DOE/EA-0918

Environmental Assessment

Treatment of M-Area Mixed Wastes at the Savannah River Site

JUNE 1994

**U. S. DEPARTMENT OF ENERGY
SAVANNAH RIVER OPERATIONS OFFICE
SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA**

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**FINDING OF NO SIGNIFICANT IMPACT
TREATMENT OF M-AREA MIXED WASTES AT THE SAVANNAH RIVER SITE, AIKEN, SC**

AGENCY: U.S. Department of Energy (DOE)
ACTION: Finding of No Significant Impact

SUMMARY: The Department of Energy has prepared an environmental assessment, DOE/EA-0918, to assess the potential environmental impacts of the treatment of mixed wastes currently stored in the M-Area at the Savannah River Site, near Aiken, South Carolina. Based on the analyses in the environmental assessment, the Department of Energy has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required, and the Department of Energy is issuing this finding of no significant impact.

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PROPOSED ACTION: Mixed radioactive and hazardous wastes generated in the Savannah River Site's M-Area currently are stored in two Resource Conservation and Recovery Act (RCRA) permitted interim status treatment and storage facilities: the Interim Treatment/Storage Facility and the Mixed Waste Storage Shed. The M-Area mixed waste must be treated, stabilized and disposed of in accordance with Department of Energy commitments made in the Land Disposal Restrictions Federal Facility Compliance Agreement.

The proposed action is to treat and stabilize the M-Area mixed wastes using a thermal vitrification process. All process-related equipment would be provided by a private vendor company and would constitute a temporary facility within a containment area of approximately 5,000 square feet immediately adjacent to the Interim Treatment/Storage Facility tanks. The containment area would be equipped with a dike and sump to provide secondary spill containment for the enclosed facilities. To minimize the potential for environmental releases, the treatment process would be close-coupled directly to both the Dilute Effluent Treatment Facility and the Interim Treatment/ Storage Facility. Stabilized waste would be placed in storage and would require no further treatment before disposal in RCRA vaults (when ready, before 2005). Treatment of the M-Area wastes would be completed within 18 to 20 months.

Upon completion of waste removal and treatment, the Interim Treatment/Storage Facility tanks and related piping would be clean-closed and left in place. Clean closure would involve removal of all waste materials and radiological contamination from the tank system, pumps, and piping to meet the RCRA clean closure criteria.

ENVIRONMENTAL IMPACTS: The proposed action would be sited in M-Area, which is not near wetlands or within the Savannah River Site 100-year base floodplain. No threatened or endangered species, or other sensitive environmental resources, occur within M-Area. The proposed action would result in no impacts to ecological resources, groundwater, cultural resources, the socioeconomics of the region, or the noise environment. The proposed action would pose no disproportionate effects on any minority community or low income community.

The environmental assessment identifies negligible impacts to surface water resources, Savannah River Site waste management systems, and air quality. Process waste water would be collected and piped to the Dilute Effluent Treatment Facility for treatment and discharge via a National Pollutant Discharge Elimination System permitted outfall. This treated effluent would not differ from the treated Interim Treatment/Storage Facility supernate which the Dilute Effluent Treatment Facility has discharged since 1990. The 50,000 gallons of effluent discharged from the facility would not adversely impact water quality or the indigenous biota within the receiving stream.

The proposed action would generate 280 m³ of construction related debris, 67 m³ of low-level radioactive waste and approximately 20 m³ of sanitary waste. This waste would be disposed of in the Savannah River Site sanitary landfill, the Solid Waste Disposal Facility, and an offsite sanitary treatment plant, respectively. The proposed action also would generate 27 m³ of miscellaneous mixed waste, consisting of contaminated protective clothing, wipes or rags, tools and other debris contaminated by the M-Area sludges. These mixed wastes would be placed in metal containers and into interim storage in Building 316-M or into the Savannah River Site mixed waste storage facility. The treatment of M-Area mixed waste would result in the generation of approximately 660 m³ of vitrified

stabilized waste. The treatment, storage, and disposal of the wastes generated by the proposed action would have negligible impacts.

Air quality impacts associated with construction of the proposed action would be from fugitive dust, controlled by wetting ground surfaces during dry periods, and emissions from internal combustion engines. Air quality impacts associated with construction would be negligible. The proposed action would generate 27 tons per year of nitrogen oxides, 0.5 tons per year of sulfur oxides, and 0.05 tons per year of particulate emissions. The emissions are small and would not affect ambient air quality adversely. Depleted uranium would be the primary radionuclide emitted by the vitrification process. These emissions would be controlled by the use of high efficiency particulate air filters. The estimated maximum annual release of radionuclides from the vitrification process is 1.1×10^{-4} curies, which would yield an effective dose equivalent to a maximally-exposed offsite individual of 3.1×10^{-3} millirem (mrem). This corresponds to a latent cancer fatality risk of 1.5×10^{-9} (1.5 chances in a billion) to the offsite individual.

The proposed action would result in transportation activities within M-Area and transportation of wasteforms from M-Area to a RCRA permitted disposal facility. Because of the short distance, the limited amount of waste and the highly controlled conditions, this activity is not expected to have environmental or health impacts. However, in the event of an accidental release, the solid material would be readily contained and cleaned up and would pose no exposure threat to spill response personnel or the environment. The dose rate to drivers transporting a similar radioactive sludge from the M-Area settling basin to an onsite storage facility was estimated to be 0.046 millirem per hour. This rate

is 2.3 percent of the Department of Transportation limit for driver exposure in an occupied cab (2 millirem per hour).

Radioactive sources in the Interim Treatment/Storage Facility sludge are primarily depleted uranium with a small volume containing enriched uranium. An onsite treatment process worker can expect to receive a dose of no more than 250 millirem per year from the Interim Treatment/Storage Facility sludge. The primary occupational hazard for personnel is considered to be the caustic nature of the M-Area sludge. The sludge has a pH of approximately 12.0; exposure to bare skin, over a period of hours, might cause some discomfort.

ALTERNATIVES CONSIDERED: The Department of Energy considered five alternatives to the proposed action. These alternatives were not selected for the following reasons:

(1) No Action. The No Action alternative is in violation of the RCRA Land Disposal regulations and the Federal Facility Compliance Agreement, in which the Department of Energy committed to treating and stabilizing the M-Area mixed waste as expeditiously as possible. In addition, there is a potential environmental risk associated with the continued storage of mixed waste in the Interim Treatment/Storage Facility tanks (i.e., possible leaks).

(2) Onsite Treatment in a Temporary Facility Using a Cementitious Process. The cementitious process would result in a substantially greater volume of liquid effluent to be treated and discharged, bulk loading facilities for Portland cement or other dry additives would be required, the final volume of the cementitious wasteform would be substantially greater than the final vitrified wasteform volume, and a cementitious wasteform is expected to have a lower

long-term durability than a vitrified wasteform. The disposal cost for this alternative would be about \$6 million more than the proposed action.

(3) and (4) Onsite Treatment Using a Cementitious Process at a Permanent Treatment Facility in M-Area or the Center of the Savannah River Site. These alternatives would offer no advantages over the temporary facility, and would require a longer implementation period, cost more, and pose increased risks.

(5) Transport to Offsite Location for Treatment and Subsequent Return of Stabilized Material to Savannah River Site for Storage and Disposal. There are currently no offsite facilities possessing the required hazardous waste treatment permits to handle the M-Area wastes. The health, safety and environmental impacts of offsite treatment would be higher than onsite treatment due to risks associated with transportation of liquid mixed wastes.

DETERMINATION: Based on the information and analyses in the environmental assessment, the Department of Energy has determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an environmental impact statement is not required for this proposed action.

Issued at Washington, D.C., this 20th day of August, 1994.

for Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

Environmental Assessment

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1.0 SUMMARY

The U. S. Department of Energy (DOE) is proposing to treat and stabilize approximately 700,000 gallons of mixed (radioactive/hazardous) waste currently stored in the Interim Treatment/Storage Facility (IT/SF) and Mixed Waste Storage Shed (MWSS) in M-Area at the Savannah River Site (SRS) near Aiken, South Carolina (see Figure 1-1). This waste material is proposed to be stabilized using a vitrification process, so that the DOE can comply with Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions and with commitments made within the Land Disposal Restrictions-Federal Facility Compliance Agreement (LDR-FFCA) (DOE, 1992). The stabilized waste material would be temporarily stored in a RCRA permitted storage facility until final disposal in a RCRA permitted disposal facility is available at the SRS before 2005. Following the treatment and stabilization of waste materials, the IT/SF storage tanks would be "clean closed" and left in place. "Clean closure" is defined by and will occur in full accordance with South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.265 Subpart G and R.61-79.265.197. The final disposition of stabilized material to the Hazardous Waste/Mixed Waste Disposal Facility was addressed within the Final Environmental Impact Statement; Waste Management Activities for Groundwater Protection; Savannah River Plant, Aiken, South Carolina (DOE/EIS-0120, December 1987) and will be reevaluated in the Environmental Impact Statement for Waste Management at the Savannah River Site (59 FR 16494; April, 1994).

The Federal Facility Compliance Act (FFC Act) of 1992 (EPA 1992) requires each DOE site that generates or stores mixed waste to prepare a Site Treatment Plan (STP) which presents a schedule for treating mixed waste at the site. The SRS has completed preparation of a conceptual STP and is preparing a draft STP. The conceptual and draft STPs will be used by the DOE as planning documents and in discussions with the State regulators. The final STP will be submitted to the State of South Carolina for its approval, approval with modifications, or disapproval. The action proposed in this Environmental Assessment was described in the conceptual STP, which was presented to the State of South Carolina on 10/27/93 (WSRC, 1993c). The decision reached on the basis of this EA will be included in the draft Site Treatment Plan, which the DOE intends to provide to the State in August, 1994.

This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, and the requirements of the Council on Environmental Quality Regulations for Implementing NEPA (40 CFR Parts 1500-1508) and DOE NEPA regulations (10 CFR Part 1021). NEPA requires the assessment of environmental consequences of Federal actions that may affect the quality of the human environment. For the purposes of DOE Order 5400.1, "General Environmental Protection", this EA and the SRS annual environmental report (WSRC, 1992) will fulfill the requirements for preoperational monitoring of facilities, sites, and operations.

Figure 1-1. Location of M-Area at the Savannah River Site, South Carolina.

2.0 PURPOSE AND NEED FOR ACTION

This document has been prepared by the Department of Energy to assess the potential environmental impacts attributable to the treatment and stabilization of the M-Area mixed wastes, the clean closure of the Interim Treatment/Storage Facility (IT/SF) at the Savannah River Site, Aiken, South Carolina, and storage of vitrified waste until disposal in onsite RCRA vaults.

