

Lifecycle Management of Used Nuclear Fuel in Ontario Hydro

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Abstract

This paper reviews the status of lifecycle used fuel management activities in Ontario Hydro. Both wet and dry used fuel storage facilities and programs are discussed. An historical review of used fuel disposal development over the last twenty years is included, culminating in a summary of the conclusions and recommendations of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel. Stakeholder consultations and the results of an Ontario Hydro-initiated international independent panel review of its nuclear waste strategies are discussed. The paper concludes with a summary of Ontario Hydro's current approach to lifecycle used fuel management.

1.0 Introduction

Ontario Hydro has been producing used nuclear fuel since 1971 when the first Pickering reactor came into operation. Since that time Ontario Hydro has commissioned a further nineteen reactors at its Pickering, Bruce and Darlington sites, and has accumulated, to date, approximately 1.2 million used fuel bundles (23,000 MgU). At the projected end of life of the current reactors it is estimated that 3.2 million used fuel bundles will have been generated (60,900 MgU).

Used nuclear fuel must be managed in an environmentally, socially and financially responsible manner and Ontario Hydro views this as one of its key responsibilities. The purpose of this paper is to briefly outline how Ontario Hydro is meeting this responsibility now, and how long-term aspects of lifecycle used fuel management are currently being addressed.

2.0 Used Fuel Storage

Upon being removed from a reactor, used fuel bundles are stored in water-filled bays located at each nuclear generating station. Once a fuel bundle has spent 6-10 years in a bay, its rate of heat generation will have decreased sufficiently that it is possible to store the fuel in dry storage containers. Dry storage technology is widely used internationally and is a more economical mode of storage than building additional water-filled bays, primarily because it can be added in small increments and requires little maintenance. A used fuel dry storage facility was commissioned at Pickering in 1995 and currently about 75 dry storage containers have been filled and are in storage at the site. The dry storage containers in use were developed by Ontario Hydro and are concrete-filled, steel-shelled vessels each containing 384 fuel bundles with a welded lid and helium cover gas.

An application to construct a dry storage facility at the Bruce Nuclear Power Development site has been submitted to the Atomic Energy Control Board and the proposed project is currently undergoing environmental assessment under the Canadian Environmental Assessment Act. The planned in-service date for this facility is 2002. A similar dry storage facility is planned for in-service at the Darlington site in 2005.

Experience with both wet and dry used fuel storage has been good. Examinations of used fuel in long-term test storage conditions have shown that this fuel is not degrading and that used fuel integrity can be maintained while stored in wet or dry environments for an extended period.

3.0 Used Fuel Disposal

3.1 Historical Review

In 1978 the Governments of Canada and Ontario announced a joint program of research with the intention of verifying “...that permanent disposal in a deep underground repository in intrusive igneous rock is a safe, secure and desirable method of disposing of radioactive waste.” Atomic Energy of Canada Limited (AECL) was given the role of developing disposal technology, while Ontario Hydro was tasked with the development of interim storage and used fuel transportation technology. In 1981 the two governments issued a second joint statement in which they announced the process by which acceptance of the disposal concept will be undertaken and announced the government decision that “...no disposal site selection will be undertaken until after the concept has been approved”.

In September 1988, following ten years of disposal concept development, the federal Minister of Energy, Mines and Resources wrote to the federal Minister of the Environment, referring for review according to the federal Environmental Assessment and Review Process (EARP), the specific concept of deep geological disposal of nuclear fuel wastes developed by AECL. The referral also requested that a board range of associated nuclear fuel waste management issues be addressed. In the letter the Minister recommended that an Environmental Assessment Panel be established, along with a supporting Scientific Review Group.

The EA Panel, chaired by Blair Seaborn, was established in 1989. The Panel issued guidelines to AECL in March 1992 and AECL submitted its Environmental Impact Statement in October 1994. A process of review then occurred, including public hearings, and the Panel submitted its report to the federal government in March 1998.

3.2 EA Panel Conclusions and Recommendations

The Panel’s key conclusions were:

- Broad public support is necessary in Canada to ensure the acceptability of a concept for managing nuclear fuel wastes;
- Safety is a key part, but only one part, of acceptability. Safety must be viewed from two complementary perspectives: technical and social;
- From a technical perspective, safety of the AECL concept has been on balance adequately demonstrated for a conceptual stage of development, but from a social perspective, it has not;
- As it stands, the AECL concept for deep geological disposal has not been demonstrated to have broad public support. The concept in its current form does not have the required level of acceptability to be adopted as Canada’s approach for managing fuel wastes.

The Panel’s key recommendations were:

- A policy statement on managing nuclear fuel wastes should be issued;
- An Aboriginal participation process should be initiated;
- A nuclear fuel waste management agency should be created;
- A public review of AECB regulatory documents, using a more effective consultation process, should be conducted;
- A comprehensive public participation plan should be developed;
- An ethical and social assessment framework should be developed;
- Options for managing nuclear fuel wastes should be developed and compared.

