**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

MAR 2 4 2005

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) Safety Evaluation Report (SER) Approving the Justification for Continued Operations (JCO) for Handling and Processing of Flammable Drums on SWMF Transuranic Waste Pads

REFERENCES: (1) Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00017, 03/18/05
(2) Letter, Spencer to Hansen, "Hydrogen Flammable Drum Processing TRU Waste Pads Justification for Continued Operations," OBU-SWI-2005-00024, 3/24/2005

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of the JCO WSRC-TR-2004-00618, Revision 3.B transmitted in Reference 1. Based on the review, DOE-SR approves the submitted JCO as a safety basis document. The enclosed SER documents the results of the DOE-SR evaluation and provides the basis for approval. The enclosed SER (Appendix 14) supersedes SER Appendix 11 approved January 31, 2005, which addressed JCO Revision 2.

It is expected that the JCO will be added to the SWMF Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 30 days. Per the SWMF Authorization Agreement, WSRC-RP-2002-00557, the approval of this document does not warrant a revision to this agreement.

The items in this letter have been discussed with Keith Stone of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following

submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Jeffrey M. Allison
Manager

WDED-05-035

Enclosure:
SWMF SER, Rev. 0, Appendix 14

cc w/ Enclosure:
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**SAFETY EVALUATION REPORT**
**REVISION 0, APPENDIX 14**

**FOR THE**
**SAVANNAH RIVER SITE**

**SOLID WASTE MANAGEMENT FACILITY (SWMF)**
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER**
**CONTRACT NO. DE-AC09-96SR18500**

# JUSTIFICATION FOR CONTINUED OPERATION (JCO) FOR HANDLING AND PROCESSING OF FLAMMABLE DRUMS ON SWMF TRU PADS WSRC-TR-2004-00618, REVISION 3

March 2005

Prepared by: _____
T. Tran

Reviewed by: _____
J. Ridley

Approved by: _____
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

Enclosure: Letter, Allison to Pedde, subject: SWMF SER Approving the JCO for Handling and Processing of Flammable Drums on SWMF Transuranic Waste Pads, dated

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 14**

## 1.0 Introduction

By letter OBU-SWI-2005-00006, dated February 15, 2005 (Reference 1), WSRC requested DOE-SR approval of JCO WSRC-TR-2004-00618, Revision 3 (Reference 2), to allow handling and movement of TRU waste drums on TRU pads. DOE requested additional information and clarification (Reference 17) to support the conclusion of the JCO. WSRC submitted a revised version of the JCO Rev. 3B that incorporated and/or resolved the DOE request via Reference 30. WSRC submitted page changes (Reference 29) to address additional DOE comments. This JCO is needed to provide an approved basis for lifting the compensatory measures of Potential Inadequacy of Safety Analysis (PISA) PI-04-0011 (Reference 3). Due to Volatile Organic Compound (VOC) deflagration concern, the PISA PI-04-0011 restricts movement of vented drums unless the drum has a valid headspace gas result indicating the TRU drum is not flammable. This restriction also includes movement of vented drums to Pad 4 where the operation of WIPP Mobile Characterization Units (MCU) are located. Only drums (compliant) that comply with WIPP Waste Acceptance Criteria (WAC) and those that meet the inspection procedure of the MCU would be allowed to be shipped to WIPP. This JCO provides SRS inspection criteria similar to the WIPP criteria which allows only vented and compliant drums to be moved to Pad 4 by remote-handling means, for the purpose of MCU characterization to be shipped to WIPP. Suspect drums (non-compliant) are moved between Pad 4 and Pad 6 under special safety procedures, which require personnel protective equipment including respirators and the use of a transport-box ("engineered-box"). Unvented drums are non-compliant and not allowed to be moved to Pad 4. This JCO incorporates the processing of Unvented drums which are covered under restrictions of the existing Authorization Agreement (AA) associated with the JCO Rev. 2 (Reference 8). The AA does not allow the use of Pad 6 Drum Venting System (DVS) with bulging drums due to unvented conditions.

This SER appendix documents the basis for approval of the submitted JCO (WSRC-TR-2004-00618, Revision 3) and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Background

The Solid Waste TRU pads Technical Safety Requirements (TSR) require that there are no flammable drums and that the risk of encountering and working with a flammable drum is low. The composite LFL compares the sum of fractions of individual VOC chemical specie against the LFL of the individual specie (i.e. specific concentration divided by LFL of the chemical specie). If the sum of fractions is greater than 1, then this is an indication of flammability. In August 2004, two drums were found on Pad 4 (SR235165 on 08/05/04 and FBL03143) while undergoing MCU inspection that showed a sum-of-fraction greater than 1. Specifically, isopropyl-alcohol was detected with concentration of 22,000 ppm which is greater than the LFL of 20,000 ppm for isopropyl-alcohol. This resulted in a sum-of-fraction of 1.12 (greater than 1).

Note, 22,000 ppm is also greater than TSR Rev. 4 limit of 10,000 ppm total VOC. A TSR violation was declared and a TSR response plan WSRC-TR-2004-00414, Rev. 1 (Reference 4) was developed and approved, with allowable actions to bring the facility into TSR compliance. The response plan directed the vented VOC flammable drum to Vent and Purge for complete VOC removal. The DOE SER (SER Appendix 8) for this response plan noted that per TSR requirements, drums stored on TRU pads shall not generate VOC concentrations exceeding LFL, and that adequate vent installation must be maintained to prevent build-up of flammable gases. However, for VOC of high density (heavier than air), installation of vent(s) would not prevent build-up. As such, the conditions for these two drums were outside of TSR specifications for operation. JCO Rev. 3 addresses processing vented drums on Pad 4.

On October 2004, a JCO WSRC-TR-2004-00513 (Reference 5) was submitted to DOE for approval to allow exiting the Response Plan as well as deleting the existing VOC flammability TSR requirement of purging total VOC concentration to less than 10,000 ppm. TSR Administration Control (AC) 5.5.2.6.3m stipulates that a drum undergoing Vent and Purge must achieve a VOC concentration of less than 10,000 ppm to be below LFL, before exiting. The JCO noted that: "based on the current rate of identifying potentially flammable VOC drums, it is quite possible that 160-drum [VOC flammable] limit will be exceeded." The 160-drum estimate of VOC flammable drums was derived based on the estimated frequency of risk reported in the response plan (implied response plan limit), in providing justification of risk associated VOC flammable drum activities (Reference 5). These issues are directly applicable to JCO Rev. 3 and addressed in this SER: (a) *Pressure Retaining Capability of TRU Drum (*non-conservative use of assumed 50 % radiative-heat loss in pressure calculation based on unrealistic formulation. Inadequate justification of the use of 90 psig Figure of Merit for lid-failure pressure comparing to 35-50 psig lid failure pressure used in earlier DSA and USQ calculations), (b) *Functional Classification of TRU Drum* (the calculation postulates the lid would fail first during the deflagration accident; however, no Safety Significant inspection was addressed to ensure the integrity of the drum), (c) *TRU Drum Inventory Limit* (the vents provide release paths affecting both pressure and mass release of potential airborne radiation contamination to facility workers). These issues are addressed as a part of this SER evaluation in Section 5.

On December 2, 2004, a legacy drum was found to exhibit "VOC bounce-back." The drum was processed through Vent and Purge on May 2, 2004 to remove VOCs. On December 2, 2004, the drum was reintroduced into the MCU for characterization to be shipped to WIPP and shown to have re-established VOC flammability (i.e. sum of fraction greater than 1). The earlier response plan directed VOC flammable drums to Vent and Purge (V&P) for complete VOC removal (Reference 4). With an extensive 6 months waiting time between V&P and the re-establishment of VOC flammability bounce-back, the method of complete VOC removal via V&P was deemed ineffective and a PISA (Reference 7) was declared. The PISA imposes compensatory measures to prohibit movement of TRU drums that do not have a valid headspace gas measurement indicating that the drum is not flammable (i.e. sum of fraction less than 1 or total VOC less than 10,000 ppm).

