APPENDIX A

TECHNOLOGY DESCRIPTIONS

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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.

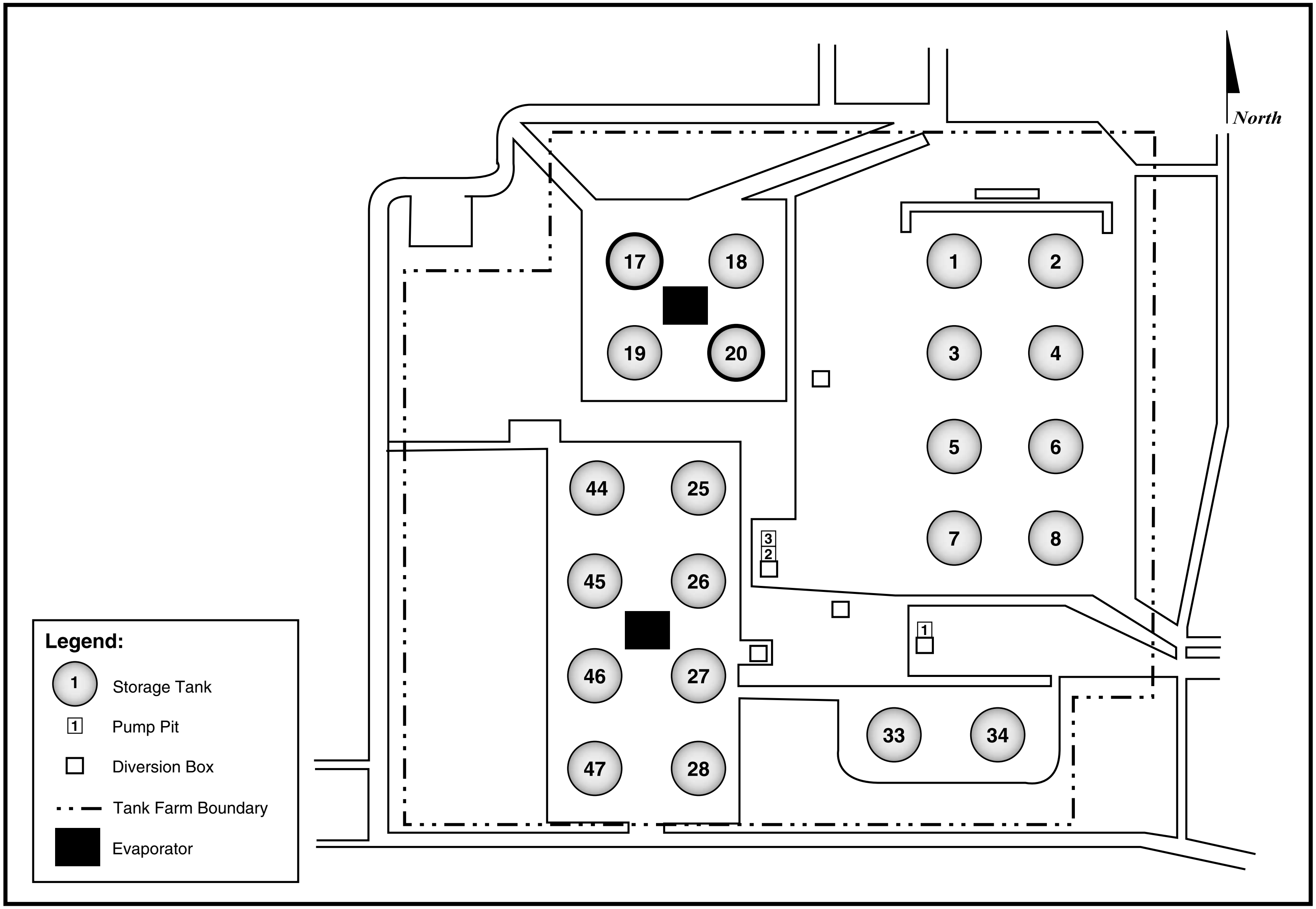
The sludge processing operations were successfully implemented and immobilization of these wastes in glass at DWPF is in progress. During startup of the ITP process, however, the decomposition of the tetraphenylborate produced benzene in amounts higher than predicted. A comprehensive process review concluded 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).



