ACCELERATED CLOSURE OF THE SPENT NUCLEAR FUEL PROJECT

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ABSTRACT

The K East and K West Basins, built in the early 1950s, have been used to store irradiated nuclear fuel from the Hanford N Reactor. This fuel, which is referred to as spent nuclear fuel (SNF), has been stored underwater since 1975 in KE Basin and since 1981 in KW Basin. There are 54,000 N Reactor fuel assemblies in 3,800 canisters in the K West Basin, and 51,000 fuel assemblies in 3,700 canisters in the K East Basin that total 2,100 metric tons of SNF.

BACKGROUND

In 1992, the decision to deactivate the PUREX fuel reprocessing plant left the SNF in the K Basins with no means for near term disposition. A significant fraction of the SNF in the K Basins has become degraded due to cladding breaches that occurred during reactor discharge and corrosion that has continued during underwater storage. The K Basins are only 400 yards from the Hanford Reach of the Columbia River, which was recently designated a national monument.

The N Reactor fuel in the KE Basin is stored in open top canisters, some of which have closed bottoms while others have both open and screened bottoms. The open canisters in KE Basin release soluble fission products into the basin water and allow fuel corrosion products to combine with canister rack rust, concrete dust and environmental particulate matter, which settles to the basin floor as a fine sludge. Because the fuel in KW Basin is stored in sealed canisters, most of the sludge is in the KE Basin.

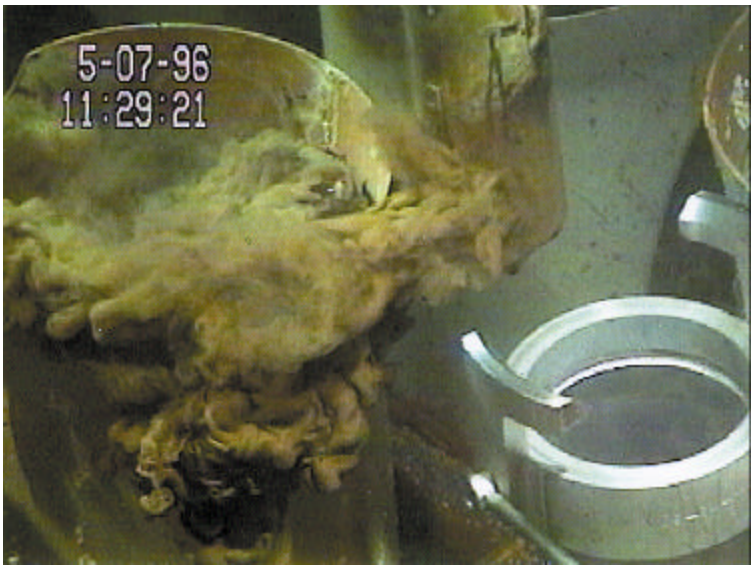

Fig. 1. Sludge trail from an element during characterization activities (May 1996).

Potential leakage of the basin water and sludge to the environment due to the age and condition of the basin provides the impetus for removing the sludge from the basins as soon as possible. It is important to note that the sludge, rather than the fuel, poses a greater risk to the environment, especially to the Columbia River, since the sludge is much more mobile than the SNF. For the purposes of differentiating SNF from sludge, sludge is defined as any material less than or equal to 0.64 cm (0.25 inch) in diameter. The K Basins sludge will be dispositioned as remote-handled (RH) transuranic (TRU) waste upon its removal from the basins.

Approach

The mission of the SNF Project is to move the fuel, sludge, equipment and debris from the K Basins and deactivate and decommission the entire area so it can be released to the Hanford Environmental Restoration contractor as rapidly as possible. To accomplish this mission, the Hanford Site Integrating Contractor, Fluor Hanford, Inc. (FH) established the Accelerated Closure Team, which had the objective of accelerating closure of the K Basins in order to reduce long-term mortgage costs and risks to the environment. The multi-contractor team included experts from within the SNF Project and other major projects from the Hanford Site, including the Waste Management Project and the Plutonium Finishing Plant. One of the goals of this team was to incorporate lessons learned from the other Hanford Site Accelerated Closure efforts.