With the approval and implementation of JCO Rev. 2 (Reference 8) in January 2005 for unvented hydrogen-flammable drums, the response plan for vented VOC-flammable drum was canceled and deleted from the Authorization Agreement. DOE determined that the safety

controls of JCO Rev. 2 for unvented hydrogen-flammable drums were deemed applicable and bounding for vented VOC-flammable drums. JCO Rev. 2 credits compensatory measures of Reference 7 to prohibit vented VOC-flammable drums from being sent to Pad 4. However, JCO Rev. 2 does allow necessary movement of VOC-flammable drums on other Pads (other than Pad 4) for the purpose of installing vents on unvented hydrogen-flammable drums. JCO Rev. 3 maintains these controls for unvented drums; however, JCO Rev. 3 allows vented drums that meet the JCO requirements to be moved to Pad 4 for MCU characterization.

In February, 2005, a review of the results from the Gas Chromatography (GC) of the Vent and Purge machine on Pad 6 showed inaccuracies of the total VOC results. The methodology used does not account for an anomaly in the results due to baseline effects of the carrier-gas (e.g. nitrogen). The Kelly letter of 12/21/2004 (Reference 6) describes the working of the Pad 6 GC. Until the methodology review for the GC is completed, a new PISA (Reference 7) was declared with compensatory measures to treat all vented drums that have been processed through V&P and have *not been purged* as suspected VOC flammable drums. Under JCO Rev. 2 (Reference 8), all vented drums that have been processed through V&P and have *been purged* are treated as suspected VOC-flammable drums because of potential "VOC bounce-back". As such, all vented drums that have been processed through V&P are suspected VOC-flammable drums either because of VOC bounce-back or GC inaccuracy.

Furthermore, because generator-installed vented drums do not have a headspace gas measurement, these are deemed suspected VOC-flammable drums. Note, the FBL03143 drum of the two drums involved in the TSR violation of August 2004 was a generator-installed vented 2003 drum. SWMF/SRS Waste Acceptance Criteria (WAC) enforcement actions are being addressed as a part of the root cause analysis listed in Reference 1, to ensure programmatic performance of the SWMF WAC program in protecting inputs and assumptions of the SWMF DSA/TSR.

JCO Rev. 3 (Reference 2) is submitted for DOE approval to justify the risk of processing potentially/suspected VOC-flammable vented drums through MCU to be shipped to WIPP. The JCO states: "Vented drums are considered to be compliant drums until they are discovered to present a hazard either through inadequate venting, weaken structural integrity, a high assigned PEC inventory, or a measured/calculated flammability," and "if a suspect or unvented drum is found on TRU Pad 4 it will be moved to another pad." As such, under JCO Rev. 3, drums of less than 130 Plutonium Equivalent Curie (PEC) Pu-239 are inspected to confirm compliant status. Compliant drums are allowed to be processed through the MCU. If a compliant drum fails the MCU sum-of-fraction (calculated flammability), the drum status would change to suspect and the drum is to be moved to another pad for holding. This SER provides the safety evaluation of the JCO justification of risk and the associated compensatory measures.

None of the authorized activities under the JCO (e.g., moving drums with forklifts, transporting drums from one TRU pad to another, loading drums into the DVS, etc.) is different than the types of activities described in the SWMF DSA (WSRC-SA-22), nor do these activities change the function and purpose of the SWMF. Since SWMF DSA/TSR incorporated the MCU operation via a USQ process, the MCU operation consequence is bounded by SWMF TRU pad

DSA and JCO. MCU operation, postulated accidents, and associated safety controls are listed in the Basis for Interim Operation (BIO) for the WIPP Mobile Characterization Unit (Reference 9).

JCO Rev. 3 is intended to be used as a stand-alone document for which a DSA/TSR consistency review has been completed (Reference 10 and 11); therefore, no revision to the TSRs is needed.

**3.0 Review Process**

This SER appendix is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1B, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

The review of this JCO Rev. 3 is built upon inputs and assumptions from the previous DOE SER Appendix 12 for the JCO Rev. 2, which received a wider review with input from Hanford and INEEL reviews. In addition, this SER for JCO Rev. 3 includes inputs from the following contributing reviewers:

- Mr. S. Goff, Senior Facility Representative SWMF
- Dr. T. Hunt, LANL Senior Flammability Expert
- Mr. D. Blake, WDED Safety Engineer
- Mr. G. Christenbury, AMMFS Criticality Engineer
- Ms. A. Haire, WDED Chemistry Expert (GC and GC/MS analysis)
- Dr. B. Gutierrez, NPH Manager

The DOE review documented in this SER ensured that the DOE issues and/or questions from Reference 18 have been adequately resolved.

**4.0 Review Criteria**

- Valid/acceptable reason for the continued practice of processing and storage of TRU drums that have the potential of being flammable (i.e., the need for JCO) and the duration of use
- The risk for continued operation is adequately identified and justified
- Appropriate compensatory measures for safety controls are analyzed, evaluated, and implementable to protect the workers and the public

**5.0 Evaluation**

5.1 Valid/acceptable reason for the continued practice of processing and storage of potential flammable drums (i.e., the need for JCO) and the duration of use

Under JCO Rev. 2, 295 unvented-hydrogen-flammable drums are identified as needing vent installation. Vent installation is currently processed through Pad 6 Drum Venting System

(DVS). The JCO Rev. 3 identifies an increased likelihood for more unvented drums to exist on TRU Waste Pads. JCO Rev. 3 identifies the frequency of unvented hydrogen flammable drums as Anticipated. As such, JCO Rev. 3 is needed to establish consistent safety controls for encountering unvented drums as routine and the JCO is no longer limited to 295 unvented drums.

JCO Rev. 3 also identifies the increased likelihood of encountering vented VOC-flammable drums. Reference 12 states: "given a 95% level of statistical confidence, the probability that any remaining drum not having been through headspace gas analysis will fail headspace gas analysis ranges from 0.38% to 3.29%." Since SWMF processes about 10,000 drums per year, the expectation of encountering VOC flammable drums is 40 - 300 drums per year. As such, JCO Rev. 3 is also needed to establish consistent safety controls for encountering vented drums that are suspected VOC-flammable drums.

The JCO recognizes the need to process vented TRU drums through the MCU characterization process to accurately identify the VOC-flammable hazard via Head Space Gas Analysis (HSGA), so that appropriate actions can be taken to address the hazard adequately. Furthermore, this would allow drums that meet the MCU inspections (radiography, radio-assay, and Head Space Gas Analysis) to ship to WIPP thus reducing the Material-At-Risk inventory at SRS. The JCO states: "shipping of WIPP characterized drums reduces facility risk, by reducing the radiological inventory stored on TRU waste pads and freeing up TRU waste pad space to provide buffer for drums that could be potentially flammable."

DOE review of the need for routine safety controls in encountering flammable drums (unvented-hydrogen and vented-VOC) concludes that there is an adequate reason for the JCO (submitted to DOE for evaluation), and its inclusion as a part of SWMF safety basis for processing and storage of TRU drums that have the potential of being flammable.

5.2 The risk for continued operation is adequately identified and justified

Since JCO Rev. 3 provides needed safety controls to address routine encountering of potential flammable drums (unvented hydrogen-flammable drums and vented VOC-flammable drums), three safety categories of TRU drums and the associated safety controls are being established in JCO Rev. 3: Unvented drum (hydrogen flammable), Suspect drum, and Compliant drum. Here after, these are referred as UV (Unvented Drum), SD (Suspect Drum), and CD (Compliant Drum).

The risk associated with the frequency of encountering flammable drums are described in two statistical analyses: one for hydrogen (Reference 13) and one for VOC (Reference 12). For hydrogen risk, Reference 13 shows a probability of encountering unvented hydrogen-flammable drums to be 8.8%. Since SWMF processes about 10,000 drums per year, the frequency of encountering a flammable UV drum is about 900 drums per year. As such, frequency classification of UV drums as Anticipated is appropriate and adequate. For VOC risk, Reference 12 shows the probability of encountering a vented VOC-flammable drum as follow:

| Vented drums | Probability (%) | Comment |
|---|---|---|
| General | 0.38 – 3.29 | Entire population |
| Generators installed vent | 0.25 – 2.81 | Newly generated or non-legacy drums |
| V&P | 0.93 – 13.3 | Completed Vent and Purge |
| V&P (non-remediated) | 0.99 – 10.9 | Completed Vent and Purge but no remediation |
| Remediated | 0.56 – 6.70 | Remediation (drums are opened and sorted) |

The expectation of encountering an SD drum is 40 – 300 drums per year. Frequency classification of purged SD drums and remediated SD drums as Anticipated is appropriate and adequate.

