WSRC-TR-2002-00249

KEY WORDS: Performance Assessment
Evaluation
LLW Disposal
Slit Trench

Discovery of Disposal of Low-Level Waste in Slit Trench Segments Shallower Than Analyzed in Performance Assessment

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REVIEWS AND APPROVALS

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Waste Disposal and Environmental Development

Solid Waste Division Approval

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Solid Waste Division

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Chairman, Solid Waste Facility Operations Safety Committee — Date 5/29/02

Summary

The effect of disposing of low-level waste in slit trenches that are shallower than those analyzed in the revised performance assessment for the E-Area low-level waste facility is evaluated. The conclusion of the evaluation is that such disposal is bounded by the performance assessment if all of the disposed waste packages meet the slit trench Waste Acceptance Criteria and if at least four feet of soil is placed over the disposed waste packages.

Introduction

One intent of DOE Order 435.1[1], as expressed in the performance assessment/composite analysis guidance[2], is to ensure that proposed changes in wasteforms, containers, radionuclide inventories, facility design, and operations are reviewed to ensure that the assumptions, results, and conclusions of the DOE approved performance assessment[3] (PA), and composite analysis[4] (CA), as well as any Special analyses (SA) that might have been performed, remain valid (i.e., that the proposed change is bounded by the PA and CA) and the changes are within the bounds of the Disposal Authorization Statement[5]. The goal is to provide flexibility in day-to-day operation and to require those issues with a significant impact on the PA's conclusions, and therefore the projected compliance with performance objectives/measures, to be identified and brought to the proper level of attention. It should be noted that the term performance measure is used to describe site specific adaptations of the DOE Order 435.1 Performance Objectives and requirements (e.g., performance measures such as applying drinking water standards to the groundwater impacts assessment).

The intent of this document is to provide an evaluation to determine if the discovered activity (disposal of LLW in slit trenches that are shallower than those analyzed in the PA) is within the assumptions, parameters, and bases of the approved PA[3] and CA[4]. If it is, then this document serves as the technical basis for authorizing the activity. If not, then, in order to authorize the activity, the PA and CA would need to be updated as appropriate and DOE approval sought of the update (special analysis or revision of the PA or CA).

Description of Discovery

Currently the Solid Waste Division at SRS disposes of low-level radioactive waste in trenches as well as vaults. Waste Acceptance Criteria[6] (WAC) specific to each wasteform and disposal unit limit the wasteforms and amounts (curies) of radionuclides that are allowed to be disposed in each unit. The WAC radionuclide limits are derived in part from the Radiological Performance Assessment (PA)[3]. The PA provides reasonable assurance through analysis that DOE performance objectives for LLW disposal are met. Other requirements (e.g., DOE Order 435.1, Safety Analysis Report[7]) are also incorporated into the Waste Acceptance Criteria (WAC).

For the disposal of waste in slit trenches, the PA analyzed a set of five trenches. Each trench was assumed to be 200 meters long by 6 meters deep by 6 meters wide, with 1.2 meters of soil over the disposed waste (i.e., only the bottom 4.8 meters of the trench contains waste) and with 3 meters between trenches. It was also assumed that the set of five trenches was situated within an area 48 meters wide (Figure 2.2-4 in the PA) to provide space between the sets of trenches or other units.

The discovery that is the subject of this report is that two sections of Slit Trench Set 1 (Figure 1) are less than the 6 meters depth analyzed in the PA. These trench sections are in one of the sets of slit trenches analyzed in the PA[3].

Background

In the revised E-Area PA[3], the only trench configuration analyzed was slit trenches (i.e., 6 meters wide by 6 meters deep), with 3 meters between trenches (i.e., the same configuration historically used at SRS; trenches 20 feet (6.1 m) wide and deep with 10 feet (3.05 m) between trenches). For convenience in interpreting the results of the analysis, a set of five trenches was assumed to occupy the same land area as a Low Activity Waste (LAW) vault footprint (i.e., 200 meters (656 ft) long by 48 meters (157.5 ft) wide).

