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United States Department of Energy

Savannah River Site

Explanation of Significant Difference (ESD) for the Plug-In ROD for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil - C-Area Reactor Seepage Basin (U)

WSRC-RP-2000-4032

Revision 1.1

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SRS
SAVANNAH RIVER SITE

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Introduction

This Explanation of Significant Difference (ESD) is being issued by the U.S. Department of Energy (US DOE), the lead agency for the Savannah River Site (SRS) remedial activities, with concurrence by the U.S. Environmental Protection Agency (US EPA) – Region IV and the South Carolina Department of Health and Environmental Control (SCDHEC). The purpose of this ESD is to announce that the C-Area Reactor Seepage Basin (CRSB) Operable Unit (OU) will use the remedy described in the *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)* (WSRC-RP-98-4099). The plug-in record of decision (ROD) was issued on November 29, 1999.

The plug-in ROD selected a common remedy, in situ stabilization with a low-permeability soil cover system, for high-risk, radioactively contaminated OUs at SRS with similarities in history of use, contaminants, and location. The plug-in ROD identified CRSB as a candidate for the plug-in remedy.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 117 (c), SRS is required to publish an ESD whenever there is a significant change to a component of a remedy specified in a ROD. Sections 300.435 (c) (2) (i) and 300.825 (a) (2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires the lead agency to provide an explanation of the difference and to make this information available to the public in the Administrative Record File and information repositories.

The ESD and technical evaluation report are part of the Administrative Record File, and are available for public review during normal business hours at the following information repositories.

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina Aiken
171 University Parkway
Aiken, SC 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, SC 29208
(803) 777-4866

Reese Library
Augusta State University
2100 Walton Way
Augusta, GA 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Thompkins Road
Savannah, GA 31404
(912) 356-2183

Summary of Site History, Contamination Problems, and Selected Remedy

The CRSB is located in the central portion of the SRS in C-Reactor Area (Figure 1). The CRSB, consisting of three connected basins and the associated pipeline, is approximately 800 feet (ft) west of C-Reactor.

The CRSB was used from 1959 to 1986 to receive low-level radioactive wastewater from

C-Area disassembly basin purges. An 850 ft long, 3-inch diameter buried polyethylene pipe discharged to the south end of the first basin. To prevent overflow, a second and third basin was connected to the first basin in series. Basin 1 is L-shaped, about 35 ft wide, 7 ft deep, 250 ft long in the north-south direction, and 180 ft long in the east-west direction. Basin 2 is about 300 ft long (north south) by 60 ft wide, and is about 11 ft deep. Basin 3 is about 180 ft long (east west) by 90 ft wide, and is about 12 ft deep.

The basins and the surrounding soils were characterized in detail in 1997 and are documented in the *Unit-Specific Plug-in Technical Evaluation Report for the C-Area Reactor Seepage Basin Operable Unit (U).* (WSRC-RP-2000-4008). These studies indicate that the seepage basin soils present a significant potential hazard from radionuclides to future industrial workers and that remediation of the CRSB is warranted.

Basis for the Explanation of Significant Difference

The purpose of this document is to demonstrate that the CRSB OU meets the criteria specified in the plug-in ROD; thus the remedy selected in the plug-in ROD should be applied to the CRSB.

The detailed determination of how this unit meets the criteria is presented in the technical evaluation report (WSRC-RP-2000-4008), which is available in the Administrative Record File.

Description of Significant Differences and the Basis for those Differences

This ESD is unique in that it does not describe a change to the remedy selected in the ROD, but rather documents that the remedy will be implemented at a specific OU (CRSB).