JCO Rev. 3 identifies the bounding consequence of 450 PEC per drum and 520 PEC per pallet associated with UV and SD drums. These consequences are consistent with the authorized TRU Pad DSA and the DOE approved JCO Rev. 2 (Reference 8). Therefore, controls based on 450 PEC and 520 PEC are appropriate and adequate.

JCO Rev. 3 identifies the bounding consequence of 130 PEC per drum and 520 PEC per pallet for CD drums. These consequences are consistent with the authorized TRU Pad DSA for collocated and facility workers. Section 4.2 of the JCO defines possible risks to collocated and facility workers as a result of handling a flammable TRU drum or processing it through the characterization process. Although the likelihood/probability of a VOC deflagration is unlikely, the Consolidated Hazard Analysis (CHA) for vented VOC-flammable drums (Reference 14) correctly concluded that the hazard could result in serious worker injury or significant radiological exposure (vented drums of airborne concern). Revision 2 of this JCO credited protective equipment (e.g., respirators) and over-packing if the drum does not pass drum integrity inspection (failure of the drum itself, not the lid, and the dispersal associated with this failure), for protecting workers when drum deflagration could result in lid ejection and dispersal of radioactive material.

This JCO Rev. 3 establishes the TRU drum container as the primary barrier to protect workers and references technical bases that demonstrate the Safety Significant Component (drums) can withstand a VOC deflagration (after passing the drum integrity inspection). These bases include a calculation for internal drum pressures following a VOC deflagration (Reference 16) and a drum assessment (Reference 15) to determine the need to back-fit drums in use at the facility. Further, inspection criteria were defined to ensure the drum's physical condition is maintained with those technical bases. The CHA indicated that, even with crediting the drum as primary barrier, a VOC deflagration would cause some combustion gasses/aerosolized radioactive material to be released through the drum vent and around the circumference of the drum lid.

This mitigated release (i.e., material release through the drum vent and around the lid) was qualitatively evaluated by WSRC and judged to represent a hazard for significant radiological exposure to workers approximate to the drum deflagration. Therefore, additional controls were defined for workers handling or characterizing credited compliant drums. DOE performed an informal estimate of the dose potential for VOC deflagration in a credited compliant drum.

Assuming 15 percent of the VOC combustion gases are released from handling a single 130 PEC source term compliant drum, inhalation doses could be as high as 300 Rem TEDE per minute. DOE's estimate was based upon an ARF/RF of 1E-03 (dose conversion factors from ICRP 68/72) and initial expansion of the released material into a 20 foot cube. WSRC's judgment regarding the need for additional compliant drum controls was consistent with DOE's estimate of the inhalation dose potential.

Either facility egress or the use of respirators (PPE) was considered by WSRC as an additional compliant drum control. To justify a conclusion that only a small fraction of the drum inventory would be available to be entrained during deflagration, the JCO references studies and reports that demonstrate limited charring of packaged waste (bagged) inside the drum would be expected to minimize burning/entrainment of the packaged waste matrix. Qualitatively, this assumption would further limit the aerosolized release from a compliant drum deflagration. WSRC used that understanding to conclude release from a VOC deflagration involving bagged TRU waste would be significantly less than the release involving unbagged TRU waste. Given that aerosolized material from bagged TRU waste would be even further limited, WSRC selected facility egress as a specific administrative control in the event of a compliant drum VOC deflagration. The JCO requires facility egress to be performed when deflagration precursors occur (e.g., dropping a pallet of drums). DOE reviewed the referenced studies and concluded they provide an adequate basis to assume limited release would be expected from a VOC deflagration involving bagged material. Therefore it is reasonable to conclude significant exposure would not result during egress in the event of a VOC deflagration. DOE finds it acceptable to use egress as a control to further mitigate worker consequences following VOC deflagration in a compliant drum.

Associated with the need for PPE, during review of the JCO, DOE noted that use of an overpack when drums fail drum-integrity inspection was no longer invoked as a compensatory measure (unvented or vented drums). The hazard analyses (CHAs) does not credit placement of unvented weakened drums in overpacks as a worker protection control. Other controls, such as standoff areas, respirators, and remote handling, were specifically credited for assuring worker protection. Discussions were held with the facility to determine the basis for the decision to discontinue JCO use of the compensatory measure. The facility indicated the decision was based upon a qualitative determination that the additional handling to load/unload a weakened unvented drum into/out of an overpack unnecessarily added to worker risk. Since the lower ignition energies associated with hydrogen hazards make unvented drum deflagrations easier to initiate, the facility concluded less risk would be incurred if unvented drum handling was minimized. Therefore, unvented drums with weakened structural integrity are transported directly to the DVS using controls identified from the hazard analysis. WSRC concluded discontinued use of the practice to require overpacking all weakened unvented drums was prudent and reduced worker risk. Similarly, drum breach inspection on a pallet (vs. individual drum inspection on the floor, involving breaking the pallet drum-band) is also prudent. DOE agrees with the conclusion.

JCO Rev. 3 identifies the bounding consequence of storage of 650 drums (or 84,500 PEC) on Pad 4 with 3900 PEC associated with the Thermal Conditioning Unit processing (TCU, where the temperature of the drums is elevated as a part of the MCU characterization process). These consequences are consistent with the authorized and current DOE approved TRU Pad DSA/TSR for a limit of 3900 PEC per Temporary Storage Area (TSA) on a Pad. TSAs are designated

storage areas of high activity drums for radiological hot-spot management consideration, outside of culverts (greater than 130 PEC).

JCO Rev. 3 identifies the bounding consequence of 9 drums (or 1170 PEC) involving forklift transport mishap associated with removal of drums from co-located storage arrays (containing UV and SD drums). The scenario conservatively involves one pallet from the top third-tier, one pallet on the forklift, one pallet from the top second-tier being jarred, and one pallet from the bottom-tier being jarred (only one drum from the bottom two tiers being jarred is counted in the 9 drums involved). A deflagration probability of 1E-3 is used for the second and bottom tier. This consequence is bounded by a TSA of 3900 PEC on a Pad, and is appropriate and adequate.

Note, the review of the SRS consequence methodology, which is used in providing the results listed above, identifies the discrepancies between Hanford, SRS, and the WIPP MCU BIO (LLNL methodology). These discrepancies have yet to be reconciled. However, DOE agrees that for the purpose of this JCO, the results are acceptable and adequate based on the application of these results in establishing compensatory measures.

In addition, DOE has evaluated the criticality risk associated with the use of nuclear-investigation techniques for TRU content characterization by the MCU processes (x-ray, gamma, and neutron investigation) to determine the adequacy of the JCO Rev. 3 to justify operations associated criticality risk. The evaluation is listed below.

Criticality Safety (detail evaluation documented in SIMTAS database, #202924 and #202923):

For the JCO Rev. 3 being evaluated here, the proposed activity pertinent to potential criticality safety concerns is the resumption of TRU waste drum characterization activities on TRU Waste Pad 4 and the associated movement of drums to support this. The Contractor has evaluated these activities to conclude that there is no credible criticality hazard (documented in the following calculations):

- N-NCS-E-00029, "Nuclear Criticality Safety Evaluation (NCSE): IQ3 Unit and Sealand Container on Pad 4 and SWMF Transport Box," Revision 0;
- WSRC-TR-2005-00119, "Nuclear Criticality Safety Assessment (NCSA): NDA Equipment on SWMF Pad 4", Revision 1

The JCO authorizes activities for some categories of drums while excluding others. It excludes all activities associated with drums which have an assigned Fissile Gram Equivalent Pu-239 (FGE) of greater than 100 FGE and contain an indeterminate amount of beryllium as these are currently subject to compensatory measures defined in PISA: "Indeterminate Beryllium Content of Some TRU Waste Drums" (PISA: PI-04-0010, 11/18/2004). It excludes all activities associated with 124 drums that do not have sufficient identification to positively link them with generator records. For the 55 drums remaining to be characterized (from the set of 2,574 drums identified in 2004 where the assigned FGE was zero), it excludes introducing additional ones on Pad 4 or processing any of them in the IQ3 unit. These 55 drums are referred to as indeterminate drums. The JCO also authorizes vented drums (other than the indeterminate drums) processed through Pad 4, including the IQ3 Unit. The activities authorized in the JCO Rev. 3 are

appropriately consistent with the referenced criticality analyses. As discussed below, these analyses were also found to be technically acceptable.

