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Oral Presentation

Written submission from Anna Tilman

Exposé oral

Mémoire de Anna Tilman

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

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Submission to the Canadian Nuclear Safety Commission (CNSC)

with respect to

Canadian Nuclear Laboratories Ltd. Application for an Amendment to its Decommissioning Licence for the Douglas Point waste Facility

October 30, 2020

Prepared by

Anna Tilman

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OVERVIEW OF SUBMISSION

Introductory Comments

Canadian Nuclear Laboratories (CNL) has applied for an amendment to its decommissioning licence for its Douglas Point Waste Facility (DPWF). CNL is seeking a 14-year licence period from 2020-2034 that, in effect, would advance decommissioning activities to include clearing out the reactor building that was not part of its current licence.

In examining the proposed activities in CNL's submission, it is important to ensure that the best and most considered options regarding decommissioning activities are fully explored and are considered in the interests of the long-term health and safety of the region.

Thus, the overall focus of this submission is whether CNL's proposed methods and paths for decommissioning this facility in its entirety will properly and sufficiently address the radiological and non-radiological hazards posed by the nature of work involved, particularly with respect to the workforce engaged in this undertaking, and whether and to what degree these hazards may pose further risks than the facility already has had on the environment and the local community.

Because the current status of the facility is Storage with Surveillance (SWS), as it moves toward more clean-up activities and in time, the actual dismantling and decommissioning of nuclear facilities, it is essential that all relevant activities and plans, including in particular, the removal operations, waste management and storage, the transportation of wastes, emergency planning and responses, monitoring and surveillance, and protection of the workforce the community and the environment from exposure to radiation and other toxins, be carried out with the utmost caution and scrutiny.

Of major concern in reviewing submissions by CNL and the CNSC, is the characterization of the components of the waste, the methods that would be employed to "handle" the waste itself, and its containment, especially in the very longterm. In addition, it is also essential to recognize and address the potential impact of fugitive materials that would occur as a consequence of decommissioning and dismantling activities, as such materials, both radiological and non-radiological, would likely to become part of the atmosphere, and eventually be deposited on land and water bodies within the region of this facility.

These concerns apply to both radioactive materials and non-radioactive substances including for example, asbestos, lead, mercury and Polychlorinated Biphenyls in the waste, and the interactions of all such material in containment.

Thus, it is essential that measures be in place to routinely check the storage of the wastes, both nuclear and non-nuclear, to prevent any deterioration of the waste packaging, facilities and leakage of these toxic substances to the environment. Whether this hazardous waste would be or even can be "isolated" safely from the environment for the foreseeable future is currently unknown and unknowable.

This submission questions whether CNL's decommissioning plan for the DWMF has given appropriate and sufficient attention to these overriding issues. It also questions whether the emergency plans prepared in case of failure of containment are adequate and complete. Furthermore, it questions the findings and recommendations of the CNSC staff that the proposed decommissioning activities at the DWMF are "not likely to cause significant environmental effects (in accordance with section 67 of the *Canadian Environmental Assessment Act 2012*)" [CMD 20-H4, p.ii].

Where feasible, and based on what information is available, this submission also comments on the potential adverse effect that decommissioning work may have on the health and well-being of the local community and the workers carrying out the tasks involved. Of additional concern is the nature and frequency of inspections that need to be carried out by CNL and the Canadian Nuclear Safety Commission (CNSC) throughout the whole process of dismantling and decommissioning and for a very long time (indefinite) after.

It also questions the need for this project at this time, as it will not result in returning the Douglas Point site to its Greenfield state but only address some of the wastes. Furthermore, it questions what other options have been considered for the storage of this waste, in particular Low and Intermediate Level Radioactive Wastes (L&ILW), and whether shipping some of these wastes off-site as is currently being done to CNL's Chalk River Laboratories by the Ottawa River appears to be the only option on the table.

Further topics of note in this submission relate to categories of radioactive waste, the lack of an inventory for these wastes, the storage of spent fuel, the releases of radionuclides to air and water, and health effects, in particular for the workforce.

DOUGLAS POINT WASTE FACILITY (DPWF) - OVERVIEW

History of DPWF

The Douglas Point prototype nuclear reactor situated on the shores of Lake Huron, was built and owned by the Atomic Energy of Canada Limited (AECL), and operated by the former Ontario Hydro. The facility was shut down in 1984, after having been in service for approximately 16 years. The site was relicensed as waste management facility and in 2014 renamed the Douglas Point Waste Facility (DPWF). The AECL retains ownership of the site and its liabilities on behalf of the Government of Canada.

The site includes a range of nuclear and non-nuclear facilities, including the reactor building, a dry storage facility for spent fuel, and administrative ancillary buildings. The DPWF has been in a state of "Storage with Surveillance" (SWS) for more than thirty years.

Licensing of DPWF – Role of Canadian Nuclear Laboratories (CNL)

Canadian Nuclear Laboratories (CNL) has been managing the DPWF site since 2015 and is also responsible for reducing risks to human health and the environment. During the licence period 2014-2019, several non-nuclear buildings and structures were removed as the initial stage of decommissioning the site. According to CNL, the wastes removed were predominately "Clean Waste" but also included spent resins, classified as Intermediate Level waste (ILW). These wastes were sent to Chalk River Laboratories (CRL), a federal entity, and to "other facilities". Decommissioning the site and all facilities (nuclear and non-nuclear) would take place in stages over several decades.

CNL's plan is to relocate DPWF's radioactive waste to CRL and other locations, expect for spent fuel, which, at some unknown time and place in the future, would purportedly be transferred to Nuclear Waste Management Organization's (NWMO) high-level waste repository.

CNL's application to amend its current 14-year decommissioning licence for the DPWF would authorize it to conduct specific decommissioning activities that include dismantling nuclear-related structures, namely the clearing out the reactor building, an activity not currently included in its licence. In other words, this would mean advancing the decommissioning schedule, which in light of the nature of this facility, is a major change in the overall decommissioning of the DPWF and a matter of great concern.

As CNL moves forward into more decommissioning activities from the current status of Storage with Surveillance (SWS) of the DPWF, it is essential that all relevant plans, including waste management, radiation protection, emergency planning and response, surveillance and monitoring, be carried out "while ensuring the safety and health of workers, the public and the environment" as stated in CNL's submission (CMD 20-H4.1 p. 20) and that the CNSC carries out objective inspections of the work being done.

Thus, it is important to ensure that the plans and stages of decommissioning activities are fully explored and investigated in the interests of the long-term health and safety of the region.

Questions and Comments

Will the additional decommissioning work that CNL has proposed in its amendment consider and address the radiological and non-radiological hazards posed by the workforce engaged in this undertaking, and the potential impact on the workforce as well as the health and well-being of the local community and the environment?

What training will CNL provide to protect the workers carrying out the tasks involved? What types and frequency of inspections does CNL and the CNSC plan to be carried out throughout the whole process of decommissioning and dismantling in the 2020-2024?

How does CNL plan to address the potential impact of fugitive materials resulting from decommissioning and dismantling activities?

While the handling of and safe containment of spent fuel is of utmost concern, given the numerous toxic materials resulting from decommissioning activities, how does CNL plan to address similar concerns on other radioactive materials and non-radioactive substances in the waste, and the interactions of all such material in containment?

Are the emergency plans prepared in case of failure of containment are adequate and complete?

Additional concerns relate to shipping decommissioning radioactive waste off-site to CNL's Chalk River Laboratories (CRL) and other unnamed locations for storage. Shipping radioactive and hazardous wastes to other locations, such as CRL, is also problematic, considering transportation and also capacity at CRL. What other options have been explored for storing Low-level and Intermediate-Level Radioactive Waste (L&ILW)?