The M-Area mixed wastes are presently stored in two RCRA permitted (Hazardous Waste Permit "Part A, Savannah River Site, Aiken SC, United States Department of Energy, ID# SCI-890-008-989) interim status Treatment Storage Disposal (TSD) facilities:

- (a) the Interim Treatment/Storage Facility (IT/SF) and
- (b) the Mixed Waste Storage Shed (MWSS).

The M-Area mixed waste must be treated, stabilized, and disposed of so that the DOE-SR can comply with commitments made within the Land Disposal Restrictions-Federal Facility Compliance Agreement (LDR-FFCA). A synopsis of these commitments is as follows:

1. DOE-SR will submit a completed permit application for construction of the "M-Area Treatment Process" to the South Carolina Department of Health and Environmental Control (SCDHEC) by June 30, 1994. Progress reports detailing contract placement and permit acquisition activities for the proposed facility will be provided to the Environmental Protection Agency, Region IV (EPA-IV) on a semi-annual basis.
2. DOE-SR will propose to EPA-IV waste processing milestones and a final completion date for treatment of the M-Area waste within 90 days of contract award.
3. DOE-SR will begin operation of the "M-Area Treatment Process" within 180 days of the effective date of the M-Area industrial waste water treatment operating permit (or RCRA treatment permit) and approval of the RCRA stabilized sludge storage facilities. An additional 45 days to conduct an Operational Readiness Review (ORR) has been requested.

Implementation of the proposed action described in this Environmental Assessment (EA) will fulfill these LDR-FFCA commitments.

3.0 PROPOSED AND ALTERNATIVE ACTIONS

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to WSRC. The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final wasteform, could be completed for the lowest cost (including final disposal costs) of all the alternatives, and would result in minor environmental impacts.

Alternative actions which were considered include:

- on-site treatment by a subcontractor, using a cementitious process,
- on-site treatment using a cementitious process at a permanent facility located in M-Area,
- on-site treatment using a cementitious process at a permanent facility located in the center of the SRS,
- transport to an off-site location for treatment, and
- no action.

The proposed action and alternatives were evaluated with respect to the technical ability to meet the Land Disposal Restrictions criteria for the final stabilized wasteform, the overall cost of the activities, and environmental impacts. The ability to meet the durability requirements (i.e., TCLP leaching concentrations for the constituents of concern) for the final wasteform was a critical consideration. The total life cycle cost of each alternative, including the cost of treating the waste itself, the cost to DOE-SR to treat any effluents generated by the vendor, and the cost to DOE-SR to dispose of the final wasteform were also considered. The environmental impacts, on- and off-site health effects, and occupational health and safety concerns for each alternative were considered.

3.1 Description of Mixed Wastes to be Treated

Waste material stored in the M-Area Interim Treatment/Storage Facility tanks initially consisted of approximately 1.2 million gallons of mixed waste. This waste originated from plating line, metal finishing, and aluminum forming operations for the production of reactor fuel and targets. During storage, this waste separated into sludge and supernate phases (approximately 350,000 and 850,000 gallons, respectively).

The IT/SF is composed of six 35,000 gallon above ground storage tanks (Numbers 1 through 6) which are inside Building 341-1M. The building is constructed of a concrete foundation, with sufficient internal capacity to retain the contents of two 35,000 tanks. Four 500,000 gallon tanks (tanks 7, 8, 9, and 10) are located immediately adjacent to Building 341-1M. These are double walled,

above ground tanks. Tanks 7, 8, and 10 are currently in use; Tank No. 9 has not been used.

This sludge is listed as a F006 waste material in South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.261.31. SCHWMR R.61-79.261.31 defines the F006 waste code as follows: "Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc plating a carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating a carbon steel, and (6) chemical etching and milling of aluminum." All of the waste materials to be treated under the proposed action are F006 or characteristically hazardous wastes. These materials are also contaminated with uranium and are therefore radioactive wastes. Throughout the text of this EA, the IT/SF sludge is referred to as "F006 mixed" waste.

The supernate is currently being decanted from the storage tanks and pumped to the M-Area Dilute Effluent Treatment Facility (DETF) for treatment. Treatment of this supernate will ultimately generate about 300,000 gallons of mixed waste sludge (perlite filtercake consisting primarily of sodium/ potassium aluminosilicate). The filtercake will be stored in the IT/SF tanks and blended with the existing IT/SF sludge material prior to its treatment and stabilization in the treatment process. The treatment of the supernate is being conducted under an industrial waste water treatment permit (M-Area Liquid Effluent Treatment Facility Construction Permit #14,832; an addition to Construction Permit #10287). The M-Area DETF is a component of the M-Area Liquid Effluent Treatment Facility (LETf). The management of the M-Area liquid effluents in the LETf/DETF received NEPA review in a Memorandum-to-File entitled Liquid Effluent Treatment Facility, M-Area, SRP-Compliance with the National Environmental Policy Act (NEPA), July 1984 (DOE, 1984).

When blending and treatment of the IT/SF sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This will include an estimated 50,000 gallons of supernate which cannot be separated from the sludge. This volume of sludge is different from the volume reported in the conceptual Site Treatment Plan submitted to the State in October, 1993. This difference is attributable to new sludge measurements taken in December, 1993 and the fact that it has been determined that all of the supernate cannot be removed for treatment. The revised waste volumes will be included in the draft Site Treatment Plan and the annual update to the Mixed Waste Inventory Report.

Other M-Area mixed wastes to be stabilized are currently stored within the MWSS (Mixed Waste Storage Shed) and contained in 55-gallon drums. These wastes include:

- (a) Watts plating bath solution (nickel bearing acid with very low uranium concentration - a D001, D008 for lead, and "California List" waste),
- (b) Mark 15 sludge/filtercake (F006), and
- (c) Solid treatability sample residues (F006).

The Watts Plating bath solution contains approximately 30 mg/L depleted uranium. The Mark 15 material is 34% uranium by dry weight (enrichment equals 1.1 wt % U-235). The treatability sample residues consist of solid F006 mixed waste cementitious and vitreous material originating from WSRC and vendor treatability studies.

Two 55-gallon drums of sump clean-out material from Building 313-M are stored at the SRS Mixed Waste Storage Facility (Bldg. 709-2G). This material would be returned to M-Area and treated with the other M-Area wastes. Additional materials which could be treated, but do not currently exist, would include sand from potentially contaminated process sumps and/or excavated soils from spills of materials described in this section. These additional materials could result from the action proposed in this EA, and it is expected that no more than 1000 gallons would be generated. Both of these materials (contaminated sand or soil) are amenable to the proposed treatment process. When treatment is completed, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

3.2 Discussion of Proposed and Alternative Actions

3.2.1 Proposed Action: DOE will Contract with a Vendor to Treat and Stabilize M-Area Mixed Waste Using a Vitrification Process and Clean Close the Interim Treatment/Storage Facility, Store Vitrified Mixed Waste in a New Facility, and Ultimately Dispose of Vitrified Mixed Waste in RCRA Vaults.

The proposed action is for the DOE to contract with a vendor to treat and stabilize mixed waste materials stored within M-Area's IT/SF and MWSS and to clean close the IT/SF. The proposed action is for a vendor to use a process of vitrification to transform the M-Area plating line wastes into an amorphous glass. The proposed action would result in the lowest volume of stabilized waste that would require eventual disposal to a RCRA disposal facility, and the least amount of liquid effluents that would need to be treated in the M-Area waste water treatment facility. The proposed action would also have the lowest cost versus any other alternative and would result in minor environmental impacts.

All process-related equipment would be provided by the vendor and would be considered a temporary facility. The vendor would be allowed to demobilize process-related equipment and remove it from the SRS if it met Department of Transportation (DOT) shipping criteria for radioactivity. If the equipment could not be decontaminated to meet the DOT transportation criteria, the equipment

would be disposed onsite. The value of any such equipment is included in the total cost of the contract, and the amount of potential wastes to be disposed at the SRS is discussed in Section 5.6. The temporary facility would be located within a containment area (approximately 5,000 ft² or 465 m²) that would be constructed as part of the proposed action and located immediately adjacent to the IT/SF tanks (see Figure 3-1). All project-related land disturbing activities will be covered by a State approved stormwater management and sediment control plan.

The vendor treatment facility would include a containment area equipped with a dike and sump to provide secondary spill containment for the enclosed facilities. Any material spilled during the treatment/stabilization process or closure activities would be flushed with water into the containment sump and pumped to the subcontractor's treatment process or the DETF for treatment. In the case of a liquid release outside of the containment area, any contaminated soil would be excavated, blended with, and stabilized with the M-Area sludge. To minimize the potential for environmental releases, the vendor's treatment process would be close-coupled directly to both the DETF and the IT/SF. Site utilities (air, water, steam, and electricity) would be utilized by the process. It is expected that treatment of the M-Area wastes will be completed within eighteen (18) to twenty (20) months after treatment begins.

A flow diagram for the proposed M-Area vendor treatment process is shown in Figure 3-2. Most of the wastes to be treated would be stored in IT/SF Tanks 7, 8, and 10. The sludge in Tanks 1 through 6 would be mixed proportionately with the larger volumes of sludge, in one of the blend tanks. Tank 10 would be used to store filtercake generated by treatment of the supernate in the DETF. Tank 9 would be held in reserve to hold emergency transfers of waste from any leaking tanks.

Prior to beginning the treatment process, the MWSS wastes, the 709-2G waste, and the contents of all of the tanks would be mixed into homogenous feedstock batches. Blending of wastes would be accomplished by mixing the waste streams in one or more of the IT/SF storage tanks. The IT/SF would be "close-coupled" to the vendor treatment process, and pumps and process lines would be used to transfer material from the IT/SF tanks. Wastes from the MWSS would be transported by truck or forklift from the MWSS to an IT/SF blend tank. The vendor would use appropriate material handling equipment and procedures to transfer the mixed wastes. For example, the vendor would use metering pumps and process lines to transfer the Watts Plating Bath solution; drum dumpers and solids feeders to transfer Mark 15 filtercake/sludge, excavated soil and sump clean-out material; and manual addition to transfer solid treatability sample residues.

Figure 3-1. Location of the Proposed Vendor Treatment Process within M-Area.

Figure 3-2. Flow Diagram of the M-Area Vendor Treatment Process.

Direct Vitrification

Figure 3-3. Flow Diagram of the Vitrification Process.

The proposed treatment process would involve direct vitrification of waste materials to produce a stabilized wasteform. A conceptual flow diagram of the proposed vitrification process is presented in Figure 3-3.

Using vitrification, the mixed waste would be treated to meet the land disposal restriction (LDR) requirements of SCHWMRs for all applicable waste codes. The final stabilized waste would possess no free water (SCHWMR R.61-79.264.314) as determined by the EPA's "Paint Filter Liquids Test" (SW 846, 1986, Method 9095) and the Toxicity Characteristic Leaching Procedure (TCLP) leachant concentration for nickel would be less than the Land Disposal Restriction treatment criterion of 0.32 mg/L (SCHWMR R.61-79.268.41). All F006 waste constituents would be tested by the TCLP to confirm compliance with their respective LDR standards, but only nickel is of concern because none of the other F006 constituents were used in the M-Area plating processes. The final wasteform would also be tested via the TCLP to demonstrate that LDR criteria are achieved for lead (Pb) and chromium (Cr), as "characteristic" hazardous wastes. This is because two of the waste streams to be stabilized, the plating line solution and the 313-M sump material, are D008 (for Pb) and D007 (for Cr), respectively.