The supporting analyses define the maximum credible FGE loading for the two categories of drums which may be processed under the JCO. For the 55 indeterminate drums, the criticality safety basis assumes the maximum credible FGE loading is bounded by 768 FGE. This loading was first justified in 2004 by N-NCS-E-00026, "Nuclear Criticality Safety Evaluation (NCSE): Handling and Storage of TRU Drums with Indeterminate Fissile Contents", Revision 0. This document was reviewed by DOE in 2004 and found to be technically acceptable (see SIMTAS #201441). This bounding number was defined by the facility based on historical results of assayed drums, waste acceptance criteria, and other relevant factors, while also factoring in some additional uncertainties based on the fact that the generator assigned FGE of zero seemed questionable. For the vented drums, the criticality safety basis assumes the maximum credible FGE loading is bounded by 500 FGE (Pad 4 TSR limit is 485 FGE). This loading was justified in N-NCS-E-00029. As stated above, this document was reviewed by DOE and found to be technically acceptable. This bounding number was defined by the facility also based on historical results of assayed drums, waste acceptance criteria, and other relevant factors, but recognizing that the generator as provided an assigned FGE for the drums. The DOE found that these bounding values were based on an appropriately rigorous process consistent with ANS requirements and seemed reasonable.

Drums with an indeterminate FGE loading were evaluated in N-NCS-E-00026 in 2004. In this analysis, single drums of up to 768 FGE were shown to be subcritical in the highly reflective environment of the SWMF 8E PAN Unit (SRS facility and equipment). Also, two drums of up to 768 FGE were shown to be safe adjacent to another drum loaded to the 195 FGE limit, fully reflected by water. Finally, this analysis shows several drums with up to 768 FGE (in various configurations) were safe in arrays of drums loaded to the 195 FGE limit. The NCSE demonstrates masses of up to 768 grams Pu-239 (when accompanied with 32 grams of Pu-240) as safe in these drums. Criticality is incredible because of the following reasons:

- More than 500 grams must be present in the drum. While this is possible (one such drum has been discovered), it is rare. In fact, it is unlikely that any drum will have greater than 300 grams based on historical evidence and waste acceptance criteria which has limited loading to less than 200 grams.
- The mass must come together in a single location. This is unlikely as the fissile material is randomly placed in the drum through a series of poly encased waste cuts or other similar means.
- The mass must come together as a sphere (versus a cylinder which is shown to be safe at the larger mass). This is in itself unlikely as there is no mechanism to drive this.
  Fourth, the mass would need to be nearly uniformly distributed. While no quantitative measurement is attempted, it is clear that sphere of small "clumps" of Pu would not be as reactive as a uniformly distributed sphere. This is in itself unlikely as there is no a mechanism to drive this.
- The Pu would need to be intimately mixed with the moderating material. Again, while no quantitative measurement is attempted, it is clear that small "clumps" of Pu surrounded

by poly/water would not be as reactive as Pu mixed with hydrogen at the atom level. This is in itself unlikely as there is no mechanism to drive this.

- The Pu – moderator mixture would need to be at near full density. This is very unlikely in these waste drums. Past evaluations have shown the polyethylene in the waste matrix can normally be expected to exist at 15% to 25% of full density. The introduction of free moving water into these drums in any significant quantities is also unlikely based on waste acceptance criteria and the control of the drums. In the absence of the full density mixture, the larger mass can be shown to be a safe sphere due to the increased neutron leakage from the system.
- The Pu-moderator mixture would need to be nearly significantly reflected by full density water (or equivalent). For many of the reasons discussed above, as well as the size constraints of the waste drum, criticality is unlikely (if not impossible). LA-12808, Nuclear Criticality Safety Guide, Figure 10 shows the increased mass would be subcritical as an optimally moderated sphere absent the reflector.

DOE concludes that this analysis is adequately conservative in determining criticality to be incredible.

The NCSA (based on NCSE N-NCS-E-00026) completed to support this JCO shows that the following Pad 4 instruments are bounded, from a reactivity standpoint, by the 8E Pan Unit: IPAN Unit, the Real Time Radiography Unit, and the Head Space Gas Sampling Unit. The 8E Pan instrument has a very efficient reflector constructed of graphite and polyethylene. The NCSA shows that given its materials of construction and cavity dimensions, the 8E PAN unit with a single drum would result in a more reactive system than the Pad 4 instruments mentioned above. Thus, it can be concluded that the 55 remaining indeterminate drums may be safely placed into these instruments. Likewise, the vented drums can be safely placed in these instruments since the maximum credible FGE loading they can have is less than the indeterminate drums.

The NCSA did not show that the IQ3 Unit is bounded by the 8E PAN Unit. Instead, new computer analysis documented in NCSE N-NCS-E-00029 was completed for this Pad 4 instrument. This analysis was done with FGE loadings of up to 500 FGE. While it can likely be shown that higher fissile loadings can safely be accommodated in the IQ3 Unit, this work has not yet been done. Accordingly, compensatory measures from existing PISAs (above) prohibits introducing indeterminate drums into the IQ3 Unit as they may conceivability contain greater than 500 FGE. This NCSE also evaluated the likelihood of a criticality occurring due to the inadvertent introduction of one of these drums into this instrument and concluded that it is not credible due to the number of failures that must occur. The JCO permits introduction of vented drums into the IQ3 since the bounding credible loading for these has been shown to be safe.

NCSE N-NCS-E-00029 also showed that the drums authorized to be handled in the JCO revision can be safely handled by the Transport Retaining Boxes (TRB, or "engineered box") and safely stored in the Thermal Conditioning Units (a.k.a., Sealand Containers). This NCSE relies upon analyses completed in N-NCS-E-00026. It shows that the credible arrangements of high FGE drums in these devices was bounded, from a reactivity standpoint, by systems analyzed in N-NCS-E-00026 and shown to be safe.

The SWMF has a waste acceptance criterion of no more than 195 FGE in a 55 gallon TRU waste drum. This criterion is consistent with the 200 FGE limit in WIPP MCU Basis for Interim Operation (BIO) and thus supports shipping these drums to WIPP. The MCU BIO concludes that as long as 55 gallon drums do not exceed 200 FGE (i.e. comply with the WIPP WAC), there is no credible criticality hazard for the operations evaluated within it, which includes activities being conducted on Waste Pad 4 within the SWMF. While most drums in the SWMF do not approach the WAC limit of 195 FGE Pu-239, TRU waste drums in excess of 195 FGE do exist. A limited number have been encountered and it would be unreasonable to assume no more will be discovered. Therefore, the conservative evaluation reflected in the MCU BIO will not provide an adequate technical safety basis for assaying facility drums in the MCU processes. JCO Rev. 3 establishes the technical basis for safely characterizing drums with higher FGE quantities than the MCU BIO.

ANS 8.19, "Administrative Practices for Nuclear Criticality Safety", requires that prior to initiating an operation, it shall be determined and documented that the entire process will be subcritical under both normal and credible abnormal conditions. As discussed above, DOE has reviewed the criticality safety basis embodied in the revision 3 of the JCO and concluded that this requirement has been met. The DOE considers that the Contractor's conclusion that these operations are safe is based on an acceptably rigorous evaluation, is reasonable and is adequately justified. DOE agrees that this analysis provides the technical basis for concluding that, for the operations authorized in this JCO revision, criticality is not credible during the Pad 4 operations for credible TRU drum loadings beyond 200 FGE. Accordingly, DOE is authorizing the introduction of drums at SRS with FGE loading in excess of the MCU BIO limits for operations described in the JCO.

DOE review concludes that the risks for continued operation are adequately identified and justified.

5.3 Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public

The JCO Rev. 3 identifies compensatory measures associated with UV, SD, and CD Drums. These measures are developed to provide necessary safety controls commensurate with the risk of encountering unvented hydrogen flammable drums and vented VOC flammable drums. A Consolidated Hazard Analysis (CHA) dated March 7, 2005 was performed to evaluate the potential field condition hazards associated with the activities of handling and processing drums. The CHA (Reference 14) addresses the following hazards: Fire, Explosion, Loss of Containment, Direct Radiological Exposure, Nuclear Criticality, External Hazards, Natural Phenomena, and Industrial Hazards. Note, Pad 4 is where the MCU inspection takes place for which a drum can be determined if it is a SD drum by means of calculation (i.e. sum-of-fraction) or valid measurement of total VOC from calibrated GC/MS instrument with adequate uncertainty analysis.

These hazards and the postulated scenarios are appropriate and adequate to define the field conditions associated with handling and processing flammable drums.

