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DECOMMISSIONING AND DISMANTLING OF 305-M TEST PILE AT THE SAVANNAH RIVER PLANT

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INTRODUCTION & SUMMARY

The 305-M Test Pile was started up at the Savannah River Plant in 1952 and operated until 1981. The pile was used to measure the uranium content of reactor fuel. In 1984 work began to decommission and dismantle the pile. Extensive procedures were used that included a detailed description of the radiological controls and safety measures. These controls allowed the job to be completed with radiation doses as low as reasonably achievable.

DECOMMISSIONING AND DISMANTLING

The 305-M test pile was a graphite moderated, natural uranium fueled, low power (30 watt) test reactor. The test pile was completed and started up in 1952 and operated until May of 1981. It had been maintained in a "standby" condition from 1981 until decommissioning and dismantling began early in 1984. The original purpose of this pile was to measure the reactivity of various reactor components and other materials. This function is now performed by nuclear test gages.

The test pile was a rectangular solid of graphite blocks 15 ft. X 15 ft. by 16 1/3 ft. high. The graphite in the pile weighed 190 tons. The total weight of the uranium slugs in the pile was 19,858 kg. The graphite was surrounded by a 1/2 inch thick steel plate and 5 ft. of concrete around the four sides and top. The fuel channels were spaced at 8 3/8 inch intervals. Prior to startup of the pile in 1952, fuel channels were loaded with fuel until criticality was reached in air (325 channels were filled before reaching criticality in air). At this point fuel was removed from 16 channels to obtain the amount of excess reactivity desired in a helium atmosphere. The 309 positions were then reloaded from the bottom of the pile leaving empty channels near the top where additional fuel could be more easily added, if needed. There was a total of 351 channels in the pile.

In late 1983 a test authorization (TA) was issued permitting plans for decommissioning & dismantling of the test pile to proceed. This action would eliminate the safety and safeguards considerations required to keep the pile in a standby condition. After carefully studying all the parameters of dismantling the test pile, it was decided that no existing Technical Standards or Technical Specifications would be violated, no new unresolved safety aspects would be encountered as a result of dismantling the test pile, and that there would be no significant environmental impact by this action.

The following work program was developed in a stepwise procedure to perform D&D of the test pile:

- Make tests to determine radiation, contamination, and atmospheric condition inside the test pile.
- Remove the biological shielding from the top and north face of the pile.
- Remove the steel plate that forms the north face of the atmospheric containment tank.
- Remove fuel slugs from the test pile.
- Remove the control rods, safety rods, and borated nickel shot.
- Remove the graphite blocks that compose the pile.
- Remove the biological concrete shield and steel plate of the atmosphere containment tank for the remaining faces.
- Install a concrete floor in place of the test pile.

Calculations indicated that the pile would not become critical with all the safety rods, control rods, and the borated-nickel shot removed when air replaced the operating atmosphere of 98% helium. However, these items were left fully inserted and locked out until all but six fuel slugs were removed (these six slugs at the bottom of the pile will be removed as graphite is removed). Also the existing ion chambers were left in place for the work. Flux monitoring was also performed during the entire time that fuel was being removed from the test pile.

A californium-252 source (52.97 micro grams) used for calibrating neutron monitors during unloading opearation became disconnected from a source rod during testing of the flux monitors. The exact location of the source was pinpointed by use of instruments and verified by gold foil devices placed at various positions of test holes in the pile, before permitting the removal of fuel to begin. This source also will be removed as graphite is removed from pile.

After all nuclear safety and HP control measurements were obtained, the test pile was fully isolated from the building structure by a plastic hut. This hut was exhausted by a series of copus blowers in line with roughing and HEPA filters and then to the outside of Building 305-M. This was done for the purpose of removing dust particles from the working atmosphere and to contain any potential radioactivity. A large motorized concrete chipper was brought into the building and used to chip the 5' concrete shield from the north side of the pile. The major portion of concrete was removed by this method, then manually operated chippers were used to complete the work. Protective clothing worn for this work consisted of coveralls, gloves, rubber overshoes, "Comfo II" respirators, and caps. No contamination was detected on any of the materials or equipment during this phase of the work. After the concrete was removed, the metal plate on the north side of the pile was removed, and the horizontal ends of fuel channels were exposed to allow removal of the slugs. As stated earlier, 309 channels were originally loaded with uranium slugs and each channel contained 16 uranium slugs. These slugs weighed approximately 8.92 pounds each. A complete Health Physics (HP) survey was made before, during, and after chipping, and no contamination was detected in the area. The removal of slugs was then started (after a scaffold was erected) at the top section of the pile.

As the channels were emptied, the scaffold was lowered to accommodate the work. The slugs contained a loose coating of oxidized material (later determined to be layers of oxidized uranium) varying from about 1/32 to 1/4 inch. This material was easily removed by wiping each slug with rags as the slugs were removed from the channels with a special tool. This material was collected in plastic bags by a batch method, and was later sampled, bagged, and canned for eventual disposition. After the slugs were wiped down, they were placed in shipping boxes to be transported to an off plant vendor. Transferable contamination ranged to a maximum of 40,000 d/m alpha (15,000 c/m beta gamma) depending on the amount of oxidized uranium collected on the smear. The average transferable contamination was 8,000 d/m alpha (6,000 c/m beta gamma) during the entire job. The maximum radiation level was 30 mR/hr at 2" from slugs with average dose rate of 5 mR/hr in the general work area.

All but six slugs were removed from the pile by this method. These six slugs were near the bottom of pile where oxidation of uranium slugs was more pronounced and probably attributed to the failure of the tool used to remove slugs. These six slugs will be removed later as the graphite and magnesium lined channels are disassembled.

The job was completed safely and without any radioactive assimilations. The total estimated radiation dose to six personnel performing work was .6 rem. There was no release of radioactivity to the environment, no spread of contamination in work area, and no personnel contamination as a result of this work.

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