SITE DECOMMISSIONING OF AECL WHITESHELL LABORATORIES

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ABSTRACT

AECL Whiteshell Laboratories (WL), near Winnipeg, Canada has been in operation since the early 1960s. In the late-1990s, AECL began to consolidate research and development activities at its Chalk River Laboratories (CRL) and began preparations for decommissioning WL. As a prerequisite to AECL's application for a decommissioning licence, an environmental assessment (EA) was carried out according to Canadian environmental assessment legislation. The EA concluded in 2002 April when the Federal Environment Minister published his decision that WL decommissioning was not likely to cause significant adverse environmental effects and that no further assessment by a review panel or mediation would be required. In 2002 December, the Canadian Nuclear Safety Commission issued a decommissioning licence for WL, valid until December 31, 2008. The licence authorized the first planned phase of site decommissioning as well as the continuation of selected research programs. The six-year licence for Whiteshell Laboratories was the first overall decommissioning license issued for a Canadian Nuclear Research and Test Establishment.

The first phase of decommissioning is now underway and focuses on decontamination and modifications to nuclear facilities, such as the shielded facilities, the main R&D laboratories and the associated service systems, to achieve a safe state of storage-with-surveillance. Later phases have planned waste management improvements for selected wastes already in storage, eventually followed by final decommissioning of facilities and infrastructure and removal of most wastes from the site.

This paper provides an overview of the planning, environmental assessment, licensing, and organizational processes for decommissioning and selected descriptions of decommissioning activities currently underway at AECL Whiteshell Laboratories.

I. INTRODUCTION

AECL operates two nuclear R&D laboratories in Canada, Chalk River Laboratories (CRL) near Ottawa, Ontario, and Whiteshell Laboratories (WL), near Winnipeg, Manitoba. AECL Whiteshell Laboratories have been in operation since the early 1960s. In the late-1990s, AECL began to consolidate research and development activities at CRL and initiated preparations for decommissioning WL. Decommissioning work is now underway. This paper provides an overview of the planning, environmental assessment, licensing and the decommissioning activities currently underway at AECL Whiteshell Laboratories.

II. OVERVIEW OF WHITESHELL LABORATORIES AND FACILITIES

R&D programs carried out at Whiteshell Laboratories included the 60 MW WR-1 organic liquid-cooled research reactor, which operated from 1965 to 1985, shielded facilities, materials science, post irradiation examination, reactor safety research, small reactor development, chemistry, biophysics and radiation applications. The Canadian Nuclear Fuel Waste Management Program was conducted and continues to operate at WL and also at the nearby Underground Research Laboratory. Figure 1 is an aerial view of the Whiteshell Laboratories, showing the Winnipeg River in the background.

Figure 1: Aerial Photograph of AECL Whiteshell Laboratories

WL Decommissioning encompasses all the site buildings, facilities, land and infrastructure associated with the WL site. AECL has already completed Phase 1 decommissioning of the WR-1 Reactor to a safe state of storage-with-surveillance.

The decommissioning of WL is planned in three phases:
Phase 1 will last six years and focuses on decontamination and modifications to nuclear facilities, such as the Shielded Facilities, Research Laboratories and the associated service systems (active ventilation and drain systems), to achieve a safe state of storage-with-surveillance while reducing the cost of maintaining the facilities in the safe state.
Phase 2, lasting approximately ten years, maintains the storage-with-surveillance state of the decommissioning facilities and focuses on waste management improvement activities for selected wastes already in storage.

Phase 3 covers the last forty years of the program. Initially, this phase is continued storage-with-surveillance, followed by final decommissioning of facilities and infrastructure and removal of most wastes from the site.

III. ENVIRONMENTAL ASSESSMENT AND LICENSING

Prior to decommissioning, AECL was required to obtain a decommissioning licence from its regulator, the Canadian Nuclear Safety Commission (CNSC). As part of the documentation provided in support of the licence submission, AECL was required to complete an environmental assessment (EA) in accordance with the Canadian Environmental Assessment Act (CEAA). WL decommissioning qualified as a major project under CEAA and required an EA at the Comprehensive Study Level.