Whether all this hazardous waste would be or can even be "isolated" safely from the environment for the foreseeable future is currently unknown and unknowable. Thus, it is essential that measures be in place to routinely check the storage of the wastes, both nuclear and non-nuclear, to prevent any deterioration of the waste packaging, facilities and leakage of these toxic substances to the environment.

This submission questions whether CNL's decommissioning plan for the DWMF has given full and appropriate attention to these overriding issues and. It also questions the findings and recommendations of the CNSC staff that the Commission make a determination that the proposed decommissioning activities at the DWMF are "not likely to cause significant environmental effects (in accordance with section 67 of the *Canadian Environmental Assessment Act 2012*)" [CMD 20-H4, p.ii].

There is an inherent assumption that nuclear sites can be "cleaned up". But after several decades of operation, the land, surface water and deep underground have been the recipients of hazardous materials, from asbestos, mercury, etc. to a host of radionuclides with long half-lives.

Decommissioning a nuclear facility is a very complicated and dangerous task that would take several decades, if not longer. Can the DPWF site ever be returned to a Greenfield stage? The answer is likely not. But what degree of contamination are we willing to accept to consider such a site clean and for what usages?

With respect to the DPWF, what are the possible ultimate options – leave the site as is for a much longer period, i.e., maintain Storage with Surveillance (SWS). As to the storage of L&ILW does it make sense or is it even acceptable to ship these waste (in particular, LLW & ILW) to other communities? Should this waste be stored at the Bruce site at Ontario Power Generation's Western Waste Management Facility (WWMF)? Should the decommissioning timetable be linked to that for the Bruce Power units?

Unless we, as a society, come to terms with the issues at the core, we are playing with dice, and the odds do not look promising. We owe it to future generations to protect their environment the best we can, and that does not include dispersing nuclear waste here and there and everywhere. Shifting the onus of the effects of nuclear power and its hazardous waste, both radioactive and non-radioactive, on future generations is not fair or just.

PHASED APPROACH TO DEFERRED DECOMMISSIONING OF THE DPWF[1]

Introduction

The Douglas Point Waste Facility (DPWF)'s current decommissioning licence (WFDL-W4-332.02/2034) was issued to Canadian Nuclear Laboratories (CNL) on the basis of activities associated with continued storage with surveillance (SWS) of the facility. This licence is set to expire in the year 2034.

A deferred decommissioning approach was selected for the DPWF following the permanent shutdown of the reactor in 1984. In accordance with this strategy, the decommissioning of the DPWF was to consist of three phases:

> Phase 1 - Establishment of a Safe, Sustainable, and Shutdown State: in which activities focused on reducing the radioactive inventories, removing hazards and implementing monitoring and surveillance systems, which included defueling and dewatering the reactor, and the construction of a dedicated dry-storage facility for the irradiated fuel. Phase 1 was achieved in 1988.
>
> Phase 2 - The DPWF is currently in Phase 2, Storage-with-Surveillance (SWS), a long-term storage state intended to allow for radioactive decay. CNL has progressed in the removal of hazardous substances such as asbestos, mercury and polychlorinated biphenyls (PCBs), and reduced the quantity of stored radioactive waste during this phase by physically removing them from the site and transporting them to Chalk River Laboratories (CRL). CNL has reduced inventories of low-level radioactive wastes (LLW) stored in the reactor and service building, and retrieved the Heat Transport Purification System (HTPS) and Moderator Purification System (MPS) resins. These resins were volume-reduced and sent to CRL. Non-nuclear structures were removed.
>
> Phase 3 - Final Decommissioning, which will involve the decommissioning and dismantling of all remaining structures over a period of approximately 50 years.

On 2019 July 18, CNL submitted an application to the CNSC Secretariat to amend its current 14-year Waste Facility Decommissioning Licence to allow it to proceed with the decommissioning and dismantlement of all remaining facilities and structures of the DPWF.

The scope of CNL's request for this amendment is limited to a discrete set of proposed decommissioning activities that form part of a proposed longer-term, multi-stage, 50-year decommissioning project. It would not include the decommissioning of the Spent Fuel Canister Area of the Reactor building.

CNL's current licence for the DPWF was granted on the basis of continuing SWS until the year 2034. Essentially CNL's amendment to its current licence would mean that SWS would no longer continue in the way it was originally envisioned. In fact, CNL's licence request for the next phase of decommissioning is intended to accelerate the process.

[1] CMD 20 –H4

Environmental Effects Reviews (EERs)

As the proposed decommissioning activities at the DPWF are subject to the federal lands provision of CEAA 2012, CNL is required to conduct Environmental Effects Reviews (EERs) to assess the potential adverse environmental effects of non-routine work and propose mitigation measures to prevent, reduce or control the identified effects.

The scope of the EER submitted as part of CNL's licence amendment application was limited to the activities that CNL intends to perform during the current licence period which included "Reactor Building Clear-out" – in other words, the decommissioning, dismantling, and removal of systems and components within the reactor Building itself, but not the decommissioning of the Reactor or the Reactor Building. As stated in the CNSC's CMS 20-H4 document, these activities would be deferred "until a permanent waste disposal facility for intermediate and high-level waste is available in Canada".[2]

While decommissioning as a whole is expected to be conducted over a period of 50 years, CNL is required to undertake Detailed Decommissioning Plans (DDPs) for each of the five stages of decommissioning, referred to as Planning Envelopes (PEs)[3].

CNL is also required to submit dose estimates for the work involved in each planning envelope (PE). With respect to the Reactor Building itself, and the spent fuel canister area, which are not part of CNL's licence request, the decommissioning timeframe would remain as 2055-2070. CNL requires approval by the CNSC Commission to proceed with these timelines.[4]

Decommissioning Timelines

CNL's proposed changes would shorten the overall timeframe for all of the decommissioning activities, including non-nuclear buildings and structures, by about 5 years, and for nuclear buildings and structures, it would shorten the timeline by 46 years. This is a very considerable change from what has been previously proposed.

Additionally, the timeline for the Reactor-Building Clearance would be carried out during the period of 2022-2029 instead of 2055-2070.

CNSC staff have recommended that the licence period as requested by CNL be aligned with the proposed activities by revising the expiration date of the licence from 2034 to December 31, 2030. This would align with the timeline in CNL's Program Overview DDP for decommissioning of PEs A, B, and C. CNL has indicated that a standard 10 year licence with an expiration date of December 2030 would align well with its decommissioning timeline.

Comments

The changes in CNL's current licence renewal and amendment request are substantial. By accelerating the timeframe, situations may arise, such as potential heightened exposure of the workforce to hazardous substances and radionuclides, limitations to storage issues, and other matters that would not have been encountered under SWS. Compressing the timeframe for

[2] CNSC CMD H-4 p. 6-8
[3] Table 2, Decommissioning Timelines (CMD H-4 p.10)
[4] Ibid p. 10,11

decommissioning may not necessarily be a wise strategy to follow. There appears to be no advantage to doing so, and thus it begs the question as to why.

The decommissioning, dismantling and removal of systems and components within the Reactor Building are included in CNL's proposed scope of work in its licence request (under planning envelopes A, B and C).

The decommissioning and demolition of the Reactor and Reactor Building and the Spent Fuel Canister Area (under planning envelops C, D and E) are deferred "until a permanent waste disposal facility for intermediate (ILW) and high-level waste (HLW) is available in Canada".[5] The timing for completing these activities is estimated to be the year 2070.

