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DISCLAIMER

Key Words:
PA Maintenance
DOE Order 435.1
SDF

Retention:
Permanent

PROGRAM PLAN FOR REVISION OF THE Z-AREA SALTSTONE DISPOSAL FACILITY PERFORMANCE ASSESSMENT (U)

James R. Cook

DECEMBER 7, 2005

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy Under Contract Number DE-AC09-96SR18500

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REVIEWS AND APPROVALS

Author

James R. Cook, Environmental Analysis and Performance Modeling — Date 12/8/05

Reviews/Approvals

Byron T. Butcher, Level 4, Environmental Analysis and Performance Modeling — Date 12/8/05

Jeffrey C. Griffin, Level 3, Chemical Science and Technology — Date 12/8/05

Dennis G. Thompson, Saltstone Project — Date 12/15/05

John E. Occhipinti, Waste Solidification Engineering — Date 12-8-05

Welford T. Goldston, Waste Management Area Project — Date 12/8/05

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LIST OF ACRONYMS

DOE	Department of Energy
GCL	Geosynthetic Clay Liner
HELP	Hydrologic Evaluation of Landfill Performance
ITP	In-Tank Precipitation
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	Low-Level Waste
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
QA	Quality Assurance
RWMB	Radioactive Waste Management Basis
SDF	Saltstone Disposal Facility
SRNL	Savannah River National Laboratory
USEPA	United States Environmental Protection Agency
WMAP	Waste Management Area Projects

1.0 EXECUTIVE SUMMARY

Savannah River National Laboratory (SRNL) and the Saltstone Project, are embarking on the next revision to the Saltstone Disposal Facility (SDF) performance assessment (PA). This program plan has been prepared to outline the general approach, scope, schedule and resources for the PA revision. The plan briefly describes the task elements of the PA process. It discusses critical PA considerations in the development of conceptual models and interpretation of results. Applicable quality assurance (QA) requirements are identified and the methods for implementing QA for both software and documentation are described. The plan identifies project resources supporting the core team and providing project oversight. Program issues and risks are identified as well as mitigation of those risks. Finally, a preliminary program schedule has been developed and key deliverables identified.

A number of significant changes have been implemented since the last PA revision resulting in a new design for future SDF disposal units. This revision will encompass the existing and planned disposal units, PA critical radionuclides and exposure pathways important to SDF performance. An integrated analysis of the overall facility layout, including all disposal units, will be performed to assess the impact of plume overlap on PA results. Finally, a rigorous treatment of uncertainty will be undertaken using probabilistic simulations. This analysis will be reviewed and approved by DOE-SR, DOE-HQ and potentially the Nuclear Regulatory Commission (NRC). This revision will be completed and ready for the start of the DOE review at the end of December 2006.

This work supports a Saltstone Vault 2 fee-bearing milestone. This milestone includes completion of the Vault 2 module of the PA revision by the end of FY06.

2.0 INTRODUCTION

2.1 BACKGROUND

A performance assessment of DOE LLW disposal operations is required by DOE Order 435.1, Radioactive Waste Management (USDOE 1999). The LLW chapter of the Order requires maintenance of PA's including periodic updates. DOE M 435.1-1 IV.P.(3)(a) requires revision of the PA when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing PA. Since initial design and facility construction, the Saltstone Facility has undergone revisions in the anticipated radiological inventory, vault design and the models used to evaluate compliance with performance objectives. Thus, over the course of time, the performance objective compliance evaluations have been calculated in various documents to reflect new information and methodologies. The current Performance Assessment (PA) was approved in 1992 and was based upon disposal of decontaminated salt solution from the In-Tank Precipitation Facility (ITP). A Special Analysis was approved in 2002 to account for suspension of the ITP process and disposal of low curie salt solution.

The latest information on the Saltstone Disposal Facility feed solutions, updated modeling methods, updated closure cap design and evaluations are captured in the 2005 Special Analysis (Cook et al. 2005), which supplements the Saltstone Performance Assessment (MMES 1992; WSRC 1998) and supersedes the 2002 Saltstone Special Analysis (Cook et al. 2002)..

Waste Solidification Area Projects is developing a new Saltstone vault design concept of a vendor supplied, pre-fabricated, post-tensioned, thin wall concrete tank (Vault 2). This design is being proposed as the replacement for the poured-in-place vaults (Vaults 1 and 4) currently in use in the Saltstone Disposal Facility.

2.2 SCOPE

The PA revision will cover all existing and currently planned disposal units in the SDF (Vault 1, Vault 4 and the new Vault 2 design). It will include all pathways and radionuclides of concern. Sensitivity studies and a probabilistic uncertainty analyses will be performed as necessary to ensure accurate representation of disposal conditions in the conceptual models.

2.3 REGULATORY FRAMEWORK

This revision will follow DOE Order 435.1 methodology and objectives in establishing disposal limits. However, due to the requirements of Section 3116 of the National Defense Authorization Act for Fiscal Year 2005 (U.S. Congress 2004), NRC 10CFR61 performance objectives will also be considered in establishing disposal limits.

3.0 TASK ELEMENTS

3.1 GROUNDWATER ANALYSIS

The analyses performed in this revision will use results from the automated groundwater screening application to select radionuclides to include in the detailed evaluation. All groundwater modeling will be performed using the latest version of PORFLOW© adopted by the Site. The unsaturated zone will be modeled as two-dimensional. The saturated zone will modeled in three dimensions. The latest facility layout and any unique waste emplacement strategies identified by Saltstone will be considered and modeled as appropriate.

