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 - P-Area Reactor Seepage Basins (U)

WSRC-RP-2002-4105

Revision 1.1

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Introduction

This Explanation of Significant Difference (ESD) is being issued by the U.S. Department of Energy (USDOE), the lead agency for Savannah River Site (SRS) remedial activities, with concurrence by the U.S. Environmental Protection Agency (USEPA) – Region IV and the South Carolina Department of Health and Environmental Control (SCDHEC). The *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)* (WSRC 1999) selected a common remedy, in situ stabilization with a low-permeability soil cover system, for high-risk, radioactively contaminated waste units at SRS with similarities in history of use, contaminants, and location. The Plug-In Record of Decision (ROD) was issued November 29, 1999, and identified the P-Area Reactor Seepage Basins Operable Unit (PRSB OU) as a candidate for the Plug-In remedy.

The Plug-In ROD specifies criteria that an operable unit (OU) is required to satisfy prior to applying the Plug-In remedy. A Technical Evaluation Report (TER) (WSRC 2002), written to evaluate the PRSB OU, demonstrates that the PRSB OU satisfies the Plug-In criteria. The purpose of this ESD is to demonstrate that the PRSB OU meets the Plug-In criteria by summarizing the TER and describing the remedial action.

Under 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. In this case, this ESD is also being used to document the decision that the PRSB OU meets the Plug-In criteria. Sections 300.435 (c) (2) (i) and 300.825 (a) (2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require 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 TER 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 PRSB OU consists of three unlined, earthen basins, a high density, polyethylene inactive process sewer line (IPSL), a carbon steel IPSL, and soils within the soil contamination area/underground radioactive material area (SCA/URMA). The PRSBs are located in the southwestern portion of SRS in P-Reactor Area (Figure 1).

The PRSBs received low-level radioactive purge water from the P-Reactor between 1957 to 1970 and 1978 to 1991 when P-Reactor was placed on warm standby. Basin #1 is L-shaped and was constructed with an approximate outside dimension of 211 x 50 feet in the north-south direction, approximately 254 x 50 feet in the east-west direction, and a depth of 15 feet below land surface (bls). Basin #2 was constructed with an approximate outside dimension of 211 x 70 feet and a depth of 8 feet bls. Basin #3 was constructed with approximate outside dimensions of 340 x 70 feet and a depth of 9 feet bls (Figure 2). All three basins are currently open. The IPSLs each measure approximately 660 feet in length. Historical records indicate that the original IPSL leaked in an area east of Basin 1, contaminating the soils in a 15 ft by 30 ft (450 ft^2) area (designated as the SCA/URMA).

The basins and the surrounding soils were characterized in detail in 1998 and 2001. (WSRC 1998). These studies indicated the following:

- The seepage basin soils present a significant potential hazard from radionuclides (primarily cesium-137) to future industrial workers.
- Strontium-90 is a contaminant in the basins that could leach and impact the groundwater above health-based limits.

Basis for the Explanation of Significant Difference

The purpose of this document is to demonstrate that the PRSB OU meets the Plug-In ROD criteria and, thus, the remedy selected in the Plug-In ROD should be applied to the PRSBs. The detailed determination of how the PRSB OU meets the criteria is presented in the TER (WSRC 2002), which is available in the Administrative Record File. USEPA, SCDHEC and USDOE decided to utilize the ESD format to communicate remedial decisions for the Plug-In ROD.

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 (PRSBs). USEPA, SCDHEC, and USDOE decided that an ESD format is the preferred way to communicate remedial decisions for the Plug-In ROD.