The Nuclear Waste Management Organization (NWMO) is searching for a repository site for HLRW. Any timelines for selecting a site, let alone for such a site to be ready for accepting this waste is not known. This "deferral" could well exceed timeline expectations of the CNL and the CNSC. Therefore, using the date of 2070 is spurious. In addition, the storage of ILW is now being considered along with HLW. Does CNL plan to address the storage of ILW at the same location and timeframe in a repository for HLW? Confusion reigns.

What is even more disconcerting, let alone confusing, is that the CNL is proposing to accelerate decommissioning activities under planning envelopes A, B and C, rather than maintaining SWS until the year 2034. What, if any, is the advantage for advancing the timeline for decommissioning? Moreover, what is the disadvantage?

Will the DPWF site be considered "clean", decontaminated, earlier and then be used for other purposes? And what are such purposes that would be or should be allowed?

Considering that the decommissioning, dismantling and removal of components within the Reactor Building as proposed by CNL under the planning envelop C could well involve heightened exposure to hazardous substances and radionuclides will the workforce need to be augmented? Will they be fully informed about the nature of the work to be done and the potential harm of exposure? Will they be subject to testing, screening, to check on potential levels of exposure? Will workers be provided with appropriate protection, especially with respect to protection from exposure to radioactive contaminants in ILW?

What are the emergency and evacuation plans during the upcoming licence period requested? Do they take into account the decommissioning work that has proposed by CNL?

With respect to the licence period, CNL had requested a licence with an expiration date of December 2034, CNL indicated that it can adapt to CNSC's request for an expiry date of 2030 as "it would also align well with CNL's decommissioning timeline of the first three planning envelopes."[6]

Is the shortening of the period of the licence warranted? The issue is that CNL is proposing to accelerate its decommissioning activities. The overriding concern is whether CNSC will permit accelerating decommissioning activities as requested by CNL over a shorter timeframe than its

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[5] P.8

[6] CMD 20-H4.1 p. ii

original licence, and whether this could lead to further requests by CNL to alter the timetable in the direction of shortening it.

Is it is sound and safe to advance decommissioning for the reactor building? Does it make sense?

Unfortunately, given the nature of radioactive waste within the Reactor Building, conducting activities involving this material (demolition, demolishing structures, etc.,) let alone transporting this waste, it would be far more prudent to continue to monitor the site, i.e., continue with storage with surveillance (SWS). It would also be safer for workers who would be involved in demolition activities.

According to the CNL submission (p. 22 CMD 20-H4.1):

> "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."

It is anyone's "guess" that a storage site for "spent fuel" will be announced in 2023. It is even more unlikely when such a site would be ready for receiving this waste and whether it would safely isolate this waste from the ecosystem. Any dates proposed for receiving such waste (e.g., the year 2070), are highly conjectural.

CNSC staff have concluded that the licensee: [7]

1. Is qualified to carry on the activity that the licence will authorize the licensee to carry on.

2. Will, in carrying out that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

CNSC staff have also determined, in accordance with section 67 of the CEAA 2012, that carrying out of the proposed project is not likely to cause significant adverse environmental effects.

These conclusions are debatable, and also troublesome. There is so much uncertainty as to what is being proposed, the stages of decommissioning, the acceleration of these activities, the destination of the waste, and the future use of the site.

Does it even make sense to send the decommissioning waste to CRL, when there are already issues with capacity at that location or as has been indicated previously in this submission, would it be preferable and safer to continue SWS and monitor the contaminants, both non-radioactive and radioactive?

Furthermore, neither CNL nor CNSC's submissions have included an inventory of the specific radionuclides in the Low and Intermediate Level Radioactive Wastes in the DPWF. If such wastes are to be "stored" either in some future DGR or other means, then it is critical to know

[7] CMD20-H4 p. 11

what radionuclides are in this waste and their respective activities. This is not adequate or acceptable by any means and the CNSC should require it.

Incidentally, the only "inventory" I have found for the Douglas Point facility specifies the amount of ILW waste, nothing more, for 3 specific years.[8]

Year	2019	2050	2100
Amount (m^3)	60	60	202

It is incumbent on both the CNL and the CNSC to provide a detailed public inventory of radionuclides in ILW at present and to provide projections of these wastes for the requested licence period and beyond.

Whether the requested licence period terminates in 2030 or 2034 is not the crucial issue. More to the point, it is the "speeding up" and advancing the decommissioning schedule to include Reactor Building Clear-out in CNL's proposed schedule that is the matter of concern, and is potentially acceptable by the CNSC.

SHIPMENTS OF WASTE FROM DPWF – PAST AND FUTURE PLANS

As stated in CNL's submission (CMD 20-H4.1 p. 61):

> "During the 2014-2019 licensing period, under the Transportation of Dangerous Goods (TDG) program, DPWF made safely 13 shipments of ILW and 22 shipments of LLW to CRL (Chalk River Labs) and other licensed waste management facilities".

However, no indication is given as to how many shipments of LLW and ILW were made to facilities "other" than CRL. Nor does CNL indicate what, if any, criteria were used to decide what wastes CRL or "other facilities" receive, in amounts and/or activity.

With respect to future shipping plans for the next proposed licence period (2019-2034), CNL states:

> "While CNL strategy to safely accelerate decommissioning, environmental remediation, and waste management, will result in a significant increase in shipments involving the TDG program, however the number of shipments from DPWF will not increase.
>
> The number of estimated shipments for the next proposed licensing period (2020-2034) will vary depending on the volume reduction factor that will be achieved at the time of disposal considering ALARA principle."

Clarification is needed as to how the number of shipments from DPWF will not increase over the proposed 15-year licence period, although "there will be a significant increase in shipments involving the TDG program".

There is no explanation given as to the "volume reduction factor".

The following table illustrates the Anticipated Waste and Associated Shipments of both LLW and ILW for the period 2020-2034.[9]

[8] Inventory of Radioactive Waste in Canada 2016, National Resources Canada 2016
[9] CNL's CMD 20-H4.1 p. 62

Period	LLW		ILW	
	Waste Amount (m^3)	No. of shipments	Waste Amount (m^3)	No. of shipments
2020-2025	60	6	6	1
2026-2030	140	14		
2031-2034	< 1m ^{3}/year			

Each LLW shipment is estimated to carry 10 m^3 of waste and each over the requested ILW shipment 6 m^3 of waste.

Comments:

Does CNL have an inventory of radionuclides and their estimated activity for both L&ILW?

All of the ILW is intended to be shipped between the years 2020-2025. Is this reasonable or even practical?

Is CRL the recipients of all of this waste, or would some of these wastes being sent to "other facilities"?

Does CRL have the capacity and methodology to safely store all the waste it will receive from other facilities in addition to the wastes from the DPWF?

Given the lengthy licence period being requested, much more information needs to be provided as to whether the amount of waste being shipped, particularly of LLW, is even possible or practical, and also the final destination of some of this waste, if not the CRL.

CLASSIFICATION OF L&ILW RADIOACTIVE WASTES

In Canada, low-and intermediate-level radioactive waste is defined by exclusion. In other words, if a waste is radioactive, but is neither used nuclear fuel waste (high-level waste, (HLW)) nor uranium mine and mill tailings, it is classified as low level radioactive waste (LLW) or Intermediate Level Wastes (ILW).[10]

There are several problems with this "exclusion" approach. Unlike what the names of these wastes imply, L&ILW is not restricted to wastes that contain relatively low concentrations of radionuclides compared with nuclear fuel wastes. Rather, these wastes can range from very low-level waste with low hazard to highly hazardous wastes with long time frames that require much more secure containment than the very low-level waste.