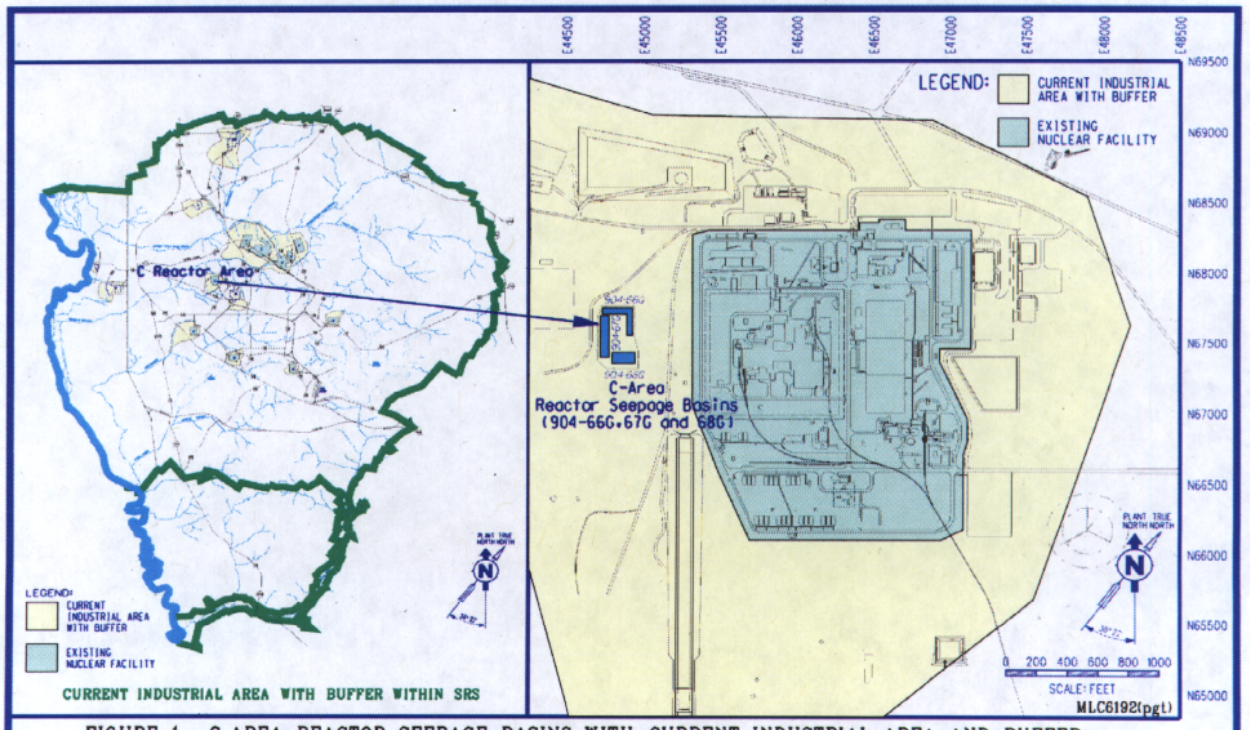

FIGURE 1. C-AREA REACTOR SEEPAGE BASINS WITH CURRENT INDUSTRIAL AREA AND BUFFER

US EPA, SCDHEC and US DOE decided that an ESD format is a good way to communicate remedial decisions for the plug-in ROD.

In order to show that the plug-in remedy is the appropriate response action for CRSB, plug-in criteria are used to evaluate whether the waste unit matches the conditions that the plug-in remedy has been designed to address. The plug-in criteria have been formulated as four key questions that follow. If the answer to any of the four questions is "NO", other remedial alternatives should be considered.

1) Is the Unit Radiologically Contaminated?

Yes. Data collected for the CRSB OU indicate that soil in the seepage basins are contaminated by radionuclides. Four radionuclides, cesium-137, strontium-90, carbon-14, and nickel-63 account for about 95 percent of the radioactive contamination in the basins. The distribution of cesium-137, the contaminant contributing to the highest risks, is shown in each basin in Figure 2.

2) Is the Unit Located in a Current Industrial Use Area (With Buffer) Adjacent to a Nuclear Facility?

Yes. The CRSB is approximately 800 ft west of the C-Reactor Area (Figure 1). This area is located in an industrial zone identified in the proposed SRS future land use map of the SRS Federal Facility Agreement Implementation Plan, and is adjacent to a nuclear facility.

3) Does the Unit Contain Principal Threat Source Material (PTSM)?

Yes. For the plug-in remedy, PTSM has been defined as soil that poses a radiological (or cancer) risk to the future industrial worker equal

