term management will not take place until a suitable disposal facility for HLW and irradiated fuel becomes available in Canada. Until such time, the spent fuel may continue to remain on-site at the DPWF canister area. If the DPWF undergoes complete decommissioning before a suitable spent fuel disposal facility is available, one of the options will be to transfer the spent fuel to a similar facility at the Chalk River Laboratories for interim storage [6-13]*
>
> *At the time of decommissioning of Spent Fuel Canisters, the fuel bundles will be either disposed-off in a permanent spent fuel disposal facility, if available or transferred to CRL for interim storage; [p 7-1]*
>
> *Before the decommissioning of the Spent Fuel Canister Area begins, the spent fuel bundles will be transferred to a future Deep Geological Repository (DGR) for permanent storage. If such a facility is not available at the time of decommissioning the Canister facility, the spent fuel will be transferred to a similar canister facility at CRL or elsewhere for interim storage. The location of the DGR is being currently determined by the Nuclear Waste Management Organization (NWMO). [P 7-3]*

In nothing else, CNL is relatively consistent in these descriptions: their plan is to send the waste away, either to a facility which is not yet been sited, designed, developed by the NWMO but which intended, or to the Chalk River site for "interim storage" in a system that is not even described, here or elsewhere. More problematically, these descriptions are so hypothetical they can only be ranked as the equivalent of having no plan.

In the case of "Plan A", send the waste off to the NWMO, these assumption of off-site transfer relies on the perpetuation of the illusion that a convincing technical case has been made for geological disposal, and the ability of a geological repository – even as part of a multi-barrier approach – to effectively isolate and contain the wastes for a sufficient period of time.

In point of fact, there is currently no operating geological repository for used fuel, and for more than 40 years several countries have been depicting themselves at various times as being on the brink of operating a geological repository for used fuel, and yet none have, despite decades of effort and extremely large sums of public funding.[23] Canada, for one, is now further away from "opening day" of a geological repository than the nuclear industry considered it to be twenty years ago. The U.S. equally so.

As outlined in several international reports, there are a host of technical deficiencies of the geological disposal concept, and numerous unresolved technical issues, including the longevity of the containers, the availability of rock formations of the size and quality required, and the reliability of all of the computer predictions being made, to name a few.[24]
In addition to not having made the technical case for the geological "disposal" of used nuclear fuel, neither the federal government or the nuclear industry have convincingly made the social case for geological disposal.

This was a matter of great significance during the 10 year federal review of Atomic Energy of Canada Limited's geological disposal concept. In the end, the Panel concluded that broad public support was necessary in Canada to ensure the acceptability of a concept for managing nuclear fuel wastes and that the AECL concept for deep geological disposal had not been demonstrated to have broad public support, and the concept did not have the required level of acceptability to be adopted as Canada's approach for managing nuclear fuel wastes.[25]

In Canada, there are many indications that social acceptability will continue to elude nuclear fuel waste repository proponents, as has been the subject of several academic papers.[26] While the NWMO is currently engaged in a siting process through which they intend to contract a community to become the recipient of geological repository for nuclear fuel waste – in the case of the Revell Lake area in northwestern Ontario the NWMO intent appears to be to contract a municipality to accept a geological repository in an area that is distant to the municipality and considerable distance outside their municipal boundaries - the process is still in the preliminary stages (Step 3 of 9) and the outcomes are wholly unknown. To rely on such a conceptual notion as the NWMO's "Adaptive Phased Management" approach for the long term management of the nuclear fuel wastes currently in "storage" at Douglas Point is equivalent to saying that there is no plan, simply an idea, or – at best – a plan to have a plan.

CNL's version of "Plan B", to send the waste off to the Chalk River site for "interim" storage is wholly unsupported and unsupportable. CNL provides no information to support this notion, and it has all the appearances as having been offered only as a means of being able to check of the box "provided a contingency", presumably in anticipation of the criticisms that would inevitably be leveled at relying on the NWMO as the lone option for the long term management of high level nuclear waste.

CNL provides no information about the containment system, location within the CRL properties, the design features, the transportation requirements, the anticipated doses to the public or

workers that would be associated with the transfer, transportation, transfer, and interim storage and then the subsequent transfer, transportation, and transfer into some "permanent storage".

Given the obvious weaknesses of both CNL's "Plan A" and their "Plan B" the Commission must direct CNL to develop realistic long term alternatives for the management and isolation of high level radioactive waste. While the storage / containments requirements extend out into perpetuity, a realistic alternative that CNL should be directed to consider is extended on-site storage. Given the unknowns with the current Spent Fuel Canister Area (SFCA) and the era and circumstances under which it was constructed, it is not Northwatch's recommendation that the current SFCA be extended, but that CNL be directed to develop an

Increasingly, discussion both in North America and internationally is shifting to an examination of options related to extending on-site storage of nuclear fuel waste into the long or very long term, for periods ranging from 100 to 300 years.[27] The precise location of the waste management facility within the nuclear generating station boundaries may not be the most appropriate for extended storage that may reasonably be expected to be in place for 100 to 300 years. This will be particularly evident in light of the features of robust storage.