Only wastes which pass the free liquids test would be placed into storage containers. Prior to sealing the containers, each container would be inspected to ensure no free liquids are present. The stabilized waste would require no further treatment prior to land disposal in a RCRA subtitle "C" hazardous waste disposal facility (i.e. the HW/MW Disposal Facility).

Although not required for land disposal or for compliance with environmental regulations, the subcontractor would also stabilize the mixed wastes to meet TCLP leachant concentrations for uranium and nitrate (less than 0.14 mg/L and 70 mg/L, respectively). These limits were established as the levels which may allow DOE to "delist" or remove the stabilized wasteform from SCHWMRs in the future. The limits are based on EPA drinking water standards (proposed and final) for nitrate (10 mg/L as nitrogen) and uranium (0.020 mg/L) (EPA, 1991), multiplied by a factor of seven, which EPA used for delisting petitions (EPA, 1985). A more recent delisting guidance is now available, and will be used as appropriate (EPA, 1993). "Delisting" the stabilized mixed waste would also allow the SRS to dispose of this material in the E-Area Solid Waste Disposal Facility. The E-Area facility is intended to be used only for the disposal of low-level radioactive wastes, and is being designed and constructed in accordance with DOE Order 5820.2A, "Radioactive Waste Management". Based solely on costs, disposal in the E-Area Solid Waste Disposal Facility would be preferable to disposal in a RCRA subtitle "C" facility. However, neither delisting nor disposal to a non-subtitle "C" facility is required for full compliance with SCHWMRs.

The final vitrified product would be "splat quenched" as produced. "Splat quenching" involves producing small (about 1/2 inch diameter) beads from the

molten glass and impinging the beads onto a rotating, water cooled, metal plate. The beads cool immediately, resulting in flattened spheres. This process provides immediate solidification to an amorphous glass, thereby preventing any thermal effects on the wasteform.

The stabilized wasteform would be sealed in 71-gallon metal drums and held at a RCRA permitted storage facility in M-Area until vault space in a RCRA permitted facility becomes available, which is anticipated prior to the year 2005. A modification to the existing SRS interim status permit (#SCI-890-088-989) would be submitted to SCDHEC as a portion of the permit package for vendor treatment by 6/30/94. The modification would request that a portion of the SRS interim status capacity be allotted to the interim status facility (storage pad) in M-Area. This storage facility would be up to 30,000 ft² in area and consist of an existing concrete pad adjacent to Building 315-M (see Figure 3-1). Access to this storage facility would be controlled by a chain link fence. It is projected that the treatment and stabilization of the M-Area mixed wastes will begin six (6) to eight (8) months after SCDHEC issues all regulatory permits and take approximately 18 to 20 months to complete.

Upon completion of waste treatment and stabilization (i.e., as the waste is removed from each tank), the vendor would "clean close" the IT/SF and related piping. This would eliminate the need for long term (30 year) post-closure monitoring. Clean closure is defined by and will occur in full compliance with South Carolina Hazardous Waste Management Regulations (SCHWMRs) R.61-79.265 Subpart G and R.61-79.265.197. Clean closure of the IT/SF would primarily involve removal of all waste materials and decontamination of the tank system and associated pumps and piping. Tanks 1 through 8 and 10 are currently contaminated, while Tank 9 has never been used for storage of waste, but is available for emergency transfer of wastes from the other tanks. If Tank 9 were to become contaminated, it too would be cleaned. Decontamination of interior tank walls would be accomplished by using a high pressure water rinse. The volume of rinse water used would be minimized by reusing slightly contaminated rinsate to clean more highly contaminated surfaces. This rinsing process would be repeated until the rinsate becomes too contaminated to use. Clean closure of the IT/SF would take approximately 24 months after the start of treatment. The tanks and equipment would be considered "clean closed" when they are visually clean and nickel and lead concentrations within the rinsates are less than 0.100 mg/L and 0.050 mg/L, respectively. Nickel and lead are the primary hazardous constituents within the waste sludge. WSRC, DOE-SR, and the South Carolina Department of Health and Environmental Control (SCDHEC) (Wilson, 1990) have agreed that a demonstration of "clean closure" would be defined in terms of the concentrations of these two constituents in the final rinse. The nickel concentration is based upon its proposed drinking water standard (55 FR 30370, July 25, 1990) and the lead concentration is based upon the South Carolina analytical detection limit.

The cleaning and rinsing of the tanks and equipment to meet the RCRA "clean closure" criteria would remove the associated radiological contamination. However, this EA does not address the eventual closure of the IT/SF from a radiological perspective, since the standards and techniques for determining whether a material has been decontaminated to meet "background radioactive limits" are not yet defined. After closure, the IT/SF would be monitored to determine if it is a "Radiological Control Area" (RCA), and maintained and inspected appropriately.

The IT/SF tanks are under interim status (Application for a Hazardous Waste Permit "Part A", Savannah River Site, Aiken, SC, United States Department of Energy, ID #SCI-890-008-989) and therefore must meet the requirements of SCHWMMR R.61-75.265 - Interim Status Standards for Owners and Operators of Hazardous Waste Facilities. The LDR-FFCA also requires that any SRS tanks used to store mixed wastes must comply with the more stringent tank standards contained in 40 CFR Part 264. However, these latter requirements are not applicable to closure of the IT/SF tanks (after the sludge has been removed) due to their interim status. The SRS would request the removal of the IT/SF from interim status and that the Part B permit (submitted in 1987 and revised in 1992) be withdrawn following certification of closure of the facility.

The clean closure of the IT/SF tanks is considered to be an integral part of the proposed action. This is because treatment of the mixed waste would empty the IT/SF tanks, and because no further use of these tanks is proposed, RCRA regulations would require their closure. The vendor equipment used to treat the M-Area sludges would also be utilized to treat the rinsates generated by clean closure of the tanks. In essence, clean closure of the IT/SF represents a continuation of the treatment of M-Area mixed wastes. The costs and environmental impacts of clean closure are considered part of the overall costs and impacts associated with the treatment and stabilization of the M-Area waste materials.

The clean closure of the tanks would involve exactly the same activities for any alternative considered in this EA, except for the treatment of the rinsates, which is different for the cement and vitreous processes. The primary radiological concern during the treatment/stabilization activities is exposure of the worker to the concentrated sludge. As discussed in Section 5.10, this is expected to result in an average of 250 mrem/year to an exposed worker. No significant additional radiological exposure from transferring and treating the dilute rinsates from the tank closure is anticipated. The primary concern with the clean closure activities is that the rinsing activities (i.e., the use of high pressure water wands to remove any contamination from the interior tank surfaces) will occur in a closed vessel, and therefore supplied air will be needed. All applicable OSHA requirements for closed vessel entry will be followed.

Filter cake material resulting from the treatment process and tank closure effluents in the DETF will be transferred back to the treatment process for treatment and stabilization.

RCRA Land Ban regulations [40 CFR 268.50 (c)] state that storage or disposal facilities may store hazardous wastes only for purposes of accumulation to facilitate proper recovery, treatment, or disposal. The storage of the M-Area sludge in the IT/SF tanks has been determined by the USEPA to be in violation of this regulation. DOE has committed in the LDR-FFCA to treat and dispose of this waste as quickly as possible. Implementation of the proposed action will fulfill this commitment. Estimated cost of the proposed action is \$16.0 million, which includes the RCRA vault disposal capital costs.

3.2.2 Alternative Actions

Five alternatives to the proposed action were considered. These alternatives are:

- on-site treatment by a subcontractor, using a cementitious process,
- on-site treatment using a cementitious process at a permanent treatment facility within M-Area,
- on-site treatment using a cementitious process at a permanent facility located in the center of the SRS,
- transport to an off-site location for treatment, and
- no action.

3.2.2.1 Contract with a Vendor to Treat and Stabilize M-Area Mixed Wastes Using a Cementitious Process, Storage of Vitrified Mixed Waste in a New Facility, with Ultimate Disposal of Stabilized Sludge in RCRA Vaults.

Implementation of this alternative would yield a stabilized waste which would require no further treatment prior to land disposal. This alternative is similar to the proposed action, except that a cementitious process would be utilized, instead of vitrification. In both cases, temporary facilities would be constructed for the treatment of the wastes. The facilities would either be removed by the vendor for the treatment of other radioactive or mixed wastes, or the facilities would be decommissioned and the residues disposed of onsite. A conceptual flow diagram of the alternate cementitious process is presented in Figure 3-4.

A vendor cementitious process would be very similar to the proposed vitrification action, in that:

- the temporary facility would be located in the same area (adjacent to the tanks).
- containment would be provided by the vendor.

Cementitious Stabilization

Figure 3-4. Flow Diagram of the Cementitious Stabilization Alternative.

- the existing 35,000 gallon storage tanks would be utilized to prepare homogenized feed batches.
- The existing tanks would be used to store the filtrates and rinses, until treated in the DETF.
- the process equipment would be close-coupled to the waste tanks and to the DETF.
- the cementitious wasteform would meet the LDR disposal criteria and the delisting criteria.
- the cementitious waste would be placed in 71-gallon square drums.
- the stabilized waste would be stored in an storage facility in M-Area, until a RCRA disposal facility is available.
- the clean closure of the tanks is the same, except that the rinses would have to be treated in the DETF. Rinses from the vitrification process would be treated (evaporated) in the melter.

The major differences between the vendor cement process and the proposed action (vendor vitrification) are:

- the cement process would result in substantially greater volume of liquid effluent to be treated and disposed at the DETF. It is estimated that the pressure rinsing and filtration of the M-Area sludge would result in at least 300,000 gallons of rinsates to be treated.
- the waste water treatment would result in an additional volume of filtercake from the DETF. The additional filtercake volume is estimated to be 50,000 to 75,000 gallons, which would then have to be stabilized.
- bulk loading facilities for Portland cement or other dry additives such as flyash, blast furnace slag, or proprietary additives would be required.
- tank storage of concentrated (50%) sodium hydroxide would probably be needed.
- the cementitious process would be expected to reduce the volume of the sludge by 25% (vs. a 75% volume reduction for the vitrification process).
- the final volume of the cementitious wasteform would be approximately 562,000 gallons (including the treatment of the initial 700,000 gallons of sludge and the additional 50,000 gallons of filtercake resulting from the pressure rinses and tank closure operations). This is substantially greater than the final volume of the vitrified wasteform, which is estimated to be 175,000 gallons.
- the disposal cost in a RCRA disposal facility is estimated to be approximately \$5.7 million more for the cementitious product than for the vitrified wasteform. This assumes a disposal cost of \$10.00/gallon (\$75/ft³). This disposal cost is based on the estimated capital construction cost for an onsite Hazardous Waste/Mixed Waste Disposal Facility (HW/MWDF) vault of \$6.5 million (in 1993) and a disposal volume of 639,000 gallons (9000 71-gallon drums) (WSRC, 1991).
- storage of the cement wasteform would require more space.