The Accelerated Closure Team worked to first understand the existing baseline. During this period, experts from within the SNF Project were interviewed, and visits to the site were conducted so the team gained a full understanding of the scope of the project, the technical requirements and proposed solutions, and the operational challenges facing the project. During their review, the Accelerated Closure Team challenged several key assumptions and planning bases, and new alternatives were brainstormed. In response, the Hanford Site's technology staff was brought in to determine if any off-site technology could be applied to the SNF Project. Throughout the review, the client and regulators were briefed regularly and apprised of the Accelerated Closure Team's progress. As a result of their review, the Accelerated Closure Team developed a proposal that reduced the overall project costs, leveled costly manpower peaks, and accelerated sludge removal from the K Basins by a full year.

Benefits

The Accelerated Closure Team's planning efforts resulted in a proposed path forward that accelerated the start of sludge removal by eighteen months over the original schedule, significantly reducing environmental risk. Additional benefits of the new path forward included leveling resource needs by changing the approach to conducting fuel removal from both the K East and K West basins. The new plan proposed the removal of all the fuel from K West Basin before starting fuel removal activities in K East Basin. Elimination of overlapping fuel removal reduced peak resource requirements and resulted in an overall reduction in total project costs. These changes reduced the life cycle cost of the SNF project by $16 million. These changes were documented in a Baseline Change Request, which was approved by the Department of Energy in April 2000.

With the establishment of the new project baseline, the SNF Project is able to focus on completing construction and readiness activities to allow the project to start moving fuel out of the basins and away from the Columbia River. Since 1994, the SNF Project has designed and built two brand new facilities – the Cold Vacuum Drying Facility and the Canister Storage Building (currently the two newest nuclear facilities in the DOE complex). In addition, the Project has completely refurbished the K West Basin with millions of dollars worth of new, first-of-its-kind fuel removal equipment. In order to move the fuel from the basins, the canisters are de-capped, and the fuel elements are washed in a specially designed cleaning machine. Any sludge present in the canisters, or created in the fuel washing process, is captured and stored in the basins until fuel removal activities are completed. This sludge will then be transferred to a container and shipped to a waste storage facility on the Hanford central plateau.

After the fuel is washed, it is dumped out onto a long sorting table, and the outer fuel elements are separated from inner portions. Remote manipulator arms pick up each individual fuel element, and the intact fuel is placed in a new, stainless steel basket fabricated for long-term storage. These baskets, when full, are loaded into Multi-Canister Overpacks (MCOs) using the basin crane. The cleaned fuel then proceeds to the Cold Vacuum Drying Facility, located in the 100 K Area of the Hanford Site, where the fuel is dried and water is removed from the MCO.

Although spent fuel is routinely dried and stored at nuclear power plants in many parts of the world, the work being done by Hanford's SNF Project is unique. The fact that the Hanford fuel is solid uranium metal, not an oxide powder or in pellet form like most commercial nuclear fuel, is one key factor that makes this job one of the toughest and riskiest at Hanford. When the proof-of-dryness test for the MCO is completed, it is transported over the site road system for storage in the Canister Storage Building, which is located on the Hanford central plateau, miles away from the Columbia River.