The EA for WL decommissioning was carried out over a three-year period.[1] The scope of the EA included decommissioning of nuclear facilities, non-nuclear facilities, and all lands used by AECL's operations. Characterization and clearance surveys were carried out to support the definition of scope of the project. Three alternative timeframes were considered. A consultation process was maintained throughout the EA, as required by the Act, involving experts from government departments, members of the public and First Nations. Techniques used to inform the public and obtain feedback included: key person interviews, interviews with experts and lay persons, newsletters, letters to interest groups and local organizations, public open house sessions, information sessions for elected officials and selected presentations to interested parties.

The EA culminated in publication of the Comprehensive Study Report (CSR).[2] The CSR was formally reviewed by experts from provincial and federal government departments and by the public. In April 2002 the Federal Minister of the Environment responded with a decision that the decommissioning of Whiteshell Laboratories 'is not likely to cause significant adverse environmental effects and that no further environmental assessment by a review panel or mediation is warranted'.

Successful completion of the EA cleared the way for application to the CNSC for a decommissioning licence. In the licence application, the Commission considered written and oral submissions from AECL, CNSC Staff and several interveners, over the course of two public hearings. The Commission concluded that AECL is qualified to carry out the activities under the licence and, in doing so, will make adequate provision for the protection of the environment, the health and safety of persons, and the maintenance of national security and measures required to implement international obligations to which Canada has agreed. The WL decommissioning licence, issued December 31, 2002, valid until end of 2008, authorized the planned Phase 1 of WL decommissioning as well as the continuation of selected research programs.

Issuance of the WL decommissioning licence was significant. This was the first overall site decommissioning licence issued for a Nuclear Research and Test Establishment in Canada. It was also the longest licence term ever granted for a nuclear installation of this complexity.

IV. ORGANIZATIONAL PROCESSES FOR DECOMMISSIONING

Management of Work to Protect Employees and the Environment

AECL's Occupational Safety & Health (OSH) and Radiation Protection Programs provide a management system and processes that, together with active employee involvement, ensure the safety and health of people in all aspects of AECL's activities. As expressed in AECL's corporate policy, *Health, Safety & Environment,* all organizational units, facilities and projects are bound to comply with these programs.

Work planning, documented working procedures and worker training are used to ensure that hazards are identified and mitigation measures are implemented. Work plans are independently reviewed and approved by technical experts, such as qualified Health Physicists and by company-wide Compliance Program staff (e.g., Radiation Protection and Environmental Protection). Depending on the level of risk or hazard associated with the activity, work plans may also be reviewed by the Corporate Safety Review Committee (SRC) and staff of the regulator, Canadian Nuclear Safety Commission (CNSC). The Facility Authority authorizes all work plans.

The details of individual work packages are discussed, reviewed and rehearsed, as required, with work teams prior to the start of work. Facility Managers, or designated supervisors, authorize the day-to-day work carried out in their facilities through AECL's Work Permit process, which includes pre-checks that radiological and industrial health and safety measures are in place to protect AECL staff, contractor personnel and the environment before the work can begin.

Safety-related systems, such as ventilation systems and active drain systems are removed or modified only after a thorough review is completed to ensure that the system is no longer required or an alternate system is in place.

These processes are applicable for both conventional industrial safety and radiation protection, and are incorporated in AECL's Occupational Safety & Health and Radiation Protection Programs. Where new technology is introduced to improve these processes, it is done in a controlled manner after the safety implications are assessed, necessary controls are put in place and the employees are trained and qualified.

Where it is not practical for AECL to sustain expertise in-house, or where additional expert resources are required for time-limited tasks, contractors qualified to undertake this type of work are hired. Contractors are only allowed to commence work once the radiological hazards have been removed, or where this is not possible, the radiological hazards have been fully characterized and appropriate work controls put in place. Contractor staff must have the appropriate level of Radiation Protection training before they are permitted to work on WL property.