The inherent ambiguity and interpretation as to what precisely is included in LLW and ILW, and why, has resulted in varying descriptions of these wastes that tend to be dependent on the context of the circumstances when these terms are applied and how they may be treated.

Classification and Descriptions of L&ILW

In general terms:

[10] NWMO Background Papers 7-2 Rennick & Associates p. 22

LLW consists of mops, rags, paper towels, temporary floor coverings, floor sweepings, protective clothing, and hardware items such as tools. It also includes steam generator segments.

ILW consists of ion exchange resins, filters and irradiated reactor core components. There is usually a caveat indicating that while the majority of LLW is processed through incineration or compaction for volume reduction, because of its physical condition and greater levels of radioactivity, ILW is "non-processible".

Ontario Power Generation (OPG) uses the following classification of Radioactive Waste in general and at its Western Waste Management Facility (WWMF) at the Bruce site.[11]

Low-Level Radioactive Waste (LLW) is radioactive waste having a dose rate less than 10 mSv/h (1 rem/h) at 30 cm (unshielded). LLW consists of minimally radioactive material that has become contaminated with radionuclides during routine operations, cleanup and maintenance. This waste includes (but is not limited to) lightly contaminated metal objects and parts, incinerator ash, insulation, drummed wastes, solidified liquids and desiccant.

LLW received from the Bruce, Darlington and Pickering NGSs are received at the Waste Volume Reduction Building (WVRB) at the WWMF where it is processed through either incineration or compaction to reduce its volume, or stored as is.

Intermediate-Level Radioactive Waste (ILW) is radioactive waste having a dose rate greater than or equal to 10 mSv/h (1 rem/h) at 30 cm (unshielded). ILW consists primarily of used reactor core components, ion exchange columns, resins, and filters used to keep the reactor water system clean. ILW is more radioactive than LLW, and requires shielding to protect workers during handling. This waste is not processed for volume reduction. It comprises about 5% of the total volume of non-fuel waste produced by the NGSs.

High Level Radioactive Waste (HLW) is defined as a CANDU fuel bundle that was irradiated in a reactor core. It is stored at the nuclear station in irradiated fuel bays for a period of typically ten years or more, and then transferred into dry storage containers (DSCs). The WWMF provides storage for the used fuel generated by the Bruce Power reactors.

However, there are other variations in the terminology and hence classification of LLW&ILW. [12] For example**:**

1. **LLW** consists of non-fuel waste in which the concentration or quantity of radionuclides is above the clearance levels and exemption quantities established by the Nuclear Substances and Radiation Devices Regulations [32], and which contain primarily short-lived radionuclides (i.e., half-lives shorter than or equal to 30 years). LLW normally does not require significant shielding for worker protection during handling and storage.

   ILW consists of non-fuel waste containing significant quantities of long-lived radionuclides. ILW often requires shielding for worker protection during handling.

[11] OPG Licence Renewal Document p. 12, or 4,5; OPG CMD 17- H.3.1 p. 4,5

[12] DGR 2013: Environmental Impact Statement 2011(EIS Section 4.5) The classification is consistent with Canadian Standards Association (CSA) N292.3

2. **LLW** – Radioactive waste in which the concentration or quantity of radionuclides is above the clearance levels established by the regulatory body (CNSC), and which contains primarily short-lived radionuclides (half-lives shorter than or equal to 30-years).

   ILW – Radioactive non-fuel waste, containing significant quantities of long-lived radionuclides (generally refers to half-lives greater than 30 years). [13]

These classifications include the term "clearance levels" in the classification of LLW. Clearance levels are radioactive levels at which radioactive materials can be freely released into the environment into landfills, and through recycled products, into the marketplace, without any regulatory control or consumer knowledge. This is a slippery slope, and while it may not be stated specifically in OPG's classification of L&ILW for example, is nevertheless being practiced by the nuclear industry throughout in Canada and other countries.

Yet there are other "definitions", "qualifiers" of radioactive waste in particular for ILW. For example, OPG's Predictive Environmental Assessment Document has provided additional qualifiers to the classification of wastes:[14]

LLW is waste having a dose rate less than 10 mSv/h at 30 cm.

ILW is waste having a dose rate greater than or equal to 10 mSv/h at 30 cm.

While this is in line with OPG's classification, this document has included additional types of waste in the category of ILW:

All alpha emitting waste that is not used fuel waste, LLW or high thermal spent cobalt waste; or all filters and ion exchange columns with long half-life radionuclides, and reactor core components and bulk ion exchange resins.

Questions

How are alpha-emitting radionuclides separated out of the ILW alpha-emitting waste? How is it stored (what type of containment)?

Can it be completely assured that no alpha-emitting radionuclides are processed via incineration?

With respect to filters and ion-exchange columns, what is considered to be **long half-life** radionuclides? Is it related to just the half-life itself and/or the specific radionuclide?

A further set of criteria (or classification) is used based on contact dose that applies to the type of storage required. These contact doses (i.e. radiation fields) refer to the state of the waste before any volume reduction is performed. [15]

The three types of wastes are as follows:

Type 1 $\leq$ 2 mSv/hr; 2 mSv/h < Type 2 $\leq$ 150 mSv/hr; Type 3 > 150 mSv/hr

Comments

[13] Ibid Vol. 1 Acronyms (p.15.27)

[14] OPG's Predictive Effects Assessment (PEA) Page 17, 4.4.1

[15] Ibid P. 12 footnote: Note the PEA report uses the unit 0.15 Sv/h, which is equivalent to150 mSv/hr.

- How were these "types" (Types 1, 2 and 3) derived and when? Are they legal limits?
- How do these types relate to the classification of L&ILW?
- Why is there such a large range in the contact dose for Type 2?
- Is there an upper range for LLW based on these types? Is ILW classified only as Type 3?
- How do these dose rates relate to the classification of ILW and LLW?
- What level of protection is provided for workers exposed to these radiation fields?

STRATEGIES FOR "MINIMIZING" RADIOACTIVE WASTE

Clearance Levels: Free-Release of Radioactive Material

As a means of dealing with the sheer volume of materials contaminated with "low-level" radioactive waste (LLW), governments and nuclear agencies have implemented policies to reduce the quantity of this type of waste that would otherwise require safe storage. In particular, materials contaminated with low levels of radioactive (LLW) would be free from regulatory control if they meet designated criteria referred to as "clearance levels".

The deregulation of low-level radioactive waste material has been in place in Canada for several years. Amendments to the *Nuclear Substances and Radiation Devices Regulations* (NSRDR) that were made in 2008 included the addition of "clearance levels".

If LLW is considered to be no longer radioactive, i.e., it meets clearance levels, it can be "free-released", that is, transferred without any restriction or regulatory control, to municipal landfills, to recycling streams, metal recyclers, etc., and ultimately into commercial and consumer products, ranging from building materials, steel, roads, vehicles, tools, utensils, furniture, playgrounds, roads, fertilizers, etc. without public knowledge or consent, or any means of tracking it. No labelling is required. There is no way of knowing what portion of recycled material or a product contains "cleared" radioactive waste.

This practice allows the nuclear industry to claim that it has "minimized" or "reduced" its radioactive wastes, without any consequences. This is not reducing or minimizing waste but dispersing it in the public domain.

Free-releasing radioactive-contaminated material and dispersing it in products, landfills, and so on, without public knowledge or consent removes responsibility and liability from the nuclear industry and the government. It is <u>not</u> a sound or safe practice but a rather dubious and devious means of reducing radioactive active waste as though such waste never even existed.