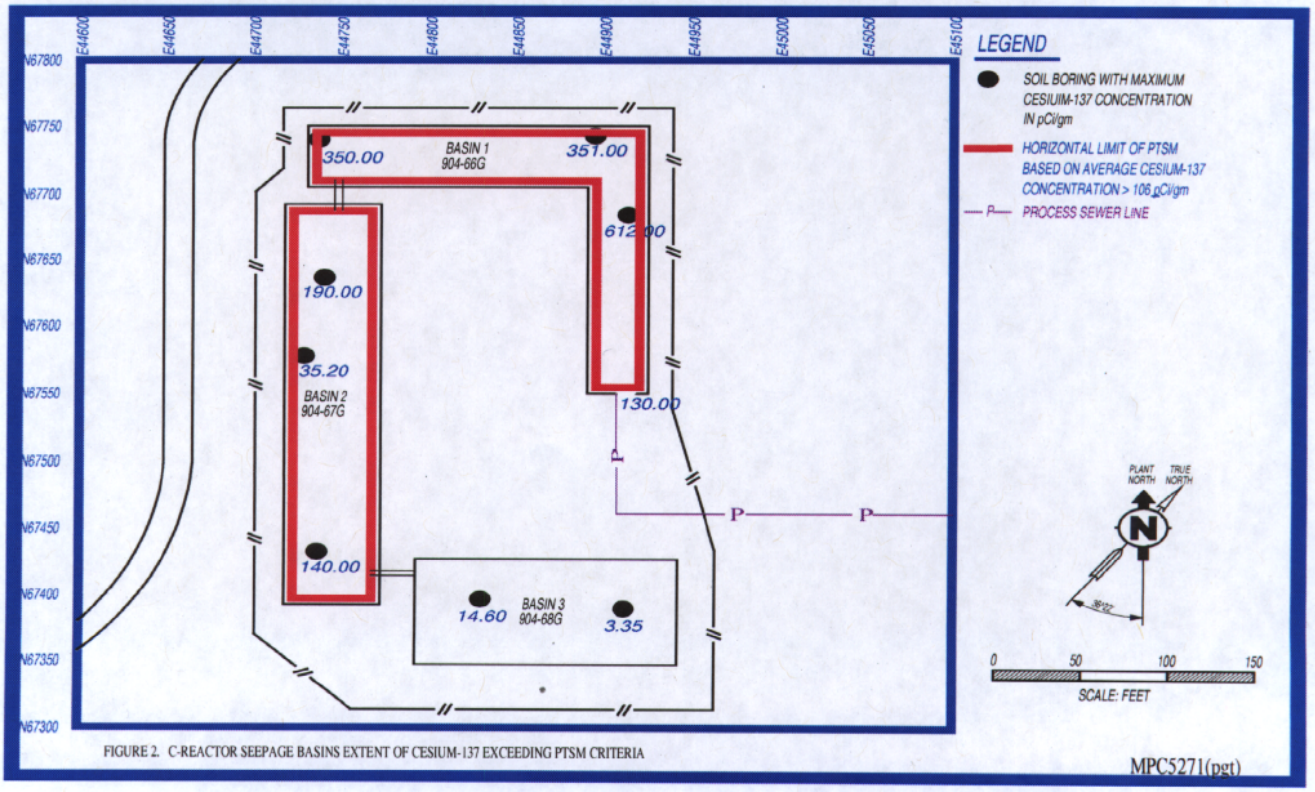

FIGURE 2. C-REACTOR SEEPAGE BASINS EXTENT OF CESIUM-137 EXCEEDING PTSM CRITERIA

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to or greater than 1 x 10^{-3} (1 additional predicted cancer in 1000 people). The characterization data indicate that an approximate risk of 2 x 10^{-3} may result from exposure of a future industrial worker to surficial basin soils. Cesium-137 is the major contributor to this risk. PTSM has been identified to the depth of 6 ft in basin 1, and to a depth of 4 ft in basin 2 (Figure 2). PTSM soils are not present in basin 3; risks from surficial basin bottom soils in basin 3 are about 9 x 10^{-5}. Basin soil is the only PTSM at the CRSB OU.

4) Is PTSM Not in Direct Contact with Groundwater or Immediately Adjacent to Surface Water?

Yes. The PTSM at CRSB is not in direct contact with groundwater or surface water. The groundwater table at CRSB is approximately 70 ft bls at the waste unit (Figure 3). Rainwater is temporarily impounded and stays within basin 2. No surface water features are located adjacent to the CRSB OU. The closest surface water is an unnamed tributary of Fourmile Branch about 600ft to the west.

Conclusion

Because the CRSB OU meets all plug-in criteria, the plug-in remedy will be used at the CRSB. A schematic drawing (Figure 3) shows how the remedy will be applied. The remedy consists of four components:

- Land use controls (institutional control) will be used to prevent disturbance of the cover system and excavation into the PTSM. Residential or agricultural use of the area will be prohibited.

