1.0 SUMMARY

This environmental impact statement was prepared as a supplement to The Final Environmental Impact Statement - Waste Management Operations, Savannah River Plant, Aiken, South Carolina, ERDA-1537, September 1977 as directed by the Federal District Court for the District of Columbia on September 29, 1979. This supplement covers construction and operation of 14 additional high-level waste storage tanks authorized for fiscal years 1976, 1977, and 1978 at the Savannah River Plant.

In the continuing production of nuclear material for national defense at the Savannah River Plant, highly radioactive waste by-products are generated. These defense wastes are being stored initially as liquids in underground, near-surface storage tanks. After suitable decay of short-lived radioactive isotopes, during which time insoluble constituents settle to the bottom as a sludge, the waste solution is then evaporated and returned to another waste tank where it partially crystallizes to form a soluble salt cake. This volume reduction program, which has been in operation for about 19 years, converts the waste to a form less mobile than the original liquid waste and reduces the number of storage tanks required. Storage of liquid wastes has been conducted safely during the 25 years of operation at the Savannah River Plant. These additional waste tanks are needed to meet forecast production of nuclear materials and to replace 24 older-design tanks which will be removed from service. Nine of these older tanks have leaked.

The storage of liquid waste, salt cake, and sludge in near-surface storage tanks is considered as an interim plan for waste management. Long-term options for the Savannah River Plant wastes are also being investigated. The continuation of a research and development program on the immobilization of the waste for long-term management is considered in the Final Environmental Impact Statement, Long-Term Management of Defense High-Level Radioactive Waste (Research and Development Program for Immobilization), DOE/EIS-0023, November 1979.

The new facilities, now under construction, consist of fourteen 1.3-million-gallon high-activity waste tanks and associated auxiliaries; four tanks are in the F Area and ten in H Area on the basis of forecast production requirements and the need for tank replacement. Design of the tanks will be similar to that of the previous seven Savannah River Plant tanks authorized in fiscal years 1974 and 1975.* The tanks will incorporate the latest technology in fabrication, stress relief, inspection, and acceptance testing. This concept is consistent with the base case in ERDA-1537, i.e., Alternative 4, "Improve Waste Management Practices in Accordance with ERDA Policies and Standards."

Ventilation air is the only normal effluent from the waste tanks. With this air approximately 650 Ci/year of tritium oxide will be released to the atmosphere from the waste tank vapor space. This tritium oxide will result in an average dose commitment to individuals at the plant perimeter of about 0.0009 mrem/year for each new tank. The population annual dose commitment within a 100-kilometer radius of the center of the Savannah River Plant will be about 0.18 man-rem for each new tank. However, since most of these tanks will replace older tanks, this exposure estimate is not an incremental increase in dose. The population dose from atmospheric release from 14 waste tanks is less than 0.5% of the total dose from SRP releases to the atmosphere (135.8 man-rem in 1978) and less than about 0.0001% of the dose received from natural sources by this population (5×10^5 man-rem).

Preferred Alternative

The preferred alternative is to complete construction and utilize in waste management operations the 14 tanks currently under construction. The 14 Type III** double-walled tanks covered in this EIS are in various stages of construction.

Construction of the Type III series of double-walled tanks began in FY-1966. The most important change in Type III tanks compared to those of previous designs is incorporation of a post-fabrication heat treatment of the primary tank to eliminate the high residual stresses induced by seam welding in the field of the many individual steel plates. This heat treatment is to help prevent stress corrosion cracking that has been experienced in nine Type I and II tanks, which were not heat treated. No leaks have been discovered in any of nine Type III tanks that are now in service.

* Additional High-Level Waste Facilities, SRP, WASH-1530 (August 1974) (Tanks 25-28) and Future High-Level Waste Facilities, SRP, WASH-1528 (December 1972) (Tanks 35-37).

** Type III tanks are double-walled steel tanks with the secondary (outer) tank walls rising the full height of the primary tank and with both tanks contained in a cylindrical watertight reinforced concrete vault. Capacity is 1,300,000 gallons. The earlier Type I and II tanks hold about 750,000 and 1,000,000 gallons, respectively, and are of similar basic design except that their steel secondary tanks (or "pans") have walls only five feet high, and their roof supports differ.

