Lesson Learned in Preparation for Decommissioning of Three Canadian Prototype Power Reactors

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Lesson learned by Canadian Nuclear Laboratories (CNL)(former AECL) in preparation for decommissioning of three Prototype Reactors is a result of various strategies used for each site. CNL is responsible for the eventual decommissioning of three prototype power reactors; Nuclear Power Demonstration (NPD), Gentilly-1 and Douglas Point. Each of the Canadian prototype power reactor sites shutdown using different strategies. Depending on the site location, configuration, and intended designation of the respective sites, the individual facility systems (ventilation, electrical system, fire detection etc.) were also shut down using different strategies and operating objectives. As CNL embarks on decommissioning the first Canadian prototype reactor, this paper will reflect on the lessons learned over the past thirty years and what CNL is adjusting in the decommissioning strategy to prepare better plans for the future.

The Nuclear Power Demonstration Nuclear Generating Station (NPDNGS) was constructed in late 1950s and operated from 1962 to 1987 when it was permanently shutdown after exceeding its operational goals. The NPD reactor was the first Canadian nuclear power reactor and it consisted of a single 20 MWe pressurized heavy water reactor located on a single facility site in Rolphton, Ontario. The NPD facility was shutdown to a "Cold, Dark and Quiet" state and is maintained using an unmanned strategy by managing the site remotely with active fire detection and security surveillance systems, minimal electrical supply and an active ventilation system which is operated periodically to allow for intermittent inspections.

The Douglas Point Nuclear Generating Station (DPNGS) was constructed in the early 1960s and operated from 1968 to 1984 when it was permanently shutdown. It consisted of a 200 MW prototype Canada Deuterium Uranium (CANDU) reactor and is embedded on the Bruce Power site near Kincardine, Ontario. The Douglas Point site is maintained in a semi-custodial state as an active safe enclosure strategy. As a result of continued occupancy and repurposing some of the buildings post shutdown, most of the building services including heating, ventilation, water and fire detection systems at the Douglas Point site have been maintained operational. With the exception of the fuel canister area, security is maintained as access control for the multi facility site.

The Gentilly-1 Nuclear Generating Station was put into service in 1972. It consisted of a 250 MW CANDU- BWR experimental reactor located in Béancour, Quebec on a shared site with the Gentilly-2 Nuclear Generating Station (owned by Hydro Quebec). Following issues in attaining a full operational status, the reactor was put into a lay-up state in 1980 and permanently shutdown in 1982. The Gentilly-1 site is maintained with a safe enclosure strategy primarily in a "Cold and Quiet" state with all ventilation and heating systems shutdown. However, a dehumidifier is installed to maintain the moisture levels within the reactor building envelope. Fire detection is limited to areas of concern and, with the exception of the canister area, security is maintained for access control to a multi-facility site.

Lesson learned from the deferred decommissioning strategy on the maintenance of existing building structures and associated storage facilities while we allow for decay of the radioactive materials; the impact on costs and other associated factors will be explored. This paper will discuss the lesson learned from shutdown strategies and the impact of these strategies on the safe enclosure period through to decommissioning as it was employed at the three Canadian prototype power reactor sites. Topics will include the advantages and drawbacks, as well as, the repercussions of these strategies, due to the extended shut down periods which affect shut down operating costs, life management strategies, regulatory implications and progression into the final decommissioning phase.