APPENDIX C

WASTE REMOVAL AND DECOMMISSIONING

Waste Removal

The 14 new Type III tanks together with existing Type III tanks are expected to provide interim storage of SRP waste until plans are put in operation for long-term waste management. The principal option being considered is the removal of the wastes from these tanks, followed by immobilization of the bulk of the radioactivity in an inert solid form for ultimate storage in a geologic repository. Efficient and safe processes for removing the wastes from the tanks are required to implement this program; such processes have been developed and are being demonstrated in SRP storage tanks. Design of facilities is also in progress to provide for waste removal from all the older generation tanks (Types I, II, and IV) and transfer to the Type III tanks.

Waste management practices at SRP result in wastes of two major types in addition to the readily removable liquid supernate. One is a settled sludge containing oxides and hydroxides of iron, manganese, and aluminum plus most of the fission products from the irradiated fuel, except cesium. This sludge is about 70% solids with the remainder being the supernatant liquid. The other form is a damp, crystallized salt mixture of mostly sodium nitrate, sodium nitrite, and sodium aluminate. These two types are largely formed (or collected) and stored in separate tanks.

On past occasions the settled waste, or sludge, has been transferred between tanks by breaking it up with high-velocity jets of water and pumping out the resulting slurry with centrifugal pumps. Up to 95% of the sludge was removed, but significant volumes of water were added to the inventory, and the evaporator capacity would be taxed if this method were used for a series of transfers.

Recently improved techniques have been developed to remove a higher percentage of the sludge with less addition of water to the system. For example, more than 98% of a 22-inch layer of aged sludge was removed from Tank 16 by low-pressure hydraulic slurrying using recirculated supernate and three long-shaft centrifugal pumps installed through tank top risers.[1] The arrangement is shown schematically in Figure C-1, and the appearance of the tank bottoms before and after slurrying is shown in Figure C-2. Inspection equipment locations (camera and periscope) are also shown for information. The slurry was transferred to another tank using a long-shaft centrifugal transfer pump. Most remaining sludge was in a dilute heel (2 inch depth) and can be readily removed by additional slurrying.

Some residual sludge will remain as difficult-to-dissolve material, solids left in crevices, and deposits on walls and cooling coils above the slurrying step liquid levels. This material will be removed by chemical cleaning in which hot water and oxalic acid will be sprayed into the tops of waste tanks using rotary spray jets. The liquid accumulating in the tanks will be mixed using the slurry pumps installed for sludge removal and transferred to other waste tanks. Tests of these procedures are now in progress.

Salt deposited in waste tanks can be readily dissolved in water. Earlier, salt removal was demonstrated using steam jets to circulate fresh water to contact salt. This method was slow and required the liquid to be cooled before transfer. Two alternate methods of salt dissolution are being considered for salt removal from the older generation tanks, i.e., density gradient and mechanical agitation. In the density gradient method a vertical well is hydraulically mined into the salt cake. Water is added to the tank to cover the salt. As the salt dissolves, higher density supernate flows by gravity into the well, bringing lighter unsaturated liquid into contact with the elevated salt. Material with the maximum density is removed by jet from the well bottom as fresh water enters the tank top. This process is currently being demonstrated in Tank 10.

In the mechanical agitation method, unsaturated liquid is made to dissolve the salt cake by circulation of a liquid layer above the salt using a long-shaft centrifugal pump. The dissolved salt is transferred by jet. Salt removal by mechanical agitation is expected to provide the fastest dissolution rate and result in the least addition of fresh water to the waste inventory. In addition, this method can slurry the sludge mixed in with the salt in the tanks. This could enable both the salt and the sludge to be removed with the same equipment. This technique will be demonstrated in Tank 19 during FY-1980.

All of these methods are applicable to the new tanks under construction.