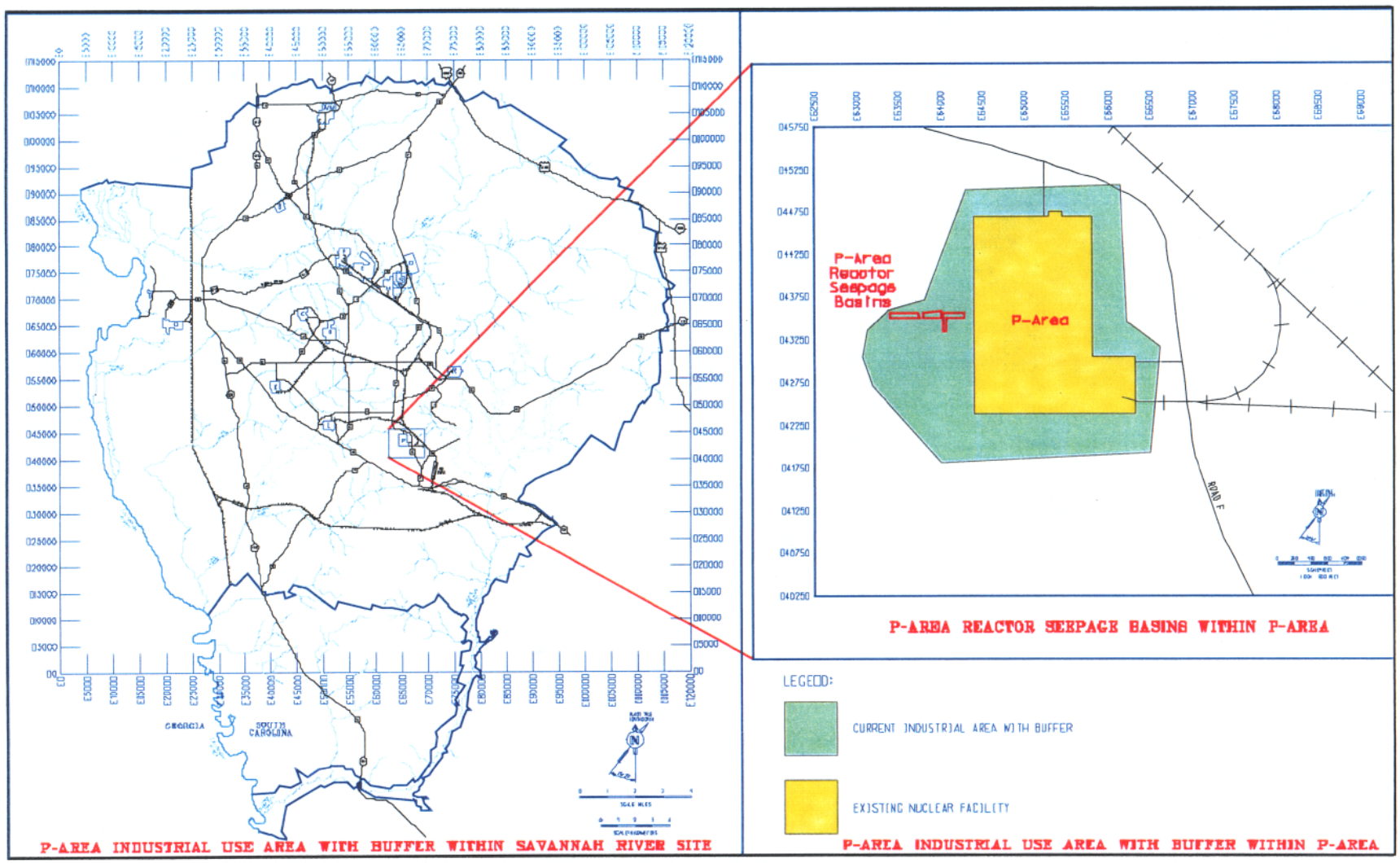

Figure 1. **P-Area Reactor Seepage Basins with Current Industrial Area Buffer**

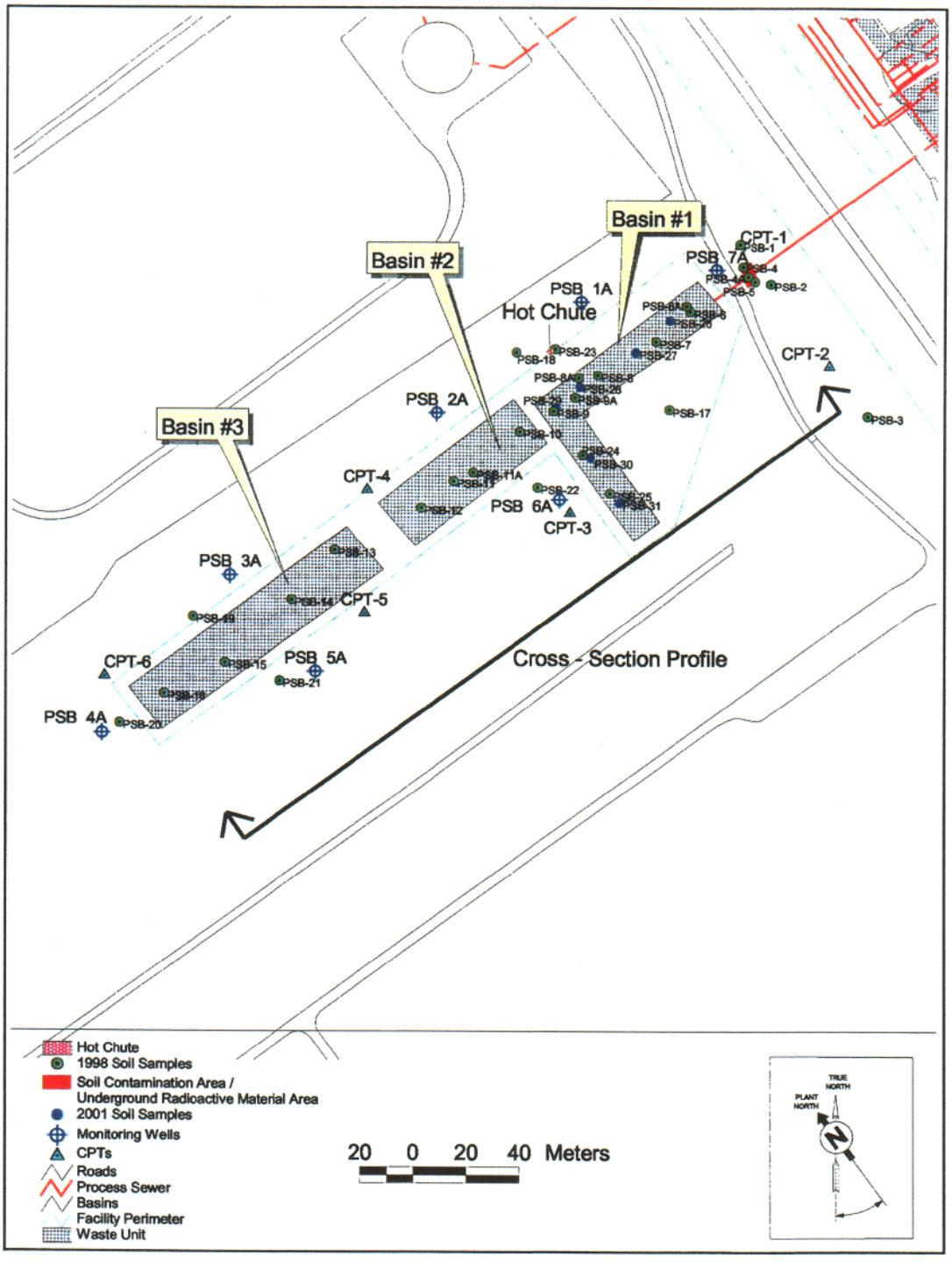

Figure 2. **Plan View of P-Area Reactor Seepage Basins**

Plug-In Criteria Evaluation

In order to show that the Plug-In remedy is the appropriate response action for PRSBs, criteria identified in the Plug-In ROD are used to evaluate whether the waste unit matches the conditions that the Plug-In ROD remedy has been designed to address. The criteria in the Plug-In ROD have been formulated as the following four key questions. 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 PRSB OU indicate that soil in Basin #1, Basin #2, and the SCA/URMAcontains principal threat source material (PTSM). Cesium-137 is the primary radionuclide in the OU.

