

**APPENDIX A**

**TECHNOLOGY DESCRIPTIONS**

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
A.1 Introduction.....	A-1
A.2 Current HLW System Configuration.....	A-4
A.3 Processes and Facilities .....	A-4
A.3.1 HLW Storage and Evaporation .....	A-4
A.3.2 Extended Sludge Washing .....	A-6
A.3.3 Salt Processing .....	A-6
A.3.4 DWPF Glass Processing .....	A-6
A.3.5 Saltstone Processing.....	A-7
A.4 Salt Processing Alternatives .....	A-7
A.4.1 Screening.....	A-8
A.4.2 Recommendation and Review.....	A-10
A.4.3 Process Descriptions .....	A-10
A.4.3.1 Small Tank Tetraphenylborate Precipitation.....	A-10
A.4.3.2 Crystalline Silicotitanate Ion Exchange.....	A-13
A.4.3.3 Caustic Side Solvent Extraction .....	A-16
A.4.3.4 Direct Disposal in Grout.....	A-20
A.4.3.5 Process Inputs and Product Streams .....	A-22
A.5 Process Facilities.....	A-25
A.5.1 Process Buildings .....	A-25
A.5.2 Tank Requirements .....	A-36
A.5.3 Transfer Facilities .....	A-36
A.5.4 Support Facilities .....	A-36
A.5.5 Saltstone Vaults.....	A-36
A.5.6 Pilot Plant.....	A-38
A.5.7 Decontamination and Decommissioning .....	A-50
References.....	A-51

## List of Tables

<u>Table</u>	<u>Page</u>
A-1 Chemical composition of saltstone for salt processing alternatives.....	A-23
A-2 Radionuclide content of saltstone for salt processing alternatives.....	A-24
A-3 Salt solution processed.....	A-24
A-4 Product outputs. ....	A-25
A-5 Building specifications for each action alternative .....	A-26
A-6 Site requirements for the process building and required support facilities. ....	A-27
A-7 Tanks for Small Tank Precipitation Process. ....	A-37
A-8 Tanks for Ion Exchange Process. ....	A-38
A-9 Tanks for Solvent Extraction Process. ....	A-39
A-10 Tanks for Direct Disposal in Grout Process.....	A-40
A-11 New transfer facilities. ....	A-41

## TABLE OF CONTENTS (Continued)

### List of Figures

<u>Figure</u>		<u>Page</u>
A-1	General layout of F-Area Tank Farm .....	A-2
A-2	General layout of H-Area Tank Farm.....	A-3
A-3	SRS high-level waste system configuration .....	A-5
A-4	Phased approach to screening and selecting salt processing technologies .....	A-9
A-5	Small Tank Precipitation process flow diagram .....	A-12
A-6	Precipitate Hydrolysis Cell flow diagram for Small Tank Precipitation process .....	A-14
A-7	Ion Exchange process flow diagram.....	A-15
A-8	Solvent Extraction process flow diagram.....	A-17
A-9	Direct Disposal in Grout process flow diagram.....	A-21
A-10	Floor plan for Small Tank Precipitation facility .....	A-28
A-11	Elevation plan for Small Tank Precipitation facility .....	A-29
A-12	Floor plan for Ion Exchange facility.....	A-30
A-13	Elevation plan for Ion Exchange facility .....	A-31
A-14	Floor plan for Solvent Extraction facility.....	A-32
A-15	Elevation plan for Solvent Extraction facility .....	A-33
A-16	Floor plan for Direct Disposal in Grout facility .....	A-34
A-17	Elevation plan for Direct Disposal in Grout facility .....	A-35
A-18	Transfer facilities for Small Tank Precipitation alternative.....	A-44
A-19	Transfer facilities for Ion Exchange alternative .....	A-45
A-20	Transfer facilities for Solvent Extraction alternative.....	A-46
A-21	Transfer facilities for Direct Disposal in Grout alternative .....	A-47
A-22	Proposed location of new Grout Facility and saltstone disposal vaults in Z Area .....	A-48

## APPENDIX A. TECHNOLOGY DESCRIPTIONS

### A.1 Introduction

The Savannah River Site (SRS) currently stores 34 million gallons of aqueous high-level waste (HLW) in F- and H-Area Tank Farms (Figures A-1 and A-2; see also text box on this page). This waste comprises approximately 2.8 million gallons of insoluble sludge, 15.2 million gallons of solid saltcake, and 16 million gallons of supernatant salt, all contained in 49 large underground steel tanks. The U.S. Department of Energy (DOE) is committed to removing this waste material from the HLW tanks and processing it for final disposal to resolve critical safety and regulatory issues.

DOE has developed processes and facilities to convert the aqueous wastes into environmentally safe forms for long-term storage and final disposal (DOE 1994, 1995). Sludge components of the wastes, which contain most of the radioactive strontium and alpha-emitting actinides (such as plutonium), are washed and treated with sodium hydroxide to reduce the aluminum content, then mixed with glass frit for melting into a glass waste form in the Defense Waste Processing Facility (DWPF). Soluble salt components of the wastes were to be treated in a large waste tank, using a precipitation-sorption process denoted In-Tank Precipitation (ITP), to remove radioactive cesium (principally cesium-137) and other radionuclides for vitrification, along with sludge, in DWPF. The cesium would be precipitated

as an insoluble tetraphenylborate salt, and residual strontium and actinides would be sorbed on a particulate solid, monosodium titanate, to be filtered from the solution for transfer to the DWPF. The low activity salt solution would be fixed in a concrete-like material (saltstone) for onsite disposal in engineered vaults. After interim storage at SRS the waste glass in stainless steel canisters would be shipped to a monitored geologic repository for final disposal.

The sludge processing operations were successfully implemented and immobilization of these wastes in glass at DWPF is in progress. During startup of the ITP process, however, the decomposition of the tetraphenylborate produced benzene in amounts higher than predicted. A comprehensive process review concluded that the tetraphenylborate decomposition and benzene release associated with ITP operation could exceed the design capability of the existing facilities, preventing safety and production requirements being met in a cost-effective manner (see text box page A-4).

Evaluation of alternative technologies resulted in the identification of four candidates to replace the ITP process (WSRC 1998a):

- Small Tank Tetraphenylborate Precipitation
- Crystalline Silicotitanate Ion Exchange
- Caustic Side (non-elutable) Solvent Extraction
- Direct Disposal (of cesium) in Grout.

#### Waste Tank Concerns and Commitments

Two of the original 51 HLW storage tanks (numbers 17 and 20) at SRS had waste removed and have been closed. Of the remaining 49 tanks, 10 (numbers 1, 6, 9, 10, 11, 12, 13, 14, 15, and 16) have leaked observable quantities of liquid waste from primary to secondary containment and one tank (number 16) leaked a few tens of gallons of waste to the environment (WSRC 1998a). One other tank (number 19) has cracks in the tank wall above the level of the waste, although no waste has been observed to leak through these cracks. Tanks 1 through 24 do not meet U.S. Environmental Protection Agency (EPA) secondary containment and leak detection standards for storage of hazardous waste, effective January 12, 1987 (40 CFR 264). Removal of wastes and closure of these tanks by 2022 is required by the Federal Facility Agreement (FFA) for SRS entered into by the DOE, EPA, and the South Carolina Department of Health and Environmental Control (SCDHEC) (EPA 1993). All HLW at SRS is land-disposal-restricted waste, prohibited from long-term storage, and must be removed from the HLW tanks by the year 2028 as a result of FFA (WSRC 2000a).

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