Although optimum methods and procedures have not yet been selected, these successful demonstrations of waste removal show that none of the options for long-range management are foreclosed

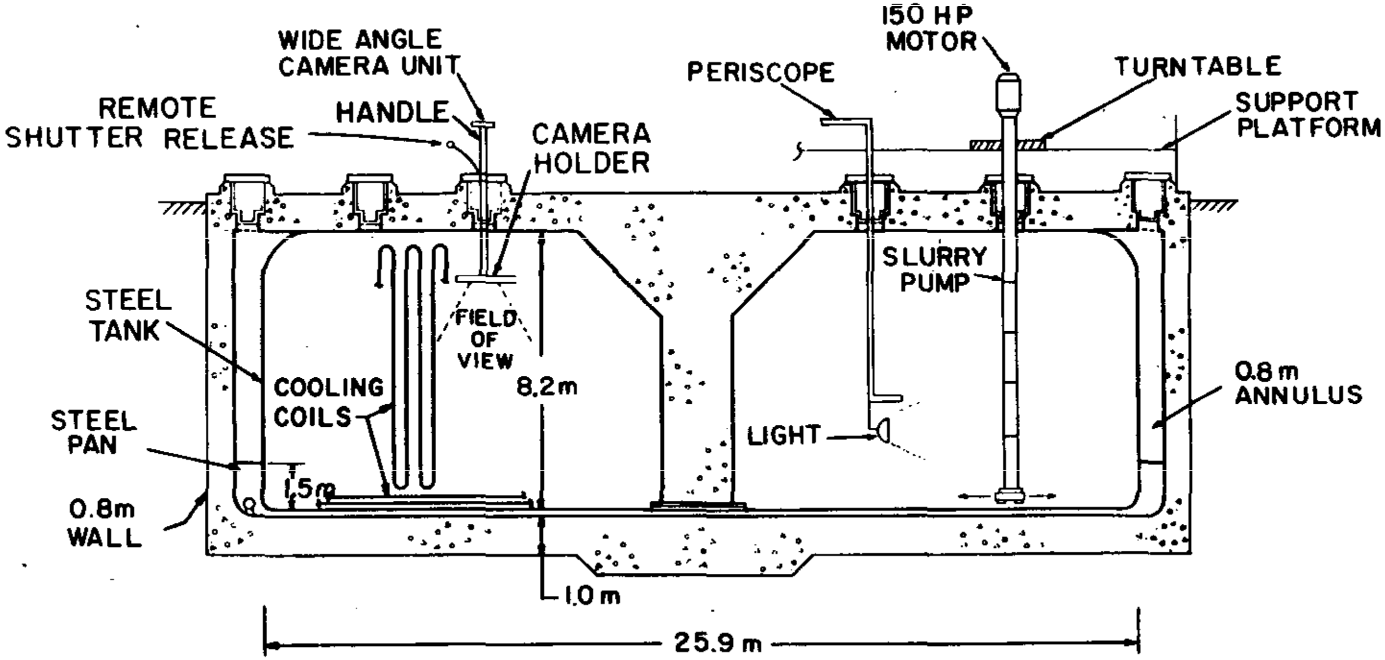
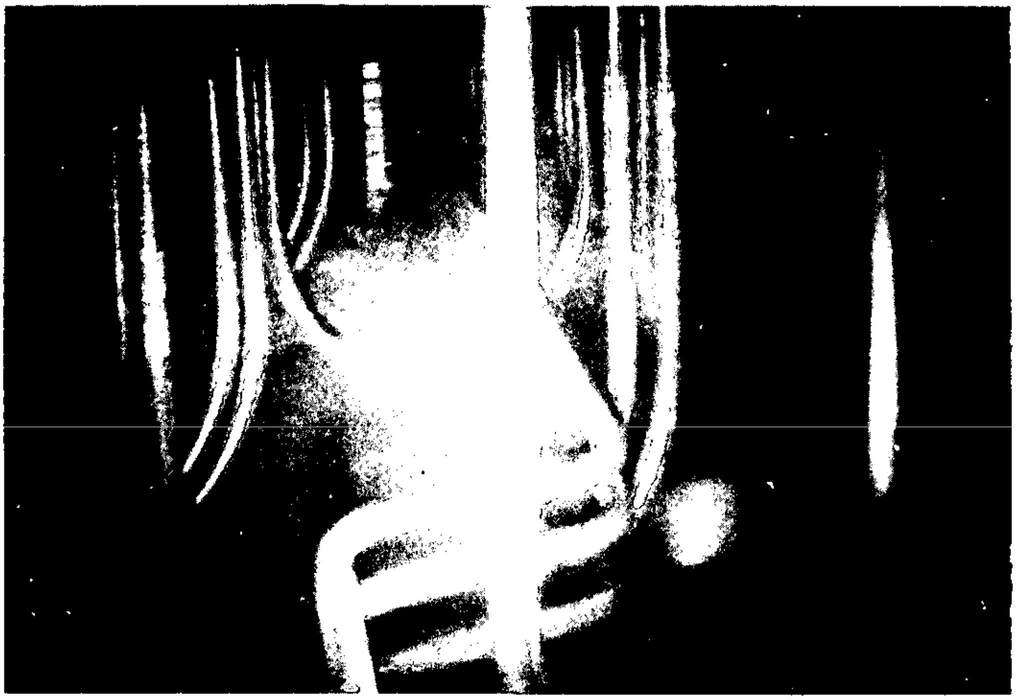