5.3.1 General Compensatory Measures

The JCO identifies the following general compensatory measures applicable to all drums (UV, SC, CD):

1. Drum inspections shall be performed in accordance with drum inspection criteria upon receipt of newly generated TRU waste and after drums are removed from a storage array. Drums shall not be transported to another location until the inspection is complete.

Technical basis: consistent with ISM principles, newly generated drums need to be inspected to properly identify drum hazards (UV, SD, CD) and to establish adequate safety controls commensurate with the hazards. This includes identification of required PPE as appropriate. Drum inspections upon receipt or after removal from an array for transport is appropriate and adequate.

2. After determining that a drum is an Unvented, Suspect or Compliant Drum and an associated compensatory measure is not met, then the actions of additional compensatory measures shall be complied with, commensurate with the hazards.

Technical basis: The JCO identifies the additional compensatory measures in the drum management strategy commensurate with drum hazard (UV, SD, or CD).

3. Drums with an assigned quantity greater than 450 PEC shall not be handled.

Technical basis: consistent with earlier JCO Rev. 2, the limit of 450 PEC per drum is needed to bound the consequence to collocated workers. This is appropriate and adequate.

4. Pallets with drums with a total assigned value greater than 520 PEC shall not be moved.

Technical basis: Limiting 520 PEC per pallet is consistent with earlier JCO Rev. 2 and therefore is appropriate and adequate.

5. Only Compliant Drums shall be moved to TRU Waste Pad 4. If a suspect or Unvented Drum is found on TRU Waste Pad 4, it will be moved to another pad other than TRU Waste Pad 3, unless precluded from doing so by other safety basis constraints.

Technical basis: Only CD are allowed to be moved to Pad 4 for undergoing MCU processing. UV do not meet the WAC and therefore are not allowed to be moved to Pad 4. CD (vented

drums), undergoing MCU characterization and measured by the Pad 4 GC/MS to be flammable, are then treated as SD and moved off Pad 4 to another Pad other than Pad 3. Pad 3 is reserved for drums that have passed MCU inspection and are ready to be shipped to WIPP. As such, not moving SD to Pad 3 is appropriate and adequate. DOE recognizes that SD may be staged on Pad 4 on temporary basis, using SD compensatory measures.

6. TRU Waste Pad 4 is limited to 650 TRU waste drums.

Technical basis: the 650 TRU drums limit of up to 130 PEC per drum is needed to bound the consequence within the evaluation guidelines. Also, this drum limit is needed to support an implementable egress plan for workers on Pad 4 since PPE compensatory measures are not invoked for CD. Note, on Pad 4 in addition to storing/staging drums up to 650 drums, there are 3 Mobile Units (trailers) in addition to TCUs that would take up space in this enclosed space. 650 drums limit is appropriate and adequate.

7. TCUs are limited to 3900 PEC each, based on assigned drum quantities.

Technical basis: 3900 PEC is equivalent to the DSA/TSR credited limit of a TSA. This is appropriate and adequate.

8. The V&P process shall process Unvented Drums ahead of other drums.

Technical basis: hydrogen-flammable UV drums have lower ignition energy than VOC-flammable drums (about one order of magnitude lower). This is consistent with JCO Rev. 2 and is appropriate and adequate.

9. Visual Examination (VE) and remediation of drums shall not be performed.

Technical basis: remediation of drums is outside the scope of this JCO.

10. The training program shall address safe drum handling techniques that prohibit the worker from placing the upper body (i.e. head and torso) over drums.

Technical basis: training on safe drum handling techniques is needed to alert the workers about the potential hazards. The JCO credits the worker awareness of the hazard consistent with ISM principles. In addition, the JCO credits the workers position shall be away from the lid-trajectory. This is appropriate and adequate.

11. Radio communications shall be established at a work location prior to processing drums. If radio communication becomes suspended, movement and handling of the drums involved in the activity being monitored shall safely stop until radio communication is re-established.

Technical basis: the JCO credits an implementable egress plan for TRU pads. A part of this egress plan is having adequate public announcement and radio communication to the workers. Without adequate radio communication, the egress plan is not valid. This requirement is appropriate and adequate.

12. In the event of a drum deflagration or VOC deflagration precursor (e.g., dropped drum), personnel (e.g., forklift driver, spotter) at the scene will immediately evacuate and make notification of the event via radio.

Technical basis: PPE is not invoked for CD. Notification by radio and public announcement by the evacuated personnel to the collocated workers so that adequate response can be taken is appropriate.

13. Personnel not directly involved in the drum processing activity, but located in the affected process area will monitor a radio and immediately evacuate on notification of a drum deflagration or deflagration precursor (e.g., dropped drum). If radio communication becomes suspended, movement and handling of the drums involved in the activity being monitored shall safely stop until radio communication is re-established.

Technical basis: Adequate egress plan involving functioning radio communication is credited by the JCO technical basis. If functionality of radio communication is suspended, this compensatory measure is invalid. This is appropriate and adequate.

14. Adequate egress routes will be maintained for permanent work stations near drum processing location to ensure workers can safely evacuate.

Technical basis: PPE is not invoked for CD; however, adequate egress is established and evaluated (see section 5.2 above)

5.3.2 UV Compensatory Measures

There is no significant implementation deviation from previous practices for UV drums. The UV practices have been validated per Contractor Readiness Determination and DOE Validation.

5.3.3 SD Compensatory Measures

The JCO considers SD drums as: (1) PEC content greater than 130 PEC Pu-239; or (2) significant rusting as defined by drum inspection criteria; or (3) unsound structural integrity to withstand deflagration pressure as defined by drum inspection criteria; or (4) undetermined PEC content and/or fissile content (Fissile Gram Equivalent) due to inadequate generator record; or (5) VOC-flammable as determined by measurement (e.g. calibrated Pad 6 GC or Pad 4 GC/MS) or calculation (e.g. approved methodology of composite LFL or sum-of-fraction determination), including VOC that exits the DVS earlier than the required purging of 8 hours and total VOC concentration of less than VOC LFL; or (6) overpacked drums. Early exiting VOC-flammable drums are controlled as SD drums with PPE for worker protection.

1. Movement of Suspect Drums shall be by forklift, drum grabber, drum mover or other remote means. Drums may be manually repositioned at the staged location while performing drum inspection, tightening of the closure ring, or drum cleaning, etc. using safe drum handling techniques.

   Technical basis: in order to establish appropriate safety controls commensurate with the potential hazard of the drums, inspections must be performed to identify the applicable hazards, based on established drum inspection criteria. This involves repositioning the drums out of the array onto an empty floor space for close-inspection. This movement is performed by remote means such as the use of the forklift so that the workers position will be away from the lid-trajectory. This is appropriate and adequate.

2. When Suspect Drums are transferred outside a covered facility (e.g., a Pad with a RUBB structure), the drums shall have lid-restraining controls (e.g., engineered box) in place prior to and during the transfer. Once placed in a covered facility the drum lid restraining controls may be removed. The safety function of the drum lid restraining controls is to ensure that waste ejected during a deflagration is not widely dispersed. The control shall be constructed of material and built to a thickness capable of deflecting expelled waste resulting from a drum deflagration.

   Technical basis: the engineered box is a Safety Significant control. The design was based on two safety calculations: pressure calculation and structural calculation. These calculations have been evaluated during JCO Rev. 2 readiness review (Contractor Readiness Determination) and found ready for operation by DOE.

3. The Radiological Protection Program shall establish a safe standoff area while Suspect Drum operations are underway, where respiratory protection is required, except for workers in enclosed workspaces (e.g., an enclosed forklift, DVS control room, equipment trailers). Workers in enclosed workspaces will have respirators readily available and can quickly don the respirator and evacuate in the event of a radiological release. The standoff area affords worker protection from physical injuries.

Technical basis: SD poses potential airborne release hazard. As such, respirator protection and stand off area are required commensurate with the airborne hazard.

4. Workers inside the standoff area shall wear hardhats while Suspect Drum operations are underway, except for workers in enclosed workspaces (e.g., an enclosed forklift, DVS control room, equipment trailers).

Technical basis: consistent with industrial hazard safety, requiring PPE such as hardhats and safety glasses for facility workers processing and handling potential energetic hazard is appropriate and adequate. Workers in enclosed workspaces are protected by the safe-haven provided by the surrounding structure from potential debris and projectiles, and therefore, do not require PPE. This is appropriate and adequate.