3.2 AIR AND RADON ANALYSIS

SRNL will perform a screening analysis for the air pathway to select radionuclides to include in the detailed evaluation. The air and radon analyses will be performed with a 1D vertical numerical model which considers the effects of cracks to represent vapor phase transport. Air dispersion of the contaminant flux at the surface will consider effects of distributed sources in calculating air doses. A dose will be calculated at the current SRS site boundary until the end of Institutional Control at which time a dose will be calculated at a distance of 100-meters from the facility.

3.3 INTRUDER ANALYSIS

SRNL will perform an analysis for inadvertent intruder scenarios. The recently developed automated intruder analysis application (Koffman 2004) will be used to generate results for the intruder analysis. Intruders will be assumed to have access to the disposal site immediately following the end of active operations and Institutional Control (i.e., ~125 years from now).

3.4 ANALYSIS OF FACILITY LAYOUT

Waste Solidification Engineering will provide a drawing with the projected facility layout of all disposal units in Z-Area based on waste projections and proposed operating strategies. SRNL will evaluate the impacts of plume overlap on disposal unit limits based on this layout and make recommendations to optimize disposal unit locations and orientation as needed.

3.5 ALL-PATHWAYS ANALYSIS

Prior treatment of All-Pathways assumed that the only exposure pathways of concern were; 1) the pathway involving direct ingestion of groundwater, and, 2) direct radiation and inhalation from the airborne plume. This simplistic representation ignored effects of consumption of vegetables, meat, fish and milk produced from contaminated groundwater or contaminated from the airborne plume. This revision will explicitly analyze the All-Pathways case assuming these additional exposure pathways using the groundwater concentrations

derived in the groundwater analysis and the air doses derived in the air analysis that will generate the peak all-pathways response. The LADTAP XL© program will be used to derive these doses.

3.6 SENSITIVITY AND UNCERTAINTY ANALYSIS

Sensitivity cases will be run using PORFLOW© for inputs to the model and other model parameters for which there is a great deal of uncertainty in the values or are known to have a significant impact on the results. To the degree practical, a probabilistic approach to the uncertainty analysis will be undertaken for each disposal unit using GoldSim©.

4.0 PA CONSIDERATIONS

4.1 MATERIAL PROPERTIES

Studies completed since the last PA revision have improved our understanding of the overall disposal system properties and long-term performance. The latest information on initial material properties for the various materials composing the disposal system will be used. These materials include; geosynthetic clay liner (GCL), concrete, native soil, backfill, crushed rock, grout and the waste layer. Where possible the mechanisms of degradation will be explicitly modeled, for example seismic, settling, erosion, silting, rebar corrosion, sulfate attack, etc.

4.2 GEOCHEMISTRY

A number of significant studies have been completed that have improved our understanding of the radiochemistry and geochemistry in the Z-Area disposal environment. New information that will be considered in this PA revision include: longevity of Saltstone reducing conditions, latest understanding of Pu geochemistry in the SRS environment, effect of high pH vault conditions on radionuclide sorption and solubility, role of carbonate chemistry in controlling C-14 in the vapor phase, and impact of colloid facilitated transport of radionuclides.

4.3 TIME OF ASSESSMENT

Radionuclide disposal limits will be set based on a 10,000 year Time of Assessment in line with NRC methodology. Results will also be captured for information only at 1,000 years per DOE Order 435.1. Maximum groundwater concentrations for selected radionuclides with peaks beyond 10,000 years will also be obtained for information.

4.4 POINT OF ASSESSMENT

Radionuclide disposal limits will be set based on a 100-m Point of Assessment for the groundwater pathway.

4.5 INSTITUTIONAL CONTROL PERIOD

The period of Institutional Control will be assumed to last for a period of 100 years. The modeling will assume that all waste will be emplaced at the end of the Active Operations period.

4.6 CLOSURE CONCEPT

Modeling will represent the latest closure concept (Phifer and Nelson 2003). Any changes to the closure strategy or closure system identified through the PA Revision process will be incorporated in the next revision to the closure plan.

4.7 QA REQUIREMENTS

Federal rule 10 CFR 830.120, Subpart A established quality requirements for DOE contractors conducting activities, including providing items and services that affect, or may affect, nuclear safety of DOE facilities. The Department has also developed DOE Order 414.B, “Quality Assurance” and its associated manuals to ensure quality assurance for all products and services provided by DOE contractors. At SRS, DOE-Savannah River has developed a Quality Assurance Program Manual, SRM 414.1.1.C, which describes its quality assurance program as required by DOE Order 414.1B. DOE contractors are required to identify, via the S/RID process, and incorporate the requirements of 10 CFR 830 and DOE Order 414.1B in their company-level procedures and processes. General WSRC requirements for software quality assurance are described in company-level procedure1Q, Quality Assurance Manual (WSRC 2003). The following Chemical Science and Technology Task QA Plan Checklist identifies the applicable sections of the WSRC 1Q Manual for the SDF PA Revision.

CST TASK QUALITY ASSURANCE PLAN CHECKLIST

Task Technical Plan No: WSRC-RP-2005-01772 Task Title: Program Plan for the Revision of the E-Area Low-Level Waste Facility Performance Assessment

Listed below are the sections of WSRC QA Manual (1Q). Check the 1Q sections applicable to your task. Also, check procedures CST implements to control the task. This checklist identifies controls for task activities performed by CST only. **(Form Revised 5/25/2005)**