The Panel's recommendations are advisory. The Government of Canada must issue a response to the Panel Report – accepting or rejecting the recommendations. A response from the federal government is expected in the fall of 1998.

3.3 Ontario Hydro's Disposal Program Activities

The federal government, through AECL, initially funded all disposal concept development activities while Ontario Hydro funded work on interim storage and transportation. Disposal concept development later came under the CANDU Owners Group (COG) jointly-funded R&D program with Ontario Hydro contributing 50% of the cost. Correspondingly, Ontario Hydro participated on COG Working Groups that developed associated work programs. The federal government/AECL stopped providing funding for used fuel disposal development in March 1996.

Ontario Hydro's Board of Directors approved a radioactive waste strategy in 1995 which included recommendations that Ontario Hydro should have a forward-moving program on used fuel disposal, subject to the outcome of the CEEA hearing, and that Ontario Hydro should take a controlling interest and lead role in implementing used fuel disposal. Ontario Hydro has, beginning in 1996, assumed responsibility for maintaining the technological capability required in the near-term to support a disposal program. Key capabilities include: an underground research laboratory, safety assessment modeling, in particular, geosphere modeling; geotechnical support to siting and unique aspects of geotechnical engineering.

4.0 Review of Ontario Hydro Used Fuel Management Strategy

4.1 Stakeholder Review

In late 1997 as a result of several developments, including the issuance of the Natural Resources Canada's 1996 Radioactive Waste Policy Framework, the Ontario Government's White Paper on electricity industry restructuring, the new Nuclear Safety and Control Act, and the EA Panel review, Ontario Hydro initiated a review of its strategy for the long-term management of used nuclear fuel. As part of this review, broad stakeholder consultations were conducted involving individuals from a number of groups including, the federal and provincial governments, Aboriginal communities, nuclear station communities, other nuclear utilities, northern communities, industry stakeholders, professional associations, the academic community, environmental/energy interest groups and internal Ontario Hydro stakeholders.

A Discussion Paper was developed which outlined the context for the strategy review and questions for discussion. The four question areas were program direction, program management, financial management and implications for the management of other nuclear wastes.

Different involvement mechanisms were used at different times with the various stakeholder groups according to the needs of the interests involved. Mechanisms included information-education activities (newsletters, etc.), information-feedback activities (presentations, mail-out for comment, etc.), consultation (facilitated workshops, interviews) and public attitude research.

The stakeholder review did not try to ascertain or develop a consensus view of the discussion areas, hence the findings reflect a broad range of opinion. However, the following is a sampling of commonly-held views:

- Disposal is not urgent, but storage is not permanent;
- Station communities expect that fuel will be eventually moved off site;
- Consider storage alternatives, but maintain disposal option;
- Ontario Hydro created the waste and must retain responsibility;
- Preference for a separate not-for-profit Waste Management Agency;
- A separate externally-invested fund to cover waste management should be established.

4.2 Independent Panel Review

Earlier this year Ontario Hydro established an ad hoc Independent Panel Review (IPR) on Nuclear Waste Strategies and Management Processes to provide advice related to used fuel management strategy, relationships with other used fuel owners, and on other matters related to waste management and reactor decommissioning. The IPR was composed of Jane Allen (Canada), Garry Brewer (USA), Ken Hare (Canada, Chair), Tom LaGuardia (USA), Charles McCombie (Switzerland) and Bernard Page (UK).

In relation to the long-term management of used nuclear fuel, the IPR recommended that Ontario Hydro should reassess its preferred timing for fuel disposal, and then develop alternative strategies in which progress is faster or slower, by choice or for political reasons outside its control. The Panel also recommended the creation of a Nuclear Waste Management Organization by the producers of nuclear wastes.

4.3 Proposed Strategic Direction

As a result of the Stakeholder Review, the Independent Panel Review and other considerations, Ontario Hydro has proposed a strategic direction for used fuel management that includes the following:

- Study the costs and public acceptability of options for long-term used fuel management;
- Maintain disposal as the reference plan pending the outcome of the study;
- Consider the creation of a new agency by the waste owners;
- Establish a segregated fund for waste management liabilities.

5.0 Summary of Ontario Hydro's Current Approach to Lifecycle Used Fuel Management

With respect to short-term used fuel storage, it is Ontario Hydro's intention to continue to employ used dry storage technology once the existing wet bays at each station are full. There is sufficient space at the current reactor sites to store the used fuel projected to be generated during the stations' 40-year lives.

With respect to long-term used fuel management, Ontario Hydro currently awaits the federal government's response to the March 1998 Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel.

Ontario Hydro is committed to the environmentally, socially and financially responsible management of its used nuclear fuel.