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

Yes. The PRSBs is approximately 450 feet west of the P-Reactor Area (Figure 1). This area is located in an industrial zone identified on the proposed SRS future land use map in the SRS Federal Facility Agreement (FFA) 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 of 1 x 10^{-3}, which is equal to one additional cancer in 1,000 people. The characterization data indicate that an approximate risk equal to or greater than 8×10^{-3} may result from exposure of a future industrial worker to surficial basin soils. Cesium-137 is the primary contributor to this risk. PTSM has been identified to the depth of 19 feet in Basin #1, 4 feet in Basin #2, and 7 feet in the SCA/URMA (Figures 3, 4 and 5). Basin #3 contains no PTSM (Figure 6).

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

Yes. The PTSM at the PRSBs is not in direct contact with groundwater or surface water. The groundwater table at the PRSBs is approximately 55 feet bls at the basins (Figure 3). Rainwater occasionally collects in Basin #1 after periods of precipitation; currently there is no standing water in the basins. No surface water features are located adjacent to the PRSB OU. The closest surface water is Steel Creek, located about 2,500 feet to the west.

Selected Remedy

Because the PRSB OU meets all Plug-In criteria, the Plug-In remedy will be used at the PRSBs. A conceptual sketch (Figure 7) shows how the remedy will be applied. The remedy consists of five components:

- Land use controls (institutional controls) 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. The PRSB OU future

land use will be industrial usage. Unrestricted land use is inappropriate at the PRSB OU due to the presence of contaminated soil.

- PTSM soils to the top of the clay layer (a depth of 2 to 10 feet) in Basin #1 and 4 feet in Basin #2 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. Past operational difficulties and limitations with grouting equipment have made grouting beyond 10 feet impracticable. Geotechnical evaluation of the basin soils indicates a layer of low permeability clay (10^{-7} cm/s) at a depth of 2 to 10 ft bls. Grouting into this layer would not be beneficial since the permeability of the clay is low and it is currently retarding contaminant mobility. Furthermore, the low permeability soil cover and grouted soils left above the untreated PTSM will effectively prevent access and exposure to the untreated PTSM. This remedy will satisfy the RAOs by preventing human exposure to highly contaminated soils, preventing the release of COCs in the soil to groundwater beneath the unit, and protecting the ecological receptors indigenous to the area. The low permeability clay layer also poses an impracticability problem. Attempting to grout tight clay layers at other reactor seepage basins has led to repeated equipment failures. The estimated cost of grouting an additional nine feet to reach the vertical extent of the PTSM in Basin #1 is over a half million dollars. It is likely that the actual cost will exceed this estimate because it can not take into account the schedule delays and equipment failures experienced at previous plug-in seepage basins where the tight clays have been encountered. In addition, more than 95% of the risk associated with the PTSM is located between 0 to 10 feet bls. Contaminant migration analysis has shown that the PTSM left in place below 10 feet in Basin #1will not pose a future impact to groundwater. Basin #3 does not contain PTSM and may be used as a secondary waste trench. All secondary waste will be encapsulated with controlled low-strength material. If Basin #3 is not used as a secondary waste trench, it will be backfilled with clean soil and covered with a low permeability soil cover.

  For the previous Plug-In ROD basins, in situ stabilization process used the below ground mixing of the PTSM soils with the stabilization reagents. Based on lessons learned from those Plug-In ROD basins, to facilitate and enhance the in situ stabilization process, the stabilization process may also include above-ground mixing of all PTSM material with the stabilization reagents on-unit and inside the area of contamination. Details of the stabilization process will be developed during the remedial design, which will be reported in the Remedial Action Implementation Plan .

- The IPSLs from the disassembly building to the PRSBs will be grouted in place, excavated, and placed into Basin #1 or #2

with the stabilized soils to eliminate a potential pathway into the basin.

- The PTSM level soils in the SCA/URMA, as well as any soils exceeding radiological screening levels during excavation of the IPSLs, will be consolidated with soils in Basin #1 and/or Basin #2 and included in the stabilization treatment.
- A low permeability soil cover (10^{-5}cm/s hydraulic conductivity) placed over Basin #1, Basin #2, and Basin #3 will reduce infiltration through the stabilized soil, prevent contaminant migration to groundwater, and prevent exposure of humans or animals to radionuclides in the basin soils.

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 P-Area Groundwater OU.

Cost

The estimated cost to implement the remedy at PRSBs is $5,010,000, which is presented in detail in Table 1. This is a present worth cost, including 500 years of maintenance activities. The present worth cost of the maintenance activities is estimated to be $596,000, which was discounted at 3.9% per year. These costs are feasibility study type estimates considered to be +50% to –30% accurate. The PTSM will persist for approximately 150 years; thus, the actual maintenance costs will be less than these estimated costs.