Other major design improvements in the Type III tanks include:

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- Full-height steel secondary vessels, rather than the 5-ft pans used in Types I and II
- A single roof support column mounted on the foundation pad rather than on the bottom of the primary tank
- Air-cooling of the center column and bottom of primary tank
- Bottom-supported distributed cooling coils

There are two basic needs for the new tanks. First, they will provide interim storage capacity and ensure containment of new high-level waste generated by continued operation of SRP. Second, they will provide improved reliability of storage of high-level waste already generated and in storage.

Significant engineered safety features in the new tanks include:

- Primary and secondary leak detection systems to allow prompt detection and containment of leaks through either barrier
- Ventilation systems to purge combustible gases and maintain vapor space negative with respect to atmospheric pressure
- Emergency power to maintain critical systems if normal power is lost
- SRP design basis earthquake protection to 20% of the acceleration of gravity (0.2 g) at zero period
- Tornado-resistant design greater than SRP design basis

Each waste tank has a capacity of 1,300,000 gallons and is 85 feet in diameter and 33 feet tall. The tank form is two concentric cylinders joined to washer-shaped top and bottom plates by curved knuckle plates. The primary tank sits on an 8-inch bed of insulating concrete within the secondary containment vessel. The concrete bed is grooved radially so that ventilating air can flow from the inner annulus to the outer annulus. Liquid would also flow through the slots, facilitating detection at the outer annulus, if any were to leak from the bottom of the primary tank.

The secondary vessel is 5 ft larger in diameter than the primary to provide an outer 2.5-ft-wide annulus. Its side wall rises to the full height of the primary tank. A channel grid system was installed in the concrete base slab under the secondary container to detect leakage from the secondary container. The grid system drains to a sump for collection and monitoring.

The nested two-vessel assembly is surrounded by a cylindrical reinforced-concrete wall 30-inches-thick.

The enclosure has a 48-inch-thick, flat, reinforced-concrete roof, which is supported by the concrete wall and the central column. The roof reduces the radiation field above the tank to less than the amount permissible for continuous occupancy by operating personnel; hence, no earth overburden is required.

Type III tanks under construction have permanently installed cooling coils. Vertical coils will be bottom-supported and on 3-ft triangular centers. No horizontal coils will be installed. In the nominal design, total heat removal capability is about 6,000,000 Btu/hr, but effectively reaches 10,000,000 Btu/hr for liquid waste in which convective circulation is effective. An example is "as received" waste service (liquid plus about 8% sludge). On the other hand, widely distributed cooling surfaces are necessary in tanks to be used for forming and storing crystallized salt, in which salt deposited on the coils restricts heat transfer.

All plate welds will be radiographically inspected as part of a rigorous Quality Assurance Program. All radiographs are permanently retained. The primary tank will be stress-relieved in place at 1100°F in accordance with the general requirements of the ASME Boiler and Pressure Vessel Code. A full hydrostatic test, consisting of filling each primary tank with water to a depth of 32 feet and allowing it to stand for 48 hours, is conducted after stress-relieving.

The top openings into the Type III tanks and annular spaces are closed with stepped concrete or lead plugs. These openings are used for instrumentation, cooling units, ventilation system connections, and waste transfer connections.

The tank ventilation system is a negative pressure system designed for purging the interior volume at a rate in excess of 100 ft^3/min. Air enters through a High Efficiency Particulate Air (HEPA) filter and is conducted by a 4-inch-diameter pipe through the roof into the waste storage space. Air leaves the storage space via a 12-inch-diameter pipe positioned across the tank from the inlet. The exhaust air passes through a condenser to extract potentially radioactive moisture and a HEPA filter to free it from solid particles; it is then discharged to the atmosphere through an exhaust blower.