The trenches were assumed to be 20 ft deep, with 16 ft of waste and the top 4 ft of each trench was assumed to be filled with non-contaminated backfill. Thus the disposal capacity of each of the five trenches in a set is 209,920 ft^3 and the disposal capacity of the set of five trenches is 1,049,600 ft^3.

The aspect of the trenches significant to this evaluation is the depth of portions of two of the trenches depicted in Figure 1. Survey results reported in the Unreviewed Disposal Question Screening show that these segments are 15 feet in depth., which exceeds the nominal variance of 10% (+/- 2 feet out of 20 feet).

Supporting Analysis

The PA assumed that the slit trenches would be excavated to a depth of 20 feet and that only the bottom 16 feet of the trench would contain waste. Trenches shallower than those analyzed in the PA could impact PA results in two ways.

The shallow trench segments will impact the groundwater pathway by increasing the distance between the bottom of the waste layer and the top of the water table by 5 feet. This greater distance will increase the travel time for radionuclides in the waste, and thus the time for radioactive decay. If all other factors remain the same, the shallower trenches will result in lower concentrations and doses at the compliance well 100 meters from the edge of the waste.

The second relates to the concentration of waste allowed for disposal in the shallower trenches. In the PA, the results are interpreted to determine radionuclide inventories allowable for disposal in each disposal unit (i.e., the total curie quantity of each radionuclide that could be disposed in the unit without exceeding performance measures). The radionuclide inventory limits are then divided by the disposal unit volume to provide an assumed average radionuclide concentration for the unit. The average radionuclide concentrations are multiplied by 10 to provide for concentration averaging in establishing the WAC. If the radionuclide inventory were to be applied to the shallower trenches, the average radionuclide concentration would increase above that assumed in the PA. Thus, to ensure that the average radionuclide concentration assumed in the PA is maintained, waste accepted for the shallower trenches must meet the current slit trench WAC.