In Situ Stabilization with Low-Permeability Soil Cover System

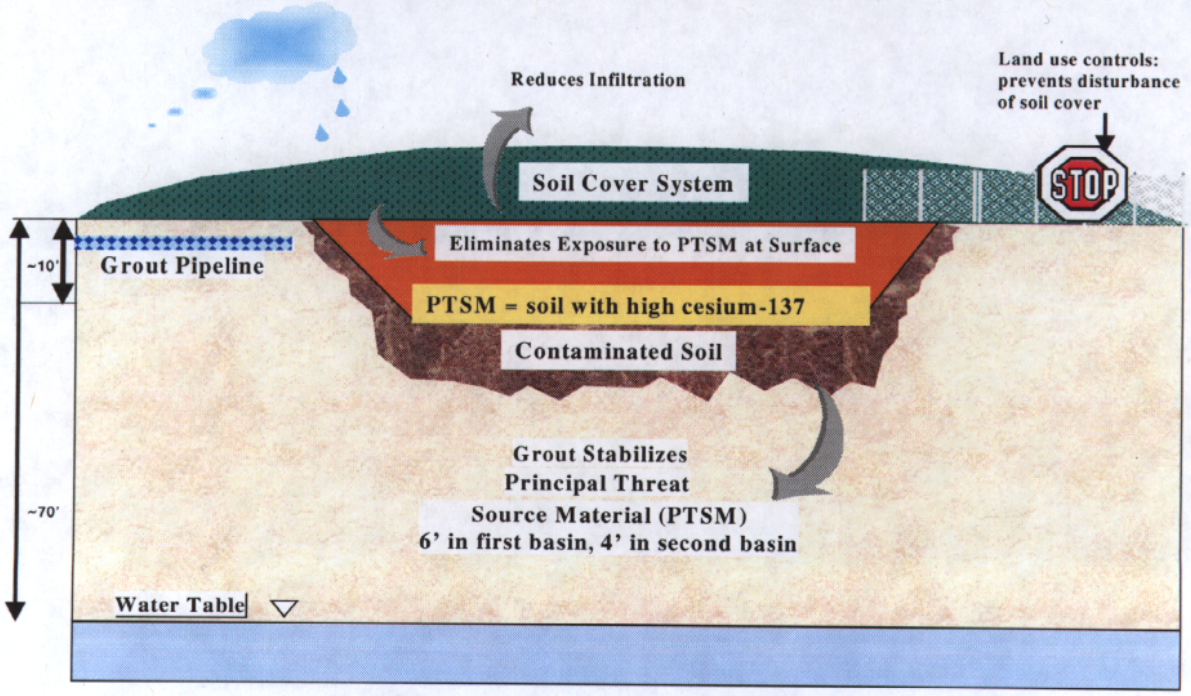

Figure 3. Plug-In Remedy at C-Area Reactor Seepage Basins

- PTSM soils to the depth of 6 ft in the first basin and to the depth of 4 ft in the second basin will be stabilized in place using a cement-based grout mixture. This treatment will convert the waste into a form less likely to result in human exposure to radionuclides.
- A low permeability soil cover will be placed over all three basins. This will reduce infiltration through the stabilized soil and prevent exposure of humans or animals to radionuclides in the stabilized soil.
- The pipeline will be grouted to prevent exposure to burrowing animals.

This remedy will be the final remedy for this OU, since the groundwater contamination associated with this basin is being addressed in conjunction with the C-Area Reactor groundwater OU. Any potential residual tritium contamination in the vadose zone below the basin will be considered part of the groundwater contamination.

Cost

The estimated cost to implement the remedy at CRSB is $7,738,123, which is presented in detail in Table 1. This is a present worth cost, including 30 years of maintenance activities. The present worth cost of the maintenance activities are estimated to be $1,135,945, which were discounted at 5% per year. These costs are feasibility study type estimates considered to be +50% to –30% accurate.

Statutory Determinations

The plug-in remedy meets the requirements specified in CERCLA Section 121 to:

- Protect human health and the environment
- Comply with applicable or relevant and appropriate requirements
- Be cost-effective
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable
- Satisfy the preference for treatment as a principal element

Public Participation Activities

The public has been notified of a 30-day public comment period on this ESD through mailing of the *SRS Environmental Bulletin*, a newsletter sent to approximately 3,500 citizens in South Carolina and Georgia, and through the *Aiken Standard,* the *Allendale Citizen Leader,* the *Barnwell People Sentinel, The State,* and the *Augusta Chronicle* newspapers. The public comment period began on May 8, 2000 and ended June 6, 2000. Two questions were received and are addressed in the Responsiveness Summary that follows.

