Comments on the Deep Geological Repository (DGR) for Canada's Used Nuclear Fuel Project

Concerned Citizens of Renfrew County and Area

Summary

The Initial Project Description (IPD) does not provide a clear, fully detailed plan for nuclear fuel waste management. Discussion of activities at reactor sites, such as fuel storage (including prolonged storage), and fuel transfer into casks, is inadequate. Key topics such as fuel types, design and function of transport casks, means of transport, and transportation routes, are not well addressed or are omitted altogether. Other deficiencies of the IPD are the need for, and functions of, the Used Fuel Packaging Plant, the Underground Characterization Facility, the shallow cavern for centralized storage, and the radioactive liquid waste handling facility. Repository design alternatives (shaft versus ramps) must be considered.

About Concerned Citizens of Renfrew County and Area

Concerned Citizens of Renfrew County and Area (CCRCA) is an incorporated, non-profit organization that has been working for the clean-up and prevention of radioactive pollution from the nuclear industry in the Ottawa Valley for 40+ years. Our current focus is the proposed giant mound for one million cubic meters of radioactive waste at Chalk River, Ontario and the proposed “entombment” of the Nuclear Power Demonstration reactor at Rolphton, Ontario. The Chalk River Laboratories would be one of the sources of used fuel to be sent to the DGR. AECL’s research reactors at Chalk River used a variety of fuel types. Their varied properties are a management consideration for long-term storage or disposal. Within Renfrew County there are 200 kilometres of Highway 17. It would be part of the route for used fuel shipments from the Point Lepreau reactor, the Gentilly-2 reactor, and from Chalk River itself to the Ignace DGR site. Used fuel transport should be assessed in the impact assessment. We have concerns about accidents on this busy highway, and radiation exposures associated with proposed fuel shipments.

Fuel Containers and Fuel Types

For over 25 years, countries have examined used fuel containers that can serve multiple functions: for storage, transport, and final disposal. The IAEA conducted a review of the used fuel storage plans of various countries in December 2000. It found that the newest approaches being pursued for spent fuel management use dual-purpose and multi-purpose containers, that can “be part of the transport, storage, and possibly geological disposal systems of an integrated spent fuel management system.”[1]

Advantages of multi-purpose containers include efficiency and reduced handling. They could eliminate the transfer of used fuel from transport into disposal containers, and greatly reduce radiation exposures at the repository. Their use has the potential to eliminate the need for a Used Fuel Packaging Plant. This is a key “alternative means” consideration for the DGR project.

The “natural uranium” fuel used in Canada’s heavy water reactors has advantages and disadvantages compared to the enriched fuel used in light water reactors. CANDU fuel bundles are less radioactive and do not create criticality concerns in storage. Used fuel storage baskets can be moved directly from pool storage to dry storage facilities. However, the low efficiency of natural uranium in terms of the total energy extracted per fuel bundle means that CANDU reactors produce at least five times more used fuel per unit of electricity generated than light water reactors.[2]

Lower burnup of CANDU fuel translates to lower heat load during storage, and the possibility of higher storage densities. Calculations suggest that these higher densities make CANDU used fuel dry storage costs comparable to those for fuels from light water reactors, despite the far higher volume of spent fuel production with CANDU reactors.[3]

Changing fuel properties over time will affect prolonged dry storage at reactor sites. This should be considered as an alternative in the impact assessment. An understanding of how used fuel properties influence dry storage is equally relevant to the design and operation of a geologic repository. A plain language description of the fuel types to be put in the DGR—both CANDU power reactor fuels and AECL research reactor fuels--should have been in the IPD, with a description of key radionuclides of concern.

Fuel Reprocessing

Reprocessing operations produce waste streams that contain long-lived radionuclides. They need to be disposed of and many countries are basing their plans on using deep geological disposal to isolate these wastes from the biosphere. Direct disposal of CANDU fuel bundles eliminates this need.[4] The IPD says that "For a number of reasons, reprocessing as a management approach for used nuclear fuel is considered to be highly unlikely as a viable scenario for Canada at this time." An unequivocal statement is needed that reprocessing will not be carried out at the DGR.

Repository Design

The plain language summary of the IPD says

> Participants in the IPD review from the Township of Ignace questioned the absence of a ramp in the repository design, noting that **reliance on vertical shafts could pose safety risks** if an elevator or hoist were to fail and suggesting that a ramp could enhance both safety and evacuation options. [emphasis added]

The full IPD says

> Questions were raised about the repository design, particularly the absence of a ramp and reliance on vertical shafts. Participants expressed concern that multiple access routes could enhance safety and evacuation options in the unlikely event of an emergency.

Most countries with advanced DGR programs--including Finland, Sweden, and Switzerland--are planning to use ramps rather than vertical shafts. In addition to easier evacuation in an emergency, ramps allow the use of heavy specialized vehicles for waste transport, eliminate the possibility of accidents during shaft hoisting and lowering, and provide easier waste monitoring and retrievability. Given that ramps would improve overall operational safety, it is imperative that this alternate design feature be examined.