AECL, as a Federal Crown Corporation, is regulated under the Canada Labour Code. Human Resources Development Canada (HRDC) routinely conducts inspections of WL

with respect to the requirements of the Canada Labour Code and associated occupational safety and health regulations.

Mitigation of Impacts from Unplanned Events

In addition to measures to protect workers and the environment from the risks associated with normal operations, other measures are in place to mitigate effects from potentially significant unplanned events during decommissioning. In particular, emergency plans and procedures are maintained, resourced and exercised, as required under AECL's Emergency Preparedness Program. Furthermore, WL has qualified fire fighting staff, procedures, and modern equipment for dealing with fires. There is also qualified Radiation Protection staff on-site to respond to radiological incidents.

Decommissioning activities and facilities are designed to prevent unplanned events. For example, equipment is designed and operated in a fail-safe mode, secondary containment is provided for most existing equipment and systems where leaks can occur, and new equipment and systems will be installed with secondary containment, where necessary. However, in the unlikely event of any contaminant release as a result of a spill or fire, the mitigation measures include stopping the release, mitigating the impact of the release and undertaking immediate clean-up.

Unplanned events, when they occur, are investigated through AECL's Operational Experience (OPEX) Program in order to identify the root cause and to take steps to learn from the incident. The objective is to prevent similar events from occurring in the future.

Quality Planning

AECL's Quality Assurance (QA) Program is based primarily on the Canadian Standards Association N286 series of Standards for Nuclear Power Plants.

The *Company-Wide Decommissioning Quality Assurance Manual* applies to the activities related to the decommissioning of a nuclear facility, from the declared final shutdown to the clearance of the site. It outlines the common elements of the associated management roles and responsibilities, and the company-wide procedures used to manage decommissioning activities across AECL's sites.

The *Whiteshell Laboratories Decommissioning QA Plan* identifies the specific management responsibilities, the working procedures and operating instructions for specific decommissioning tasks.

V. SELECTED EXAMPLES OF DECOMMISSIONING ACTIVITIES

Active Liquid Waste Immobilization

AECL has three Active Liquid Waste (ALW) volumes stored at Whiteshell Laboratories. These result from reprocessing and fissile material separation experiments conducted in the 1970s and 1980s.

The ALW consist of: 146 litres of amine solution, resulting from irradiated and unirradiated CANDU fuel processing experiments, currently stored in an underground tank at the Waste Management Area (WMA); 74 litres of waste from a Thorium Fuel Reprocessing Experiment (TFRE), resulting from a thorium fuel reprocessing experiment, currently stored in a tank in the Hot Cell Facility; and 600 litres of a non-irradiated Uranium-Thorium solution (UTS). AECL's plan is to retrieve these wastes, to immobilize and place them into interim storage until permanent facilities are available.

Four immobilization options were evaluated: vitrification; calcination; drying and cementation. Cementation was chosen as the preferred option for the relatively small volumes involved.

The design, construction, operator training and commissioning of the cementation plant is complete.

Site and General Infrastructure Decommissioning

The Whiteshell licensed site and general infrastructure (SGI) includes all buildings, facilities, temporary structures, laboratories, services, and all affected land at WL, excluding licensed nuclear and radioisotope facilities. The SGI includes service buildings such as the water pump-house and treatment plants, facilities such as the site sewage lagoon and the site drainage systems, laboratories for non-nuclear experimentation, services including district heating and electrical power, and all land that may have been impacted by site nuclear development, nuclear operations or supporting activities.

Radiologically inactive buildings are generally confined to the south side of the WL site. These buildings once housed administration, design engineering and general service functions. Characterization of interior and exterior areas is needed prior to demolition and involves assessment of the industrial hazards and radiological release surveying.

A preliminary characterization of south side buildings was completed as part of the hazards assessment for the shutdown plan. In addition to radiological release surveys, this involved inspection, sampling and analysis for asbestos, lead-based paints, PCB's, fume hood residues, mercury and mould. Further surveying and assessment suitable for regulatory demolition planning, costing and scheduling purposes is underway by a contractor.

