Savannah River Site

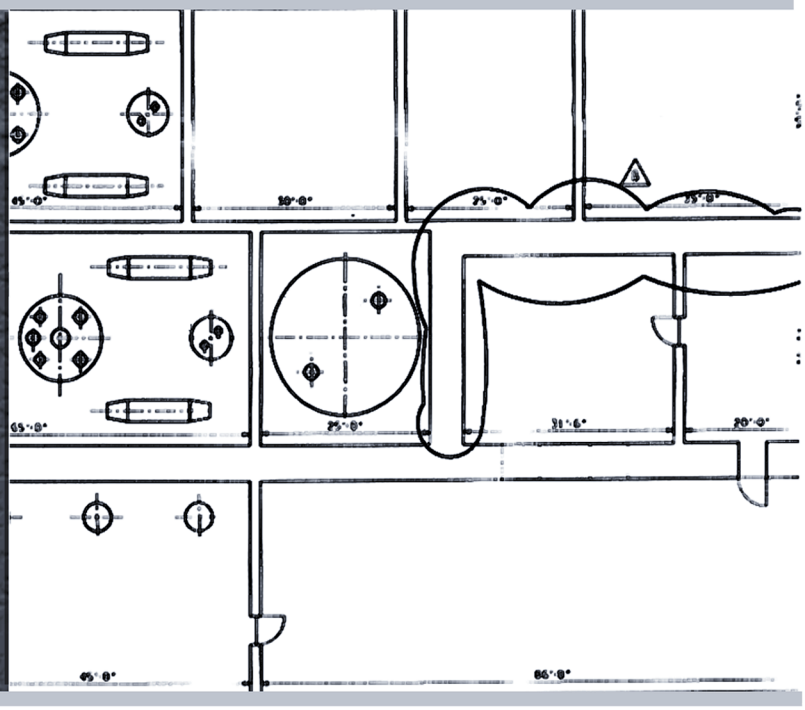
Salt Processing Alternatives

Final Supplemental Environmental Impact Statement

U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

June 2001

DOE/EIS-0082-S2



COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: Savannah River Site Salt Processing Alternatives Supplemental Environmental Impact Statement (DOE/EIS-0082-S2)

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The SEIS will be available on the internet at: //tis.eh.doe.gov/nepa/docs/docs.htm.

ABSTRACT: DOE prepared this SEIS on alternatives for separating the high-activity fraction from the low-activity fraction of the high-level radioactive waste salt solutions now stored in underground tanks at the Savannah River Site (SRS) near Aiken, South Carolina. The high-activity fraction of the high-level waste (HLW) salt solution would then be vitrified in the Defense Waste Processing Facility (DWPF) and stored until it could be disposed of as HLW in a geologic repository. The low-activity fraction would be disposed of as low-level waste (saltstone) in vaults at SRS.

A process to separate the high-activity and low-activity waste fractions of the HLW salt solutions is needed to replace the In-Tank Precipitation (ITP) process which, as presently configured, cannot achieve production goals and safety requirements for processing HLW. This SEIS analyzes the impacts of constructing and operating facilities for four alternative processing technologies – Small Tank Precipitation, Ion Exchange, Solvent Extraction, and Direct Disposal in Grout – and the No Action Alternative. Solvent Extraction is DOE's preferred alternative. Sites for locating processing facilities within S and Z Areas at SRS are identified.

Because replacing the ITP process constitutes a substantial change to the HLW salt processing operation of the DWPF, as evaluated in a 1994 SEIS (DOE/SEIS-0082-S) to the 1982 DWPF EIS (DOE/EIS-0082), DOE prepared this second SEIS to evaluate the potential environmental impacts of alternatives to the ITP process.

PUBLIC INVOLVEMENT: DOE issued the Draft Salt Processing Alternatives SEIS on March 23, 2001 and held a public comment period on the Draft SEIS through May 14, 2001. In preparing the Final SEIS, DOE considered comments received via mail, fax, and electronic mail and transcribed comments made at public meetings held in North Augusta, South Carolina, on May 1, 2001, and Columbia, South Carolina, on May 3, 2001.

FOREWORD

The U.S. Department of Energy (DOE) published a Notice of Intent (NOI) on February 22, 1999, to prepare this supplemental environmental impact statement (SEIS). DOE prepared this SEIS on alternatives for separating the high-activity fraction from the low-activity fraction of the radioactive high-level waste (HLW) salt solution now stored in underground tanks at the Savannah River Site (SRS) near Aiken, South Carolina. The high-activity fraction of the HLW salt solution waste would then be vitrified in the Defense Waste Processing Facility and stored until it could be disposed of as high-level waste in a geologic repository. The low-activity fraction would be disposed of as low-level waste (saltstone) in vaults at SRS.