WSRC 1Q Section	***Applies To Task***	***Procedures Implemented by WPT***	***Procedure Used***
Organization	x	1Q, QAP 1-1, Organization	x
		L1, 1.02, SRTC Organization	x
		1Q, QAP 1-2, Stop Work	x
QA Program	x	1Q, QAP 2-1, Quality Assurance Program*	x
		1Q, QAP 2-2, Personnel Training & Qual.	x
		L1, 1.32, SRTC Read and Sign/Briefing Program	x
		1Q, QAP 2-3, Control of R&D Activities*	x
		L1, 7.10, Control of Technical Work	x
		L1, 7.16, Laboratory Notebooks and Logbooks	x
		1Q, QAP 2-4, Auditor/Lead Auditor Qual. & Cert.	NA for CST
		1Q, QAP 2-5, Qual. & Cert. of Independent Insp. Personnel	NA for CST
		1Q, QAP 2-7 QA Program Req. for Analytical Measurement Systems	
Design Control	x	1Q, QAP 3-1, Design Control	
		L1, 7.10, Control of Technical Work	x
Procurement Document Control		1Q, QAP 4-1, Procurement Document Control E7, 3.10, Determination of Quality Requirements for Procured Items 7B, 3E (for reference only)	
Instructions, Procedures and Drawings		1Q, QAP 5-1, Instructions, Procedures, & Drawings E7, 2.30, Drawings L1, 1.01, SRNL Procedure Administration	
Document Control	x	1Q, QAP 6-1, Document Control	x
		1B, MRP 3.32, Document Control	x
Control of Purchased Items and Services		1Q, QAP 7-2, Control of Purchased Items & Services 7B & 3E (for reference only)	
		1Q, QAP 7-3, Com. Grade Item Dedication E7, 3.46, Replacement Item Evaluation/Commercial Grade Dedication	
Identification & Control of Items		1Q, QAP 8-1, ID and Control of Items*	
Control of Processes		1Q, QAP 9-1, Control of Processes	NA for CST
		1Q, QAP 9-2, Control of Nondestructive Exam.	NA for CST
		1Q, QAP 9-3, Control of Welding & Other Joining Proc.	NA for CST
		1Q, QAP 9-4, Work Processes 1Y, 8.20, Work Control Procedure	

WSRC 1Q Section	***Applies To Task***	***Procedures Implemented by WPT***	***Procedure Used***
Inspection		1Q, QAP 10-1, Inspection L1, 8.10, Inspection	 NA for CST
Test Control		1Q, QAP 11-1, Test Control (applies to WPT only for acceptance testing; R&D test activities are controlled by 1Q, QAP 2-3)	
Control of Measuring & Test Equipment		1Q, QAP 12-1, Control of Measuring & Test Equipment	
		1Q, QAP 12-2, Control of Installed Process Instrumentation	
		1Q, QAP 12-3, Control & Calibration of Radiation Monitoring Equipment	
Packaging, Handling, Shipping & Storage		1Q, QAP 13-1, Pkg., Handling, Ship. & Storage*	
Inspection, Test, and Operating Status		1Q, QAP 14-1, Inspection, Test, & Operating Status*	
Control of Nonconforming Items & Activities		1Q, QAP 15-1, Control of Nonconforming Items*	
Corrective Action System		1Q, QAP 16-3 Corrective Action Program 1.01, MP 5.35, Corrective Action Program	
QA Records	x	1Q, QAP 17-1, QA Records Management* L1, 7.16, Laboratory Notebooks and Logbooks	x x
Audits		1Q, QAP 18-2, Surveillance	
		1Q, QAP 18-3, QA External Audits	
		1Q, QAP 18-4, Management Assessment Program 12Q, Assessment Manual	
		1Q, QAP 18-6, Quality Assurance Internal Audits	
		1Q, QAP 18-7, Quality Assurance Supplier Surveillance	
Quality Improvement		1Q, QAP 19-2, Quality Improvement*	
Software Quality Assurance	x	1Q, QAP 20-1, Software QA L1, 8.20, Software Management & QA	x x
Environmental QA		1Q, QAP 21-1, Quality Assurance Requirements for the Collection and Eval. of Environmental Data	NA for CST

Exceptions/Additions-Procedures identified on the checklist with an asterisk (*) are supplemented by a SRNL clarification in L1, 8.02, "SRNL QA Program Clarifications". WSRC-IM-2002-00011, "Technical Report Design Check Guidelines," will be used to help ensure the quality and consistency of the technical reviewer process for technical reports produced by SRNL Chemical Science and Technology.

4.8 MODELING APPLICATIONS

A number of software applications are being employed in the PA analysis of the SDF. The following summaries briefly describe the current versions of the primary software applications being used in the PA process:

PORFLOW© version 5.97 – PORFLOW is a commercially available computer code developed by ACRi, Inc, and acquired by WSRC for use in simulating ground water flow and contaminant transport in the vadose zone and underlying aquifers. The current versions used in PA-level calculations are being placed under configuration control in the Process & Control Services SourceSafe© software library. PORFLOW has been classified as level D software in the Software Inventory Database and assigned identification L323-B-001V.

SRNL Automated Intruder Analysis version 1.0 – SRNL developed this desktop computer application for evaluating the impact of closure system design alternatives on inadvertent intruder exposure pathways. The application, programmed in Visual Basic©, mitigates the QA vulnerabilities encountered with Excel© spreadsheet-based intruder calculations which are time-intensive and potentially error-prone. The advantage of a computer application is that calculations are performed by the same function or subroutine, which need only be checked one time. Input values are entered only one time and thereafter used by the program as needed, thus eliminating redundant input. The application produces output that can be used directly without manually transcribing results. The versions being used in PA-level calculations are being placed under configuration control in the Process & Control Services SourceSafe© software library. This software has not yet been classified or placed in the site software inventory database.

LADTAP XL© version 5.0 – LADTAP was originally developed by Oak Ridge National Lab for assessing doses from liquid releases. LADTAP XL© Spreadsheet is the site adaptation of this code used to calculate dose to the maximally exposed offsite individual and to downriver population from routine releases of radionuclides to the Savannah River. The application contains two worksheets: LADTAP and IRRIDOSE. The LADTAP worksheet estimates dose from environmental pathways including external exposure resulting from recreational activities (swimming, boating, and shoreline use) and from ingestion of water and fish. IRRIDOSE estimates dose from food crops irrigated with contaminated water. LADTAP XL© has been classified as level B software in the Software Inventory Database and assigned identification L041-Z-107V-001.