Three features make spent fuel storage more secure, in terms of potential security threats:

- Wastes are placed in a condition where it is passively safe, i.e. it does not rely on electrical power, cooling water or active ongoing maintenance
- The facility is "hardened", through layers of concrete, steel, gravel or other materials being placed – in various combinations – above and around the irradiated fuel waste
- The fuel wastes are dispersed, with the fuel spread more uniformly across the site rather than concentrated in a single area[28]

The feature of passive safety is key in making the waste more secure from human or operational error or natural events. In some situations and designs, dispersal can also be advantageous in keeping the waste secure from human or operational error of natural events.

Inarguably, there are benefits to taking a planned approach to extending on site storage, rather than simply have "short term" or "interim" storage extend over the long term simply due to program failure.

REQUEST: Direct CNL to develop as an alternative a plan for extended on-site storage of the irradiated fuel; this alternative should be developed as alternative to off-site shipments, and should include comparative costs and benefits (environmental, social and fiscal) of on-site versus off-site, which incorporate transportation impacts.

REQUEST: Encourage CNL to work collaboratively with Ontario Power Generation in examining options for the long term / extended storage of high level (irradiated fuel) wastes and intermediate level wastes on the Bruce site, including options to develop combined storage systems for the high and intermediate level wastes from operations at Douglas Point, Bruce A and Bruce B generating stations.

Conclusion

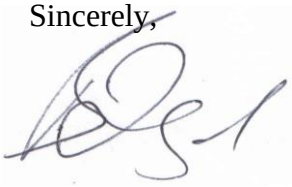
Having reviewed CNL's Application and supporting attachments, we draw the following conclusions:

- The recommendations set out in earlier sections of this submission should be adopted by the Commission
- CNL's request to amend their license, purportedly in order to accelerate decommissioning, should be denied for reason set out in this submission and the submissions of other intervenors

In addition to our own submissions, Northwatch adopts the submission made by the Canadian Environmental Law Association and the expert report and findings attached to their submission.

Thank you for your consideration.

Sincerely,



Brennain Lloyd
Northwatch

ENDNOTES

[1] CMD 20-H4.1 2020/09/10 page i

[2] As posted at https://www.cnl.ca/en/home/news-and-publications/news-releases/2020/cnea-awarded-four-year-contract-extension-for-t.aspx on 27 April 2020

[3] The Nuclear Waste Management Organization is currently studying the Revell Lake area in Kenora District as part of their nine step siting process for a geological repository for high level nuclear fuel waste. See www.knownuclearwaste.ca for details.

[4] CMD 20-H4.1 2020/09/10, page ii

[5] CMD 20-H4.1 2020/09/10, page ii

[6] CMD 20-H4.1 2020/09/10, page ii

[7] CMD 20-H4.1 2020/09/10, page ii

[8] CMD 20-H4.1 2020/09/10, page ii

[9] CMD 20-H4.1 2020/09/10, Page 22

[10] Application for License Amendment to Proceed with Phase 3 Decommissioning at Douglas Point Waste Facility, from Kristan Schruder, General Manager Decommissioning, Canadian Nuclear Laboratories, 22-CHHO-19-0008-L KS-2019-007, 18 July 2019

[11] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1: Program Overview, Douglas Point Waste Facility, 22-00960-DDP-001, Revision 1, December 2019

[12] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 1-1

[13] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 2-20

[14] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 2-20

[15] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 2-29, 2-32

[16] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 2-33

[17] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 5-2

[18] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 5-7

[19] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page 5-28

[20] Douglas Point Waste Facility Detailed Decommissioning Plan Volume 1, page Pages 5-10 and 5-11

[21] CMD 13-H2.1B, page 1

[22] “Evaluation of the Technical Basis for Extended Dry Storage and Transportation of Used Nuclear Fuel”, United States Nuclear Waste Technical Review Board, December 2010

[23] “Wasting the Future”, Australia, 2006 http://www.energyscience.org.au/FS08%20Radioactive%20Waste.pdf

[24] "Rock Solid? A scientific review of geological disposal of high-level radioactive waste", Dr. Helen Wallace, GeneWatch UK, September 2010, as foundo online at

http://www.greenpeace.org/raw/content/eu-unit/press-centre/reports/rock-solid-a-scientific-review.pdf

[25] Seaborn Panel Report for Nuclear Fuel Waste Management and Disposal Concept, 1998, as found online at http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=0B83BD43-1&xml=0B83BD43-93AA-4652-9929-3DD8DA4DE486&toc=show

[26] For example, see ""Nuclear Waste Management in Canada: Critical Issues, Critical Perspectives", Darrin Durant and Genevieve Fuji Johnson, 2010, details at http://www.ubcpress.ubc.ca/search/title_book.asp?BookID=299172872

[27] For example, see IAEA, "International Atomic Energy Agency (IAEA) Technical Meeting On Extending Spent Fuel Storage Beyond The Long Term", 22–24 October 2012 and Mcconnell1, Paul*, Brady Hanson2, Moo Lee3, And Ken Sorenson1 1Transportation Manager, "Extended Dry Storage Of Used Nuclear Fuel, Technical Issues: A Usa Perspective", US Department of Energy Fuel Cycle Technologies Program Received September 28, 2011

[28] For example, see Alvarez, Robert, et al "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States", Science and Global Security, 11:1–51, 2003 and Alvarez, Robert "Improving Spent-Fuel Storage at Nuclear Reactors", Winter 2012 and Thompson, Gordon, "ROBUST STORAGE OF SPENT NUCLEAR FUEL: A Neglected Issue of Homeland Security" Institute for Resource and Security Studies, January 2003