5.3.4 CD Compensatory Measures

The JCO considers CD drums as any vented drums that have: (1) approved vent configuration (adequately vented to prevent hydrogen build-up), and (2) less than or equal 130 PEC (to be bounded by DSA and SRS evaluation guideline considerations), and (3) passed drum inspection criteria (proper lid-closure and drum integrity considerations).

The JCO identifies the following compensatory measures specifically applicable to compliant drums:

1. Compliant Drum movements shall be performed by forklift, drum grabber, drum mover or other remote means. However, Compliant Drums may be manually handled or moved short distances using safe drum handling techniques when remote handling techniques are not applicable. These tasks include, but are not limited to, manually pushing or sliding drums inside the TCU, placing drums on or off manual drum carts, checking closure ring, manually pushing into TRU Waste Pad 4 HSGA chamber and aligning drums on pallet.

Technical basis: The JCO credits CD drums to be moved by remote means as defense in depth since CD may be identified as SD via Pad 4 MCU. In addition, the workers are trained in safe drum handling techniques when remote means (preferred) are not available, so as to place their positions away from the lid-trajectory. As such, this is appropriate and adequate.

2. When removing Compliant Drums from an array on TRU waste pads storing Unvented or Suspect Drums, Suspect Drum controls shall be used when Unvented or Suspect Drums are adjacent to (i.e. immediately left or right, or immediately below) a pallet of Compliant Drums being removed from the array.

Technical basis: when collocated drums of CD, SD, or UV exist on a Pad, SD compensatory measures are used to move CD. Under SD compensatory, the workers are protected with PPE for airborne releases. The consequence analysis postulates deflagration of a moving pallet (forklift moved), a pallet on the top row and 1 drum beneath the 3 tiers high stack. The consequence is determined to be 1170 PEC which is bounded by the DSA credited TSA limit of 3900 PEC. It is recognized that Standard Waste Boxes (SWB) containing drums of less than 500 PEC may be moved but are not addressed in JCO Rev. 3. The SWB provides secondary containment to the drums in the case of postulated deflagration accidents. As such, the risk of moving SWB is deemed bounded by JCO Rev. 3.

### 5.3.5 Drum Inspections

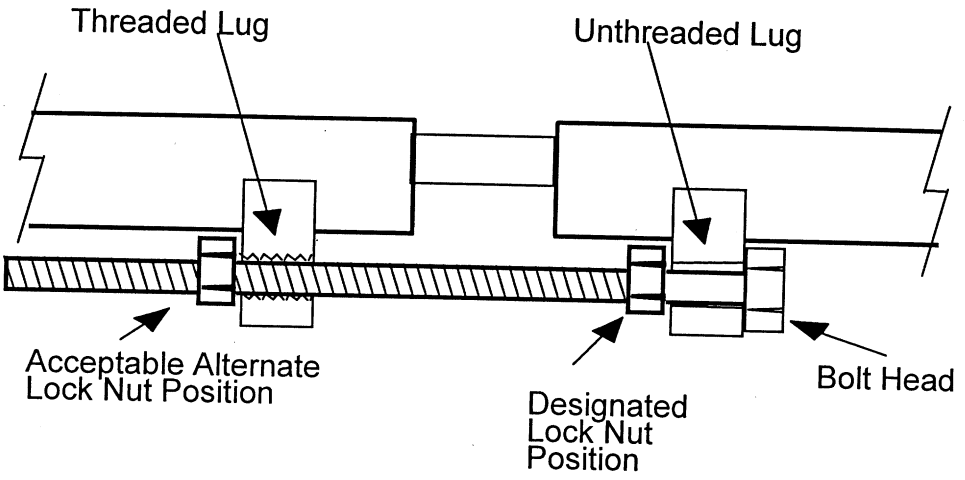
Consistent with ISM principles, the drum inspection activities are developed to identify and assess the hazards associated with handling and processing of flammable drums, consistent with field conditions. Established compensatory measures (listed above) are used to protect the workers and the public, commensurate with the flammable-drums hazards determined by drums inspections. A SWMF TRU Drums Assessment/evaluation report (Reference 15) was developed to establish the technical basis for the drum inspection activities. The report credits the MCU BIO in addressing drum deflagration accident scenarios and the WIPP drum inspection criteria in protecting the worker. SRS drum inspection criteria are built upon the technical attributes of the WIPP criteria to ensure adequate drum integrity. Workers are trained on safe handling techniques of keeping the workers position away from the lid-trajectory. In this respect, drum-integrity is a primary barrier to protect the workers, such that, the lid is assumed to fail first instead of the drum walls or the drum bottom. In addition, the Drums Assessment report refers to a deflagration calculation (Reference 16) for the determination of the lid-failure mode. Therefore, proper lid-closure configuration is needed to protect the lid-failure pressure input in this deflagration calculation, and it is included in the inspection criteria below.

Based on the analysis listed in the Drums assessment/evaluation, the JCO identifies the following compensatory measures for drum inspection.

Drum Inspection Criteria (included in facility's procedure PFD-01, MINE-01)

| **Inspection Criteria** | **Requirements Description** |
|---|---|
| The drum does not show signs of bulging. | • Uniform expansion of the sidewalls, top, or bottom (e.g., the top or bottom visibly protrudes beyond the top or bottom ring, or a sidewall visibly protrudes beyond the peaks of the drum hoops).<br>• Expansion of a sidewall such that it deforms a drum hoop.<br>Technical basis: DOT 17C (or equivalent) bulging drum, such that the drum does not sit or roll level to the floor, is indicative of pressurized hydrogen build-up beyond the existing analyzed condition of 6 psig. |

| | |
|---|---|
| The drum is not significantly rusted. | • If less than 50% of the visible surface is obscured by dirt/soil, continue the inspection. If unable to see at least 50% of the visible surface, brush the dirt/soil off the affected area prior to inspection of the drum for rust using SD controls.<br>• Significant rusting is a readily observable loss of metal due to oxidation (e.g. flaking, bubbling, caking, or pitting)<br>• Rusting that causes discoloration of the payload container surface or consists of minor flaking is not considered significant.<br>Technical basis: 50% sample area criterion is consistent with SRS QA/QC inspection technical basis. The drums are assumed to rust randomly on the surfaces (there is no preferred-rusting). Observable loss of metal is consistent with the drums assessment technical basis (WIPP WAC) |
| The drum is not breached | • Breaching is defined as a penetration that exposes the internals of the drum; e.g. broken welds, split seams, tears, holes, through cracks, or punctures.<br>Technical basis: drum integrity is credited by VOC pressure safety-calculation (Reference 16), such that, the lid is postulated to fail first. This design input assumption is protected so that workers safety controls of PPE for airborne concern and remote/safe-handling of energetic source (e.g. enclosed-cab forklift and the assumed worker position away from the lid trajectory) remain valid. This is also applicable for egress. |
| The drum is not significantly dented or deformed. | • Significant denting/deformation is defined as damage that results in creasing, cracking, or gouging of the metal.<br>• Minor dents/deformations that do not crease, crack, or gouge the metal are not significant.<br>Technical basis: see above |
| The drum lid is present and properly secured with a drum closure ring | • A steel closure ring is present, including an appropriate closure bolt, and in good material condition of no significant signs of rusting, cracking, or gouging.<br>• The closure ring is fully engaged with the drum lip and does not move when pulled on, such that an operator attempts to move the closure ring with their hand using reasonable force.<br>• The closure nut should be against the unthreaded lug or should be against the threaded nut as shown in illustration below. Either position is acceptable as long as the closure nut can not be moved by hand.<br>Technical basis: JCO Rev. 2 prohibits jostling of UV due to low ignition energy of hydrogen (~0.02 mJ). However, moving the closure ring with reasonable force under JCO Rev. 3 is consistent with the technical basis as documented in the VOC deflagration analysis (see below). |




Lid Ring-Closure: Closure Bolt, and Locking Nut Schematic

Technical basis: proper lid ring-closure is needed to protect the assumption of lid-failure as listed in the VOC deflagration analysis. Evaluation of the VOC deflagration analysis is discussed below.

VOC deflagration analysis (TRU Drum Deflagration Calculation S-CLC-F-00533, Rev 5):

The purpose of this calculation is to determine the potential for drum breach of vented TRU drums based on the hypothetical combustion of volatile organic compounds (VOCs). The technical approach of the calculation is to compute the hypothetical deflagration pressure due to the combustion of various VOCs and compare this pressure to the minimum drum lid lift off pressure of 105 psig, determined through a series of experimental deflagration tests conducted in 1986 and 1989. The calculation is founded on thirteen assumptions, which were evaluated for their technical basis and merit.