Statutory Determinations

Based on the evaluation performed in the TER (WSRC 2002), the PRSB OU poses a risk to human health from exposure to PTSM, and from the migration of arsenic, and strontium-90 which are predicted to exceed the Safe Drinking Water Act maximum contaminant level in groundwater in less than 1,000 years. Therefore, a determination has been made that in situ stabilization with a low permeability soil cover over the PRSBs will be protective of human health for the PRSB OU.

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.

The selected remedy leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. Because these remedies will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial actions to ensure that the remedies continue to provide adequate protection of human health and the environment.

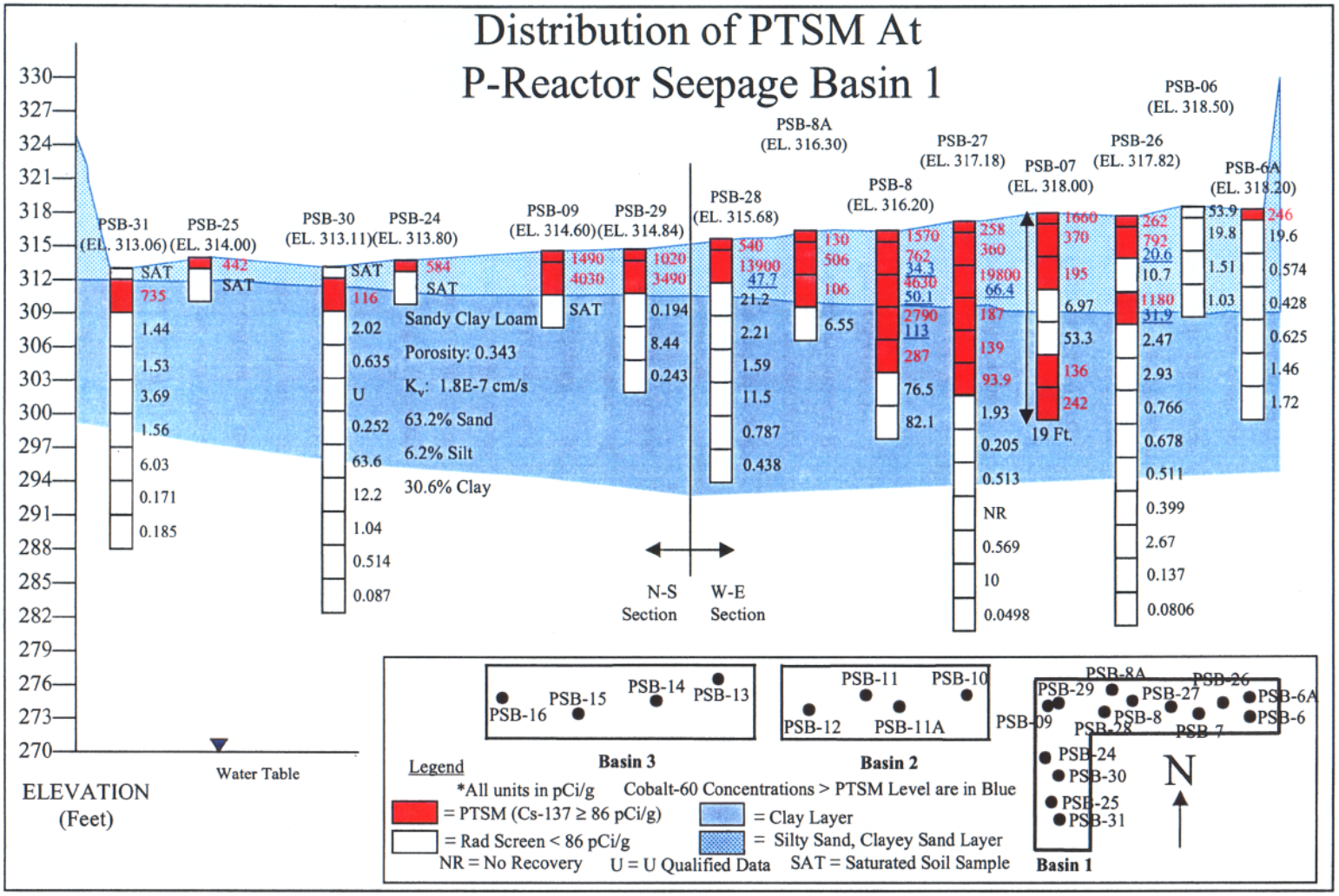