- no off-gases would be generated by the cement process (such as NO_x). Only solid particulate filtration would be needed for the process equipment.
- the energy requirements for a cement process would be lower.
- a cementitious wasteform is expected to have a lower long term durability than a vitrified wasteform.

The cementitious wasteform would continue to "cure" during the initial 14 to 28 days of storage. The relatively small volume of the 71-gallon containers, and the resulting high surface to volume ratio, would result in the final wasteform not being adversely affected by excess heat during curing.

The total cost of the onsite vendor cementitious alternative would be approximately \$6.5 million more than the vitrification alternative. This is due to a combination of treatment cost per gallon sludge, higher treatment costs for the SRS of the effluents generated by the treatment process, and the estimated final RCRA vault disposal cost (due to the larger volume of stabilized waste).

3.2.2.2 Construction of a Permanent Treatment Facility in M-Area, Storage of Vitrified Mixed Waste in a New Facility, and Ultimate Disposal of Stabilized Sludge in RCRA Vaults.

Treatability tests conducted by WSRC have demonstrated that the M-Area plating line sludge must be prefiltered and rinsed, using pressure filtration, in order to prepare a cementitious wasteform that can meet the LDR disposal criteria (Pickett and Musall, 1993). The treatability tests also indicated that Portland cement can be blended with the M-Area sludge prior to the filtration and rinsing so that the volume of the final wasteform can be reduced to approximately 75% of the original sludge (25% volume reduction). These filtration and rinsing processes, however, generate additional liquid effluents which would need to be treated and released by the existing M-Area Dilute Effluent Treatment Facility (DETF).

Implementation of this alternative would yield a stabilized waste which would require no further treatment prior to land disposal. This option would involve the construction and operation of a permanent treatment facility in M-Area to pretreat and stabilize the mixed waste material. This facility would add Portland cement to the sludge, rinse the sludge using pressure filtration, and then place the resultant filter cake in suitable containers for storage. Eventually, this wasteform will be transferred to the HW/MW vaults for disposal when vault space becomes available (estimated before the year 2005). Pretreatment and stabilization of wastes would start in 1998 to 1999, after design, congressional project authorization, and construction. The capital cost of the filtration and stabilization facility was estimated to be \$12 million (WSRC, 1991). The facility was designed to treat approximately 75,000 gallons of sludge per year. The treatment and storage of sludge would take approximately 10 years, with completion projected for the year 2008. The operating cost was estimated at \$2

million/yr. The ten year operating period was also expected to support on-going production operations in M-Area. However, a permanent facility is not needed since no on-going production operations are anticipated in M-Area after 1997-1998. The estimated cost of implementing this option is \$46.6 million, which is inclusive of vault disposal costs. This cost estimate did not include the cost and timing of "clean closure" of the IT/SF tanks. This alternative action is not considered to be cost-effective due to the high cost of constructing and maintaining a permanent treatment facility. Also, because of the time required to arrange funding and designing a permanent facility, this alternative would not meet the DOE's LDR-FFCA commitment for RCRA permit application by 6/30/94.

There are some environmental and health effects differences between the proposed action (vendor vitrification) and the permanent on-site cementitious treatment facility in M-Area alternative. Some potential environmental impacts of the permanent facilities would be a longer period of exposure to treated effluent releases (although the annual volume would be less), and the eventual decontamination, decommissioning, and disposal of the permanent facilities. Occupational exposure and off-site risks would be similar to vendor vitrification, since the total volume of waste to be treated is equal in all cases. Some incremental environmental risk increase would arise from continued current storage (with the potential for leakage and releases) of the wastes and the potential human exposure to process chemicals for an additional eight years (such as sodium hydroxide, which would be added in the cementitious process to improve the final wasteform durability and leaching resistance).

3.2.2.3 Construction of a Permanent Pre-Treatment Facility in M-Area and a Permanent Stabilization Facility at a Centralized SRS Location, Storage of Vitrified Mixed Waste in a New Facility, with Ultimate Disposal of Stabilized Sludge in RCRA Vaults.

This option is similar to the previous option, in that the WSRC treatability tests demonstrated that the M-Area sludge must be pre-treated by filtration and rinsing, prior to preparing a cementitious grout, to meet the LDR disposal criteria. This option would use a portion of the operating capacity of the centralized stabilization facility. The rate at which the waste could be treated in the central facility would be dependent on the pre-treatment rate in M-Area (about 75,000 gallons per year).

Implementation of this alternative would yield a stabilized waste which would require no further treatment prior to land disposal. This option would involve the construction and operation of a permanent pre-treatment filtration facility in M-Area. The rinsed and filtered sludge would be re-slurried, and transported to the centralized stabilization facility (Y-Area). The Y-Area facility would mix Portland cement, fly ash, and blast furnace slag with the sludge, and pump the resulting grout to a RCRA disposal vault.

The capital cost of the pre-treatment filtration facility in M-Area was estimated to be \$12 million (WSRC, 1991). The facility was designed to treat approximately 75,000 gallons of sludge per year. Pretreatment in M-Area and stabilization (at Y-Area) of wastes could start in 1998 to 1999, after design, congressional project authorization, and construction. The treatment and disposal of the sludge would take approximately 10 years, with completion projected for the year 2008. The operating cost for the pretreatment facility in M-Area was estimated at \$2 million/year. The operating cost for the Y-Area centralized stabilization facility was ~1.5 million/year (this was a prorated operating cost, assuming that the M-Area waste stream was ~ 20% of the total wastes to be treated). The estimated life cycle cost of implementing this option is ~\$68 million, which is inclusive of Y-Area RCRA vault disposal costs. This cost estimate did not include the cost and timing of "clean closure" of the IT/SF tanks, or any of the capital investment costs for Y-Area. This alternative action is not considered to be cost-effective due to the high cost of constructing and maintaining two separate, permanent treatment facilities. Also, because of the time required to arrange funding and to complete design of these facilities, this alternative would not meet the DOE's LDR-FFCA commitment for RCRA permit application by 6/30/94.

The environmental impact of the central "Y-Area" alternative was evaluated within the Final Environmental Impact Statement; Waste Management Activities for Groundwater Protection; Savannah River Plant, Aiken, South Carolina (DOE/EIS-0120, December 1987) and will be reevaluated in the Environmental Impact Statement for Waste Management at the Savannah River Site (59 FR 16494; April 1994).

There are some environmental and health effects differences between the proposed action (vendor vitrification) and a permanent M-Area pretreatment/centralized on-site cementitious treatment alternative. Some potential environmental impacts of the permanent facilities would be a longer period of exposure to treated effluent releases (although the annual volume would be less), and the eventual decontamination, decommissioning, and disposal of the permanent facilities. Occupational exposure and off-site risks would be similar to the vendor vitrification, since the total volume of waste to be treated is equal in all cases. Some incremental environmental risk increase would arise from continued current storage (with the potential for leakage and releases) of the wastes and the exposure to process chemicals (such as sodium hydroxide, which is used to improve the cement wasteform stability) for an additional eight years. The on-site centralized treatment alternative would also increase the risk of environmental impact due to spills of the slurry during transport from M-Area to the central facility.

3.2.2.4 Off-Site Treatment

Off-site treatment was considered, but there are currently no operational off-site facilities possessing the required hazardous waste treatment permits to handle

the M-Area wastes. The health, safety, and environmental impacts of off-site treatment are considered to be much higher than on-site treatment, due to the risks associated with transport of liquid mixed wastes off-site. The cost of off-site treatment would be equivalent to or greater than that of on-site treatment because of the costs associated with the transportation of sludge off-site for treatment and subsequent return of stabilized materials to the SRS for storage and disposal. Current guidance for preparation of the FFC Act Site Treatment Plan(s) for DOE mixed wastes assumes that liquid wastes will not be transported off-site, but will be treated on-site. For these reasons, off-site treatment of the M-Area wastes was not considered to be a reasonable alternative.

3.2.2.5 No Action

The No Action alternative is to allow the waste to remain in the IT/SF tanks. The storage of hazardous wastes for purposes other than to facilitate proper treatment or disposal is a violation of the RCRA Land Ban Regulations. The M-Area IT/SF is included in the Land Disposal Restrictions-Federal Facilities Compliance Agreement (LDR-FFCA) between the USEPA and USDOE. Under this agreement, the DOE is committed to treating and stabilizing the M-Area mixed waste as expeditiously as possible. Failure to meet LDR-FFCA commitments could result in significant financial penalties for the DOE. Also, the indefinite storage of an untreated hazardous waste is illegal under SCHWM regulations. The LDR-FFCA allows the SRS continued storage and generation of F006 waste only because of DOE's commitment to develop and implement treatment capacity for this waste.

There is a potential environmental risk associated with the continued storage of mixed wastes in M-Area's aging IT/SF tanks. If one or more of the tanks were to develop a leak, the receiving environment and area personnel would be exposed to this toxic material. The tanks have been in service for eight (8) years and have a design life of 30 years. The pH in all tanks, except Tank 10, have been maintained above 10.0 to minimize corrosion. Each of the 500,000 gallon tanks is equipped with secondary containment and leak detection and all six (6) of the 35,000 gallon tanks are contained within a dike inside Building 341-1M. This building is inspected four (4) times daily for leaks. The equipment, procedures, and contingency plans necessary to transfer the sludge from one leaking IT/SF tank into another IT/SF tank will be procured and developed in the near future. Also, Tank 9 has never been placed into service and is available for emergency transfer and storage. Primarily for reasons of regulatory noncompliance, but also because of potential environmental risks, the "No Action" alternative is not considered to be an acceptable option.

4.0 AFFECTED ENVIRONMENT

4.1 Geography

The SRS occupies an area of approximately 800 km² (198,737 acres) in Aiken, Barnwell, and Allendale counties in southwestern South Carolina (Figure 4-1). The site is located 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina. SRS facilities include five inactive nuclear production reactors, an inactive nuclear fuel and target fabrication facility, two chemical separations facilities, tritium facilities, waste management facilities, and administration facilities. Public access to SRS is restricted to state and Federal highways which border and traverse the site. The entire SRS boundary is fenced with the exception of the Savannah River which forms its western boundary for approximately 27 kilometers (17 miles). Detailed site information on the SRS and its physical and environmental characteristics can be obtained from the Final Environmental Impact Statement for Continued Operation of K-, L-, and P-Reactors (DOE, 1990).