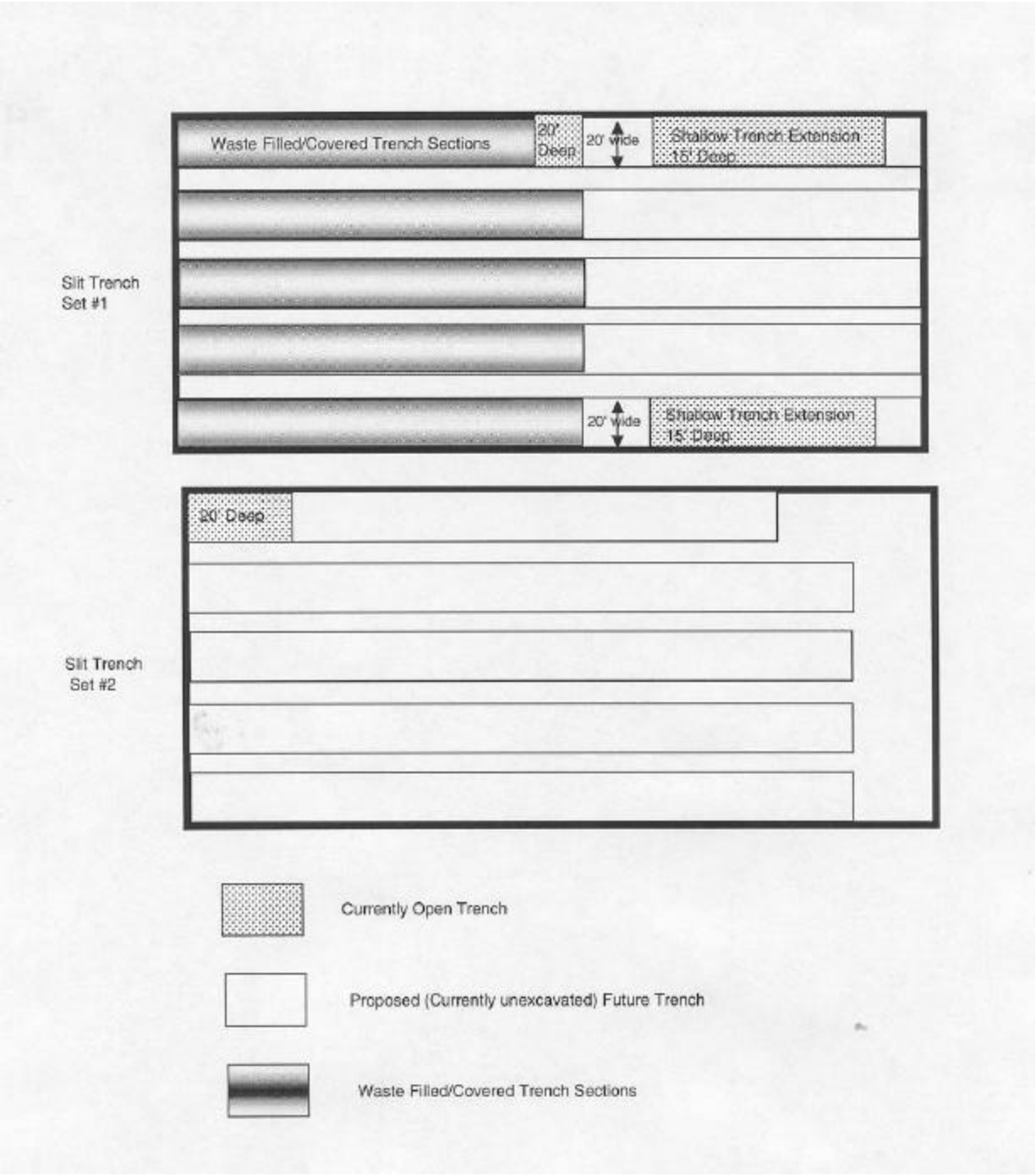

Figure 1. Slit Trench Configuration

The above analysis of the impacts of shallow trenches on PA results depends upon two assumptions. The first is that the slit trench Waste Acceptance Criteria are maintained. The second is that four feet of clean backfill is placed over the disposed waste, i.e. the waste thickness in a 15 foot deep trench cannot exceed 11 feet.

Evaluation

1. Does the proposed activity involve a change to the Performance Assessment or exceed PA performance measures/conclusions?

   No. The discovered change does not involve a change to the Performance Assessment. Per the evaluation above disposing of waste in trenches shallower than analyzed in the PA will not cause PA performance measures or conclusions to be exceeded provided the slit trench WAC are not exceeded and four feet of clean backfill is placed over the disposed waste.

2. Does the proposed activity involve a:

   a. change to the basic disposal concept as described in the PA?

      No. The basic disposal concept, trench disposal of LLW, was analyzed in the PA. The proposed activity is merely a change in one of the dimensions (i.e., depth) of the slit trenches.

   b. change to the analyses or radionuclide limits as described in the PA?

      No. The analyses and radionuclide limits developed in the PA and the WAC derived from them do not change.

   c. change in the disposal authorization that leads to a significant change in projected dose?

      No. The discovered change will not result in a significant change in projected dose as long as the disposed waste meets the slit trench Waste Acceptance Criteria and four feet of clean backfill is placed over the disposed waste.

   d. change in the results in the approved PA that is greater than 10%?

      No. The proposed activity is related to an in-field excavation and has no affect on the Performance Assessment results.

   e. change of greater than 10% in the dose calculated in the approved PA?

      No. As shown in the analysis above, the proposed activity will result in a somewhat lower dose than calculated in the PA. Because the disposal volume impacted by this change is small relative to the volume analyzed in the PA, the change in dose will be less than 10%.

f. Does the proposed activity modify the analysis or conclusions provided in the Composite Analysis?

No. The proposed activity would alter slightly the volume of waste modeled in the Composite Analysis. The change would be so small that neither the analysis nor the conclusions provided in the Composite Analysis would change.

g. change to the Disposal Authorization Statement?

No. The proposed activity is an operational variance and not a change to the Disposal Authorization Statement.