MINTEQA2 for Windows© version 1.50-MS – MINTEQA2 is a geochemical equilibrium speciation model for dilute aqueous systems originally developed through the U.S. EPA. MINTEQA2 for Windows, which uses the same EPA computational algorithms and thermodynamic databases, was developed by Allison Geoscience Consultants, Inc. and HydroGeoLogic, Inc. MINTEQA2 is capable of computing equilibria among the dissolved, adsorbed, solid, and gas phases in an environmental setting. MINTEQA2 contains an extensive thermodynamic database, EQ3/EQ6, which has been QA'd and accepted for use at Yucca Mountain by DOE and is adequate for solving a broad range of problems. MINTEQA2 has been classified as level D software in the Software Inventory Database.

HELP version 3.07 - The Hydrologic Evaluation of Landfill Performance (HELP) model is a quasi-two-dimensional water balance model designed to conduct landfill water balance analyses. Personnel at the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi developed the HELP model, under an interagency agreement with the United States Environmental Protection Agency (USEPA). The model requires the input of weather, soil, and design data. It provides estimates of runoff, evapotranspiration, lateral drainage, vertical percolation, hydraulic head, and water storage for the evaluation of various landfill designs. The HELP model has been utilized along with estimates of degraded closure cap material properties over time to estimate infiltration through the upper geosynthetic clay liner (GCL) in the SDF closure cap. This information is utilized as the upper flow boundary condition for the vadose zone PORFLOW modeling. This software has not been classified or placed in the site software inventory database.

CAP88 version 1.2 - CAP88 (which stands for Clean Air Act Assessment Package-1988) was originally developed by Oak Ridge National Laboratory as two separate codes entitled AIRDOS-EPA and DARTAB. It is one of the codes recommended by DOE Order 5400.5 for assessing compliance with the DOE 10 mrem/yr airborne-pathways dose standard for protection of the public. CAP88 uses a straight-line Gaussian plume model to estimate dose and risk from radionuclides emitted to the air and is used to demonstrate compliance with 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS). For the PA, CAP88 is being used to estimate dose to the maximally exposed offsite individual for the following exposure pathways; inhalation, plume shine, ground shine, and ingestion of vegetables, beef and milk. Dose was also estimated for the maximally exposed individual at 100 m from the release location. CAP88 is classified as Class 'B' software in the Software Inventory Database and assigned the site software identification number is L041-Z-104V-00. The current version of CAP88, which has not changed in over 10 years, is tracked within our Software Quality Assurance Manual. If we did migrate to a subsequent version of the code version 1.2 would be archived on the IBM 3090 Mainframe.

GoldSim© version 9.0 – GoldSim is a highly graphical, object-oriented computer program for carrying out dynamic, probabilistic simulations. GoldSim can represent uncertainty in processes, parameters and future events. The GoldSim Radionuclide Transport (RT) Module is a program extension to the GoldSim simulation framework that allow you to dynamically model radionuclide transport within complex engineered and/or natural environmental systems. The fundamental output produced by the RT Module consists of predicted radionuclide mass fluxes at specified locations within the system, and predicted concentrations within environmental media. This software has not yet been classified or placed in the site software inventory database.

4.9 RADIOACTIVE WASTE MANAGEMENT BASIS

The PA Revision will be formatted for easy retrieval of the key information that will serve as part of the Radioactive Waste Management Basis (RWMB) for the SDF. This information includes bounding assumptions, credited design features and administratively controlled

limits for each class of disposal units as well as for the overall facility layout. At the conclusion of the PA revision the RWMB database will be updated with this information.

4.10 TECHNICAL REVIEWS

Requirements for performing reviews of technical work are established in SRS Procedure E7 Conduct of Engineering Manual, Procedure 2.60, *Technical Reviews* (WSRC 2005). The end use of data drives the level of review required. Design Verification, the highest level review, must be performed for work affecting Safety Significant/Safety Class systems. E7 Procedure 2.60 identifies four acceptable methods of Design Verification (i.e., design review, qualification testing, alternate calculations, and operational testing). The adequacy of technical reports not subjected to Design Verification is determined by a Design Check in accordance with Section 5.1 of E7, 2.60. Design Checks and Design Verification by design review apply the same philosophy and approach. The PA revision will be reviewed at the Design Check level.

Between 2002 and 2004 SRNL developed, piloted and then implemented technical review guidelines incorporating the E7 Manual requirements for performing Design Checks and Design Verification by document review (WSRC 2004a). These guidelines also meet the requirements for review of Type 2 Calculations contained in Manual E7, 2.31, *Engineering Calculations* (WSRC 2004b). The guidelines provide a flowchart to map the SRNL technical review process, lines of inquiry for performing reviews, a checklist for communicating instructions and best management practices to set a benchmark for management expectations.

Technical reviews will be performed of completed analyses using the SRNL design check guidelines. In addition, upon development of the conceptual model for each unit the analyst will review the critical features of the conceptual model with the Saltstone PA core team for buy-in prior to starting production runs.

4.11 TASK CLOSURE

The PORFLOW Software QA Plan (Collard 2002) will be updated at the end of the PA Revision to incorporate the most recent changes in software requirements, design, testing, installation and acceptance, operation and maintenance, and retirements. The current versions of each code employed in this work will be archived in the Process & Control Services SourceSafe© software library along with input files for each of the models developed. As previously stated, the Radioactive Waste Management Basis database will be updated at the end of this work.