The outer annulus between the primary and secondary containers of double-walled tanks is also ventilated. The Type III tanks have the added feature that in addition to the direct ventilation of the outer annulus by a warm air flow, 1000 to 4000 ft^3

of air per minute is drawn through the inner annulus, passes beneath the primary tank through the radial grooves in the concrete base slab, and exhausts into the outer annulus. The new tanks, the subjects of this EIS, have an annulus ventilation system with a capacity of about 8000 ft^3/min, up to about half of which can be passed through the inner annulus and beneath the primary tank, to aid in cooling the tank bottom.

Primary reliance for leak detection is placed on methods that automatically monitor areas into which waste will migrate, especially the collection sumps provided for this purpose inside the multiple containment barriers. Although rigorous inventory surveillance is practiced as a backup, this method is not as sensitive because waste inventories are too large for reliable measurement of small differences that would constitute significant leakage.

Techniques have been developed for remote inspection and evaluation of the condition of waste tanks. These include visual inspection by means of a periscope, photography, ultrasonic measurement of wall thickness, and corrosion specimens. Since 1959, the most frequent inspections have been visual surveys in the annular spaces, and, to a lesser extent, inside the primary tank. These are made by direct observations through opened access risers and/or inspection holes in the roof.

DOE plans to place the new tanks in service shortly after their completion. Several tanks will serve temporarily as receivers for unprocessed waste supernate currently stored in older-design tanks. This will allow earlier emptying of supernatant liquid and at least some solidified salt from many of the older-design tanks. The new tanks will also provide reliable isolation of the waste from the environment to allow adequate time for the implementation of the long-term waste management program for the SRP high-level waste.

Design Alternatives

The design and safety features advocated (for SRP) by NRDC are: thicker and more chemically resistant steel plates, an impressed current cathodic protection system to guard against stress corrosion cracking, better waste retrieval equipment, and enlarged tank openings to facilitate retrieval. Consideration of cooling coils is not applicable to the SRP because the SRP tanks already have cooling coils.

Thicker steel is not required because the thinning due to general corrosion is not a problem, and thicker steel would not prevent stress corrosion. The Type III tanks under construction are not expected to suffer stress corrosion because the improved steels used are normalized, stress-relieved, and stronger, and because of improved operating controls on the composition of the wastes to minimize corrosion.

Cathodic protection was considered in 1972. The benefits of cathodic protection for waste tanks were judged to be small in comparison to the uncertainties and problems of installing such a system in a tank with widely varying contents and that, while protection may be afforded in one part of the tank, there may be a deleterious phenomenon in another part of the tank. Reliance was continued on use of more-resistant steels and improved tank designs for long-term protection.

Although adequate waste removal techniques have been demonstrated, sludge removal and chemical cleaning tests in progress plus salt removal tests during 1980 will investigate improved methods and demonstrate performance of equipment for waste retrieval.

Enlarged tank openings are not included in these new Type III tanks. The long-shafted pumps that can be used to remove liquid waste, redissolve salt, or slurry sludge from SRP waste tanks are designed to fit into any tank riser 2 feet or larger in diameter. The SRP tanks No. 38-51 contain nine access risers 3 feet or larger in diameter which can accommodate these pumps. Pumping of all three waste forms has been successfully demonstrated in existing SRP waste tanks and the equipment was safely retrieved.

In the preceeding paragraphs, the results of the examination of the three design alternatives were summarized. The design alternatives were rejected because no unique advantages were determined for the alternatives and because there are definite disadvantages (cost, delays, and potential problems) to the proposed design alternatives.

The "No Action" alternatives were discussed in ERDA-1537 and the alternatives were considered to be unacceptable. The "No Action" alternatives would preclude SRP from meeting its mission of producing special nuclear material for national defense and would violate the DOE waste management policies for existing wastes.

Site Characteristics

The Savannah River Plant site occupies a nearly circular area of about 300 square miles (192,000 acres) on the South Carolina side of the Savannah River and is about 100 air miles or 150 river miles from the river's mouth at Savannah, Georgia. Surface elevations range from about 90 to 360 ft above mean sea level. Surface streams drain to the Savannah River. About 70,000 people consume river water processed by two water treatment plants near the river mouth.