The public will be informed of regulator concurrence with this ESD through public notices in the *Barnwell People Sentinel/ Allendale Citizen Leader, Aiken Standard, Augusta Chronicle* and *The State.*

Responsiveness Summary

Question 1: What is the half-life of the tritium that was in the C-Area Reactor Seepage Basin?

Answer 1. The half-life of tritium is 12 and one half years.

Question 2: What is the current status of the tritium in the C-Area Reactor Seepage Basin, and how much of that tritium is in the Savannah River?

Answer 2. There is no tritium in the seepage basins, as they are now mostly dry, and the last tritiated wastewater discharge to these basins occurred in 1986. Any residual tritium that remains is present in unsaturated soils and is moving downward into the groundwater beneath the seepage basins. It is estimated that less than 10% of the tritium discharged to CRSB is still present in soils beneath the basins. A detailed discussion of residual tritium from the CRSB is included in the Technical Evaluation Report for the CRSB.

There is a large groundwater plume containing tritium that migrates and discharges to Four Mile Branch, a stream that eventually discharges to the Savannah River. This groundwater plume contains tritium from both the CRSB and the entire C Reactor Area. Other sources upstream from C Reactor Area also contribute tritium to Four Mile Branch. Water samples collected from Four Mile Branch downstream from C Reactor Area contain about 430 pCi/ml of tritium, which is greater than the drinking water standard or maximum contaminant level of 20 pCi/ml. SRS will be working with the US EPA - Region IV and the SCDHEC to determine the best approach to characterize and remediate all contamination, including tritium, for the groundwater in the C-Reactor Groundwater Operable Unit.

According to the 1997 Environmental Report for SRS, the concentration of tritium in the Savannah River at mile 120 (location where highway 301 crosses the Savannah River), downstream of SRS is 2.58 pCi/ml or approximately 8 times less than the Maximum Contaminant Level.

Table 1. Estimated Cost of Cleanup at CRSB

Capital Costs

General Requirements	Quantity	Units	Cost / Unit	Total	Grand Total
Submittals	1	LS	$29,120.00	$29,120	
Temporary Controls	1	LS	$51,595.00	$51,595	
Technical Requirements	1	LS	$928,128.00	$928,128	
Total General Requirements				**$1,008,843**	**$1,008,843**
Clean Sitework					
Mobilization	1	LS	$139,593.00	$139,593	
Site Surveys	17	Acre	$3,488.00	$57,901	
Preparation of Borrow Area for Common Fill	1.3	Acre	$41,032.00	$53,342	
Preparation of Borrow Area for Low Perm Soil	0.6	Acre	$56,693.00	$34,016	
Geophysical / Geotechnical Investigation (Borrow Area)	1	LS	$41,192.00	$41,192	
Silt Fence and Hay Bales	2,130	LF	$10.10	$21,513	
Temporary Swales and Diversions	120	HR	$119.76	$14,371	
Access Road	1,100	SY	$9.00	$9,900	
Geophysical / Geotechnical Investigation (Earthwork)	1	LS	$103,229.00	$103,229	
Excavation (Cut)	1,100	CY	$14.74	$16,214	
Site Fine Grading	23,000	SY	$0.37	$8,395	
Site Seeding	208	MSF	$139.83	$29,085	
Demobilization	1	LS	$124,294.00	$124,294	
Total Clean Sitework				**$653,044**	**$653,044**
Remediation					
Demolition and Removal	1	LS	$ 53,410.00	$53,410	
Equipment Requirements and Operations Demonstrations	1	LS	$58,662.00	$58,662	
In-Basin Pilot Scale Program	1	LS	$154,200.00	$154,200	
Production Waste Mixing Operation					
Instrumentation	1	LS	$19,173.00	$19,173	
Stabilization and Solidification	6,700	CY	$175.77	$1,177,659	
Material Cost	6,700	CY	$55.32	$370,644	
Sampling and Analysis	1	LS	$355,378.00	$355,378	
Engineered Soil Cover					
Grading Fill (Contaminated)	4,800	CY	$23.29	$111,792	
Grading Fill (Clean)	14,200	CY	$20.86	$296,212	
Low Permeability Soil Layer	10,100	CY	$25.33	$255,833	
Vegetative Layer	7,800	CY	$25.95	$202,410	
Equipment Decontamination	1	LS	$32,485.00	$32,485	
Total Remediation				**$3,087,858**	**$3,087,858**
Other Items					
Preliminary Engineering	1	LS	$65,180.00	$65,180	
Detailed Engineering & Preconstruction	1	LS	$221,769.00	$221,769	
Final Action Report	1	LS	$12,504.00	$12,504	
Title III Support	1	LS	$68,347.00	$68,347	
Project Support for Construction	1	LS	$118,342.00	$118,342	
Remediation Derived Waste	1	LS	$42,759.00	$42,759	
Post Construction Activities	1	LS	$54,113.00	$54,113	
Project Support	1	LS	$131,256.00	$131,256	
Total Other Items				**$714,270**	**$714,270**
Contingency Allowance (19%)					**$1,038,163**
Total Capital Cost					$6,502,178