The proposed treatment facility and storage pad will be located within M-Area, a heavily industrialized area which contains a fuel and target fabrication facility, two analytical laboratories, and a Dilute Effluent Treatment Facility (DETF) (see Figure 3-1). When active, the fuel and target fabrication facility produced fuel and target elements, control rods, and other reactor components which were used in the reactors. The laboratories provide analytical support for the reactor, heavy water, fuel fabrication, and liquid effluent treatment facilities. Waste water generated by the various M-Area processes are treated in the DETF and discharged to Tims Branch, a tributary to Upper Three Runs Creek.

M-Area is located approximately 0.5 miles from the north boundary of the SRS, immediately adjacent to the Savannah River Technology Center (SRTC). The center point coordinates for M-Area are SRS coordinates E52,000; N105,000; and UTM coordinates E430,150; N3,689,000. Surface elevations across the project area range from 350 to 380 ft above mean sea level (MSL). Surface drainage is to Tims Branch (approximately 5000 ft to the east) and other small streams to the northwest and southwest that eventually drain into the Savannah River. M-Area is on a water-table mound with the predominant flow to the east toward Tims Branch.

4.2 Demography and Socioeconomics

In 1990, approximately 90 percent (or 19,174 individuals) of the current SRS work force (21,193) resided in Aiken, Bamberg, Barnwell, and Allendale counties in South Carolina, and Columbia and Richmond counties in Georgia (Figure 4-1). The 1990 population of these six counties was 425,607, including a workforce of 208,984 (Halliburton NUS, 1992). The largest population centers within a 80 kilometer (50-mile) radius of the SRS are Aiken, South Carolina and Augusta,

Figure 4-1. Savannah River Site Location in Relation to Surrounding Population Centers and Counties.

Georgia (19,872 and 44,639, respectively). Additional information regarding demographic and socioeconomic variables relevant to the SRS can be found in Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site (HNUS, 1992).

4.3 Meteorology and Climatology

The SRS region has a temperate climate with mild winters and long summers. The average annual rainfall at SRS, about 122 cm (48 in), is fairly evenly distributed throughout the year. During the summer and fall, there is a relatively high frequency of east and northeast winds, while during the late fall, winter, and spring months, there is a relatively high frequency of south through northwest winds (WSRC, 1992). Tornadoes have been observed during every month of the year in the area encompassing the SRS, but occur most frequently during the spring period. No tornado damage has ever occurred to any production facility on the SRS (DOE, 1990) and there are only a few instances of slight to moderate tornado damage to support facilities (WSRC, 1989a). With the exception of the Savannah River, there are no unusual local topographic features which exert significant influences on the general climatology. More detailed information regarding winds, atmospheric dispersion, and SRS meteorology can be found in the Savannah River Site Environmental Report for 1991 (WSRC, 1992) and Reactor Operation Environmental Information Document. Volume III (WSRC, 1989a), respectively.

4.4 Geology and Seismology

The SRS is located in the Aiken Plateau physiographic region of the upper Atlantic Coastal Plain approximately 40 km (25 mi) southeast of the Fall Line which separates the Piedmont Plateau from the Atlantic Coastal Plain. The Coastal Plain at the SRS slopes gently seaward and is underlain by 500 to 1,400 feet of sands, clays, and limestones of Tertiary and Cretaceous age. These unconsolidated and semiconsolidated sediments contain several productive aquifers which are separated by clay-rich units. Below these sediments lie sandstones of Triassic age and older metamorphic and igneous rocks. The proposed M-Area treatment process site does not overlay any known geologic faults (WSRC, 1989a). Additional geological and seismological information (i.e. SRS fault locations and earthquake occurrences) can be found in the Final Environmental Impact Statement for the Continued Operation of the K-, L-, and P-Reactors (DOE, 1990) and Reactor Operation Environmental Information Document. Volume II (WSRC, 1989b).

4.5 Hydrology

The Savannah River forms the western boundary of the SRS and receives drainage from five major tributaries on the site: Upper Three Runs Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek. These

tributaries receive pollutant loadings from plant processes and sanitary treatment systems, all of which are permitted through the National Pollutant Discharge Elimination System (NPDES). Water for various SRS plant processes is pumped from the Savannah River or an onsite groundwater aquifer system. Additional information concerning surface hydrology and regional groundwater aquifer systems can be found in the Final Environmental Impact Statement for the Continued Operation of the K-, L-, and P-Reactors (DOE, 1990).

4.6 Ecological and Cultural Resources

The predominant land use at the SRS is rural, with less than 10 percent of the land area being developed. Major plant communities on the SRS include cypress-gum and lowland hardwood swamps, sandhills, and old agricultural fields. Additionally, there are aquatic and semiaquatic areas. SRS is populated by a tremendous diversity of fauna, including more than 50 species of mammals, 100 species of reptiles and amphibians, and more than 200 species of birds. The site provides refuge for six endangered and threatened species: Red-Cockaded Woodpecker (Picoides borealis), Southern Bald Eagle (Haliaeetus Laeetus leucocephalus), Wood Stork (Mycteria americana), American Alligator (Alligator mississippiensis), Shortnose Sturgeon (Acipenser brevirostrum), and Smooth Purple Coneflower (Echinacea laevigata). None of these species have been documented on or near the site of the proposed action (WSRC, 1989c).

The SRS was designated as a National Environmental Research Park in 1972 and is one of the most extensively studied areas in this country. The management and utilization of natural resources at the SRS are described in the SRS Natural Resources Management Plan (DOE, 1991b) and defined under the terms of a Memorandum of Agreement between DOE-SR, Savannah River Forest Station, Soil Conservation Service, and Westinghouse Savannah River Company. Additional information regarding the SRS ecosystem can be found in The Savannah River Plant Environment (Dukes, 1984) and Volume II of the Reactor Operation Environmental Information Document. Volume II (WSRC, 1989c).

Cultural resources at the SRS are managed under the terms of a Programmatic Memorandum of Agreement between DOE-SR, the South Carolina State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation. DOE-SR uses this agreement to identify cultural resources, assess them in terms of National Register eligibility, and develop mitigation plans for affected resources in consultation with the SHPO. No known archaeological or cultural resources have been documented in the proposed project location.

4.7 Radiation Environment

A person residing in the Central Savannah River Area within 80 km (50 mi) of the SRS receives an average annual radiation dose of approximately 379 mrem. Major sources of natural (i.e., background) radiation exposure include short-lived

decay products of radon (200 mrem), terrestrial radiation (43 mrem), internal radiation due to assimilation of radionuclides into the body such as naturally occurring potassium, K-40 (39 mrem), and cosmic radiation (33 mrem). Significant sources of man-made radiation include consumer products (10 mrem) and medical x-rays/nuclear medicine (53 mrem). The SRS contributes less than one mrem (<1%) to the total radiation dose. The SRS Environmental Report for 1992 (WSRC, 1992) contains additional information regarding the radiation environment.

5.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

The environmental consequences described below are considered to be the same for the proposed action and the three alternatives, including clean closure previously discussed, unless otherwise specified.

The cumulative environmental impact of the permanent on-site treatment facility in M-Area is considered to be the same as the vendor cementitious alternative, except that the impacts would occur over a ten year period rather than a one to two year period. The cumulative environmental impact of the permanent pre-treatment facility in M-Area is also considered to be the same as the vendor cementitious alternative. The environmental impact of the centralized stabilization facility was evaluated in the Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina (DOE, 1987), and is not addressed in this EA. The environmental consequences of the off-site treatment alternative and the no action alternative are not specifically addressed in this EA.

5.1 Cultural Resources

The proposed treatment process and storage facilities would be located in M-Area, a heavily industrialized section of the SRS. M-Area has been subjected to construction and developmental activity since the early 1950s, thereby destroying any previously existing archaeological, historical, or cultural resources. The siting, construction, and operation of the proposed facilities would have no adverse impact on archaeological, cultural, or historical resources.

The alternative centralized treatment facility would be located immediately adjacent to the existing Z-Area low level radioactive cementation facility. This area has also undergone significant construction and developmental activity, thereby destroying any previously existing archaeological, historical or cultural resources.

The siting, construction, and operation of the proposed or alternative on-site facilities would have no adverse impact on cultural resources. The potential for adverse impact to cultural resources from implementation of the off-site facility alternative exists but cannot be determined because no specific site has been proposed. Should this alternative be implemented, DOE would conduct appropriate surveys and consultation with the SHPO and, if necessary, mitigate any adverse impacts to cultural resources.

5.2 Socioeconomics

The estimated cost of the proposed action (including vault disposal of stabilized wasteforms) is \$16 million. A maximum vendor workforce of 30 to 40 persons would be required for construction of the proposed action or the vendor

cementation alternative process facility. Operation of the proposed action or the vendor cementation alternative process and conducting the closure activities is expected to require 10 to 15 persons. Operation of the permanent pre-treatment and centralized facilities would also be expected to require 10 to 15 persons, but would operate for 10 years instead of one to two years for the proposed action or the vendor cementation alternative. The socioeconomic impacts of the proposed action on surrounding communities would be negligible when compared to the total SRS employment and budget of 21,000 persons and >\$1.5 billion, respectively (Halliburton NUS, 1992).

5.3 Ecology

The land use impacts associated with the proposed and alternative on-site actions would be negligible. The vendor's treatment process facility or the permanent pre-treatment facility would be located within M-Area, a heavily industrialized area. Wildlife habitat within the area is severely degraded and natural productivity is limited. No sensitive ecological resources (i.e., critical habitats) or endangered/threatened species have been identified in the project area (WSRC, 1989c). Additionally, the proposed facility would not be located within or near wetlands or the SRS 100-year base floodplain. Implementation of the proposed action within M-Area would have negligible ecological impacts.

The impact of implementation of the alternative centralized treatment facility (Y-Area) on ecological resources was evaluated in the Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina (DOE, 1987).

5.4 Hydrology

Domestic and process water requirements for the proposed vendor treatment process (< 50 gallons per minute) would be met by withdrawing groundwater from the existing A-Area well system. This level of utilization would not adversely impact SRS or regional groundwater resources. There would be no surface water withdrawals associated with the proposed action. Standard erosion and sediment control practices would be implemented during site preparation and facility construction to prevent the siltation of area surface waters.