Natural background radiation (external and internal) is estimated to result in a dose of about 120 mrem/yr to individuals living in the vicinity of the SRP site. Within 100 km of the SRP perimeter, this background dose ranges from 60 to 450 mrem/yr. About another 100 mrem/yr is received from medical x-rays by the average individual in the general area population.

Environmental Impacts

Utilization of the new waste tanks covered by this Supplemental Environmental Impact Statement will allow the retirement of older-design tanks with a significant improvement in safety and reliability. Apart from the impacts of construction, which are minimal because construction is within areas dedicated to plant operations, the incremental consequences of this action include:

- Added risks of releases during waste transfer operations required to empty tanks to be retired
- Reduced risks of accidental releases from the waste operations because of the improved facilities
- Impacts associated with decontamination and decommissioning of the retired tanks

The waste management operating force will increase from about 50 to 120 people to accomplish the waste removal to new tanks and chemical cleaning of the older-design tanks. After the older-design tanks are retired from high-level waste service, the operating force will decrease to about 65 people. The extra 15 people are due to increased surveillance requirements. Adoption of the alternatives would not change, but would possibly delay the timing of the increased manpower.

Small amounts of radioactivity reach the environment from normal operation of the waste management system. Low concentrations of radioactive material, primarily tritium oxide, are carried by the tank ventilation air to the atmosphere. About 5500 Ci of tritium per year are released to the atmosphere during normal operation of the tank farm and tritium is the only radionuclide from waste tank systems perceptible off the plantsite. The whole body dose from atmospheric release to the population within a 150-km radius of SRP is calculated to be 1.3 man-rem/yr. Natural background and medical diagnostic radiation for the same population is 5×10^5 man-rem/yr. The maximum dose to an individual at the plant boundary from inhalation of tritium would be about 9×10^{-6} rem/yr.

Personnel operating the waste tank farms in 1978 averaged an exposure of 0.7 rem/year with a maximum of 2.5 rem/year. The total annual exposure averages about 50 man-rem to tank farm operations personnel.

The total exposure risk to the offsite population from potential accidents and normal operation is 16 man-rem/year with normal operation accounting for 3 man-rem/year.

The risk associated with earthquakes (10 man-rem/year) is the dominant risk. The major contribution to earthquake risk (about 70%) results from the pessimistic assumption of liquefaction of the soil around waste tanks built partially above the normal grade elevation in the waste tank farms. It is also assumed that leakage from damaged tanks could flow rapidly to Four Mile Creek, rather than being deposited in the soil beneath the tank. Most of this risk is attributable to hypothetical IX MM (or more severe) earthquakes which are unlikely to occur; the design basis earthquake based on extensive seismic analysis for SRP and other areas of the southeast is between the VII and VIII MM values.

The offsite population risk (deaths/year) of tank farm operations is negligible when compared with other natural risks experienced by the population in the vicinity of SRP. Waste tank farm accidents and effluents might cause 0.003 latent cancer deaths per year compared to possibly 100 latent cancer deaths/year from natural background and medical diagnostic radiation or 2.4 sudden deaths/year from natural accidents, such as floods or lightning strikes.

The general consideration of the environmental effects of the proposed design alternatives resulted in the evaluation that the environmental effects would not be mitigated by adoption of any of the alternatives. The adoption of design alternatives would have severe effects because of the delay in removing waste from older design tanks, additional costs to implement the alternatives, and for the cathodic protection alternative requiring a total change in the SRP Waste Management program because the waste must be maintained in the liquid form. Additional waste tanks would be required to store this liquid waste.

Adequate methods for removing the wastes from tanks are available. However, tests of improved methods for sludge removal and chemical cleaning are in progress; decontamination factors in excess of 10^3 to 10^4 are expected. Decommissioning impacts cannot be quantified until decommissioning procedures are more completely defined.

There are no known conflicts with national, state, or local plans and programs in the operation of the waste tanks under construction. The plantsite is dedicated as a controlled area for the production of materials needed for national defense.

The only significant adverse effects caused by operation of the new tanks are the small offsite population dose commitment from the release of radionuclides and the commitment of about one acre of land for each waste tank. These effects would not be materially changed by adoption of any of the design alternatives.