"Likely Clean" Waste

Other methods of minimizing L&ILW waste have evolved, such as the "Active Waste Program" which are designed to segregate this waste into categories of Active, Active Metal and "Likely Clean" by checking for levels of tritium and gamma. While waste considered to be Active is not processed on site and would need to be stored, the **Likely Clean waste** is monitored for tritium, alpha, beta, and gamma emitters. If the non-radioactive or radioactive material of this waste is below the acceptance waste criteria, it is sent for disposal at licensed landfills, in accordance with the *Nuclear Substance and Radiation Devices Regulations*.

Comments

The category of “Likely Clean” is an example where radioactive material would be free-released. However, there is no indication as to the approximate amount of the Likely Clean waste that is sent for disposal. The “acceptance waste criteria” are not specified. It is also not clear whether any of this cleared waste is sent for purposes other than disposal in landfills.

Are members of the communities where the Likely Clean waste has been disposed of aware that these wastes may be present in landfills, etc.? For example, is groundwater by these landfills, monitored for radioactivity? Can these “clean wastes” end up in drinking water?

Just as the nomenclature of “likely clean” is used, one can surmise that such monitoring is likely not used, nor are there plans to mitigate any potential damage, if there is any contamination of groundwater.

While the likely clean waste is monitored for alpha emitters, the active waste and active metal bags are not. Presumably, if alpha were in such waste, it would not be free-released, but that is not known.

What are the waste acceptance criteria (WAC) that determine whether LLW-containing material can be unconditionally or conditionally released (for recycling, disposal at landfills, etc.)? Does it depend on how such waste would be used in the marketplace (e.g., recycled metal in consumer products?)

Landfills often reveal nasty surprises in the future and resident stakeholders need to be aware that this risk might be present in the landfills accepting the Likely Clean radioactive wastes.

Commonly used merchandise, especially containing metals, are found in households, playgrounds, tools, etc. How much or radioactive material resides in the material used is unknown. What may seem “safe” today may prove fatal years later, a lesson that government, industry seem not to have learned.

None of these concerns are analyzed or discussed and they need to be, if only to be protective of public health and the environment.

As an example of Waste Minimization Practices, in 2013, OPG’s Western Waste Management facility (WWMF) instituted its “Likely Clean” waste segregation initiative to improve its waste minimization. Metals were segregated and either surveyed, decontaminated and free released, or if not able to be decontaminated, theses wastes are stored for future processing or interim storage. Accordingly, the volume of waste generated at the WWMF decreased by about 40% since this initiative was implemented.

This initiative is one more example of how widespread the practice of free-release is used as a means of “minimizing” the amount of radioactive waste (not including HRW), spent fuel) resulting from nuclear activities. In fact, as noted in OPG’s Document, the decline in the volume of waste received over the years “is mostly due to more effective waste reduction initiatives at the source”. Reducing the volume of waste that is stored merely shifts the burden of waste off of OPG and unwittingly into the public domain. Allowing such materials to enter the public domain without such identifiers is deceptive and is unacceptable.

During the 2014-2019 licensing period for the DPWF, CNL removed several non-nuclear buildings and structures. This waste is described as being “predominately Clean Waste (~99%).”[16] Further reference is made to hazard reduction campaigns which were also considered to address mainly Clean Waste (~91%). There is no definition in CNL’s document as to what constitutes “Clean Waste”.

DPWF WASTE CLASSIFICATION AND WASTE STRATEGY - CNL

The CNL has adopted the following descriptions/classifications for the different types of wastes stored, managed and/or released from the DPWF.[17]

Non-radioactive Waste:

Clean Waste - Non-hazardous material that is declared to be non-radioactive by its history, location and use; or non- hazardous material that has been determined to meet regulatory requirements for unconditional clearance by means of suitable radiological monitoring. The strategy is to identify re-use and recycle opportunities and to manage waste through local municipal landfills and processing facilities.

Hazardous Waste - Solid, liquid or gaseous waste material, other than a radioactive material, that may pose a potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed, and as specified in applicable regulations.

Radioactive Waste:

Any material (liquid, gaseous or solid) that contains radioactive “nuclear substances”, as defined in Section 2 of the *Nuclear Safety and Control Act* [10] and which the Waste Generator has declared to be waste.

The waste classification system is generally organized according to the degree of containment and isolation required to ensure safety in the short and long term. It also considers the hazard potential of the different types of radioactive waste.

High Level Waste (HLW) - Used (i.e. irradiated) nuclear fuel that has been declared as radioactive waste and/or is waste that generates significant heat (typically more than 2 kW/m^3) via radioactive decay.

HLW will eventually be emplaced in the Nuclear Waste Management Organization’s HLW 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.

Intermediate Level Waste (ILW) - Waste which exhibits levels of penetrating radiation sufficient to require shielding but needs little or no provision for heat dissipation during its handling and transportation. ILW generally contains long-lived radionuclides in

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[16] CMD 20-H4.1 p.ii.

[17] CNL Submission CMD 20-H4.1 p. 55-58. also: CW-508600-PLA-002 Revision 1 March 2019 https://www.cnl.ca/site/media/Parent/2019-CNL-IWS.pdf

concentrations that require isolation and containment for periods greater than several hundred years (i.e., more than 300 to 500 years).

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

During its 2014-2019 licensing period, CNL removed several non-nuclear buildings and structures to reduce waste on the Douglas Point site. This waste is described as "predominately Clean Waste (~99%)." Hazard reduction campaigns addressed largely Clean Waste (~91 %).[18]

13 shipments of the spent exchange resins i.e., (ILW) and 21 shipments of LLW were made to CRL and "other licensed facilities".

No indication is given as the nature of such facilities in CNL's submission.

At present, the stored waste at DPWF includes 0.02 metric tons (MT) Hazardous Waste, 22,256 spent fuel bundles (HLW) in 46 canisters, 6 m^3 of solid ILW, and 103 m^3 of solid (LLW) [19].

CNL anticipates that approximately 20 shipments of LLW (~200 m^3) and 1 shipment of ILW (~6 m^3) would be made from DPWF to CRL during its proposed licensing period (2020-2034).

CNL plans to relocate all of the DPWF's radioactive waste (i.e. stored waste and future decommissioning waste) to CRL except for the spent fuel, which would be transferred to Nuclear Waste Management Organization's (NWMO's) high level waste disposal facility.

It should be noted that there is no definition for what constitutes "Clean Waste", only that it meets "clearance levels", whatever they may be or how they are even determined.

The following table illustrates the amount and class of wastes that CNL plans to address in its proposed licence period.

It should be noted that the end date is 2030, not 2034 (which is the year for which CNL has requested the amendment to its current licence.) Furthermore, the wastes include L&ILW, not HLW.

[18] CMD 20-H4.1 p.ii
[19] ibid

Waste Estimates for CNL's Proposed Decommissioning Project 2030 [20]

Planning Envelop (PE) Phase	PE-A Non-nuclear area	PE-B Parts of nuclear area	PE-C Reactor Building Clear-out	Total	Target Dates
Potentially clearable waste	23 451 m^3 3 578 MT	9694 m^3 944 MT	0 m^3 596 MT	33 145 m^3 5 118 MT	2021-2025
Hazardous waste	340 m^3 32 MT	0	0	340 m^3 32 MT	2022 2025
Radioactive - LLW	0 0	22 m^3 19 MT	0 214 MT	22 m^3 233 MT	2025-2030
Total	23 791 m^3 3 610 MT	9716 m^3 963 MT	0 810 MT	33 507 m^3 5 383 MT	

Volume (in cubic meters – m^3) accounts for the following waste streams: concrete, masonry, miscellaneous construction and excavated materials.
MT (metric tonnes) accounts for structural steel and miscellaneous metals, rebar mechanical and electrical waste.