NW SDA EIS/Grfx/App A/A-1 Lay F Tank.ai

Figure A-1. General layout of F-Area Tank Farm (Tanks 17 and 20 are closed).

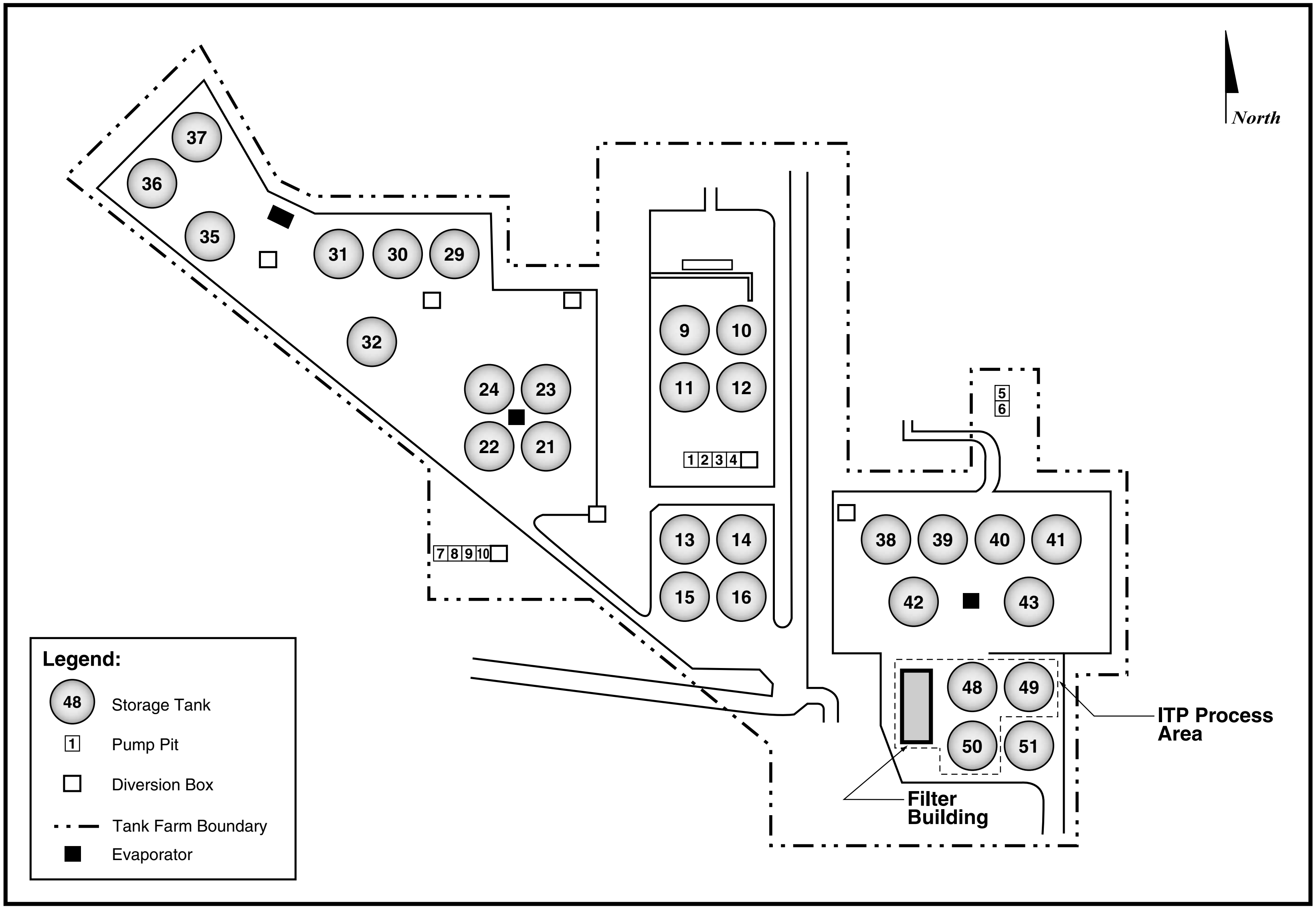


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Figure A-2. General layout of H-Area Tank Farm.