5.0 PROJECT RESOURCES

5.1 CORE TEAM AND TECHNICAL SUPPORT

A number of technical resources, representing diverse disciplines, will be needed to complete the tasks and produce the deliverables. A number of these individuals will be members of the core team that will meet on a routine basis during the project. The remainder will serve as resources that will be needed for specific tasks. The following SRS resources and their roles are anticipated to be available for this work:

- J.R. Cook*, SRNL, Core Team lead, intruder analyses, integration and interpretation
- E.L. Wilhite*, SRNL, All-Pathways analysis, integration and interpretation
- M.A. Phifer*, SRNL, Closure cap performance and degradation
- B.T. Butcher*, SRNL, Program management
- W. C. Miles, WSAP, Vault 2 Project
- W.T. Goldston*, WMAP, SRS Disposal Authorization Statement, RWMB
- J. W. Ray*, WSAP, Process Cognizant Engineer
- C. Pang, DOE-SR, Customer interface
- H.L. Pope*, DOE-SR, Customer interface
- M. M. Ewart, DOE-SR, Customer Interface
- R.A. Hiergesell*, SRNL, Hydrology, PORFLOW modeling, GoldSim modeling
- G. P. Flach*, SRNL, PORFLOW modeling
- S. E. Aleman*, SRNL, PORFLOW modeling
- T. Hang, SRNL, Air and radon modeling
- C.A. Langton, SRNL, Concrete properties
- D.I. Kaplan, SRNL, Geochemistry
- A.A. Simpkins, SRNL, Air pathway modeling
- W. L. Peregoy, BSRI, Vault structural analysis
- M.F. Jones, SRNL, Technical editor
- M. F. Peel*, SRNL, Schedule and financial controls

* PA Revision Core team members

6.0 PROGRAMMATIC ISSUES AND RISKS

The following issues remain to be worked out at this preliminary stage in the program and represent cost and schedule uncertainties.

Issue	Risk	Work Around
Technical Resources	Competition for the limited modeling resources available onsite is expected with major PA's underway in E Area, and Tank Closure, as well as support for WMAP operations.	Three new modeling resources have been brought into the PA program and gained experience during FY05 for a total of seven PORFLOW© modelers now available.
Regulatory Framework	The Waste Determination process now underway for Salt Waste Programs will have an impact on PA revision scope.	SRNL will work closely with NRC in their monitoring role.
Schedule Compression	SDF PA work has been delayed in FY05 due to the priority placed on supporting the Waste Determination process for Salt Waste Programs. Up front data collection and reporting will push start of PA modeling into the second quarter of FY06.	Additional modelers discussed above will help alleviate the crunch on technical resources. Additional resources to manage each major program area are being sought.
Scope Uncertainty	Inexperience with GoldSim will require a learning curve. The number of sensitivity cases needed is uncertain. Field program for collecting and analyzing soil and cementitious material samples is not yet defined.	The planning schedule will be adjusted to account for scope refinement during detailed planning at the beginning of FY06 while holding key milestones firm.

7.0 PROGRAM SCHEDULE AND KEY DELIVERABLES

The planning schedule for the PA revision is shown in the Appendix. PA revision tasks previously completed, currently underway, or planned for FY06 are included. This schedule will be reviewed in the core team meetings and adjusted as needed throughout the PA Revision process. The following key deliverables are envisioned:

Task	Completion Date
Program plan	11/29/05
Hydraulic material properties report	1/17/06
Geochemical properties report	1/17/06
Hydraulic parameter uncertainty report	2/27/06
Geochemical parameter uncertainty report	2/27/06
Revision of intruder analysis application report	1/3/06
Aggregate all-pathways dose application	3/16/06
Vault 2 module[#]	7/3/06
Vaults 1 and 4 module	4/12/06
Integrated facility all-pathways analysis	6/19/06
SDF PA report for DOE-SR review (Rev. 0)*	12/22/06
DOE-SR Approved SDF PA report	2/26/07
DOE-HQ Approved SDF PA report	8/27/07

[#] The Vault 2 module is a fee bearing milestone due by the end of the current site contract (9/30/06). This milestone includes completion of tasks 3.1.a-l in the schedule at the end of this program plan.

* Key project milestone

8.0 CONCLUSION

Savannah River National Laboratory and Waste Solidification Area Project are embarking on the next revision to the Saltstone Disposal Facility performance assessment. A number of significant changes have been implemented since the last PA revision resulting in new conceptual models for the SDF disposal units. This revision will encompass all disposal units, PA critical radionuclides and exposure pathways important to the SDF performance. An integrated analysis of the overall facility, including all currently disposal units, will be performed to assess the impact of plume overlap on PA results. Finally, a rigorous treatment of uncertainty will be undertaken using GoldSim©, a highly graphical, object-oriented computer program for carrying out dynamic, probabilistic simulations. This revision will be completed and ready for the start of the DOE review at the end of December 2006.

9.0 REFERENCES

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WSRC, 2004b . SRS Conduct of Engineering Manual E7, Procedure 2.31, *Engineering Calculations*, Revision 8, December 10, 2004.