The RCRA approved storage facility in M-Area would not be covered and stored waste containers would be exposed to the elements. In case of a storage container failure, stormwater runoff from the facility would present a potential pathway for environmental contamination. Storage container integrity would be insured by using containers which are constructed to resist corrosion and certified to provide leak-free containment for a minimum of 10 years. Additionally, the stabilized waste would be sealed in an inner plastic liner and storage containers would be placed on pallets to prevent their exposure to

standing water. The storage containers would not be subjected to or damaged by the heat resulting from waste curing because this process would occur primarily before the wastes are sealed into the containers. Weekly inspections of the storage facility would also be conducted to verify container integrity. Even if a storage container is breached and rainwater contacts the stabilized wasteform, leaching would be negligible. The concentrations of any hazardous or radioactive constituent in such a leaching solution would be below the concentrations which the EPA has defined as having a negligible effect on a drinking water source. Therefore, the final stabilized wasteform would meet the EPA requirements to define the wasteform as a non-hazardous material. In summary, surface and groundwater resources would not be adversely impacted by the proposed action. Isolation of the waste material from the surface and groundwater would be one of the primary purposes of the proposed action. The storage of the stabilized waste as described above will meet the corrective action requirements for groundwater protection in the RCRA hazardous waste management regulations (40 CFR 264.101). Groundwater monitoring (per 40 CFR 264.91 through 264.100) would not be required, since the storage pad would not be a surface impoundment, waste pile, land treatment unit, or landfill that receives hazardous waste.

For example, the EPA has promulgated in its Land Disposal Restrictions (LDR) regulations that a listed F006 hazardous waste must meet TCLP leachant concentration of 0.32 mg/l of nickel prior to land disposal in a RCRA disposal facility. Recent EPA guidance (EPA, 1993) indicates that the M-Area sludge could be delisted if a TCLP leachant concentration of 10 mg/l or less of nickel could be demonstrated. If delisted, the waste stream would be considered non-hazardous and could be disposed of in an industrial or sanitary landfill with no further restrictions. The EPA LDR criteria are much more restrictive than the delisting criteria, and would therefore be the limiting criteria.

The M-Area sludge treatability studies have demonstrated a TCLP leachant concentration of 0.006 to 0.17 mg/l for vitrified samples, and from less than 0.05 to 0.14 mg/l for optimized cementitious formulations. These concentrations are well below the LDR criteria and the delisting criteria. Therefore, the stabilized M-Area sludge would result in leachant solutions which would have a negligible environmental impact with regard to these criteria. All other hazardous or radioactive constituents in the M-Area waste would meet similar health based leaching criteria.

The hydrological impact of implementation of the alternative centralized treatment facility (Y-Area) was evaluated in the Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina (DOE, 1987).

In summary, surface and groundwater resources would not be adversely impacted by the proposed action or any of the alternatives. Isolation of the waste

material from the surface and groundwater would be one of the primary purposes of the proposed and alternative actions.

5.5 Noise

External noise attributable to normal operation of the vendor treatment process would be within acceptable levels for the area. Noise from the facility would not be detectable by the nearest offsite resident. The equipment would be designed to minimize noise levels to the operational personnel. The noise levels would be monitored by WSRC Industrial Hygiene personnel to determine the type of personal protective equipment required for the operational personnel.

5.6 Waste Management

Characteristics of the various liquid and solid waste streams that would be generated by the proposed and alternative treatment processes and the disposal/storage strategies to be implemented are shown in Table 5-1. The on-site permanent facility alternatives are similar to the vendor cementitious alternative in terms of waste management impacts, and are not specifically addressed.

Liquid waste flows from the treatment process and clean closure activities over the entire duration of the process would range from 50,000 to 300,000 gallons, which would be collected and piped to the DETF for treatment and discharge via a NPDES-permitted outfall (M-004) (SCDHEC Permit No. SC0000175) into Tims Branch. Qualitatively, this treated effluent would not differ significantly from the treated IT/SF supernate which the DETF has been discharging since 1990. The volume of effluent discharged due to treating the effluents from the vitrification process would be less than for a cementitious process. The volume of effluent discharged from the DETF would also be less for either alternative than the current DETF annual release (approximately 17,000 m³ or 4.5 million gallons per year). Water quality and indigenous biota within the receiving stream would not be adversely impacted by the proposed action.

Small amounts of construction-related debris (280 m³) and low-level radioactive solid waste (67 m³ uncompacted) would be generated during the construction, operation, and demobilization of the proposed or alternative vendor treatment processes. Construction of permanent on-site facilities is expected to result in larger amounts of such debris, but specific estimates have not been made. Low level radioactive waste generated during operation of the proposed alternatives would include non-incinerable materials such as tools, pumps, process equipment, etc. The criteria that these materials must meet in order to be considered low level radioactive, rather than mixed F006 wastes, will be specified in the Interim Status Closure Plan. The estimated volumes for the proposed action and the vendor cementitious alternative are very small percentages of the

Table 5.1. M-Area Treatment Process Waste Materials for On-site Vendor Disposal Alternatives.

Waste	Estimated Quantity*		Final Disposal
Initial sludge (F006, mixed wastes)	700,000 gallons 2650 m ³		
	<u>Vitrification</u>	<u>Cement</u>	
Treated M-Area wasteform	175,000 gals. or 660 m ³ (75% vol. reduction)	562,000 gals.** 2,130 m ³ (25% vol. reduction)	HW/MW Disposal Vaults 71-gallon capacity drums
Effluents to be treated	50,000 gals. 190 m ³	300,000 gals. 1,140 m ³	Treated in DETF
Treated effluents***	100,000 gals. 380 m ³	600,000 gals. 2,280 m ³	Discharge via NPDES Permit SC000175 to outfall .
Additional filtercake generated	10,000 gals. 35 m ³	50,000 gals. 200 m ³	Treated by vendor
Misc. F006, mixed wastes (rags, wipes, assorted debris)	27 m ³ (if compactable, 8 m ³)		Interim mixed waste storage in Building 316-M; or SRS mixed waste storage. Possible treatment by CIF
Low-level waste	67 m ³ # (if compactable, 16 m ³)		Solid Waste Disposal Facility (Burial Ground)
Construction debris	280 m ³		SRS sanitary landfill
Sanitary waste	5,000 gals. (or 20 m ³)		Off-site sanitary treatment plant

* Generated over the life of the treatment and closure activities (2 to 2.5 years).

** Includes additional volume of filtercake generated by treatment of the filtration and rinsing liquids.

*** Treatment of liquid effluents may increase total volume of effluents released. This is due to a solids loading treatment limitation in the DETF; streams with >10 mg/l total suspended solids must be diluted to 2 to 10 times prior to treatment.

Includes vendor equipment retained on-site.

SRS total (see section 5.9). These wastes would be disposed of in the SRS Sanitary Landfill and Solid Waste Disposal Facility, respectively, and therefore would have negligible environmental impact. Acceptance of these wastes at the disposal facilities will be in compliance with the WSRC Waste Acceptance Criteria Manual WSRC1S (WSRC, 1993a).

Approximately 27 m³ (8 m³ if compacted) of miscellaneous mixed waste would be generated by the vendor treatment process and clean closure of the IT/SF tanks. This waste would consist of contaminated protective clothing, wipes or rags, tools, pumps, lines, and other assorted debris contaminated by the M-Area sludges. These materials would be packed in B-25 metal containers and placed into interim waste storage in Building 316-M or in the SRS mixed waste storage facility.

Sanitary wastes resulting from the proposed action (approximately 5,000 gallons or 20 yd³) would not impact the SRS environment. This waste would be collected by the vendor in portable toilets and transported off-site for treatment and disposal.

It is estimated that the treatment of 700,000 gallons of M-Area mixed waste sludges would result in the generation of approximately 175,000 gallons (660 m³) of stabilized sludge, or 562,000 gallons (2,130 m³) of cementitious wasteform. These estimates are based upon WSRC treatability studies which show a maximum of 85% decrease in the volume of IT/SF sludge treated by vitrification or a maximum of 50% decrease when treated by pressure rinsing followed by cementitious stabilization. More conservative estimate of the potential volume reductions (75% for glass and 25% for cement) were used to calculate the final volume of stabilized material. On-site pre-treatment in M-Area, followed by stabilization in Y-Area, is estimated to result in a 1.5 to 2.0 increase in the final volume of stabilized waste. The vitrification method would result in a smaller volume of stabilized sludge than the cementitious method due to greater waste loading during treatment, the generation of a higher density final product, and the removal of water during treatment. The stabilized sludge would possess no free water and will meet the LDR treatment standards for F006 and other hazardous constituents present in the M-Area wastes.

The wasteform from the proposed action and the vendor cementitious or permanent cementitious facility in M-Area would be sealed in 71-gallon steel drums and held in RCRA approved storage until vault space is available in a RCRA disposal facility. There would be no mixed waste, radioactive waste, hazardous waste, waste water, construction debris, or sanitary waste generated during normal operation of the storage pad. The stabilized sludge from the permanent centralized facility alternative would be pumped directly to a RCRA disposal facility.

WSRC would attempt to "delist" the stabilized M-Area mixed waste sludges. This would allow the SRS to dispose of this material in the E-Area Solid Waste Disposal Facility rather than in a RCRA permitted facility. Although the quantity of this stabilized wasteform is large, it would be far less toxic than the original waste material and would be effectively isolated from the environment. The treatment, storage, and disposal of this stabilized waste material would have negligible environmental impacts because the final wasteform will meet the EPA definition of a nonhazardous material.

Process equipment determined by the vendor to be non-reusable would be declared a wasteform and disposed of on-site. The process equipment contaminated with F006 mixed wastes would be managed as contaminated debris in accordance with the alternate LDR standards for debris in 40 CFR 268.45 (i.e. A "clean debris surface"). The decontamination standards specified in 40 CFR 268.45 would be used to clean the contaminated debris. Process equipment cleaned by this method would, at a minimum, be considered radioactive waste, not hazardous or mixed waste. If the equipment could not be sufficiently cleaned, it would be treated as a mixed waste, stored, and when disposal sites are available, disposed of on-site. After cleaning, the appropriate radiological surveys would be conducted to determine if disposal as a low-level radioactive waste is appropriate. Based upon past experience with similar debris, demonstrating such equipment to not be radioactivity contaminated is fiscally prohibitive and very time consuming. Therefore, WSRC expects to dispose of this debris as low-level radioactive waste to the E-Area Solid Waste Disposal Facility.

Disposal of process equipment from the permanent on-site alternatives was not specifically addressed in this assessment. Offsite/site reuse of the equipment would not be an option, and the decontamination and decommissioning of permanent facilities is expected to result in larger volumes of wastes to be disposed.

5.7 Air Quality

During construction of the vendor treatment process, or the alternative vendor cementation process and the storage facilities, probable sources of air pollution would be fugitive dust resulting from site preparation activities and internal combustion engine products attributable to construction equipment. The dust will be controlled by wetting ground surfaces during dry periods. Air quality impacts associated with construction-related activities would be negligible for all on-site alternatives.