Conclusion

The trenches in the proposed set of slit trenches are shallower than those analyzed in the PA. This will tend to reduce impacts calculated in the PA, provided that waste disposed in the shallower trenches conforms to the current WAC and a minimum of four feet of soil is emplaced over the disposed waste.

References

1. *Radioactive Waste Management*, Order 435.1, U. S. Department of Energy, July 9, 1999.

2. Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses, U.S. Department of Energy, November 10, 1999.

3. *Radiological Performance Assessment for the E-Area Vaults Disposal Facility.* WSRC-RP-94-218, Rev. 1. Savannah River Laboratory, Westinghouse Savannah River Company, Aiken, SC., January 31, 2000.

4. *Westinghouse Savannah River Company Composite Analysis E-Area Vaults and Saltstone Disposal Facilities*, WSRC-RP-97-311, Rev. 0, September 1997.

5. *Disposal Authorization Statement for the Department of Energy Savannah River Site E-Area Vaults and Saltstone Disposal Facilities*, 9/28/99

6. WSRC 1S Savannah River Site Waste Acceptance Criteria Manual, Procedure WAC 3.17 Low Level Radioactive Waste Acceptance Criteria, Rev. 6, August 1, 2001.

7. Safety Analysis Report Savannah River Site Solid Waste Management Facility (U), WSRC-SA-22, Rev.2, September 1999.

8. Unreviewed Safety Question Process, USQ Screening – Part A3, USQ-SWE-2002-0067, Shawn R. Reed, 5/23/2002.

UNREVIEWED SAFETY QUESTION PROCESS
USQ SCREENING - PART A

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Title: E-Area Slit Trenches - Insufficient Slit Trench Depth

Description of Proposed Activity* (or Discovery):

The E-Area Slit Trenches are for disposal of bulky low-level waste that have limited isotopic quantities. There are two sets of five slit trench (one in LAWV #14 and one LAWV #10 footprints). It was recently discovered that two slit trench extension sections in the LAWV #14 footprint have been excavated to a significantly shallower depth than the 20' depth described in Section 2.4.14 of the E-Area SAR (WSRC-SA-22, Rev. 2 - ref. 1).

*Include intermediate configurations which might result from the proposed activity.

UNREVIEWED SAFETY QUESTION PROCESS
USQ SCREENING - PART A

USQ-SWE- 2002 - 0067 Status:

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SCREENING ORIGINATOR

1 **Does the Proposed Activity involve a change to the TSRs/OSRs?** ☒ NO ☐ YES

Provide Justification for YES or NO answers.

The directly applicable TSRs regarding the E-Area Slit Trenches are to maintain the radionuclide inventory below Hazard Category 2 thresholds and a drainage system in the area (TSR Section 5.5.2.6 paragraphs 1b and 16). These items are not effected by this discoveries. The radionuclide inventory of the facility has been maintained to the most restrictive condition specified in the SWMF SAR (e.g., all five slit trenches in the entire Slit Trench footprint maintained as a Hazard Category 3 facility).

If YES, prior DOE approval through the TSR/OSR change process is required, no further USQ screening or evaluation is required, GO TO Block 3 and 4 and complete. If NO, continue with screening.

UNREVIEWED SAFETY QUESTION PROCESS
USQ SCREENING - PART A

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2 Does the Proposed Activity involve:

A.	A change to the facility as described in the Documented Safety Analysis?	☐ NO ☒ YES
B.	A change to procedures as described in the Documented Safety Analysis?	☒ NO ☐ YES
C.	A test or experiment not described in the Documented Safety Analysis?	☒ NO ☐ YES
D.	Analytical errors, omissions or deficiencies in the Documented Safety Analysis?	☒ NO ☐ YES

NOTE: Justification is required when all section 2 questions (2A,2B,2C and 2D) are answered NO.

Question A - The description is section 2.4.14 describes the slit trench depth as approximately 20'. The actual depths for the two extension trench sections are nominally 15'. Therefore, this is not consistent with the description in the SAR (ref. 1).