A process to separate the high-activity and low-activity waste fractions of the high-level waste salt solutions is needed to replace the In-Tank Precipitation (ITP) process which, as presently configured, cannot achieve production goals and safety requirements for processing high-level waste. This SEIS analyzes the impacts of constructing and operating four alternative processing technologies – Small Tank Precipitation, Ion Exchange, Solvent Extraction, and Direct Disposal in Grout – and the No Action Alternative. The Solvent Extraction Alternative is DOE's preferred alternative. Because replacing the ITP process constitutes a substantial change to the HLW salt processing operation of the Defense Waste Processing Facility, as evaluated in a 1994 SEIS (DOE/SEIS-0082-S) to the 1982 Defense Waste Processing Facility EIS (DOE/EIS-0082), DOE prepared this second SEIS to evaluate the potential environmental impacts of alternatives to the ITP process.

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A Notice of Availability for the Draft SEIS was published in the Federal Register on March 30, 2001. Public meetings to discuss and receive comments on the Draft SEIS were held at the North Augusta Community Center in North Augusta, South Carolina on May 1, 2001 and at the Holiday Inn Coliseum in Columbia, South Carolina on May 3, 2001. The public comment period ended May 14, 2001. In the public meetings nine individuals commented on the Draft SEIS. During the 45-day comment period DOE received 12 letters commenting on the Draft SEIS. A summary of the comments received during the public comment period for this SEIS, and DOE's responses are included in Appendix C.

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Transcripts of public testimony, copies of comment letters, responses to those comments, and reference materials cited in the SEIS are available for review in the DOE Public Reading Room, University of South Carolina at Aiken, Gregg-Graniteville Library, University Parkway, Aiken, South Carolina.

DOE has prepared this SEIS in accordance with the National Environmental Policy Act (NEPA) regulations of the Council on Environmental Quality (40 CFR 1500-1508) and DOE NEPA Implementing Procedures (10 CFR 1021). This SEIS identifies the methods used for analyses and the scientific and other sources of information consulted. In addition, results available from ongoing studies are incorporated directly or summarized and referenced. The organization of the SEIS is as follows:

- Chapter 1 describes the background and purpose and need for DOE action regarding salt processing at SRS.
- Chapter 2 describes the proposed action and the alternatives that DOE is evaluating.
- Chapter 3 describes the SRS environment as it relates to the alternatives described in Chapter 2.
- Chapter 4 assesses the potential environmental impacts of the alternatives.

- Chapter 5 discusses the cumulative impacts of salt processing in relation to other past, present, and reasonably foreseeable future activities at SRS, and in the surrounding region.
- Chapter 6 identifies irreversible and irretrievable resource commitments.
- Chapter 7 discusses applicable statutes, state and Federal regulations, and DOE Orders, and agreements.
- Appendix A describes the facilities and processes that would be used for each of the alternatives.
- Appendix B discusses the methods used for accident analysis and the results of the analysis.
- Appendix C presents the comments received on the draft SEIS and DOE's responses to those comments. TC
- Appendix D gives the methods and the results of long-term performance modeling that was used to evaluate the impacts of salt processing alternatives.

Change Bars

Change bars beside text in this SEIS indicate a substantive change from the Draft SEIS. If the change was made in response to a comment received on the Draft SEIS, the comment number is as listed in Appendix C. If the change was a technical change made by DOE, the bar is marked "TC."

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

List of Appendices

List of Tables

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Figures

ABBREVIATIONS, ACRONYMS, MEASUREMENT ABBREVIATIONS, USE OF SCIENTIFIC NOTATION, AND METRIC CONVERSION CHART

Abbreviations and Acronyms

ALARA	as low as reasonably achievable
AST	alpha sorption tank
CBD	chronic beryllium disease
CCME	Canadian Council of Ministries of the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFT	caustic feed tank
CFR	Code of Federal Regulations
CIF	Consolidated Incineration Facility
CSDT	clearing solution dump tank
CSS	clarified salt solution
CST	crystalline silicotitanate
TC CWA	Clean Water Act
DCG	Derived Concentration Guide
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOE-SR	DOE-Savannah River Operations Office
DF	decontamination factor
DNFSB	Defense Nuclear Facilities Safety Board
DSS	decontaminated salt solution
DWPF	Defense Waste Processing Facility
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERPG	Early Response Planning Guideline
ETF	Effluent Treatment Facility
FDM	Fugitive Dust Model
FFA	Federal Facility Agreement
FR	Federal Register