1. Assumption 1: This assumption establishes the minimum drum lid ejection pressure of 105 psig. This ejection pressure was selected from the 1989 drum testing results using various hydrogen concentrations and simulated waste bags. The technical basis of this assumption is valid.
2. Assumption 2: This assumption establishes the ambient temperature of 25° C inside the TRU drums. This assumption is reasonable and valid considering the daily temperature variation at the SRS.
3. Assumption 3: This assumption establishes the rational to treat the VOCs and hydrogen found in the TRU drums as ideal gases. Considering the ambient atmospheric pressure and temperature of the vented drums, this assumption is valid. At higher temperatures typical of hydrocarbon combustion, this assumption is still valid.
4. Assumption 4: This assumption establishes the initial oxygen concentration in the vented drums. This assumption is valid since at atmospheric pressure, this is the oxygen

concentration found in air. Hydrogen build-up within the vented drums is minimized given the diffusive nature of hydrogen and pressure relief the drum vents provide allowing the expulsion of lighter gases through buoyant action.

5. Assumption 5: This assumption establishes that the drum vents remain in-place (structurally attached to the drum lid) during the testing. This assumption is valid based on the comparatively small surface area of the vent and the fact that no vent was observed to separate from the drum lid during testing.
6. Assumption 6: This assumption establishes that the computed hypothetical deflagration pressure in this calculation (for propane benchmark, 150 psi) is numerically higher than that of other experimentally determined values based on the simplicity of the combustion model used in this calculation and thus is expected to be significantly higher (25 psi) than the actual deflagration pressure in an empty drum. The combustion model used in this calculation is simplistic when compared to other hydrocarbon combustion models found in the literature, such as Glassman[1] in that it does not account for intermediate reaction species. Similarly, this calculation computes the maximum pressure for adiabatic, constant volume combustion (AICC) that is consistently higher than AICC values reported in the literature, such as Shepherd[2]. The AICC values Shepherd reports for propane and hexane combustion were computed using a computer model accounting for intermediate reaction species and their associated free energies and also for the dissociation of the stable species that occurs in combustion processes at temperatures above 1250 K. Since dissociation reactions are endothermic the adiabatic flame temperature and pressure of the reaction is significantly reduced. Shepherd also reports the experimentally determined combustion pressure histories for propane and hexane. These pressure histories were obtained from two different (11 liter and 1080 liter) combustion chambers of significantly different internal surface areas. The peaks of these pressure histories occur at approximately 0.4 seconds with similar magnitudes of about 7.5 bar (109 psi) and 8.5 bar (123 psi). Considering the results reported by Shepherd and since the computed deflagration pressures computed in this calculation for the various VOCs considered are within the limited range of 140 to 150 psi and the TRU drum volume (~210 liter) is within the range of the experimental combustion chambers used by Shepherd, it is acceptable to consider the computed deflagration pressures in this calculation are 25 psi higher than would be expected.
7. Assumption 7: This assumption establishes that a portion of the combustion heat is radiated to the internal surface area of the drum and the surface area of the waste bags contained within the drum. Considering the relatively high emissivity value of plastic waste bags (0.6 to 0.9) and the surface area of the waste bag that would be available for radiative heat transfer, this assumption is considered appropriate.
8. Assumption 8: This assumption establishes that an increase in vapor (available void) volume occurs inside the drum during the deflagration. Considering the reported 75% (95% confidence level) void fraction within a filled drum (S-CLC-E-00183, Rev. 1), the realizable compaction ratio of commercial trash compactors at relatively low pressures, and the magnitude of the deflagration pressure, this assumption is considered valid.

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[1] Glassman, Irvin, Combustion, 2nd Edition, 1987 Academic Press

[2] Shepherd, J.E., et. al., Spark Ignition Energy Measurements in Jet A, Revised January 2000, Explosion Dynamics Laboratory Report FM97-9, California Institute of Technology

9. Assumption 9: This assumption establishes there is an increase in the effective volume of the drum as a result of the deflagration by considering the bulging of the drum lid shown in the testing videos if these drums contained simulated waste. A computation of predicted plate deflection was performed in support of this calculation review using large deflection plate theory. Assuming uniform pressure conditions similar to deflagration pressures on a convex plate of thickness comparable to a drum lid, it was demonstrated that the measured lid deflections obtained from the videos are reasonable. Note, based on Dupont Drum Explosion Tests performed in 1986 (report is part of EC, S-CLC-G-00024, Rev. 0, App. H, pp 328 and 329) the lid bulging occurred whether the drum was empty or it has waste in it as stated in Table 1 on pages 328 and 329 of the calculation. The video did not show the contents of the waste drum.
10. Assumption 10: This assumption establishes that the venting of the combustion products at the onset of lid ejection from the drum results in a pressure reduction within the drum. Considering the drum just before lid ejection is a closed volume and the ratio of atmospheric pressure to the deflagration pressure, this assumption is considered reasonable.
11. Assumption 11: This assumption establishes that detonation will not occur and is considered reasonable.
12. Assumption 12: This assumption establishes the hydrogen concentration limit and is considered reasonable.
13. Assumption 13: This assumption establishes the internal drum pressure at atmospheric and is considered acceptable since the drums are vented to the atmosphere.

This calculation is based on the assumptions presented and an assumed drum material condition equivalent to that tested in 1989. These bases must be protected through appropriate work controls and inspections in order to preserve the entire basis of this calculation. The hydrogen tests that are the basis for this credit show that the drum has to be at least half-full of waste to keep the lid on. If this condition cannot be met, the drum is managed as SD consistent with the drum management strategy listed in the JCO. DOE evaluation is based on the VOC TRU Drum Deflagration Calculation S-CLC-F-00533, Rev 5 (Reference 16). This constitutes DOE evaluation of the technical basis for lid failure mode.

DOE concludes that these inspection criteria are appropriate and adequate.

Companion to the visual inspection above, JCO Rev. 3 identifies chemical analyses for flammability by means of Pad 6 Gas Chromatograph (GC) and Pad 4 GC/Mass Spectrometer (MS) inspections.

5.3.6 Pad 6 GC and Pad 4 GC/MS

The Pad 6 DVS Gas Chromatograph (GC), as well as, the Pad 4 GC are credited in the JCO for being able to determine whether a drum is non-flammable. The DOE review ensured an adequate technical basis exists to demonstrate that these instruments adequately accomplish these functions. Specific topics evaluated include: (1) adequacy of surveillances (2) set-points, including instrument uncertainty for $H_2$, methane, Volatile Organic Compounds (VOCs) ad $O_2$ (3) impacts of SWMF PISA PI-05-0002. The uncertainty developed as part of JCO Rev. 2

resulted in revising the procedures to lower the acceptable flammable concentrations for $H_2$, VOCs, and methane. The DOE review ensured that the status of earlier vent-and-purge drums prior to uncertainty on the DVS GC being incorporated into procedures was addressed. For example, if an earlier drum was purged in the DVS to 9000 ppm VOCs whereas the acceptable VOC limit was reduced from 10,000 ppm to 7000 ppm due to uncertainty, justification is needed why this earlier drum can still be categorized as a compliant drum.

(1) Adequacy of Surveillance (Reliability to perform function)

*Pad 6 (DVS Operations).* The review process for the Solid Waste Management Facility Readiness Assessment for JCO Rev. 0 (Reference 5) documented the DOE review of the controls in place for the DVS to perform its safety significant (SS) function. Due to it having a SS function, the GC was placed in the Installed Process Instrumentation (IPI) program. Under the purview of the 1Q Manual Section 12-2 Rev. 11 (Reference 19), Control of Installed Process Instrumentation, several requirements are documented for satisfaction of the program. Solid Waste and Infrastructure Vent and Purge Operations Training Qualification Plan, ZROI003.Q0102 (Reference 20), outlines the necessary work instruction and procedures necessary for personnel to be deemed qualified for the process equipment. The NFT Vent and Purge Calibration and Verification Procedure, DVS1-CV-01 Rev.4 (Reference 21) met all requirements outlined per the specification within 1Q for the area of calibration protocol. The Installed Process Instrumentation Calibration/Change Request form (OSR 28-126) was verified to be completed and supplied to the calibrating organization to document the equipment's ranges and tolerances. Calibration gases certifications were present and on file with the necessary documentation of each one's accuracy listed. A Design Change Form, M-DCF-E-00174, was approved to update the technical baseline that Pad 6 Vent and Purge unit as a IPI piece of instrumentation and would be added to the SWMF Instrument Setpoint/Acceptance Criteria Index, J-JX-E-00001. This list takes into account operating and calibration ranges of the equipment per manufacturer recommendations and provides the setpoint values taking into account for instrument uncertainty which is accounted for in OBU-TRU-2005-00003 (Reference 22) for hydrogen, VOC, methane and oxygen, which will be further discussed later in this SER. The addition was properly USQ Screened for its potential impacts to the facility per USQ-SWE-2005-0019.