Question B - There are no procedural requirements specified in the AB regarding slit trenches. This discovery USQ does not involve a change to procedures as described in the AB.

Question C - This discovery USQ does not involve a test or experiment.

Question D - No analytical errors, omissions or deficiencies in documented safety analysis are involved.

UNREVIEWED SAFETY QUESTION PROCESS
USQ SCREENING - PART A

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LIST REFERENCES DOCUMENTS USED IN COMPLETION OF THE USQ SCREENING.
ALSO FOR USQ EVAULATIONS LIST REFERENCES DOCUMENTS AS REQUIRED.

1. "Safety Analysis Report Savannah River Site Solid Waste Management Facility (U)", WSRC-SA-22, Rev. 2, September 1999.
2. "Radiological Performance Assessment for the E-Area Vaults Disposal Facility", WSRC-RP-94-218, Rev 1, January 31, 2000.
3. "Technical Safety Requirements Savannah River Site - Solid Waste Management Facility (U)", WSRC-TS-95-16, Rev. 2, September 1999.
4. Hazards Assessment Document, DOE-STD-1027-92 Review E-Area Vault Slit Trenches. S-HAD-E-00018, Rev. 0, Westinghouse Savannah River Company, Aiken, SC, June 1995.
5. "Establishing a Second Set of Five E-Area Slit Trenches into the Authorization Basis", USQ-SWE-2001-0033.
6. "Discovery of Operational Anomalies in Slit Trench Disposal Operations", WSRC-RP-2001-00946, October 15, 2001.
7. "Source Term for the Assessment of Maximum Consequence for a Hazard Category 3 Facility", S-CLC-G-00038, Rev. 0

UNREVIEWED SAFETY QUESTION PROCESS
USQ SCREENING - PART A

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SCREENING ORIGINATOR

3 A. Is a USQ Evaluation required? (If "YES", submit to EO for USQE) ☐ NO ☒ YES

B. If a USQE is not required, does the PA require a change to the SB in accordance with 11Q? ☐ NO ☐ YES ☒ N/A
(If yes, forward a copy of USQS to Regulatory Programs)
(If a USQE is required, the NA box should be checked)

C. Does this PA eliminate or modify an DSA identified Non-SC/SS Defense-in-Depth controls? (If yes, forward a copy of the USQS to Regulatory Programs for transmittal to DOE) ☒ NO ☐ YES

Comments:

A USQE is necessary. Regarding the CATX UDQ criteria, this discovery (shallow trench bottom) exceeds the plus or minus 10% construction tolerance described in UDQ criteria #7 (Section 2). Therefore, A UDQ Evaluation must be completed.

Signature	Shawn Reed	724-9E	5/29/2002
	Print Name	Location	Date

SCREENING REVIEWER

4 Is a USQ Evaluation required? (If "YES", and a USQ Evaluation has not been completed, return to the EO) ☐ NO ☒ YES

Comments:

Returned to SO for: ☒ Initiation of Evaluation Process ☐ Implementation of PA ☐ Preparation of TSR/OSR Change

Signature	Joe Copeland	724-9E	5/28/02
	Print Name	Location	Date

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

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5 A SAFETY EVALUATION ORIGINATOR

Could the Proposed Activity increase the frequency of occurrence of an accident previously evaluated in the facility Documented Safety Analysis? ☒ NO ☐ YES

Justification and References:

Section 3.4.15 of the SWMF SAR documents the maximum consequence event for the E-Area Slit Trenches within 643-26E. This postulated event assumes the entire inventory of a single segment (e.g., set of trenches) is released in a fire. The depth of the trench is not relevant in this event as the trench is assumed open and the inventory available for release. Therefore, the PA (depth of trench) does not increase the frequency of the bounding event .