Table 1. Estimated Cost of Cleanup at CRSB (Cont)

Operations and Maintenance Costs

	Quantity	Units	Cost/Unit	Total
Inspection (monthly)	24	500 m^2	$ 1,750	$ 42,000
Subsidence Monitoring	24	500 m^2	$ 200	$ 4,800
Mowing (Bi-monthly)	24	500 m^2	$ 1,200	$ 28,800
Cover Repair	24	500 m^2	$ 200	$ 4,800
		Total Annual O&M Cost		$ 80,400

Summary of Present Worth Analysis

Year	Capital Cost	Annual O&M Cost	Total Cost	Discount Factor (5%)	Present Worth
0	$6,502,178		$ 6,502,178	1.000	$ 6,502,178
1		$ 80,400	$ 80,400	0.952	$ 76,571
2		$ 80,400	$ 80,400	0.907	$ 72,925
3		$ 80,400	$ 80,400	0.864	$ 69,453
4		$ 80,400	$ 80,400	0.823	$ 66,145
5		$ 80,400	$ 80,400	0.784	$ 62,996
6		$ 80,400	$ 80,400	0.746	$ 59,996
7		$ 80,400	$ 80,400	0.711	$ 57,139
8		$ 80,400	$ 80,400	0.677	$ 54,418
9		$ 80,400	$ 80,400	0.645	$ 51,827
10		$ 80,400	$ 80,400	0.614	$ 49,359
11		$ 80,400	$ 80,400	0.585	$ 47,008
12		$ 80,400	$ 80,400	0.557	$ 44,770
13		$ 80,400	$ 80,400	0.530	$ 42,638
14		$ 80,400	$ 80,400	0.505	$ 40,607
15		$ 80,400	$ 80,400	0.481	$ 38,674
16		$ 80,400	$ 80,400	0.458	$ 36,832
17		$ 80,400	$ 80,400	0.436	$ 35,078
18		$ 80,400	$ 80,400	0.416	$ 33,408
19		$ 80,400	$ 80,400	0.396	$ 31,817
20		$ 80,400	$ 80,400	0.377	$ 30,302
21		$ 80,400	$ 80,400	0.359	$ 28,859
22		$ 80,400	$ 80,400	0.342	$ 27,485
23		$ 80,400	$ 80,400	0.326	$ 26,176
24		$ 80,400	$ 80,400	0.310	$ 24,929
25		$ 80,400	$ 80,400	0.295	$ 23,742
26		$ 80,400	$ 80,400	0.281	$ 22,612
27		$ 80,400	$ 80,400	0.268	$ 21,535
28		$ 80,400	$ 80,400	0.255	$ 20,510
29		$ 80,400	$ 80,400	0.243	$ 19,533
30		$ 80,400	$ 80,400	0.231	$ 18,603
Totals	$ 6,502,177.90	$ 2,412,000	$ 8,914,178		$ 7,738,123
Total Present Worth Cost					$ 7,738,123

Notes:
Capital cost estimates are not discounted because the construction work will be performed in the first year. O&M costs are reported as present worth estimates given a 5% discount rate for a 30 year duration. Cost estimates are based on soil volume estimates which are based on the Remedial Design. Cost estimates are within +50% to -30% accuracy expectation.

CY=Cubic Yard
HR=Hours
LS=Lump sum
LF=Linear Foot
MSF=Thousand Square Feet
SY=Square Yard
m = Meter

6/8/00
Date

Thomas F. Heenan
Assistant Manager for Environmental Programs
U.S. Department of Energy, Savannah River Operations Office

6/20/00
Date

Richard D. Green
Division Director
Waste Management Division
U.S. Environmental Protection Agency – Region IV

8/31/00
Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

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