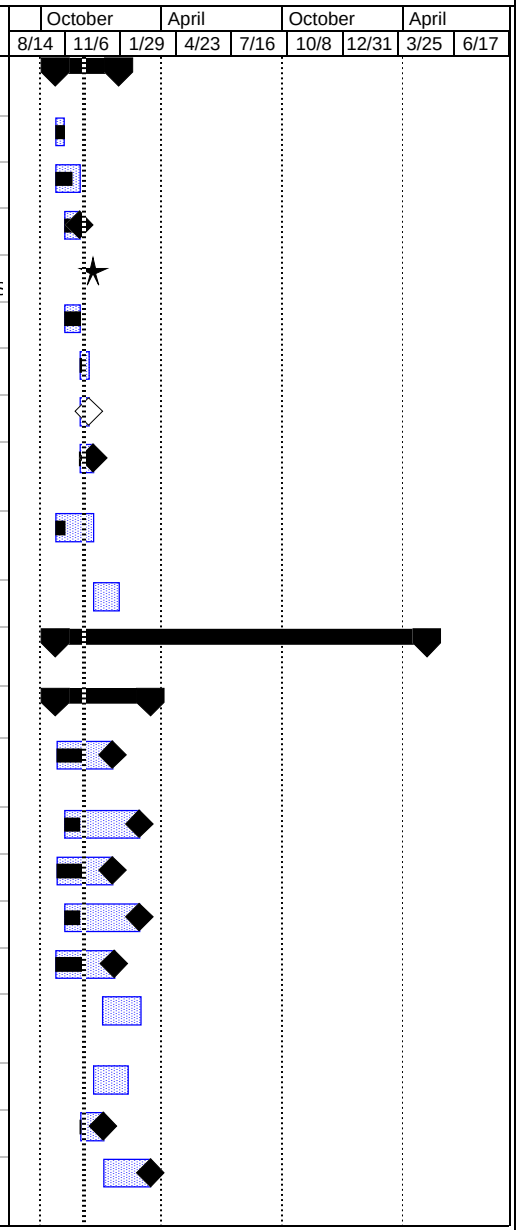
WSRC, 2005. SRS Conduct of Engineering Manual E7, Procedure 2.60, *Technical Reviews*, Revision 6, March 25, 2005.

10.0 ATTACHMENT – PROGRAM SCHEDULE

Saltstone PA Revision

Preliminary

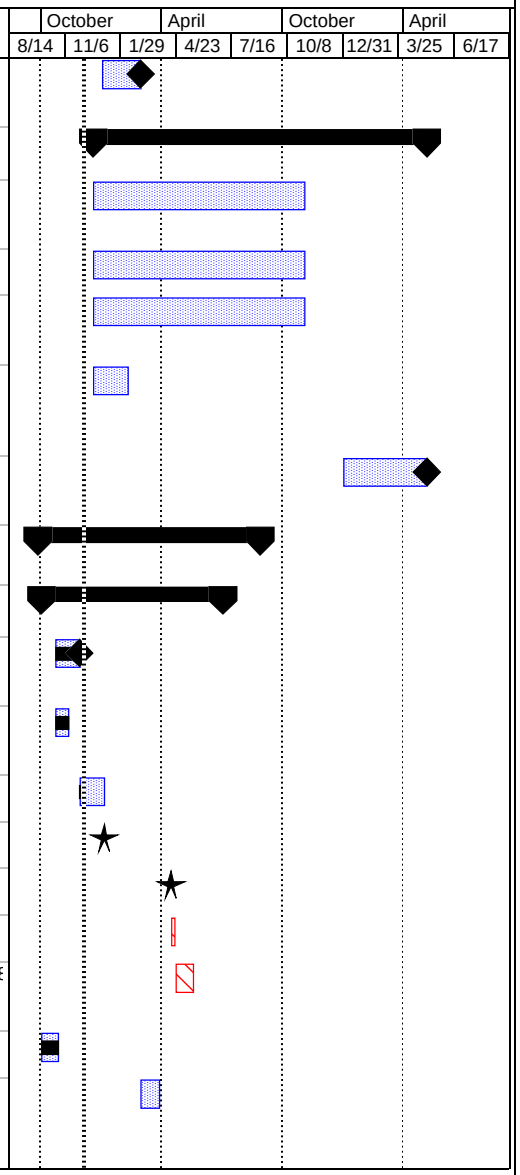
ID	Task Name	Description	Lead	Start	Finish	Duration	Tie
1	**1.0 Planning and Oversight**			**10/24/05**	**1/27/06**	**12 wks**	
2	a. Budget and schedule agreement	Agreement on FY06 cost (SRNL labor), scope and schedule. WADs in place. TTR approved.	Butcher	10/24/05	11/4/05	2 wks	
3	b. Non-labor funds	Identify needed non-labor funding to support PA revision data development effort. Gain agreement with customer.	Butcher	10/24/05	11/29/05	5 wks	2SS
4	d. Program Plan	Prepare plan, gain approval	Cook	11/7/05	11/29/05	3 wks	2
5	c. Key decision on non-labor funds and PA revision	Gain customer agreement and secure non-labor funds for identified tasks. Decision to proceed with PA revision.	Butcher	12/20/05	12/20/05	0 days	3FS+3 wks,4FS
6	e. PA revision team	Establish PA revision core team and technical resources, set up meeting schedule, begin project oversight	Cook	11/7/05	11/29/05	3 wks	2
7	f. Report format	Establish and automate PA revision format template	Butcher	11/30/05	12/13/05	2 wks	6
8	g. Review matrices	Set up review matrices to ensure meeting DOE 435.1 and LFRG requirements and compare with 10CFR61	Wilhite	11/30/05	12/13/05	2 wks	6
9	h. RWMB database protocols	Develop database to include fields for bounding assumptions, credited design featuers and operating restrictions. Prepare protocols for maintaining RWMB.	Swingle	11/30/05	12/20/05	3 wks	6
10	i. Software	Review software QA for major PA codes and identify needed improvements. Determine if additional GoldSim License will be needed.	Butcher	10/24/05	12/20/05	8 wks	2SS
11	ji. External reviewers	Establish roles and place subcontract for external review during development of PA revision	Cook	12/21/05	1/27/06	4 wks	5
12	**2.0 Data and Model Development**			**10/24/05**	**5/7/07**	**75.6 wks**	
13	***2.1 Near Term Studies Supporting PA Revision***			***10/24/05***	***3/16/06***	***18.6 wks***	
14	a. Hydraulic and diffusional material properties	Document initial properties for critical components of disposal system (i.e., HDPE, GCL, soil, concrete, clean grout, saltstone) based on existing information.	Phifer	10/26/05	1/17/06	10 wks	2SS
15	b. Hydraulic parameter uncertainty	Develop ranges and probability distributions for PA critical parameters to supply uncertainty analysis	Phifer	11/7/05	2/27/06	14 wks	2
16	c. Geochemical properties	Document baseline Kd values based on existing site-specific data, literature data and geochemical modeling	Kaplan	10/26/05	1/17/06	10 wks	2SS
17	d. Geochemical parameter uncertainty	Develop ranges and probability distributions for PA critical parameters to supply uncertainty analysis	Kaplan	11/7/05	2/27/06	14 wks	2
18	e. Saltstone degradation	Develop conceptual model of saltstone degradation mechanisms and evaluate using a geochemical code	Denham	10/24/05	1/20/06	11 wks	2SS
19	f. Slag reduction capacity longevity	Refine conceptual model of slag reduction capacity longevity and model movement of oxidation front into saltstone monolith	Thong	1/3/06	3/1/06	8 wks	
20	g. Bentonite testing	Salt solution-bentonite compatibility testing	Phifer	12/21/05	2/10/06	6 wks	5
21	h. Automated Intruder Analysis Application	Complete documentation of revision 1.1 of application	Koffman	12/1/05	1/3/06	3.4 wks	2
22	i. Aggregate All-pathways dose application	Develop an application incorporating time-dependent groundwater and air doses to generate the peak all-pathways response. (Koffman)	Wilhite	1/4/06	3/16/06	10 wks	21