Figure 3. **P-Area Reactor Seepage Basin #1 PTSM Cross Section**

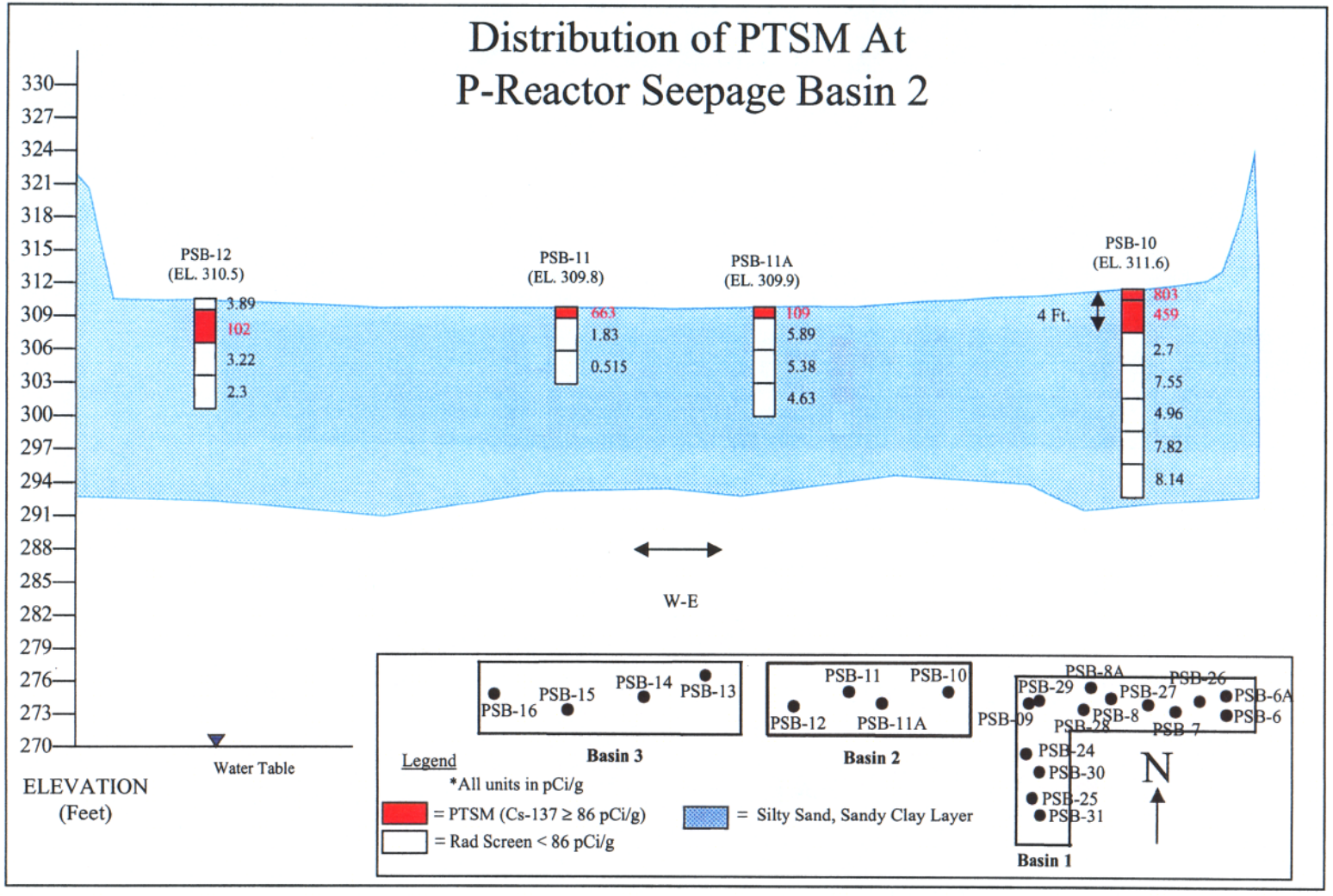

Figure 4. P-Area Reactor Seepage Basin #2 PTSM Cross Section

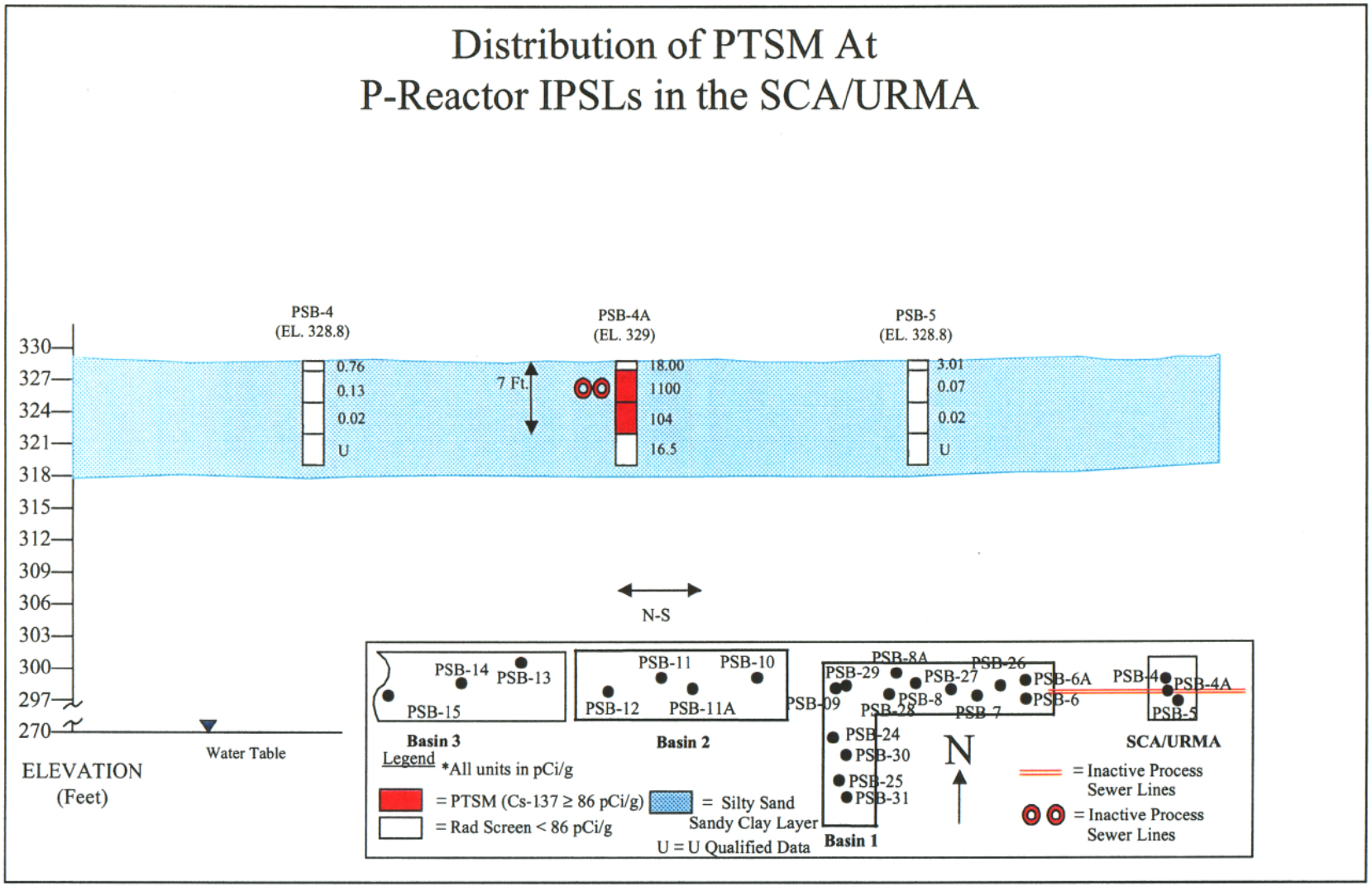

Figure 5. PTSM Cross Section for SCA/URMA

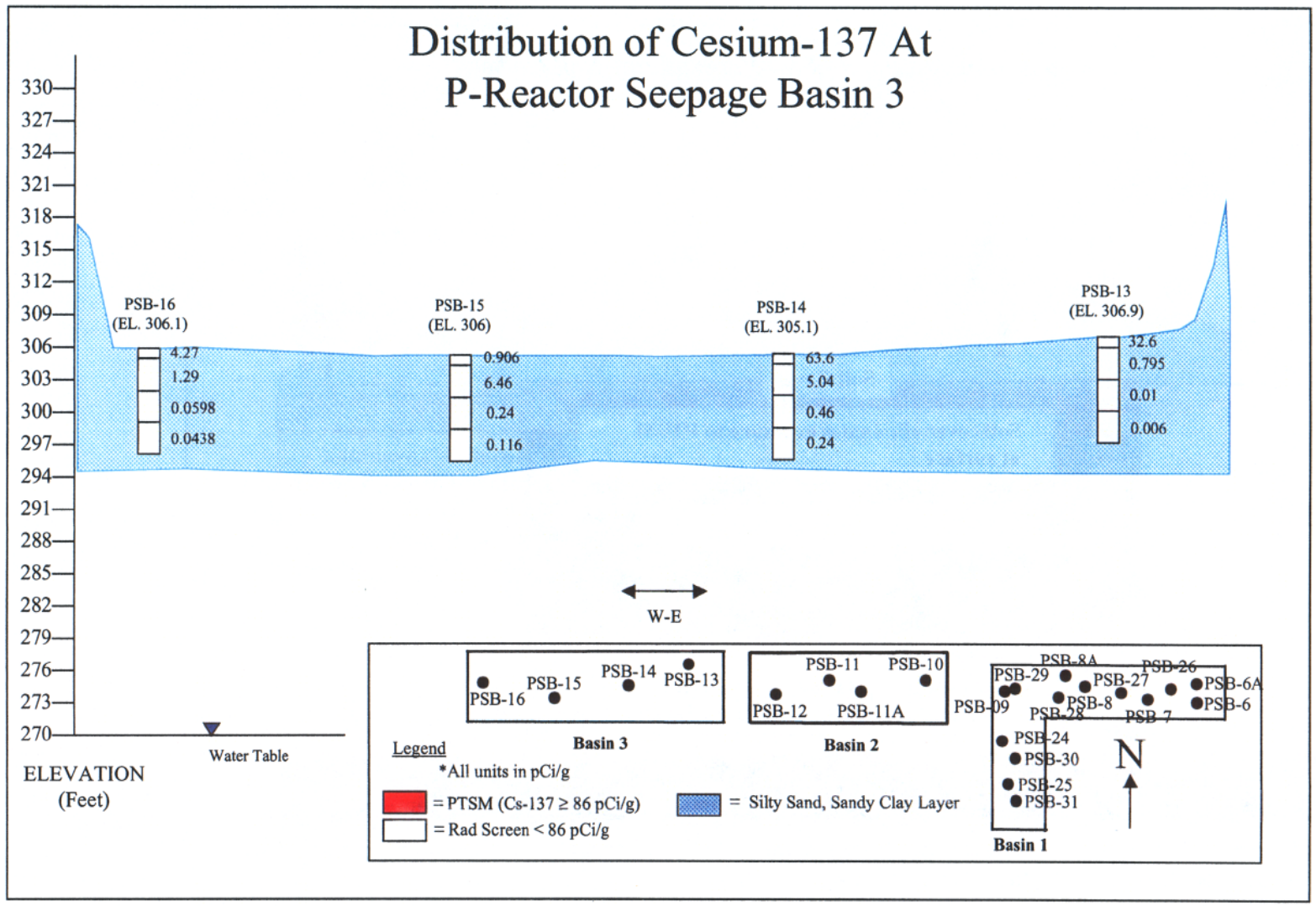

Figure 6. Cesium-137 Concentrations in Basin #3

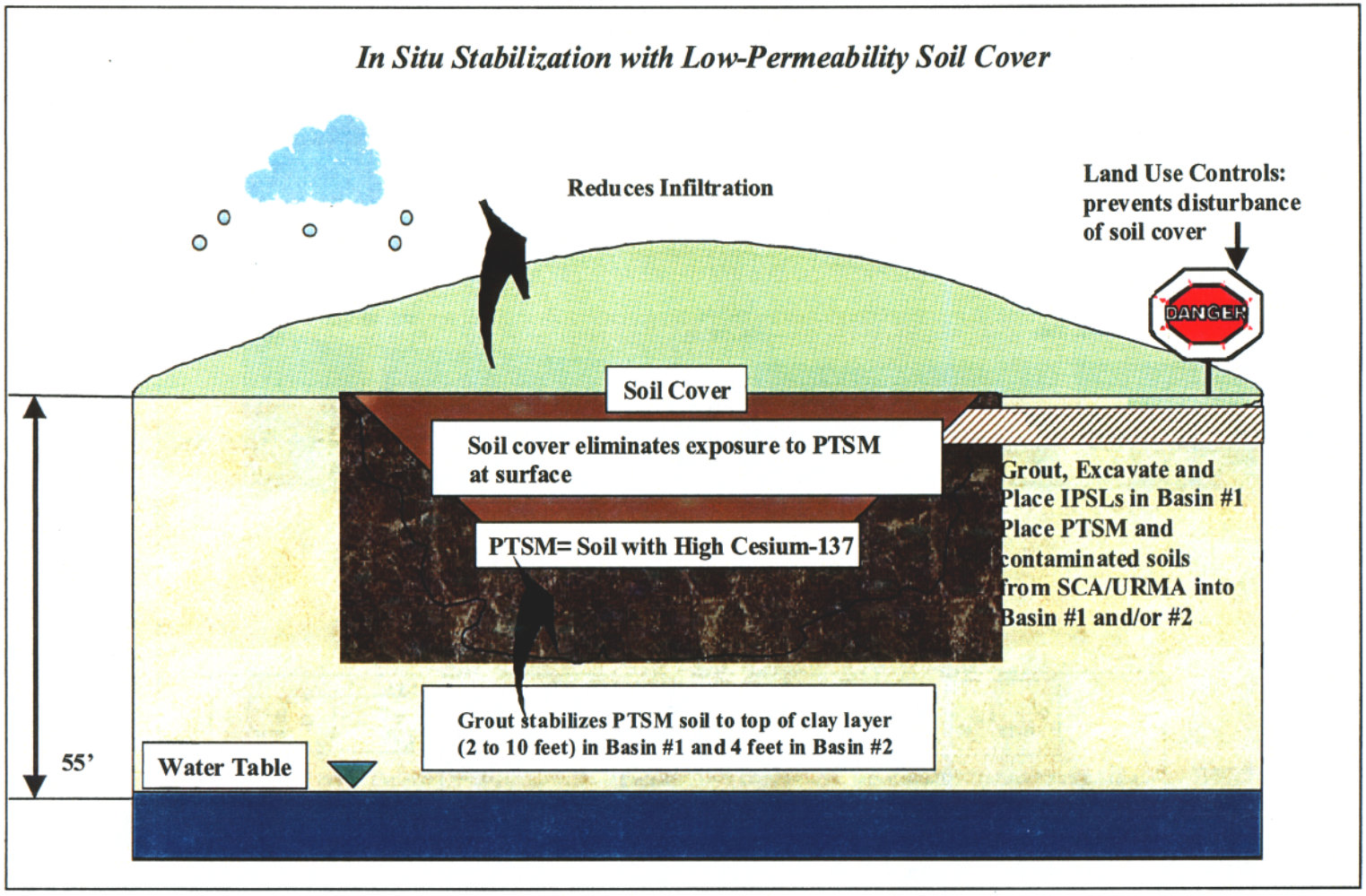

Figure 7. **Plug-In Remedy at P-Area Reactor Seepage Basins**

Table 1. Estimated Cost of Cleanup at PRSBs

Capital Costs

General Requirements	Quantity	Units	Cost / Unit	Total	Grand Total
Submittals	1	LS	$29,120.00	$29,120	
Temporary Controls/Miscellaneous Items	1	LS	$220,000.00	$220,000	
Technical Requirements	1	LS	$928,128.00	$928,128	
Dust Suppression	6	MO	$1,100.00	$6,600	
Total General Requirements				**$1,183,848**	**$1,183,848**
Clean Sitework					
Mobilization	1	LS	$139,593.00	$139,593	