FY	fiscal year
HEPA	high-efficiency particulate air (filter)
HLW	high-level waste
IRIS	Integrated Risk Information System
ISC3	Industrial Source Complex – Short Term
ITP	In-Tank Precipitation
LCF	latent cancer fatality
LFL	lower flammability limit
LLW	low-level waste
LPDT	low point drain tank
LRHT	loaded resin hold tank
LWD	lost workdays
MCL	Maximum contaminant limit
MEI	Maximally exposed (offsite) individual
MST	monosodium titanate
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
TC NPDES	National Pollutant Discharge Elimination System
NPH	Natural phenomena hazards
NRC	U.S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OWST	organic waste storage tank
PEL	Permissible exposure limit
PHA	Precipitate Hydrolysis Aqueous
PHC	precipitate hydrolysis cell
PPT	precipitate slurry
PSD	prevention of significant deterioration
PUREX	Plutonium uranium extraction
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPA	Radiological Performance Assessment
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric & Gas

SEIS	Supplemental Environmental Impact Statement
SET	Systems Engineering Team
SRI	SRS National Resource Management & Research Insitute
SRS	Savannah River Site
SSRT	sludge solids receipt tank
TOA	trioctylamine
TPB	tetraphenylborate
TRC	total recordable cases
TSP	total suspended particulates
TWA	time-weighted average
VOC	volatile organic compound
WSRC	Westinghouse Savannah River Company

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Abbreviations for Measurements

cfm	cubic feet per minute
cfs	cubic feet per second = 448.8 gallons per minute = 0.02832 cubic meter per second
cm	centimeter
ci/m^3	curie per cubic meter
ft	feet
gpm	gallons per minute
hr/yr	hour per year
kg	kilogram
kW	kilowatt
L	liter = 0.2642 gallon
lb	pound = 0.4536 kilogram
msl	mean sea level
m^3	cubic meter
µCi	microcurie
µg	microgram
µm	micrometer
mg	milligram
mg/kg/day	milligram per kilogram per day
mg/L	milligram per liter
mg/m^3	milligrams per cubic meter
mg/s	milligrams per second
mrem	millirem
nCi	nanocurie
PM_{10}	particulate matter less than 10 microns in diameter
pCi	picocurie

pCi/L	picocurie per liter
rad/d	rad per day
rem	rem
sec/m^3	seconds per cubic meter
yr	year
°C	degrees Celsius = 5/9 (degrees Fahrenheit – 32)
°F	degrees Fahrenheit = 32 + 9/5 (degrees Celsius)

Use of Scientific Notation

Very small and very large numbers are sometimes written using "scientific notation" or "E-notation," rather than as decimals or fractions. Both types of notation use exponents to indicate the power of 10 as a multiplier (i.e., 10^n, or the number 10 multiplied by itself "n" times; 10^{-n}, or the reciprocal of the number 10 multiplied by itself "n" times).

For example: $10^3 = 10 \times 10 \times 10 = 1{,}000$

$$10^{-3} = \frac{1}{10 \times 10 \times 10} = 0.001$$

In scientific notation, large numbers are written as a decimal between 1 and 10 multiplied by the appropriate power of 10:

4,900 is written $4.9 \times 10^3 = 4.9 \times 10 \times 10 \times 10 = 4.9 \times 1{,}000 = 4{,}900$
0.049 is written 4.9×10^{-2}
1,490,000 or 1.49 million is written 1.49×10^6

A positive exponent indicates a number larger than or equal to one; a negative exponent indicates a number less than one.

In some cases, a slightly different notation ("E-notation") is used, where "× 10" is replaced by "E" and the exponent is not superscripted. Using the above examples:

$4{,}900 = 4.9 \times 10^3 = 4.9\text{E+}03$
$0.049 = 4.9 \times 10^{-2} = 4.9\text{E-}02$
$1{,}490{,}000 = 1.49 \times 10^6 = 1.49\text{E+}06$

Metric Conversion Chart

To convert into metric			To convert out of metric		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.0040469	sq. kilometers	sq. kilometers	247.1	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.4536	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

Metric Prefixes

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}