Project: PA Revision Planning
Date: 12/5/05

Task
Critical Task
Progress
Key Milestone or Project Tie
PA Modules, Tables, Figures
Report, Plan, Reference
Summary

ID	Task Name	Description	Lead	Start	Finish	Duration	Tie
23	j. Numerical dispersion	Assess impact of numerical dispersion on PorFlow model results and make recommendations for how to handle in PA (i.e., do we need a real dispersion term)	Aleman	1/3/06	3/1/06	8 wks	
24	***2.2 Long Term Studies Addressing RAI Issues***			***12/21/05***	***5/7/07***	***67.6 wks***	
25	a. Slag reduction capacity longevity	Refine the conceptual model on changes in reduction capacity of saltstone through direct imaging and characterization of saltstone containing slag	Kaplan	12/21/05	11/3/06	43 wks	5
26	b. Saltstone degradation	Refine conceptual model on saltstone degradation mechanisms through direct imaging and characterization of saltstone aging	Kaplan	12/21/05	11/3/06	43 wks	5
27	c. Colloid transport of contaminants	Reduce uncertainty in our understanding of role of colloids in contam transport by characterizing tendency of colloids to move through aquifer	Kaplan	12/21/05	11/3/06	43 wks	5
28	d. Site-specific data	Develop priorities and set up program for collecting site-specific hydraulic and geochemical data for critical components of disposal system (lessons learned). Identify non-labor funds needed.	Cook	12/21/05	2/10/06	6 wks	5
29	e. Vault 2 concrete testing.	Laboratory testing of Vault 2 concrete slab and panel samples for initial hydraulic and diffusional properties (confirmatory testing).	Phifer	1/2/07	5/7/07	18 wks	
30	**3.0 PA Modules**			**9/28/05**	**8/29/06**	**45.2 wks**	
31	***3.1 Vault 2***			***10/3/05***	***7/3/06***	***36.6 wks***	
32	a. Confirmatory modeling	Document confirmatory modeling results including a determination if results are applicable to variations on the tank concept currently being considered.	Flach	10/24/05	11/29/05	5 wks	2SS
33	b. Structural assessment	Assess impact of seismic and settlement loads on alternate vault concepts being considered by project (incorporate into confirmatory modeling report)	Peregoy	10/24/05	11/11/05	3 wks	2SS
34	c. 4SIGHT concrete degradation model	Develop model of Vault 2 concrete degradation using NIST 4SIGHT model	Flach	11/30/05	1/5/06	4 wks	32
35	d. PA team key decision	Decision on whether to switch from empirical to 4SIGHT concrete degradation model	Cook	1/5/06	1/5/06	0 days	34
36	e. Project key decision	Vault 2 tank vendor award (confirms Vault 2 conceptual design)	Hopkins	4/17/06	4/17/06	0 days	
37	f. Final structural assessment	Determine if prior Vault 2 structural analysis encompasses conceptual design of successful tank vendor.	Peregoy	4/17/06	4/21/06	1 wk	36
38	g. Groundwater analysis	Rerun analysis incorporating refinements to concrete and saltstone degradation and any other new information on hydraulic and geochemical properties. Run sensitivity cases.	Flach	4/24/06	5/19/06	4 wks	14,16,18
39	h. Intruder analysis	Complete analysis	Cook	10/3/05	10/28/05	4 wks	
40	i. Air and radon analysis	Perform analysis with a 1D vertical numerical model to represent vapor phase transport. Consider effects of cracks in the concrete on diffusion of radionuclides. Air dispersion modeling (Simpkins)	Hang	3/2/06	3/29/06	4 wks	19