Site Surveys	17	ACRE	$4,700.00	$79,900	
Preparation of Borrow Area for Fill Material	11,400.0	CY	$2.50	$28,500	
Geophysical/Geotechnical Investigation (Borrow Area)	1.0	LS	$15,000.00	$15,000	
Erosion Control	1	LS	$178,000.00	$178,000	
Geophysical/Geotechnical Investigation (Earthwork)	1	LS	$30,000.00	$30,000	
Modify Existing Wells	4	EA	$2,500.00	$10,000	
Permanent Fencing	860	LF	$30.00	$25,800	
Topsoil Mix/Site Seeding	30	MSF	$800.00	$24,000	
Demobilization	1	LS	$21,000.00	$21,000	
Total Clean Sitework				**$551,793**	**$551,793**
Remediation					
Removal of Contaminated Vegetation	1	LS	$ 127,000.00	$127,000	
Grouting of Pipeline	60	CF	$185.00	$11,100	
Herbicides and Insecticides	220	MSF	$250.00	$55,000	
Grading Fill (Contaminated)	1,200	CY	$21.00	$25,200	
Grading Fill (Clean)	6,000	CY	$20.86	$125,160	
Low Permeability soil Layer	24,319	CY	$25.33	$616,000	
Vegetative Layer	12,160	CY	$19.00	$231,040	
Equipment Decontamination	1	LS	$41,000.00	$41,000	
Total Remediation				**$1,231,500**	**$1,231,500**
Other Items					
Preliminary Engineering	1	LS	$65,180.00	$65,180	
Detailed Engineering & Preconstruction	1	LS	$221,769.00	$221,769	
Project Support for Remedial Design	1	LS	$12,504.00	$12,504	
Remediation Derived Waste	1	LS	$12,000.00	$12,000	
Project Support for Construction	1	LS	$118,342.00	$118,342	
Title III Support	1	LS	$68,000.00	$68,000	
Final Action Report	1	LS	$15,000.00	$15,000	
Post Construction Activities	1	LS	$54,113.00	$54,113	
Project Support for Post Construction	1	LS	$14,000.00	$14,000	
Project Support for Remedial Action Phase	1	LS	$131,000.00	$131,000	
Total Other Items				**$711,908**	**$711,908**
Contingency Allowance (20%)					**$735,810**
Total Capital Cost					**$4,414,859**