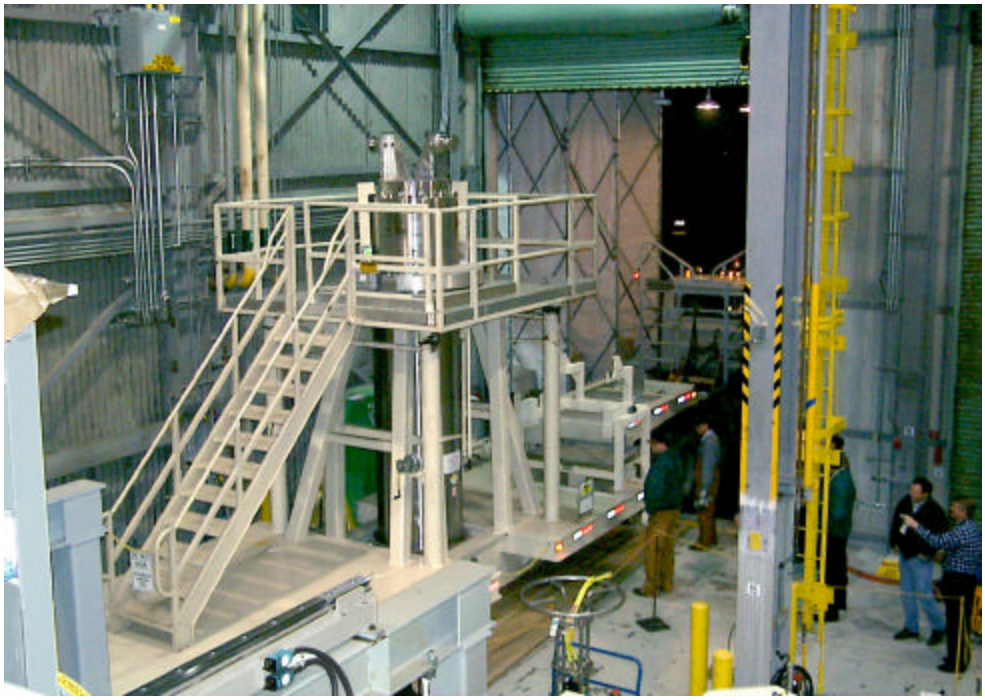

Fig. 2. First Multi-Canister Overpack loaded with spent fuel is leaving K West Basin for transport to the Cold Vacuum Drying Facility in 100K Area. (December 7, 2000).

The 105,000 irradiated nuclear fuel assemblies in K East and K West Basins represent approximately 95% of the radioactivity in the Hanford 100 Areas, the reactor production area along the Columbia River. Each MCO full of irradiated fuel that leaves the 100K Area moves about 150,000 Ci of radioactivity away from the Columbia River shoreline.

The removal of the first Multi-Canister Overpack filled with spent nuclear fuel from the aging K Basins occurred on December 7, 2000. This event marked a huge cornerstone event in Hanford's mission of moving wastes and special nuclear materials away from the river and onto the Hanford central plateau.

Fuel removal from the K West basin is to be completed by December 31, 2002, four months earlier than it would have under the original schedule. Preparations are underway to support fuel removal activities in the K East basin, which are scheduled to start as soon as K West has been emptied. Removal of the approximately 50 cubic meters of sludge in the two basins will begin simultaneously with the removal of fuel from the K East Basin. Fuel removal will conclude in K East Basin on July 31, 2004, seven months later than previously scheduled. All sludge removal will be finished by August 31, 2004, one year earlier than originally planned. During the final stages of fuel removal, canister storage racks and debris removal will begin. When that is complete, the water will be removed and processed and the basins will be deactivated and decommissioned for turn over to the Environmental Restoration contractor.

CONCLUSIONS

Fluor Hanford has developed a new baseline schedule for the Spent Nuclear Fuel Project that accelerates the movement of sludge away from the Columbia River to interim safe storage at the T Plant Facility on the Hanford central plateau, eliminates inefficient staffing profiles, and reduces the life cycle cost of the Project. Since the baseline change was implemented last spring, progress has been made throughout the project, most notably the initiation of fuel removal from the K West basin. Perhaps the biggest accomplishment of the approach and focus developed by the Accelerated Closure Team, however, is that the sludge, the real environmental threat, will be removed from the K Basins one year earlier than originally planned.