Waste Inventories

As has been pointed out in this submission, it is important to point out that no inventory of the amount and/or activity of **specific radionuclides** in any of the categories (LLW, ILW and spent fuel - HLW) is provided in CNL's or CNSC's staff submission. This is a very serious omission. It is paramount that the CNSC request such an inventory from CNL and that it be public.

[20] CNSC Doc H-4 Environmental Protection Review Report (EPRR) Table 1.3 p.9-12

RADIOLOGICAL RELEASES TO THE ENVIRONMENT

Airborne Releases

The annual radiological airborne radiological releases from the DPWF compared to Derived Release Limits (DRLs) data for the years 2014-2019 are shown in the following table. (CMD 20-H4.1 p. 47, Table 12-1)

Reactor Building HEPA-filter Ventilation System Performance and Airborne Releases for the 2014-2019 Period

Year	HEPA Filter Operation Time (Hours)	Airborne Release in Becquerels (Bq)			
		Tritium (DRL[1])	Gross Alpha (DRL[1])	Gross Beta (DRL[1])	Carbon-14 (DRL[1])
2014	2,048	2.74E+11 (1.59E+17)	n/a	n/a	3.07E+08 (2.88E+15)
2015	753.5	1.33E+10 (5.46E+17)	n/a	n/a	<4.49E+08 (1.48E+15)
2016	1,535	1.59E+11 (5.46E+17)	<1.68E+03[4] (3.69E+12)	<1.91E+04[4] (3.69E+12)	6.10E+09 (1.48E+15)
2017	834	1.12E+11 (5.46E+17)	1.64E+03 (3.69E+12)	2.29E+04 (3.69E+12)	Not measured
2018	2273.5	7.96E+11 (5.46E+17)	3.07E+03 (3.69E+12)	4.55E+04 (3.69E+12)	1.51E+09 (1.48E+15)
2019	1,017.5	2.41E+11 (5.46E+17)	4.94E+03 (3.69E+12)	3.9E+04 (3.69E+12)	Not measured

Note: The DRL for gross alpha and gross beta is based on Strontium-90.

According to CNSC's Environmental Protection Review Report (p.21CNSC CMD-H4), the DRL for annual airborne releases of tritium for the year 2014 was 5.46E+17 Bq, and the DRL for Carbon-14 is 3.22E+15 Bq for all years in the table above

What is the explanation for the different levels of activity, e.g., for tritium, for the year 2015, compared to the other years? It does not seem to bear a relationship to the hours of operation.

Waterborne Releases

The two types of drainage systems at the DPWF are an Active Drainage System and an Inactive Drainage System (which directs storm water runoff and groundwater from buildings and structures, ultimately discharging it into Lake Huron). Accordingly, the radiological releases from the Inactive Drainage System are expected to be "low", sampling and monitoring of effluents for radiological contaminants at onsite groundwater sumps for gross beta and tritium would continue (CNSC's Environmental Protection Review Report, p. 21- 24).

The following table shows the annual radiological releases from the DPWF to Lake Huron for the period 2014-2019 compared to the DRLs for specific radionuclides. (p. 49 Table 12-2 CMD 20-H4.1)

Year	Groundwater Release (Litres)	Waterborne Release (Becquerels - Bq)			
		Tritium (DRL[1])	Gross Alpha (DRL[1])	Gross Beta (DRL[1])	Carbon-14 (DRL[1])
2014*	51,400,440	5.19E+10 (1.94E+17)	nm	6.37E+07 (3.71E+12)	4.16E+09 (1.02E+14)
2015	38,050,740	4.24E+10 (2.04E+17)	nm	7.31E+07 (3.43E+13)	<3.17E+09 (2.02E+14)
2016	32,687,928	2.23E+10 (2.04E+17)	8.98E+06 (3.43E+13)	1.05E+07 (3.43E+13)	na
2017	34,506,108	3.57E+10 (2.04E+17)	1.12E+07 (3.43E+13)	2.56E+07 (3.43E+13)	na
2018	34,463,520	2.73E+10 (2.04E+17)	1.18E+07 (3.43E+13)	3.43E+07 (3.43E+13)	na
2019	37,107,252	3.73E+10 (2.04E+17)	6.75E+06 (3.43E+13)	4.52E+07 (3.43E+13)	na

na-parameter removed as of 2016: nm-not measured

Comments on Waterborne Releases:

The DRLs for gross alpha and gross beta of 3.43+13 Bq/yr are based on Cs-134, which is considered to be the most restrictive radionuclide. *The DRL for tritium is given as 2.04E+17 Bq/yr in CM DMD 20-H4.

According to CNSC's Environmental Protection Review Report, the DRL for waterborne releases of tritium for the year 2014 is 2.04+17 Bq and the DRL Gross beta is 3.43+15 Bq for all years in the table. [21] Is the precision (9 digits) for litres of groundwater releases warranted?

The graphs in CNL's submission (p.50, 51, Figures 12-2, 12-3, and 12-4) demonstrate trends of waterborne tritium, gross alpha, and gross beta on a logarithmic scale. The use of a logarithmic scale is totally inappropriate and deceptive, in that it effectively "shrinks" the magnitude of these releases and thus portrays their differences as minimal, and thus irrelevant.

[21] (p.24, CNSC CMD-H4)

DERIVED RELEASE LIMITS (DRLS)

Comparison of DRLs to Reported Emissions

Derived Release Limits (DRLs) are the legal upper regulatory bounds set by the CNSC for releases of specific radioactive substances to the environment. The DRL represents the quantity of a radionuclide that, if released from the specified facility in a year, would result in a dose to the most exposed member of the public of 1 mSv/yr, i.e., the International Commission on Radiological Protection (ICRP) public dose limit. Exceedances of the DRL trigger reporting to the CNSC, followed by a formal investigation and regulatory oversight.[22]

DRLs are calculated for specific radionuclides expected to be found in the airborne and liquid operational effluents as defined in CSA Standard N288.1.[23]

There are very serious issues regarding the determination of DRLs. Clearly, there is a total disconnect, sheer magnitudes of the difference between the emissions reported for specific radionuclides, (e.g., Tritium) and the DRLs that needs a thorough investigation. Two fundamental issues need to be addressed:

i) The methodology used to determine DRLs; and/or

ii) The accuracy of the releases that are reported and whether they account for what is actually being emitted (both monitored and fugitive emissions).

If the basis for these differences lies with the reported emissions, then one would presume that there are problems with monitoring and the applications of and assumptions made by models. Even if the reported releases are off by a factor of two or three, that would not, by any means, make the DRLs more plausible or credible because of the sheer differences in magnitude.

Supposedly, DRLs are independent of how a radioactive emission is produced, but depend on the degree of exposure of an individual to the emissions. This, in turn, depends on several factors, including the proximity of the individual to the source of the release, their age, (child, adult, sex), their lifestyle etc. Exposed individuals are classified as groups. The group predicted to receive the highest dose is referred to as the representative or critical group.

The determination of DRLs involves models (e.g., the Environmental Transfer Model) and many factors including identifying and characterizing representative persons, exposure pathways, meteorology, and dose conversion factors (also referred to as dose coefficients). These dose factors convert Becquerels to Sieverts for a specific radionuclide and provide the estimated radiation dose imparted to a cell, tissue or organism by the radioactive decay of one atom of that radionuclide.