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

Operations and Maintenance Costs

	Units	Cost/Unit	Total
Erosion Control	9300 ft^2	$ 1	$ 9,300
Ditch Repair	1860 ft^2	$ 2	$ 3,720
Mowing (Semi-annual)	5 Acres	$ 366	$ 1,830
Fertilize (Semi-annual)	5 Acres	$ 366	$ 1,830
Nonmanual Support	5 acres	$ 1,354	$ 6,770
	Total Annual O&M Cost		$23,450

Summary of Present Worth Analysis

Year	Capital Cost	Annual O&M Cost	Total Cost	Discount Factor (3.9%)	Present Worth
0	$4,414,859		$ 4,414,859	1.000	$ 4,414,859
20		$ 23,450	$ 23,450	0.465	$ 10,910
40		$ 23,450	$ 23,450	0.212	$ 4,979
60		$ 23,450	$ 23,450	0.098	$ 2,294
80		$ 23,450	$ 23,450	0.045	$ 1,057
100		$ 23,450	$ 23,450	0.021	$ 487
120		$ 23,450	$ 23,450	0.010	$ 224
140		$ 23,450	$ 23,450	0.004	$ 103
160		$ 23,450	$ 23,450	0.002	$ 48
180		$ 23,450	$ 23,450	0.001	$ 22
200		$ 23,450	$ 23,450	0.000	$ 10
220		$ 23,450	$ 23,450	0.000	$ 5
240		$ 23,450	$ 23,450	0.000	$ 2
260		$ 23,450	$ 23,450	0.000	$ 1
280		$ 23,450	$ 23,450	0.000	$ 0
300		$ 23,450	$ 23,450	0.000	$ 0
320		$ 23,450	$ 23,450	0.000	$ 0
340		$ 23,450	$ 23,450	0.000	$ 0
360		$ 23,450	$ 23,450	0.000	$ 0
380		$ 23,450	$ 23,450	0.000	$ 0
400		$ 23,450	$ 23,450	0.000	$ 0
420		$ 23,450	$ 23,450	0.000	$ 0
440		$ 23,450	$ 23,450	0.000	$ 0
460		$ 23,450	$ 23,450	0.000	$ 0
480		$ 23,450	$ 23,450	0.000	$ 0
500		$ 23,450	$ 23,450	0.000	$ 0
Totals	$4,414,859	$ 11,725,000	$ 16,139,859		$ 5,010,717
Total Present Worth Cost					**$ 5,010,717**

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 3.9% discount rate for a 500-year duration. Cost estimates are based on soil volume estimates, which are based on a conceptual design. Cost estimates are within +50% to -30% accuracy expectation.

CY=Cubic Yard
EA=Each
HR=Hours
LS=Lump sum
LF=Linear Foot
M=Meter
MO=Month
MSF=Thousand Square Feet
SY=Square Yard

As negotiated with USEPA, and in accordance with USEPA Region IV Policy (*Assuring Land Use Controls at Federal Facilities*, USEPA 1998), SRS has developed a Land Use Control Assurance Plan (LUCAP) to ensure that land use restrictions are maintained and periodically verified. The unit-specific Land Use Control Implementation Plan (LUCIP) will provide detailed and specific measures required for the land use controls selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the land use control selected under this ROD. The LUCIP developed as part of this action will be submitted concurrently with the Remedial Action Implementation Plan (RAIP), as required in the FFA, for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and will be incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect until modified as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA Section 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall include restrictions precluding residential use and groundwater use of the property. However, the need for these deed restrictions may be re-evaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any re-evaluation of the need for deed restrictions will be documented through an amended ROD with USEPA and SCDHEC review and approval.

In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency. If the PRSBs are transferred to nonfederal ownership prior to reduction of soil risks to acceptable levels and below contaminant migration levels, reevaluation of the need for deed restrictions will be performed through an amended ROD, with USEPA and SCDHEC approval. The survey plat will be reviewed and updated, as necessary, at the time the site is transferred and will be

recorded with the appropriate county recording agency.

Public Participation Activities

The public has been notified of a 30-day public review period on this ESD through 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 review period began on May 14, 2003 and ended on June 13, 2003. No public comments were received.

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.*

References

USEPA, 1998. *Assuring Land Use Controls at Federal Facilities*, April

WSRC, 1998. *Phase I Pre-Characterization for the P-Reactor Seepage Basins Operable Unit Final Summary Report (U)*, WSRC-RP-98-4214, December, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *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, September

WSRC, 2002. Unit-Specific Plug-In Technical Evaluation Report for the P-Area Reactor Seepage Basin Operable Unit (U), WSRC-RP-2002-4082, July

7/2/03
Date

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