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RE: Comments to “In Situ Decommissioning of the Whiteshell Reactor #1 Project (WR-1)”,  
“Nuclear Power Demonstration Closure Project” and “Near Surface Disposal Facility Project”

**Dear Ms. Frigault, Cianci and Harpell:**

We submit this addendum comment to the earlier comment that we provided on 2016 July 03 to Ms. Candida Cianci (RE: Comments to “In Situ Decommissioning of the Whiteshell Reactor #1 Project (WR-1)”). We also note that despite the formal titles the proponent, Canadian Nuclear Laboratories (CNL), has assigned to these three proposed decommissioning activities, the outcome of each project would not be decommissioning; it would be near-surface disposal of low- and intermediate-level wastes (LILW) in unconsolidated sediments. Our concerns relate primarily to the relatively long-lived intermediate-level wastes (ILW) which have half-lives of tens to hundreds of thousands of years.

CNL is proposing to entomb these LILW wastes in situ. This action will result in the shallow disposal of long-lived radionuclides in geographic regions of Canada that are likely to be subjected to multiple continental-scale glaciation events over the timeframe of radiological interest for ILW. Based on the geological record over the past million years, the regions being considered are likely to be covered during future glaciations by ice sheets at least several kilometres thick.

During a major glaciation event, the so-called “entombed” reactor vessels will not be protected by their original concrete structures and internal cement grouts. The compression and shear forces of the glacial ice are likely to cause the brittle concrete and grout to fracture and separate from the more compliant stainless-steel reactor vessels. Generally, intact stainless steel is 2 to 4 times stronger in compression than the intact rocks of the Canadian Shield and any man-made concretes and grouts. It is also 20 to 40 times stronger in tension, and it is far less brittle (e.g., the strains leading to failure for rock and cementitious materials are generally less than 1% whereas that for stainless steels are at or greater than 10%). Under a glaciation scenario, a relatively malleable and structurally ruptured reactor vessel is far less likely to be crushed, ground and finely dispersed as compared to the brittle rock and cementitious materials. As a result of the mechanical and hydrogeological forces associated with the advance and retreat of an ice sheet, the reactor vessels in the easily eroded unconsolidated sediments are likely to be disintombed (i.e., “bulldozed” and plucked) from their surrounding environment, demolished (i.e., crushed and torn apart), and widely scattered over a geographic area.

In effect, many of the larger vessel components would probably survive glaciation and may be removed some distance from their original location, much like naturally occurring glacial erratics. After the retreat of an ice sheet, it is plausible that humans returning to the region may encounter and collect these radioactive reactor vessel remnants for whatever purposes. This is an “inadvertent human intrusion scenario” somewhat analogous to the 1987 Goiânia accident in Brazil where a small radio-medical  $^{137}\text{Cs}$  source was removed from an abandoned medical facility and dispersed among the local population without awareness of the radiological hazard, resulting in the deaths of four people and serious contamination and exposure of hundreds of others.

In summary, the proposed decommissioning actions by CNL to carry out the so-called “in situ entombment” of their current structures at locations in Ontario and Manitoba would actually involve the shallow disposal of intermediate-level radioactive wastes within metres of the present-day surface in unconsolidated sedimentary formations. Given the likely effects of future glaciations on these proposed methods, we doubt the proponent would be able to derive a robust safety case for this near-surface disposal of ILW, as is required by CNSC Regulatory Guide G-320 (Assessing the Long Term Safety of Radioactive Waste Management), that adequately addresses long-term protection of humans and the environment on the necessary timescale.

Thank you again for the opportunity to provide this addendum comment and we appreciate your consideration. If you have questions, please feel free to contact me and I will confer with my co-contributors, below.

Sincerely yours,

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