An underestimation of this dose factor can result in a misrepresentation of the impact of a particular radionuclide. For example, tritium's dose factors are, by some margin, the lowest among common radionuclides and potentially a serious underestimation of the impact of

[22] CMD 15-H.2 e-Doc: 4579312 Environmental Assessment Information Report p. 16

[23] The methodology for establishing DRL models is based on the Canadian Standards Association (CSA) standard CSA N288.1-08: *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities.*

tritium. As a result, tritium is widely regarded as a "weak" radionuclide and is typically listed in the lowest radiotoxicity category.[24]

As well, there are complications with the variability in meteorology, the specific locations selected, and the critical (or representative) groups identified. The "safe" "public dose" of 1 mSv has come under criticism, and has been acknowledged, even by the CNSC, not to be a health standard.

Individuals or groups (*representative, critical*) residing in the proximity of the station are exposed to several sources of emissions of tritium and other radionuclides continuously, 24 hours a day, and have been exposed to these emissions for many years. DRLs do not or cannot account for the combined, cumulative exposure from all the sources of emissions of a particular nuclide or the combination of nuclides, annually let alone for decades.

The determination of DRLs is highly questionable and can lead one to draw conclusions that are misleading. Either this means that the emissions are trivial, or the DRLs are fundamentally flawed. Given that DRLs are annual **legal** limits, it is absolutely critical that the methodology used to develop them needs to be re-assessed in an open forum.

HEALTH ISSUES – CUMULATIVE EFFECTS

The Bruce site is a very busy one – given the shipments and storage and treatment of L&ILW radioactive wastes from Ontario Power Generation's (OPG's) Pickering and Darlington Nuclear Stations to the Western Waste Management facility (WWMF) on the Bruce site, and the refurbishment of reactors on site. Added to all that intensive activity is the work to be carried out at DPFW on its path to being decommissioned, including the shipment of the ensuing wastes to CRL (and elsewhere to unknown destinations).

All these operations will result in increased emissions of "dust" and other contaminants to air and water, and contribute to excessive noise levels (cacophony). The range of air pollutants emitted from these activities include Particulate Matter (PM, fine and coarse), Volatile Organic Compounds (VOCs), sulphur dioxide (SO_2), nitrous oxides (NOx), polycyclic aromatic hydrocarbons (PAHs), and many other contaminants. Many of these substances are listed as toxic under the *Canadian Environmental Protection Act* (CEPA 1999).

NOx and SO_2 are precursors to acid precipitation and also can cause respiratory and other internal diseases when inhaled in high concentrations. Particulate Matter, particularly fine PM, ($PM_{2.5,}$ i.e., particulate matter with aerodynamic diameters <2.5 µm) is inherently toxic to human health. Inhalation of fine and ultrafine particles can cause include asthma, lung cancer, pulmonary emphysema, and cardiovascular disease.

As Health Canada has noted, "Health risks for certain air quality indicator compounds (e.g. particulate matters – PM_{10}, $PM_{2.5}$) exist below ambient standards and objectives. However, air quality standards should not necessarily be regarded as "pollute up to" criteria." [25]

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[24] The dose coefficients for adults are 1.8 x 10^{-11} Sv/Bq for aqueous tritium (HTO) and 4.2 x 10^{-11} Sv/Bq for Organic Bound Tritium (OBT). Similarly, OBT's dose coefficient should be increased to be 4 to 5 times greater than that for HTO. Tritium Hazard Report June 2017: Ian Fairlie p. 47-51

While adverse health effects from exposure to $PM_{2.5}$ affect children and adults alike, the most susceptible groups in the exposed population include senior citizens, people with existing lung or heart problems, diabetics, children with asthma, and people who spend more time outdoors.[26] Exposure to $PM_{2.5}$ can also harm the brain, accelerating cognitive aging, and may even increase risk of Alzheimer's disease and other forms of dementia.[27]

VOCs are toxic substances and are also of concern as a precursor (along with NOx) to the formation of photochemical oxidants near ground level, i.e., smog.

All the work involved at the Bruce site, added to the work planned for the DPWF poses adverse risks to human health and the environment and especially the workforce involved. For example:

- The potential generational, long-term and cumulative effects resulting from exposure to both radiological and hazardous non-radiological substances from contaminated groundwater, food and air;
- The effects of exposure to radiological and hazardous non-radiological substances on the health and well-being of specific populations, including:
    - Local communities in closest proximity to and downwind of the Bruce site;
    - Vulnerable populations including foetuses, infants, pregnant women, the elderly, and people whose health is already compromised (e.g., asthmatics).
- The impact on health and quality of life of local communities and workers during the construction period (noise, increased traffic, air quality, etc.).

The effects on human health resulting from all the ongoing operations at the Bruce Nuclear site are cumulative and must be considered so, along with the decommissioning activities at the DPWF.

Even though ILW wastes themselves are not concentrated enough to cause criticality, unlike HLW (used fuel), they contain highly radioactive radionuclides, many of which have very long half-lives and are highly toxic. Many of these radionuclides are biologically active and are actively taken up by the body and incorporated into our tissues. The very long-term health consequences of radionuclides in the global environment are not known, but are likely to be cumulative as the contamination accumulates.[28]

Once released into the biosphere, radionuclides can work their way through the ecosystems, as do other industrial toxins. Multiple migration mechanisms are involved, including transport by air, water, particulate matter and biota.[29] Some of the radionuclides are able to biomagnify up the food chain, thus becoming progressively more concentrated in foodstuffs and complex

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[25] Health Canada's Technical Review of Ontario Power Generation's Response to the Request for Additional Information for the Deep Geologic Repository for Low and Intermediate-Level Radioactive Waste Project March 7, 2017

[26] http://www.env.gov.bc.ca/soe/archive/reports/et07/chapters/ET2007_Air_Quality_Chapter.pdf

[27] http://www.sciencemag.org/news/2017/01/brain-pollution-evidence-builds-dirty-air-causes-alzheimer-s-dementia and http://www.nature.com/tp/journal/v7/n1/full/tp2016280a.html

[28] http://www.psr.org/environment-and-health/environmental-health-policy-institute/responses/radiations-risk-to-public-health.html

[29]Rock Solid? A GeneWatch UK consultancy report, p. 38,39September 2010 http://www.ceaa.gc.ca/050/documents/55688/55688E.pdf

forms of life, including human life. The potential transfer of radionuclides in animal feed to domestic farm animals could contaminate the human food chain via meat and milk.

Health Effects of Radiation Exposure

The currently allowed level of exposure to ionizing radiation for the public is 1 mSv/year, and for nuclear energy workers it is 100 mSv over 5 years with a maximum of 50 mSv in one year. These limits have been set by the International Commission on Radiological Protection (ICRP) and are used by the CNSC and OPG based on fatal cancer.

The CNSC has stated that "the public dose limit of 1 mSv per year is a regulatory limit in the *Radiation Protection Regulations* – not a health limit. Dose limits have mistakenly been regarded as a line between what is safe and what is not safe".[30]

According to the BEIR VII Report on *Health Risks from Exposure to Low Levels of Ionizing Radiation*, the dose-response to radiation follows a Linear No-Threshold (LNT) model. Thus, there is no dose for which there is no risk.[31] The following summarizes health risks from exposure to radiation:

1) Radiation damage can affect any part of a cell, and can interfere with many cellular processes. Damage to the genetic material of the cell can lead to cancer, non-cancerous tumours, birth defects, hereditary illness, and immune system diseases. While this damage can sometimes be repaired by mechanisms within the cell, that is not always the case. Damage to eggs or sperm can be passed on to future generations.