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

USQ-SWE- 2002 - 0067 AREA SWMF

5 B

Could the Proposed Activity increase the consequences for an accident previously evalusted in the facility Documented Safety Analysis? ☒ NO ☐ YES

Justification and References:

Section 3.4.15 of the SWMF SAR (Ref. 1) documents the maximum consequence event for the E-Area Slit Trenches within 643-26E. This postulated event assumes the entire inventory of a single segment (e.g., set of trenches) is released in a fire. The depth of the trench is not a factor in the amount of MAR that can be impacted by the bounding consequence event as the inventory in an entire set of trenches is released. Further, the depth of the trench does not result in a more energetic event or otherwise change the MAR in a manner that could increase the consequences of this event. Therefore, the PA (depth of trench) does not increase the consequences of the bounding event .

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

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5 C

Could the Proposed Activity increase the frequency of occurrence of a malfunction of equipment important to safety previously evaluated in the facility Documented Safety Analysis?

☒ NO ☐ YES

Justification and References:

There is no important to safety equipment associated with the slit trenches.

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

USQ-SWE- 2002 - 0067 AREA SWMF

5 D

Could the Proposed Activity increase the consequences of a malfunction of equipment important to safety previously evaluated in the facility Documented Safety Analysis? ☒ NO ☐ YES

Justification and References:

There is no important to safety equipment associated with the slit trenches.

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

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5 E

Could the Proposed Activity create the possibility for an accident of a different type than previously evaluated in the facility Documented Safety Analysis? ☒ NO ☐ YES

Justification and References:

The hazard evaluation tables in Appendix C of the SWMF SAR (Table C-15) (Ref. 1) for the Slit Trenches were reviewed. The depth of the trenches is not a factor in any accidents evaluated or excluded. The only soil factor that has any safety importance for a set of trenches is the soil cover over the trench. Therefore, it can be concluded that depth of the trench will not create the possibility for an accident of a different type than previously evaluated in the SWMF SAR.

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

USQ-SWE- 2002 - 0067 AREA SWMF

5 F

Could the Proposed Activity create the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the facility Documented Safety Analysis?

☒ NO ☐ YES

Justification and References:

There is no important to safety equipment associated with the slit trenches.

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B

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5 G
Could the Proposed Activity decrease the Margin of Safety as defined in the basis for any Technical Safety Requirements or other technical analyses that define the safety limits in the Documented Safety Analysis (e.g. TSR/OSRs, JCOs)? ☒ NO ☐ YES

Justification and References:

The SWMF TSRs are administrative. No margins of safety are defined. Therefore, the PA cannot impact a margin of safety.

USQ EVALUATION ORIGINATOR

6 **Is a USQ involved?** ☒ NO ☐ YES

Signature	Joe Copeland /Print Name	Date	Location	Department	Phone No.
		5/28/02	724-36E	WSMS	2-2579

QUALIFIED REVIEWER

7 **Is a USQ involved?** ☒ NO ☐ YES

Comments:

Return to EO for: ☒ Presentation to FOSC ☐ For Resolution of Comments

Signature	Don Sink /Print Name	Date	Location	Department	Phone No.
		5/29/02	724-5E	SWE	2-4896

UNREVIEWED SAFETY QUESTION PROCESS
USQ EVALUATION - PART B (continued)

USQ-SWE- 2002 - 0067 AREA SWMF

8 **FOSC CHAIRPERSON***

Is a USQ involved? (If NO, return to EO for implementation of PA) ☒ NO ☐ YES

Does the PA require a change to the SB in accordance with 11Q? (If YES, Forward a copy of USQE to Regulatory Programs) ☐ NO ☒ YES

Is the USQE for the approval of a Categorical Exclusion? (If YES, Forward a copy of USQE to Regulatory Programs) ☒ NO ☐ YES

Comments:

If an Unreviewed Safety Question is involved indicate the required follow-up action by checking one of the following and return to EO.:

☐ Cancel PA ☐ Modify PA to attempt to eliminate USQ ☐ Initiate request for DOE approval of the PA

Or

If an Unreviewed Safety Question is not involved, sign below and forward to USQ Coordinator.

Signature	Print Name	Date	Location	Department	Phone No.
[signature]	M.E. Gater	5/29/02	724-7E	SWD	8-4820

*FOSC signature is only required for a USQ Safety Evaluation.

8 FOSC Approval Date