The proposed action would utilize a vitrification process to produce a stabilized wasteform. Table 5-2 characterizes the maximum atmospheric releases projected for the proposed action and for the cementation alternative (Musall, 1993). The vitrification process is considered to be the bounding case for NO_x, SO_x, and

radionuclide atmospheric emissions. NO_x emissions for the vitrification process (27 tons/year) would be below the 40 tons/year threshold value which would require sitewide remodeling of all NO_x emissions to demonstrate regulatory compliance with the Clean Air Act (CAA). The vitrification NO_x emissions are small when compared to other existing SRS NO_x emissions, such as the H-Area power plant boiler (1,226 tons/year), and would have a negligible air quality impact (WSRC, 1992). Atmospheric emissions of SO_x and particulates from the vitrification process would be negligible and would not adversely impact ambient air quality. Although particulate emissions from the cementitious process would be approximately seven times (7X) greater than those for the vitrification process (0.33 tons vs. 0.05 tons, respectively), they are still negligible when compared to other existing SRS particulate emissions. For example, the 1991 particulate atmospheric emissions for the A-, D-, and H-Area boilers at the SRS were 547 tons, 542 tons, and 692 tons, respectively.

The cumulative emissions from the on-site permanent cementitious alternatives would be similar to the vendor cementitious alternative, except that the emissions would be spread over a ten year period rather than a one to two year period.

Table 5-2. Characterization of Maximum Atmospheric Releases for the Proposed Treatment Process.

Pollutant	Vitrification		Cementitious	
	Avg. Hourly	Annual	Avg. Hourly	Annual
NO _x	7.5 lb	59,400 lb (27 tons)	---	---
SO _x	0.013 lb	105 lb (0.5 tons)	---	---
Particulates	0.0135 lb	106 lb (0.05 tons)	0.39 lb	730 lb (0.33 tons)
Depleted U	13.8 nCi	110 uCi (0.00011 Ci)	12 nCi	22 uCi (0.000022 Ci)

Note: NO_x and SO_x would not be generated by the cementitious process. Annual emissions estimates for the vitrification process are based on 24 hour operation, 7 days a week (including holidays) with 10% downtime for maintenance and repair. The annual emissions estimates for the cementitious stabilization process are based on 8 hour operation, 5 days a week (including holidays) with 10% downtime for maintenance and repair.

It is anticipated that either a modification to the existing M-Area air emission permit or a new permit application for constructing and operating an off-gas treatment system would be needed from SCDHEC for the vitrification process.

Depleted uranium would be the primary radionuclide emitted by both the vitrification and cementation processes. These emissions would be controlled by the use of HEPA filters. The projected maximum annual release of radionuclides from the vitrification process is 1.1×10^{-4} Ci, which yields an Effective Dose Equivalent (EDE) to a maximally exposed offsite individual of 3.1×10^{-3} mrem (yearly average dose). This EDE is about two orders of magnitude less than the maximally exposed off-site individual dose of 0.12 mrem for all SRS airborne releases in 1991 (WSRC, 1992). A review of historical data in Table 5-3 indicates that the projected level of radionuclide release for the vendor treatment process (1.1×10^{-4} Ci) is comparable to the 1991 M-Area U-235/238 atmospheric release of 1.25×10^{-4} Ci but more than area releases recorded for 1990 and 1992 (2.0×10^{-5} Ci and 5.12×10^{-6} Ci, respectively). This projected atmospheric release from the proposed action equates to an EDE for the maximally exposed off-site individual of 3.1×10^{-3} mrem. This corresponds to an Latent Cancer Fatality (LCF) risk of 1.5×10^{-9} (1.5 chances in one billion) to the off-site individual.

No atmospheric releases are expected during normal operation of the storage facility for the stabilized sludge.

Table 5-3. M-Area U-235/238 Annual Atmospheric Releases for the Period 1990 - 1992.

Year	M-Area U-235/238 Air Releases (Ci)	EDE* for M-Area Rad Air Releases (mrem)	EDE for Site Rad Air Releases (mrem)	LCF**
1990	2.00×10^{-5}	5.6×10^{-4}	0.16	--
1991	1.25×10^{-4}	3.5×10^{-3}	0.12	--
1992	5.12×10^{-6}	1.4×10^{-4}	0.09	--
Projected Vendor Treatment				
1995/96	1.1×10^{-4}	3.1×10^{-3}	--	1.5×10^{-9} #

From Hamby, 19934.

1.5×10^{-9} calculated using 3.1×10^{-3} mrem $\times$ 5×10^{-7} LCF/person-mrem (DOE, 1993).

*EDE = Effective Dose Equivalent for the off-site individual (from the M-Area air releases) was calculated assuming the radioactive releases were from the M-Area facility location.

**LCF = Latent Cancer Fatality

5.8 Transportation

Potential environmental impacts associated with transportation activities would be primarily related to vehicle exhausts and accident-induced material spills. Based upon the limited number of vendor and other vehicles which would be involved in project implementation, air quality impacts resulting from vehicle operation would be negligible. Traffic congestion is not expected to be a problem.

Wastes from the MWSS would be transported a short distance (approximately 300 meters) by truck or forklift from the MWSS to an IT/SF blend tank and would occur entirely within the fenced/controlled M-Area. The plating line solution, which is a corrosive liquid, would be moved utilizing a spill control pallet. This pallet could contain the entire volume of liquid if a drum leaked. The Mark 15 material is contained within double plastic bags, within lined 55 gallon drums, so the potential for a release during transport is very low. The short distance to move the limited amounts of these wastes (less than 80 drums) is not expected to have environmental or health impact.

Transport of the stabilized wasteform from the vendor process to the M-Area storage facility would be by truck or forklift in sealed steel drums (with inner plastic liners) under controlled conditions. The steel drums would meet or exceed the Department of Transportation (DOT) container specifications of 49 CFR, and should an accident occur involving the truck or forklift, it is unlikely that the drums would be ruptured. In the event of drum rupture and release of stabilized sludge to the environment, the solid material would be readily contained and cleaned up and would pose no exposure threat (i.e. it is not flammable, volatile, splashable, reactive, or corrosive) to the environment or spill response personnel.

The dose rate to drivers transporting a similar radioactive sludge from the M-Area Settling Basin to an on-site storage facility was conservatively estimated to be 0.046 mrem/hr (Pickett, 1987). This dose rate is a factor of 40 times lower than the DOT limit for driver exposure in an occupied cab (2 mrem/hr). No further reduction in dose rate by shielding will be required.

The cumulative driver dose during transport for the proposed action would not exceed 9.2 mrem (assuming 200 hours). Based on an occupational risk factor of 4×10^{-4} fatal cancers per person-rem a driver involved with this proposed action would not be expected to incur any harmful effects from radiation exposures they receive during normal operations. If only one driver were used for all necessary trips, the estimated probability of that driver dying from cancer induced by such radiation doses over the worker's projected exposure period is approximately 3.68×10^{-6} (3.7 chances in 1,000,000).

5.9 Environmental Justice/Equity

Analysis has shown no disproportionate effects on any minority community or low income community within the vicinity of the SRS.

5.10 Cumulative Impacts

5.10.1 Pollutant Loadings

Historically, M-Area has been permitted (Air Permit # 0080-055) to emit a total of 24 lb/hr of NO_x from Buildings 313-M (16.0 lbs/hr) and 321-M (8 lbs/hr), respectively. Due to the shutdown of Building 313-M, the area now emits only 8.0 lbs/hr from Building 321-M, and it is expected that this will no longer be an active source of NO_x emissions by the time the M-Area mixed waste treatment process goes online (Musall, 1993). Therefore, the projected atmospheric release of 7.5 lb/hr of NO_x from the vendor treatment process will represent a net decrease in overall NO_x emissions for the M-Area.

Table 5-4 lists the nonradiological air emissions from SRS power plants in 1991 and projected atmospheric emissions from the M-Area treatment process. A comparative review of these data indicates that the emissions from the vendor treatment process are very small relative to the power plant emissions. The cumulative impact of adding these vendor treatment process air emissions to the sitewide inventory would be negligible.

Table 5-5 characterizes the cumulative environmental impacts of selected waste categories associated with implementation of the proposed action. Site totals represent 1991 generation rates. A review of these data indicates that vendor waste streams associated with sanitary solid wastes (construction debris), low level solid wastes, and process waste water are very small when compared to the quantities being generated sitewide. The environmental impacts associated with the generation and disposal of these wasteforms would therefore be negligible. Quantitatively, the amount of final wasteform generated by the proposed action is fairly large (660 m³), although much less than the amount of cementitious wasteform (2,130 m³). However, this wasteform would be stabilized and far less toxic than the original material and would be effectively isolated from the environment during both storage and final disposal. The potential cumulative environmental impacts associated with this wasteform would be negligible.

5.10.2 Terrestrial and Aquatic Resources

The land and water resource requirements associated with the construction and operation of the vendor treatment process and subsequent storage/treatment of wastes would be negligible. When considered in conjunction with the sitewide use of these resources, the cumulative impacts of the proposed action would be negligible.

Table 5-4. Nonradiological Air Emissions from SRS Power Plants and the Proposed M-Area Treatment Process.

Constituent	SRS Power Plants (1)	M-Area Treatment Process (2)
SO ₂	4,575 tons/year	--
SO _x	--	0.05 tons/year*
NO _x	1,488 tons/year	27 tons/year.
Particulates	6,681 tons/year	0.05 tons/year* 0.33 tons/year**

(1) from WSRC (1993)

(2) from Musall (1993)

*vitrification

**cementitious treatment

Table 5-5. Characterization of Cumulative Environmental Impacts Associated with Selected Wasteforms Resulting from the Construction and Operation of the M-Area Vendor Treatment Process and Clean Closure of the Interim Treatment/Storage Facility

Wasteform	Vendor Process ⁽¹⁾ (Vitrification)	Site Total (2,3)	Cumulative Impact
Sanitary solid wastes	280 m ³	82,500 m ³ /year	negligible**
Low level solid wastes	67 m ³ (uncomp)* 8 m ³ (comp)*	23,800 m ³ /yr	negligible**
Process waste water	380 m ³	76,000 m ³ /year	negligible**
Mixed waste solids	615 m ³	incomplete data	not available

- (1) Musall (1992)
 (2) Grant (1993)
 (3) WSRC (1993b)

*uncomp. is uncompacted; comp. is compacted

**negligible is defined to be less than 1.0%.

5.11 Occupational Exposure

The radioactive sources in the IT/SF sludge are primarily depleted uranium with a small volume (15.4 m³) containing enriched uranium. This radioactive material resulted from the cleaning, canning, and testing of depleted uranium slugs in Building 313-M. Spent acids and caustics used to clean the uranium slugs were transferred to the IT/SF. In addition, slug failures from the autoclave and rinse waters containing uranium were transferred to the IT/SF.

Since the sludge is a diluted form of these sources, workers handling the sludge during the vendor treatment process could expect a maximum dose no higher than a Building 313-M operator historically received during production to

support four (4) operating reactors such as during the mid-1980s. At that time, a Building 313-M operator received an average dose of 250 mrem/year (Dehart, 1985). Therefore, a waste treatment process worker can expect to receive no more than 250 mrem/year.

Worker exposures to radiation under normal operations would be controlled under established procedure (DOE/EH-0256T) that require doses to be kept as low as reasonably achievable and that limit any individual's dose to less than two (2) rem/year.

