Date: December 18th 2017

From: Lawrence Johnson

To: Candida Cianci, Environmental Assessment Specialist
Canadian Nuclear Safety Commission

By email: cnsc.ea-ee.ccsn@canada.ca

Subject line: Comments on WR-1 EIS

CEAA Reference number: 80124

Comments:

Dear Candida Cianci,

Please find attached my comments on The Environmental Impact Statement for the In Situ Decommissioning of WR-1 at the Whiteshell Laboratories Site.

Lawrence Johnson

Comments on the Environmental Impact Statement for the In Situ Decommissioning of WR-1 at the Whiteshell Laboratories Site

Lawrence H. Johnson, BSc (ret.)

I have reviewed the Environmental Impact Statement for the In Situ Decommissioning of WR-1 at the Whiteshell Laboratories Site and would like to offer the following comments.

General Comments on Waste Management Fundamentals

Accepted practice, which is also discussed in regulatory documents of various nations and the IAEA, is that a disposal site should be selected based on its potential to isolate the waste (e.g. CNSC G-320 "Isolation is achieved through proper site selection"). Safety principles are important and can't simply be ignored. Obviously, the disposal site has not been selected for its isolation properties, as the disposal site is in near-surface sediments which have relatively high hydraulic conductivity. A direct statement should at least be made that these safety principles have not been applied.

The EIS does an inadequate job of addressing why this approach should be chosen compared to the other alternatives. The qualitative evaluation approach appears unsatisfactory as a quantitative occupational safety and risk assessment (including radiological aspects) has not been performed. It is stated that the risk would be lower for the *in situ* disposal approach because the risks to workers (and the public) of full decommissioning, packaging and shipment of the wastes would be higher than for the proposed approach. This may or may not be true, as no quantitative risk analysis is presented. Given that a number of reactors have been successfully and safely decommissioned in other countries and the wastes packaged for disposal and that shipment of radioactive wastes has an impressive safety record, it is also possible that the argument for *in situ* disposal based on relative risk is unsound. Without a quantitative analysis of risks it is not possible to establish the preferred approach.

As the proponents surely know, but have not acknowledged in the EIS, the IAEA Safety Standard "Decommissioning of Facilities General Safety Requirements Part 6 No. GSR Part 6" (2014) states

"*Entombment, in which all or part of the facility is encased in a structurally long-lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g. following a severe accident*)."

This Standard also states
"*This publication establishes internationally agreed requirements for the decommissioning of facilities on the basis of the fundamental safety objective and fundamental safety principles established in the Safety Fundamentals*".

It seems to me important that the EIS explain fully why the approach is being proposed given the statements in the safety standard.

I am aware that some other small reactors (e.g. Hallam, Nebraska and Piqua Ohio) have been entombed. There are DOE fact sheets available on the internet that indicate that neutron-activated metals were not removed before entombment and the total radioactive inventory appears to be comparable to that of WR-1. These cases arose prior to the Standard, but I understand that the practice continues in some countries. The absence of proper discussion on all these issues makes the EIS appear deliberately evasive on the question of safety fundamentals.

Specific comments on the radiological risk assessment

There are many uncertainties in a long-term radiological risk assessment. The EIS has attempted to deal with these, but it is difficult to deal with some of these uncertainties. The main process of contaminant release is corrosion of metals that would release neutron activation products embedded in the metals. These corrosion processes are extremely slow for steels and Zircaloy (in the range of 10 nm/a corrosion rate) in high pH grout. However, once the portlandite ($Ca(OH)_2$) is leached out and the pH drops, corrosion rates of steels can increase significantly. I was unable to determine if this was adequately covered in the risk analysis. The timing of this pH drop is related to the flow through the grout. If significant flow can occur through the grout, which may be possible if there are (eventual) cracks in the building concrete structure, the favourable high pH conditions may not last. Note that in a proper deep disposal site selected for its good hydraulic isolation, this pH drop would not be expected to occur.

While it is possible that post-glacial scouring and broad dispersion of residual activity associated with the facility would not lead to significant consequences given that this would occur after many tens of thousands of years, the entire uncertainty with the analysis presented could be avoided if the site was decommissioned with the removal of at least the most highly neutron-activated materials and the shipment of wastes to a future deep repository site.

The inventories report (Ecometrix 2017) is not available on the CEAA website, nor are other background reports. I was thus unable to check the adequacy of the assessment of radionuclide inventories and the estimated radiological consequences of the proposal. Nonetheless, my overall understanding of the situation is that wastes of this type with the nuclides and inventories in question would qualify as intermediate-level wastes (ILW) that would normally require deep geological disposal. This ILW category seems to apply to most of the highly neutron-activated core material. It is likely that with removal of such material, the remaining structure could qualify as a low-level waste site. As a result, some version of Alternative #4 does not seem unreasonable as it would likely be compatible with national and international standards. Nonetheless, this alternative is not put forward as the preferred approach, thus it is not clear if it would be fully acceptable without a revised EIS based on this approach.

General conclusions

The EIS for in situ disposal of WR-1 does not make a convincing case for the proposed approach. The most appropriate solution for much of the waste (at least the ILW portion) is likely to be disposal in a deep geological repository that is expected to be built somewhere in Ontario within the next decades.