Heavy Water Components Test Reactor Decommissioning

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INTRODUCTION

The Heavy Water Components Test Reactor (HWCTR) Decommissioning Project was initiated in 2009 as a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Removal Action with funding from the American Recovery and Reinvestment Act (ARRA). This paper summarizes the history prior to 2009, the major D&D activities, and final end state of the facility at completion of decommissioning in June 2011.

The HWCTR facility was built in 1961, operated from 1962 to 1964, and is located in the northwest quadrant of the Savannah River Site (SRS) approximately three miles from the site boundary. The HWCTR was a pressurized heavy water test reactor used to develop candidate fuel designs for heavy water power reactors. In December of 1964, operations were terminated and the facility was placed in a standby condition as a result of the decision by the U.S. Atomic Energy Commission to redirect research and development work on heavy water power reactors to reactors cooled with organic materials. For about one year, site personnel maintained the facility in a standby status, and then retired the reactor in place.

In the early 1990s, DOE began planning to decommission HWCTR. Yet, in the face of new budget constraints, DOE deferred dismantlement and placed HWCTR in an extended surveillance and maintenance mode. The doors of the reactor facility were welded shut to protect workers and discourage intruders. In 2009 the $1.6 billion allocation from the ARRA to SRS for site footprint reduction at SRS reopened the doors to HWCTR – this time for final decommissioning.

Alternative studies concluded that the most environmentally safe, cost effective option for final decommissioning was to remove the reactor vessel, both steam generators, and all equipment above grade including the dome. The transfer coffin, originally above grade, was to be placed in the cavity vacated by the reactor vessel and the remaining below grade spaces would be grouted. Once all above equipment including the dome was removed, a concrete cover was to be placed over the remaining footprint and the groundwater monitored for an indefinite period to ensure compliance with environmental regulations.

WORK DESCRIPTION

Dome Removal

The containment building was 21 meters in diameter. The structure rose 22 meters above ground, with 16 meters of the building below grade. The below-grade part was constructed of pre-stressed concrete. The hemispherical dome was fabricated from 1.9 centimeters thick carbon steel plate to a level of 9 meters above the ground. The remaining dome was 0.95 centimeters thick. The dome shell contained approximately 155,000 kilograms of steel. The demolition of the dome separated the upper portion of the dome from the cylindrical section and lifted the top portion free of the containment building allowing access to the major components inside HWCTR. Lifting lugs were welded to the dome and with the use of a large crane, the dome was removed (see Figure 1) and size reduced for disposal on site. Once the dome was removed the polar crane trolley and bridge were removed allowing access to the reactor vessel and steam generators.

Figure 1 – HWCTR Dome Lift

Reactor Vessel Removal

The reactor vessel had an overall height of 9 meters, a diameter of about 2 meters and weighed approximately 90,000 kilograms. The vessel was made of carbon steel, 8 to 13 centimeters thick, clad internally with 6.35 millimeters thick stainless steel. The Reactor Vessel was prepared for removal by removing shield blocks, cutting and sealing piping and instrumentation, and welding lifting bosses to the vessel. See Figure 2 showing the removal of the reactor vessel from the containment building.

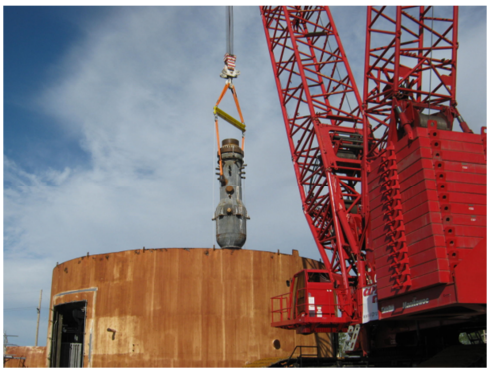

Figure 2 – HWCTR RV Removal

Steam Generator Removal

There were two steam generators located below grade that were to be removed. Each SG was about 7 meters high, weighed approximately 17,000 kilograms, and had 21 pipes that were cut and capped. A five foot thick concrete plug was removed allowing access to each generator. Using the existing lifting lugs on the steam generators each SG was removed by lifting straight out of the containment building. Using a tailing crane, each generator was placed horizontal on a transport vehicle and transported to the SRS waste disposal area.

Transfer Coffin Relocation

The transfer coffin (TC) was used to transfer driver fuel and test fuel assemblies from the reactor vessel to the fuel pool. It was relocated to the cavity left from removal of the RV.

Demolition of Structure and Final Closure Cap

After the major equipment was removed the below grade space was grouted and a final closure cap was installed over the HWCTR footprint. See Figure 3 showing the final end state of the facility.

Figure 3 – HWCTR Final End State

RESULTS

The D&D of HWCTR was completed safely with no lost time accidents and ahead of schedule. The total radiological exposure for the decommissioning of HWCTR was 4.8 man-millisieverts (0.48 man-rem).

CONCLUSIONS AND DISCUSSION

HWCTR had been shut down for almost 50 years. Decommissioning this facility presented many challenges due to the age of the facility, the lack of corporate knowledge and historical documentation, and the fact that the original facility design did not incorporate any decommissioning planning. The project team recognized these challenges and incorporated contingency planning to deal with possible unknown situations. The final end state of the HWCTR site is an environmentally safe decommissioned facility.