Based on a dose-to-risk conversion factor of 4×10^{-4} latent cancer fatalities per person-rem (DOE, 1993), the maximally exposed worker for the proposed action (assuming 500 mrem/year) would have an estimated annual probability of a fatal cancer induced by the radiation of 2×10^{-4} . The estimated probability of the worker dying from cancer induced by such radiation doses over the worker's projected exposure period (1.5 years) is approximately 3×10^{-4} , or three (3) chances in 10,000.

The group of 10 workers for the proposed action are estimated to be exposed at an average dose rate of 250 mrem/year. Assuming an occupational risk factor of 4×10^{-4} fatal cancers per person-rem, workers involved with this proposed action would not be expected to incur any harmful effects from radiation exposures they receive during normal operations. The estimated probability of a worker dying from cancer induced by such radiation doses over the worker's projected exposure period (1.5 years) is approximately 0.0015, or 15 chances in 10,000.

If an accidental line break or leak occurs and an individual is directly exposed, but does not inhale or ingest the sludge, the individual could expect to receive a dose of less than one (1) mrem. Safety showers/eyewash stations would be within close proximity of any potential exposure. The individual would be directly exposed to the sludge for only a few minutes. The concept of ALARA (radiation exposure As Low As Reasonably Achievable) would be an inherent consideration of all facility design requirements and operating procedures.

The primary occupational hazard for the vendor personnel is considered to be the caustic nature of the M-Area sludge. The sludge has a pH of approximately 12.0, which is comparable to the acidic activity of lime or lemon juice (with a pH of 2.0 - 2.4). Exposure to bare skin, over a period of hours, might cause some discomfort.

The most hazardous material to be handled would be the concentrated sodium hydroxide, which would probably be used in the cementation alternative. With respect to the proposed action, the high temperature associated with the vitreous melter is considered the primary occupational hazard. Precautions and procedures would be developed to ensure all occupational hazards are minimize.

6.0 PRELIMINARY HAZARDS ASSESSMENT

A preliminary hazards assessment of the proposed M-Area Vendor Treatment Process and storage pad has been prepared (Nadeau, 1993). The major objective of a hazards classification is to determine the applicable design requirements per DOE Order 6430.1A. The accident consequences are calculated using extremely conservative methods without considering any mitigation systems or administrative controls. The numerical results should not be used in any other context than to determine the classification, which is Low Hazard Nuclear. It should be noted that since the proposed action (vendor treatment by vitrification) is a temporary facility, the design requirements of 6430.1A are not applicable. The Low Hazard Nuclear classification would also allow the determination of the level of Operational Readiness Review which may be required by DOE Order 5480.31.

Due to the liquid state of waste materials within the treatment process, that component of the proposed action was found to present the worst-case scenario for airborne contamination. A spill of the entire inventory of the facility's blend tank (35,000 gallons) was conservatively assumed to occur. The maximum individual radiological and chemical doses were then calculated for an individual at 100 meters and at the site boundary. These results were then compared to the guidelines in the Interim Hazards Classification Guide for Non-Reactor Facilities at SRS to determine the facility hazard classification. A preliminary criticality analysis was also performed. The maximum radiological doses for an individual at 100 meters and the site boundary would be 2.31 rem and 2.32E-02 rem, respectively, due to inhalation of airborne particulates. This corresponds to a hazard classification of Low Hazard. The worst case airborne chemical concentration was determined to be caused by a spill of sodium hydroxide. Sodium hydroxide would be used in the proposed process to transform NO_x gases in the melter off-gas condensate to sodium nitrate. The airborne concentration at 100 meters was calculated to be greater than the ERPG-1 (Emergency Response Plan and Guide) value but less than the ERPG-2 value. An ERPG-1 value is the maximum airbourne concentration to which nearly all individuals could be exposed for one hour with only mild, transient health effects, or perception of an objectionable odor. An ERPG-2 value is the maximum concentration to which nearly all individuals could be exposed for one hour without experiencing or developing irreversible or other serious health effects. The airborne concentration at the site boundary was calculated to be less than the ERPG-1 value. This corresponds to a hazard classification of Low Hazard. Due to the low enrichment of U-235 in the waste materials and filtercake, criticality is not expected to be an issue. The preliminary classification of the M-Area Vendor Treatment Process and the M-Area Storage Pad is Low Hazard Nuclear.

7.0 REGULATORY AND PERMITTING PROVISIONS

DOE policy is to carry out its operations in compliance with all applicable Federal, State and local laws and regulations, as well as DOE orders. This section provides a discussion of the major regulatory permit programs which would impact the proposed action.

7.1 National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.)

This EA has been prepared in accordance with the NEPA of 1969, as amended, and with the requirements of the Council of Environmental Quality Regulations for Implementing NEPA (40 CFR Parts 1500-1508), and DOE Regulations for Implementation of NEPA (10 CFR Part 1021), and DOE Order 5440.1E. This EA has been written to comply with NEPA and assess the environmental effects of constructing and operating the proposed vendor treatment process.

7.2 South Carolina Solid Waste Regulations

Nonradioactive, nonhazardous waste materials (e.g., construction debris) would be generated by the proposed action and disposed of in the SRS Sanitary Landfill. This activity is primarily controlled by the South Carolina Municipal Solid Waste Landfill Regulations (R61-107.258), and will occur in full compliance with all applicable South Carolina regulations.

7.3 Clean Water Act (CWA)

Effluent from the vendor treatment process would be treated in the DETF and discharged to Tims Branch via NPDES-permitted outfall #M-004. The National Pollution Discharge Elimination System (NPDES) program is regulated by SCDHEC under delegated authority from the EPA. WSRC expects to permit the vendor treatment via a modification to the existing industrial waste water permit (SCDHEC Operating Permit #14,832) for the DETF. A description of any temporary piping from the M-Area tank system to the treatment equipment will be included in the permit modification request.

7.4 Clean Air Act (CAA)

The National Emission Standards for Hazardous Air Pollutants (NESHAP) is a part of the CAA which sets air quality standards for air emissions containing hazardous constituents such as radionuclides. The NESHAP radionuclide and nonradionuclide programs would impact the proposed action because of the potential atmospheric emissions of depleted uranium and NO_x, respectively.

7.5 Resource Conservation and Recovery Act (RCRA)

The 1984 amendments to RCRA established the land disposal restrictions (LDR) which require that all wastes subject to the restrictions meet treatment standards based on the best available technology prior to land disposal. The Federal Facilities Compliance Agreement was negotiated between the DOE-SR and EPA Region IV to address SRS mixed waste compliance with LDRs. The M-Area mixed waste must be treated so that the DOE-SR can comply with the Land Disposal Restrictions. Once the wastes have been treated to meet the LDR treatment criteria, the stabilized wastes will not be prohibited from storage, prior to final disposal. This treatment program will allow the DOE-SR to meet the requirements of the LDR-FFCA.

Numerous RCRA regulations apply to the proposed action. Clean closure of the IT/SF facility would occur in full compliance with South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.265 Subpart G and R.61-79.265.197. The process equipment contaminated with F006 mixed wastes would be managed as contaminated debris in accordance with the alternate LDR standards for debris in 40 CFR 268.45 (i.e. A "clean debris surface"), and the decontamination standards specified in 40 CFR 268.45 would be used to clean the contaminated debris. The use of stabilization to treat the mixed waste would meet the land disposal restriction (LDR) requirements of SCHWMR R.61.268 for all applicable waste codes.

The Federal Facility Compliance Act (FFC Act) of 1992 (EPA 1992) requires each DOE site that generates or stores mixed waste to prepare a Site Treatment Plan (STP) which presents a schedule for treating mixed waste at the site. The SRS has completed a conceptual Site Treatment Plan and is preparing a draft Site Treatment Plan. The conceptual and draft STPs will be used by the DOE as planning documents and in discussions with the State regulators. The final STP will be submitted to the State of South Carolina for its approval, approval with modifications, or disapproval.

The action proposed in this EA was described in the conceptual STP, which was presented to the State of South Carolina on 10/27/93 (WSRC, 1993a). The conceptual Site Treatment Plan did not specify the specific alternatives (cementation or vitrification), only that stabilization would be employed for the M-Area wastes. The outcome of this EA will be included in the draft Site Treatment Plan, which the DOE intends to provide to the State in August, 1994.

The State of South Carolina has indicated that even though a discussion of final disposal is not a requirement of the FFC Act, the State will require a discussion of the disposal of the treated wastes. DOE and the State continue to discuss this matter. Storage of the stabilized wasteform would be maintained in M-Area until the final disposal location is defined, permitted, and constructed.

8.0 AGENCIES AND PERSONS CONSULTED

No outside agencies or persons were consulted in the preparation of this EA.

9.0 BIBLIOGRAPHY

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APPENDIX A

List of Acronyms and Definitions;

• ALARA	As Low As Reasonably Achievable
• CFR	Code of Federal Regulations
• CSTP	Conceptual Site Treatment Plan
• DD	Detailed Description of the equipment and process
• DASA	Days After Subcontract Award
• DAPR	Days After Permit Received
• DETF	Dilute Effluent Treatment Facility (a part of the M-Area LETF, Bldg. 341-M)
• DOE	United States Department of Energy
• DOE-SR	Department of Energy, Savannah River Field Office
• DOT	Department of Transportation
• EPA	United States Environmental Protection Agency
• EPA-IV	Environmental Protection Agency, Region IV
• ERPG	Emergency Response Plan and Guide
• FFC Act	Federal Facilities Compliance Act (1992)
• GET	General Employee Training (WSRC Orientation Training)
• HP	Health Protection (WSRC)
• HW/MW DF	Hazardous Waste/Mixed Waste Disposal Facility
• IT/SF	Process Waste Interim Treatment/Storage Facility (M-Area RCRA waste storage tanks, Bldg. # 341-1M)
• LDR	Land Disposal Restrictions
• LETF	Liquid Effluent Treatment Facility in M-Area
• MAST	Months After Start of Treatment
• M-Area	The target and fuel production facility at the SRS
• Mark 15	Mixed waste resulting from production of "Mark 15" targets
• Mixed	Hazardous waste containing radioactive constituents
• NMPD	Nuclear Materials Production Division
• MWSS	Mixed Waste Storage Shed (Building 316 -m)
• NFPA	National Fire Protection Association
• NRC	U. S. Nuclear Regulatory Commission
• OSHA	U. S. Occupational Safety and Health Act
• ORR	Operational Readiness Review
• PA	Permit Application
• RCRA	Resource Conservation and Recovery Act
• RCA	Radiologically Controlled Area
• SCDHEC	South Carolina Department of Health & Environmental Control
• SCHWMR	South Carolina Hazardous Waste Management Regulations
• SDDR	Supplier Deviations Disposition Request
• TCLP	Toxicity Characteristic Leaching Procedure
• USC	United States Code
• WM	Waste Management
• WSRC	Westinghouse Savannah River Company