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Saltstone PA Revision

Preliminary

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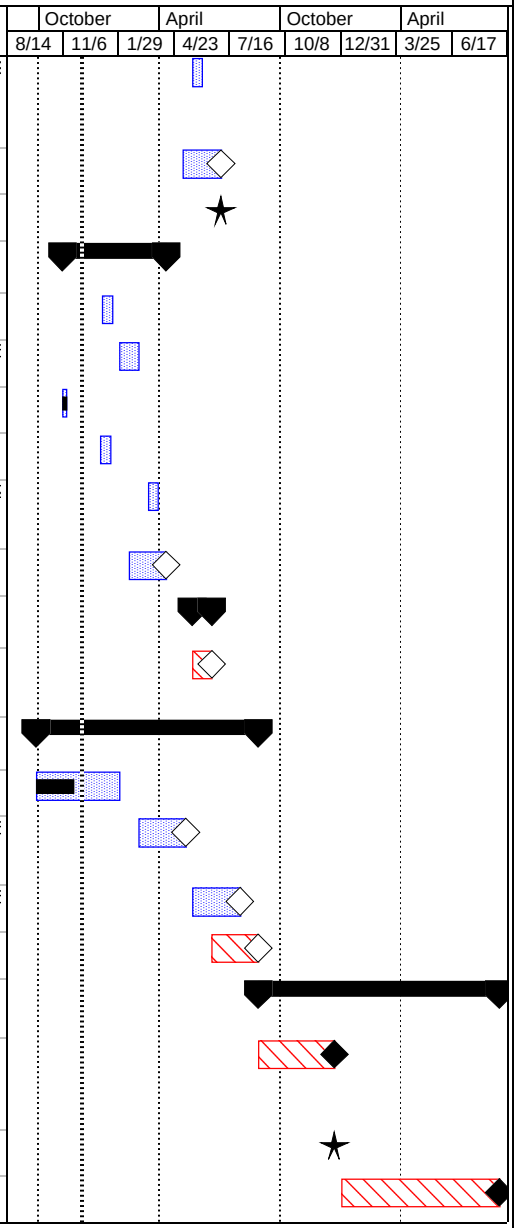
41	j. All-pathways analysis	Explicitly analyze the All-Pathways case assuming additional exposure pathways (i.e., consumption of vegetables, meat, fish and milk produced from contaminated groundwater or contaminated from the airborne plume). See item 2.1.h.	Wilhite	5/22/06	6/5/06	2 wks	38,40FS wk,22
42	k. Reporting	Document results of analyses in PA module	Flach	5/8/06	7/3/06	8 wks	38SS+2 wks
43	l. Milestone documentation	Issue letter documenting completion of Vault 2 PA module to Vault 2 project (fee bearing milestone)	Butcher	7/3/06	7/3/06	0 days	42
44	***3.2 Vaults 1 and 4***	***PA-level analysis of Vault 4 completed in FY05 SA***		***11/7/05***	***4/12/06***	***20.4 wks***	
45	a. 4SIGHT concrete degradation model	Adapt NIST 4SIGHT concrete degradation model to Vault 4 properties and dimensions	Flach	1/6/06	1/20/06	2 wks	35
46	b. Groundwater analysis	See 2.2.1.f. Evaluate extension of Vault 4 results to Vault 1.	Aleman	2/1/06	3/1/06	4 wks	14,16,45 wks
47	c. Intruder analysis	Complete. Extend Vault 4 intruder analysis results to Vault 1 footprint.	Cook	11/7/05	11/11/05	1 wk	2
48	d. Air and radon analysis	Completed for Vault 4. Evaluate extension of Vault 4 results to Vault 1.	Cook	1/3/06	1/17/06	2 wks	2
49	e. All-pathways analysis	Revise Vault 4 analysis using new application in item 2.1.h. Evaluate extension of Vault 4 results to Vault 1. See also item 2.2.1.h.	Wilhite	3/17/06	3/30/06	2 wks	46,48,22
50	f. Reporting	Document results for both Vaults 1 and 4 in single PA module	Aleman	2/15/06	4/12/06	8 wks	46SS+2 wks
51	***3.3 Integrated Facility Performance***			***5/22/06***	***6/19/06***	***4 wks***	
52	a. All-pathways analysis	Integrated analysis incorporating time-dependent and location specific air and groundwater concentrations from proposed facility layout. Run sensitivity cases?	Aleman	5/22/06	6/19/06	4 wks	38,50
53	***3.4 Uncertainty Analyses***			***9/28/05***	***8/29/06***	***45.2 wks***	
54	a. GoldSim evaluation	Evaluate application of GoldSim Vault 4 using 2005 SA model	Hiergesell	9/28/05	1/31/06	16 wks	
55	b. Vaults 1 and 4	Set up model of unit in GoldSim and use data from PorFlow model to parameterize and benchmark. Use ranges and distributions developed in 2.1.c,d for running probabilities.	Wilhite	3/2/06	5/11/06	10 wks	46,17,15
56	c. Vault 2	See item 3.4.b above	Cook	5/22/06	8/1/06	10 wks	38,17,15
57	d. Integrated analysis	Integrated analysis incorporating uncertainty from individual disposal unit GoldSim models	Cook	6/20/06	8/29/06	10 wks	52
58	**4.0 PA Revision Report**			**8/30/06**	**8/27/07**	**50 wks**	
59	a. Report Preparation	Update background sections, compile and edit, complete LFRG and 435.1 review matrices, compare with NRC performance objectives, interpretation and integration, WSRC reviews	Cook	8/30/06	12/22/06	16 wks	57
60		Issue Rev. 0 for start of DOE-SR review	Cook	12/22/06	12/22/06	0 days	59
61	b. Approvals	DOE and possible NRC reviews and approvals		1/2/07	8/27/07	34 wks	60



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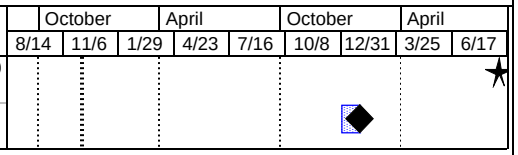
63		DOE-HQ and NRC approval of PA	LFRG	8/27/07	8/27/07	0 days	62FS+2 wks
64	c. Project Closeout	Update PorFlow software QA plan, archive models and codes, update RWMB, set up project files	Aleman	1/2/07	1/29/07	4 wks	59



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