Removal of Temporary Structures

A variety of redundant trailers and temporary structures were situated within the site-supervised area. Prior to disposition, these units were radiologically surveyed. Trailers and sheds that were in serviceable condition and cleared for unrestricted release were donated to local businesses or charitable organizations.

Shallow Borehole Remediation

A network of instrumented shallow boreholes was created over a time frame from 1968 to about the early 1980s, to assess the hydrogeological conditions of AECL's Waste Management Area (WMA), which covers an area of about 5 ha. The studies were done on a block of land approximately 5 km by 2 km (1000Ha) extending from a local upland area, westward through relatively flat land, to the Winnipeg River. Only a small portion of the total network of more than 500 will be retained for future monitoring purposes; the rest will be closed.

Enhanced Monitoring

The enhanced monitoring program is a follow-up to the EA. The enhanced monitoring program will supplement the continuing environmental site monitoring to confirm the EA findings, evaluate the performance of mitigation measures, support the end-state proposed for some project components and determine the fitness-for-service of WMA storage facilities. The following are selected examples of enhanced monitoring initiatives:

Waste Management Area (WMA) Additional monitoring and characterization investigations are being initiated to confirm hydrogeological conditions for the WMA, to support assessments of interim storage in the WMA and the proposed final endstates of facilities in the WMA. Investigations have included visual inspections, geophysical surveying, drilling and soil sampling, hydrogeological data evaluation and conventional mapping.

Inactive Landfill. Enhanced monitoring of the inactive landfill is being done to ensure that the groundwater quality down gradient from the landfill site remains acceptable. Geotechnical and waste characterization data will also be required to provide a closure plan for the landfill site. A variety of geotechnical characterization work has been carried out on the landfill, including electrical conductance mapping, conventional surveying and terrain typing. These data are currently being compiled along with the existing information.

Sewage Lagoon. Current monitoring of lagoon discharges is done to ensure that the facility remains in compliance with all applicable regulatory requirements. Enhanced monitoring will provide additional data to confirm compliance with water quality standards, and provide data for a closure plan. Geotechnical characterization work at the lagoon has included electrical conductance mapping, conventional surveying and terrain evaluation. As well, there is a plan to place monitoring boreholes near the lagoon.

River Sediments. Sampling of river sediments provides assurance that the conclusions of the Winnipeg River Sediment Assessment, documented in Volume 2 of the Comprehensive Study Report, remain valid over the entire duration of the decommissioning project. The areas to be monitored include an upstream location and selected down stream locations on the Winnipeg River.

VI. SUMMARY

AECL has initiated preparations for decommissioning the Whiteshell Laboratories, an integrated nuclear research laboratory constructed in the 1960s. As a prerequisite to AECL's application for a decommissioning licence a formal Environmental Assessment was completed in accordance with Canadian environmental assessment legislation. Following successful completion of the EA, in 2002 December AECL was successful in obtaining a decommissioning licence for WL. The licence authorizes the first planned phase of site decommissioning as well as the continuation of selected research programs. The licence is the first overall decommissioning license issued for a Canadian Nuclear Research and Test Establishment and the six-year term of the licence is the longest ever granted for a nuclear installation of this complexity in Canada.

The first phase of decommissioning is now underway and focuses on decontamination and modifications to nuclear facilities, such as the shielded facilities, the main R&D laboratories and the associated service systems, to achieve a safe state of storage-with-surveillance. Later phases have planned waste management improvements for selected wastes already in storage, eventually followed by final decommissioning of facilities and infrastructure and removal of most wastes from the site.

Organizational processes for decommissioning are in place and approved work is underway.

REFERENCES

[1] Decommissioning of a Nuclear Site in Canada: Application of the Federal EA Process; Daniel J.M. Grondin and Robert A. Helbrecht; WM'02.

[2] AECL "Whiteshell Laboratories Decommissioning Project Comprehensive Study Report" Volumes 1, 2 and 3 (2001).