Siting and Transport

It appears that the NWMO used a flawed siting process that yielded a poor result—a repository location distant from the southern Ontario location of most of Canada's used fuel. Closer Canadian Shield areas are on Crown Land with crystalline rock potentially suitable for a geologic repository. The Ignace location necessitates long-distant transport by yet-to-be defined means, with increased GHG emissions.

The justification for exclusion of transport considerations from the impact assessment makes no sense:

> Since these transportation activities support broader national and regional systems and the public and interested parties, and do not require infrastructure upgrades or changes directly attributable to the Project, they are distinct and **not** subordinate or **complementary to the** designated activity (i.e., construction and **operation of the DGR**). [emphasis added]
>
> Accordingly, the Project does not include the transportation of used fuel from reactor sites to the Project…

If transportation activities are "not complementary" to the "operation of the DGR," how would used fuel get to the repository?

Questions, and Other Issues:

Some of the issues raised above, and other issues, are framed as questions. The section(s) of the IPD to which the question(s) refer(s) is given:

Regarding repository design, has it been conclusively determined that we will be "getting the shaft," or will there be an alternative means comparison with ramps? (section 4.3.2, Areas of Focus and Shared Commitments with the Township of Ignace)

Will fuel transfer into disposal casks at the reactor sites be examined as an alternative to construction of the Used Fuel Packaging Plant (UFPP)? (section 9.5.2, Listing of Major Construction Activities; Commitments Made in the Initial Project Description Appendix: 3. Environmental Design Features)

Might there be a time in the future when reprocessing is deemed viable? Has reprocessing been conclusively ruled out as an "other management approach?" Would the construction of hot cells keep open the possibility of reprocessing? (section 9.5.2, Listing of Major Construction Activities; section 5.1 / Our Initial Screening of the Options)

Regarding the statement "At this time, the decontamination of certified transportation packages, UFPP areas and UFCs is expected to generate both liquid and solid radioactive waste streams," might there be a time in the future when the decontamination of the UFTPs, UFPP areas and UFCs would not be expected to generate liquid and solid radioactive waste streams? Would multi-purpose casks reduce or eliminate these radioactive waste streams? Might they reduce or eliminate the need for a radioactive liquid waste handling facility? (section 9.6.2, List of Major Activities During Operations)

Why is there no description of temporary dry storage containers? Will they be considered in the "alternative means" assessment? (section 10, Estimated Maximum Production Capacity of the Project)

Why does the full IPD contain 75 references to the "Underground Characterization Facility" while there are none in the plain language summary? Can a clear plain language description of its function be provided? Would its function be to characterize site suitability and develop a basis for the detailed design of the repository? What happens if the site is deemed unsuitable? (section 12.1.1, Alternatives Assessed--and many other references)

Why would there be a need to wash the Used Fuel Containers (UFCs)? Could multi-purpose, disposal-ready packages avoid the need to wash down the Used Fuel Transportation Packages (UFTPs) and reduce quantities of solid waste in the form of contaminated UFTPs? (23. List of Potential Waste and Emissions)

Will the public be given plain language descriptions of the different fuel types to be put in the DGR? Will these descriptions describe radionuclides of concern? Are the characteristics and special disposal considerations regarding "unconventional" fuel types from AECL's research and prototype reactors being ignored? (Chapter 11 / Financial Aspects; Appendix 4 / Status of Used Nuclear Fuel in Canada)

Is it the intent that the only "alternative means" to be discussed in the impact assessment will be whether or not to build "shallow underground caverns for centralized storage?" To what extent would this increase fuel handling and worker radiation exposures? Would centralized storage be needed in a scenario in which used fuel is shipped to the repository in "disposal-ready" containers? (section 16.4 / Option 4: Adaptive Phased Management)

Will prolonged (not permanent) storage at reactor sites be considered in the "alternative means" assessment? (section12.1.1.2, Option 2: Storage at Nuclear Reactor Sites)

For the chosen option 1—deep geological disposal in the Canadian Shield--did the siting process inadvertently ignore portions of the Shield in southern Ontario closest to most of Canada's used fuel (perhaps because they were not within incorporated municipalities)? (section 12.1.1, Alternatives Assessed)

Why does Table 20.3 deem the "Likelihood of Adverse Residual Effects" to the "Intermediate or Valued Component" of "Climate Change" to be "High?" To what degree does this reflect the poor choice of location of the proposed repository and the unnecessarily large greenhouse gas emissions associated with used fuel transport? (section 19.2.3.13.1, Preliminary Risk Screening of Residual Effects)

What is meant by the reference to "ceramic used fuel pellets?" (section 9, Activities, Infrastructure, Structures and Physical Works)

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[1] International Atomic Energy Agency, "Multi-purpose container technologies for spent fuel management," IAEA-TECDOC-1192, December 2000.

[2] C.J. Allan and K.W. Dormuth, "The Back End of the Fuel Cycle and CANDU," In *Proceedings of international symposium on technologies for the management of radioactive waste from nuclear power plants and back end nuclear fuel cycle activities*, IAEA-SM-357/10, 2000.

[3] M. Petrovic and J. Hashmi, Single Storage Canister to MACSTOR® - 14578: Canadian Solution and Experience in Responsible Spent Fuel Management, WM2014 Conference, March 2014.

[4] Allan and Dormuth, "The Back End of the Fuel Cycle."