

MANAGEMENT OF LEGACY SPENT NUCLEAR FUEL WASTES AT THE CHALK RIVER LABORATORIES: THE CHALLENGES AND INNOVATIVE SOLUTIONS IMPLEMENTED

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1. Introduction

AECL has operated research reactors at the Chalk River Laboratories (CRL) site since 1947, for the purpose of nuclear energy and scientific research and for the production of radioisotopes. During the 1950s and 60s, a variety of spent nuclear fuel wastes were produced by irradiating metallic uranium and other prototype fuels. These legacy waste fuels were initially stored in water-filled fuel storage bays for a period of several years before being placed in storage containers and transferred to the CRL Waste Management Areas (WMAs), where they have been stored in below-grade, vertical cylindrical steel and concrete structures called “tile holes.”

2. The FPS Project

AECL’s Fuel Packaging & Storage (FPS) Project was initiated in 2004 to retrieve, transfer, and stabilize an identified inventory of degraded research reactor fuel that had been emplaced within in-ground “tile hole” structures in Chalk River Laboratories’ Waste Management Area in the 1950s and 60s. Ongoing monitoring of the legacy fuel storage conditions had identified that moisture present in the storage structures had contributed to corrosion of both the fuel and the storage containers. This prompted the initiation of the FPS Project which has as its objective to design, construct and commission equipment and systems that would allow for the ongoing safe storage of this fuel until a final long-term management, or disposition, pathway was available.

2.1 Innovative solutions

The FPS Project provides the following systems and technologies. Fuel retrieval and transfer equipment designed to deal with the challenges with the potential for hydrogen build-up in the fuel storage containers, resulting from corrosion and radiolysis processes in sealed containers, as well as the high levels of radiation and contamination expected to be encountered. A Cold Vacuum Drying (CVD) system designed to use a combination of cyclic evacuations and inert gas purges to remove residual free water from the storage containers. A packaging station intended to interface with the retrieval system and drying station and ensures the fuel and all debris is transferred to the new storage container ready for drying. A new dry storage system designed as a concrete vault with an array of fuel storage tubes that will hold the new fuel storage containers. The storage structure will provide shielding and a secondary confinement boundary, and facilitate monitoring and inspection. All equipment and the new storage facility are designed and constructed to meet the requirements for Class 1 Nuclear Facilities in Canada.

2.2 Current status

The current status of Project activities is such that:

- Overall completion of the construction of the building and building systems is expected by end 2012 August;
- All the civil works have been completed in the Waste Management Area to enable installation of the fuel retrieval systems;
- Factory acceptance testing on the major equipment will be completed in 2012 September and installed within the FPS Facility and Waste Management Area by 2012 December;
- All commissioning procedures for commissioning of the FPS Facility and equipment are prepared and ready for execution; and
- The Final Safety Analysis Report supporting the FPS operations has been prepared and submitted to AECL's internal safety review committee.

3.0 Summary

Operational turnover of the FPS Facility is scheduled for 2013 and fuel retrieval, operations are planned to commence immediately thereafter. Approximately 22 tonnes of fuel located in five areas within the Waste Management Area is planned to be removed and safely stored over a five year period. The FPS Project is funded by the Government of Canada, as part of the Nuclear Legacy Liabilities Program.

This paper will present the challenges and the innovative solutions the FPS Project has put in place to retrieve and stabilize the fuels and store them safely in a controlled atmosphere for the upcoming decades.