2) Radiation from internal emitters is very different from external radiation, and more dangerous. If a radioactive particle is inhaled or ingested, that particle will continue to emit radiation as long as it is in the body and the particle remains radioactive. When exposed externally to a source of radioactivity, the exposure lasts only as long as the person remains close to the source of radiation.

3) Some radionuclides may bioaccumulate in an organism and biomagnify, i.e. build up in the food chain. For example, they may reach higher concentrations in fish or seafood than in the surrounding water, thereby posing a greater risk to anyone or any species eating the contaminated food than the surrounding water would.

4) The current ICRP limits do not make proper allowance for the most vulnerable members of society, foetuses and children. At these life stages, individuals are far more sensitive to radiation than in adulthood.

5) The CNSC (and nuclear facility operators) typically compare exposure levels to radiation due to the nuclear activities to natural background levels of radiation, the presumption being that the level of emissions from these facilities would be a very small fraction of background levels, and thus the effects on human health will be negligible. Background

[30] Study of Consequences of a Hypothetical Nuclear Accident and Effectiveness of Mitigation Measures – CNSC draft report, December 2014 e-Doc 4449079 A0043878_000188

[31] http://www.cirms.org/pdf/NAS%20BEIR%20VII%20Low%20Dose%20Exposure%20-%202006.pdf; see also BEIR VII report: http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/beir_vii_final.pdf

radiation gives us background levels of cancer and hereditary disease. Any radiation exposures from man-made sources will be added to background, and will cause additional harm.

Potential Effects on Workers and the Local Environment

The effects of exposure to multiple pollutants are cumulative and may be synergistic and/or additive. For example, some pollutants may compromise the immune system which in turn could result in an enhanced susceptibility to the effects of exposure to other pollutants.

How well protected are the local community and the workers from exposure to the pollutants resulting from all the decommissioning work that needs to be done? The answer is simply, we do not know. No baseline data is available that will at least provide us with some information against which we could measure or at least account for changes over time due to these new activities in addition to current activities and projects in the local regions.

Accidents and emergencies (from construction activities to events such as spills, fires, potential loss of containment, etc.) , transportation, place front-line workers at serious risk and can lead to exposure to ionizing radiation as well as non-threshold carcinogens and other toxic substances. The cumulative, synergistic, and long-term effects of their exposure to both radioactive and non-radioactive hazardous substances are not recognized, let alone addressed.

Just because emissions lie within or below current standards does not mean that they do no harm. Over the years, as more has been discovered about the hazards associated with exposure to certain substances, standards have become more stringent. The limits that are currently in place for both radioactive and non-radioactive are very likely to change over time, with increased knowledge and awareness of the harm that exposure to these substances singularly and cumulatively can cause.

While CNL indicates that their safety strategy in the decommissioning work to be undertaken will achieve an overall reduction of risk to members of the public, workers, and the environment, the burden of proof rests on both the CNSC and CNL to demonstrate that the level of exposure to radioactivity and to other contaminants **cumulatively** is safe and will not be harmful to human health and the environment. Assurances cannot be guarantees.

Can CNL guarantee that that there will be no accidents, no malfunctions, and no human error from the operations that will take place at the DPWF site and from transporting the wastes?

Can CNL and the CNSC provide science and health-based evidence to prove that exposure to radioactivity and to other contaminants is <u>not</u> harmful?

Can CNL prove unequivocally that human health is not affected by cumulative long-term exposure to radioactivity and to other contaminants from the decommissioning work?

The answers are only too evident. That is why caution must be exercised before proceeding and speeding up the process of decommissioning and perhaps causing harm not just in the present, but well into the future.

CONCLUDING REMARKS, RECOMMENDATIONS

The Submission by CNL to amend its current 14-year waste facility licence for the Douglas Point Waste Facility raises many concerns that have been highlighted in this submission. It also creates confusion, particularly with respect to the phases of decommissioning in that it seeks to advance activities, in particular, the clearing out of the reactor building (Planning Envelop C), which was not an activity covered in its current licence. This alone should give reason to not accept the amendment.

CNL has indicated that it is amenable to a 10-year licence, a term supported by the CNSC. This would further speed up decommissioning work of the first three planning envelops, which include activities regarding the reactor building itself. This is not in its current licence.

This is not the type of work that needs to be rushed or speeded up. There could likely be consequences, accidents, exposure to workers, etc., that are not expected and cannot be contained.

There is no indication that CNL has adjusted or strengthened its emergency response in the case of adverse events that can occur during is decommissioning and dismantling work or whether Occupational Safety and Health Programs have been or will be updated to protect workers who may well face heightened risks.

Given the period of the amended licence request, be it 14 years or 10 years as is acceptable to CNL, there is no opportunity for public engagement during this period. There is no mention of how or if there would be such opportunities, either by CNL or the CNSC. Decommissioning work could well bring out problems not anticipated. Certainly it is better to have opportunities for public engagement as time and activities progress.

CNL has not provided a detailed inventory of the radioactive and non-radioactive components. It is not evident that they even have this information, which, in light of its proposed activities, is vital to know and must be required.

There is no indication how or if monitoring programs will be enhanced, or even if they are adequate under the current status.

CNL seems to be practicing a “not-in-my-backyard” approach to storing radioactive waste. It plans to continue shipping low-level radioactive waste to CRL for storage and to other unnamed facilities, if the waste meets “clearance levels”. There is no consideration as to whether CRL would have the capacity to store this waste, nor is there any indication of quantities and components of these wastes, some of which will end up in municipal landfills. Furthermore, there is no discussion of clearance levels. This is a very grey area.

As to intermediate and high-level waste, well, CNL (and other nuclear generating stations) are awaiting a disposal facility. But they will be waiting for a very long time, several decades, before or even if such a facility would be available. Thus, these wastes, especially the high-level component, would need to remain on site for a very long and unknown period. Whether they can be safely contained and not pollute Lake Huron or the surrounding area is a matter of grave concern, and frankly is not known.

Furthermore, if there are any issues that arise, be it accidents, exposure, etc., it is incumbent on both the CNSC and CNL to inform and engage the communities, workers, First Nations, forthwith.

Ontario Power Generation's Western Waste Management Facility (WWMF), which stores L&ILW produced by Ontario's reactors, is on the Bruce site. Even though there have been issues with that facility, consideration should be given whether storing the quantities of DPWF waste would be manageable. The irony of this option is that OPG is now responsible for cleaning up L&ILW legacy waste from the Radioactive Waste Operation Site (RWOS1) resulting from operations of the Douglas Point reactor.[32]

The options are very limited and unpredictable. That is the real dilemma that we face.

Much more time, several decades, is needed before any major decommissioning should take place. It may not be possible to select a time, but if the property is undisturbed for decades, and if it continues in a state of SWS and is routinely monitored, that may be the best, or at least, the preferred option. If phases are decommissioned earlier, that may give rise to problems that have not been foreseen and that cannot be remedied.

In light of concerns that have been raised and what has been commented on in this submission, it is recommended that CNSC **not** grant CNL an amended licence as it has requested.

At best, it is recommended that CNSC request that CNL prepares detailed decommissioning plans for each of the three phases (A, B and C) of decommissioning and clarifies the status of each phase.

It is also recommended that the licence term be no more than 10 years, with an opportunity for public engagement, at the very least in a 5-year interval.

[32] Refer to submission by Eugene Bourgeois and Anna Tilman to the CNSC re OPG's application for the licence renewal of the WWMF, March 2017.