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Development of a Prototype Repository for Canadian Spent Nuclear Fuel

In May of 2005 the Nuclear Waste Management Organization has published its draft report, "*Choosing a Way Forward*," which deals with alternative approaches for long-term management of irradiated nuclear fuel in Canada. Canadians are invited by the NWMO to comment on the report, to improve its content. Having worked on the design of CANDU nuclear plants for the past 30 years, and on the development of dry spent fuel storage for Canadian and overseas CANDU reactors for the past 20 years, I volunteer the following comments and suggestions regarding irradiated fuel management in Canada.

The development of an irradiated nuclear fuel repository site with the capacity to accommodate all of Canada's nuclear fuel is a major project. NWMO's report estimates a total cost of $ 24 billion, over a 60-year project life. This type of project can be expected to encounter some technical difficulties, but I expect it to be dominated by the need to obtain the social consensus necessary for the realization of such a project.

My recommendation is that it would be preferable to initiate a project of such magnitude by starting with a prototype repository, accommodating only a small quantity of spent fuel.

I therefore propose to NWMO the construction of a prototype repository into the overall development program and to have the NWMO to focus its short-term objective on the realization of this prototype. Such an approach lends itself very well to the general strategy of a "progressive, adaptive management approach" highlighted in the study.

I propose that the small quantity of irradiated fuel selected for this prototype project be that of the NPD (Nuclear Power Demonstration) reactor. The reactor was decommissioned in 1987, after having served as the prototype for all CANDU reactors of today. The small NPD prototype provided an enormous amount of information for the subsequent development of high-power CANDU plants. It would be fitting if its spent fuel were also to serve for the demonstration of a prototype repository.

NPD is situated on the Outaouais River, some 20 km upstream from Chalk River Laboratories. Its spent fuel has already been packaged and sealed, and is presently in interim storage, in eleven silos at Chalk River Laboratories. The entire lot of spent fuel bundles is contained in 90 baskets, occupying just 25 cubic meters of volume.

The repository canister design would be very similar to that shown in Figure A3-11 of the report, each with five baskets. The entire inventory would require just 18 such canisters. In order to strengthen the technology base, two or three different repository canister designs could be developed.

The filling and sealing of these 18 repository canisters would be done at Chalk River Laboratories, rather than at the repository site. In this way, the construction of a large new repackaging shop needed for treating the much larger quantity of fuel from commercial reactors would be avoided. The tools available at the Laboratories can be adapted to handle such small quantities.

The initial repository site would therefore be just a simple set of tunnels, without any repackaging plant at the surface. Substantial cost savings can be achieved with this arrangement, while preventing contamination of the new site. The selected repository site would be selected to be within the Canadian Shield, but only at a relatively short distance from the current storage site of the fuel. Thus the transport costs would also be minimized.

The repository site selection process would follow the general methodology described in the study, and would need to seek consent of the host community. The site would also be intended, in the long run, for expansion to a full-scale capacity, capable of accommodating the Canadian spent fuel inventory. Naturally, the conversion from prototype to full-scale repository site would also entail seeking additional consent of the host community.

The prototype repository site would be selected and built during the next ten to twenty years. The fuel would be stored in a retrievable way, and it would be under surveillance for the multi-decade duration of the demonstration period. This strategy, will allow polishing the transport methodology and the repackaging and disposal process. It would at the same time, accustom Canadians to the existence of a repository of this type, and demonstrate its benign nature. The host community and Canadians in general would be asked for authorization to proceed with expansion to a full-scale repository following demonstration of acceptable performance. Applying the lessons learned from operation of the prototype project would then minimize the difficulties and costs of starting the full-scale repository project.

The Government of Canada is the owner of the NPD fuel. As such, the responsibility for its disposal costs lies with the owner. Nevertheless, as the unit cost of the storage process is higher for a prototype, and commercial nuclear plant operators will use the technology and the site developed, the latter could share some of the investment expenses. Alternatively, some of the funds already amassed for nuclear waste management could be used, since the project essentially represents the beginning of the final repository.
The prototype project should be feasible with a budget on the order of $200 million to $300 million, based on the limited 18-canister repository and on the fact that a repackaging plant is not necessary. The annual spending rate would be from $10 million to $30 million, which is well within the means of the member organizations.

I believe it is important for our country to proceed with the development of a national repository site for irradiated fuel. Recent development of surface dry storage technology has allowed the eventual permanent storage process to be deferred by at least half a century, if necessary. We must now make good use of this deferral period by building and operating a prototype repository.

Thank you.

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P.Q.