FIGURE C-1 TANK DIMENSION AND EQUIPMENT LOCATIONS



Periscopic View from Riser 1 after First Slurry Transfer

Wide-Angle View from Riser 1 after Hydraulic Cleaning

FIGURE C-2. Views of Riser 1

by interim storage in the newer Type III tanks. Future removal of waste for processing can be accomplished when required using proven processes and equipment.

DECONTAMINATION AND DECOMMISSIONING

When waste tanks are retired from normal service, they might be placed in alternate use, in custodial care, or decommissioned. One potential alternate use for the waste tanks is for disposal of residual salt, i.e., the nitrate/nitrite salt remaining after the bulk of radioactivity has been removed from high-level liquid waste and converted to solid form in the proposed Defense Waste Processing Facility. The degree of decontamination required for such service has not been established and will depend on the level of radioactivity in the salt itself. Evaluation of the use of the tanks for salt storage is in progress as part of the long-term waste management program.

A National Decontamination and Decommissioning Program has been established by the U.S. Department of Energy. The lead organization for this program is United Nuclear Corporation under the direction of the Richland Operations Office. This program sponsors and coordinates research and development of technologies for decontamination and decommissioning (D&D). Research and development work to be initiated at the Savannah River Plant includes preparation of a site D&D plan, selection of a facility (e.g., a waste tank) for decommissioning demonstrations and the eventual operational D&D of this facility. Current plans are to extend the studies of tank cleaning now in progress at Tank 16 to include chemical cleaning and dismantlement of the tank.

Tests with oxalic acid solutions will establish the level of cleaning that can be achieved in preparation for dismantlement. Various other reagents are being evaluated for cleaning carbon steel. A short length of cooling coil has been removed from Tank 16 and will be used in these studies. One particular reagent which will be tested is oxalic acid-hydrogen peroxide solution. This reagent is reported to be an effective cleaning agent for carbon steel.[2] The techniques used for dismantlement will depend on the degree of cleanliness (decontamination) achieved.

Decontamination and decommissioning (D&D) of high-level, liquid-waste, storage tanks has not been attempted to date. However, D&D of highly radioactive facilities have been accomplished (e.g., the Elk River reactor). Although D&D of waste tanks will require different techniques, no insurmountable difficulties are anticipated. D&D of Tank 16 will be used to demonstrate this capability.

REFERENCES

C| 1. Demonstration of Radioactive Sludge Removal from SRP Storage Tank. SRP Report DPSPU 79-30-11, E. I. du Pont de Nemours & Co. (Inc.), Savannah River Plant, Aiken, SC (September 1979).

2. A. B. Meservey. Peroxide-Inhibited Decontamination Solutions. USAEC Report ORNL-3308, Oak Ridge National Laboratory, Oak Ridge, TN (December 14, 1962).