The operations of the DVS system on Pad 6 is subcontracted to NFT Inc., so additional contract documents were reviewed to ensure that surveillances/calibrations performed, the proper appliance of Quality Assurance (QA) are in place, design changes to GC and any changes to GC operating/calibration procedures were subject to SWI approval and control and related WSRC procedures (this is contractually bound through the actual contract with NFT, NFT's approved Statement of Work (SOW) and controlled and reviewed periodically by an assigned WSRC Subcontract Technical Representative (STR)). DOE found the necessary documents to support the GC equipment being incorporated into the IPI program and that the specified documents met the specifications set per WSRC Manual 1Q Section 12-2. Additionally the surveillance/calibration requirements were found to be adequate for the equipment's function.

*Pad 4 HSGA Operations (Central Characterization Project (CCP) Gas Chromatograph/ Mass Spectrometer (GC/MS)).* The CCP HSGS analysis validates the acceptability of the drum for

compliance with the WIPP WAC. The GC/MS is setup and calibrated for specific compounds referred as Target Analytes (TALs). The GC/MS also will provide results for other non-calibrated compounds, also known as, Tentatively Identified compounds (TICs). This process is controlled and set up to fulfill WIPP characterization requirements and is not formally controlled under WSRC programs. The unit is calibrated to measure gaseous compounds in a range an order of magnitude below the LFLs.

The JCO credits the WIPP QA/QC program in DOE/CBFO CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration (Reference 23) to maintain the uncertainty of the GC/MS equipment within ± 30%.

Per CCP-TP-029, Rev. 14, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, calibration criteria for Volatile Organic Compounds are established. The analytical methods within this procedure are equivalent to those specified by DOE-CBFO for TRU waste container HSG Characterization: (1) Modified Method T0-14 for the Gas Chromatography/Mass Spectroscopy Determinations of VOCs in Waste Container Headspace, (2) ASTM Method 1946-82-Standard Method for Analysis of Reformed Gas by Gas Chromatograph, (3) EPA SW-846, Method 8260B-Volatile Organic Compounds by Gas Chromatography/Mass Spectroscopy.

This document falls under the purview of the CCP-PO-001, CCP TRU Waste Characterization Quality Assurance Project Plan and meets manufacturer requirements of the Varian GC system for calibration and surveillance requirements to ensure system operability and surveillance adequacy to ensure a functional GC/MS.

This equipment is not under the management of WSRC or DOE-SR; however, the documentation reviewed has measures that meet the criteria of the IPI Program specified for Pad 6 GC equipment.

(2) Setpoints (Determination of Drum Non-Flammability)

*PAD 6.* The Vent and Purge machine on TRU Pad 6 is used to measure the concentration of hydrogen, methane, oxygen and volatile organic compounds (VOCs) in the drum headspace.

JCO Rev. 3 credited uncertainties and setpoints are listed below:

| **DVS GC Uncertainties and Setpoints** | | | |
|---|---|---|---|
| **Compound** | **Measurement Uncertainty** | **Purge Setpoint (ppm)** | **Release Setpoint (ppm)** |
| Hydrogen | +/- 9% | 36,400 | 10,000[1] |
| Total VOCs | +/-30% | 7,000 | 7,000 |
| Methane | +/-15% | 42,500 | 42,500 |
| Oxygen | +/-20% | NA | 10,000[2] |

Notes:
(1) Drums with a hydrogen concentration above 40,000 ppm must be purged to less than 10,000 ppm per calc. S-CLC-E-00159 Rev. 3.
(2) The release criterion is only applicable to drums with a hydrogen concentration higher than 36,400 ppm. Drums may be released from the DVS if higher than 10,000 ppm oxygen if transferred to the appropriate designated holding area prior to entering the time period where the drum headspace is potentially flammable for hydrogen.

These listed values are only applicable to Pad 6 (DVS GC). As summarized in the JCO, the uncertainties were developed and applied during the implementation of Rev.2 of this JCO.

During the review process for the Solid Waste Management Facility Contractor Readiness Determination for JCO Rev. 2, DOE assessed the setpoints at that time and the technical basis which supported the values for the DVS and concluded that the values in place were acceptable for implementation. (Documented in SIMTAS Assessment #202368) (Reference 24). The acceptance of these values was based on the technical basis established in the SWMF memorandums OBU-TRU-2005-00003 and OBU-TRU-2005-00010.

OBU-TRU-2005-00010 (Reference 25) documents that due to measurement uncertainty for the GC unit, based on measurement uncertainty analysis documented within OBU-TRU-2005-00003, that it is possible under the then Old V&P Purge criteria for a drum sampled indicated as non-flammable, to be deemed flammable due to the instrument's uncertainty. In that account the purge criteria were changed to meet those requirements and take into account all the compounds instrument uncertainty values.

During the preparation of JCO Rev. 3, OBU-TRU-2005-00010 was revised and now needs to be revisited. The reason for the revision was to account for a margin of safety. In this instance a conservative GC measurement uncertainty was established by rounding the GC measurement uncertainty measured using the verification standards. An updated chart outlining the V&P Machine's Purge Flammability Criteria is listed below:

| **V&P Machine Purge Flammability Criteria** | | | |
|---|---|---|---|
| **Compound** | **GC Measurement Uncertainty** | **GC Measurement Uncertainty Measured Using Verification Standard** | **Conservative GC Measurement Uncertainty** |
| Hydrogen | +/- 6% | +/- 7.4% | +/- 9% |
| Total VOCs | +/-30% | +/- 28.4% | +/- 30% |
| Methane | +/-10% | +/- 13.6% | +/- 15% |
| Oxygen | +/-20% | +/- 19.6% | +/- 20% |

The new release requirements are listed in the forefront of the setpoint write-up. The changes made were to release criteria for total VOCs and methane to account for conservatism and the

addition of an oxygen value to account for the release criterion in the presence of elevated hydrogen. These criteria are still conservative and have the necessary documentation and analysis present to support the need.

*PAD 4.* The CCP HSGS analysis validates the acceptability of the drum for compliance with the WIPP WAC. The GC/MS is setup and calibrated for specific compounds referred as Target Analytes (TALs). The GC/MS also will provide results for other non-calibrated compounds, also known as, Tentatively Identified compounds (TICs). This process is controlled and set up to fulfill WIPP characterization requirements and is not formally controlled under WSRC programs. WSRC prescribed added calibration checks to ensure the validity of the system. These additional checks are to guarantee linearity of the results, therefore documenting the system's setpoint range.

OBU-TRU-2005-00027 (Reference 26), Results of Experiment to Determine Linearity range Possible for GC/MS Analytical Results When out of Range of Calibrations, states that CCP Headspace Gas Analyzer has reported analytical measurements of Volatile Organic Compounds (VOC) in great excess of their calibration range.

There are tentatively identified compounds (TICs) reported for which no calibration is required to ship to WIPP. A noted constituent of this nature is Isopropyl Alcohol which has been reported in excess of 20,000 ppm. The reporting of higher values have been verified and relied upon on the linearity of the calibration in the limited calibration range of the system. In lieu of this, analysis was performed to test the range of linearity for SRS compounds of interest. Savannah River National Laboratory (SRNL) prepared two standards to a maximum of 8000 ppm. The referenced report addresses the requested concentrations in ppm for compounds of interest.

The calibration linearity results reported support that using the current configurations of the CCP GC/MS values for flammable compounds that the system reports VOCs accurately up to 8000 ppm, even though this is outside of the calibration range for the equipment. Any analysis outside of this value of 8000 ppm, would have to be run through the same battery of test to document the system linearity for increasing the 8000 ppm value. For quantitative analysis to be acceptable detector linearity has to be established and through meeting the calibration ranges of the CCP-TP-029 it in essence is meeting the linearity requirements of SW-846.

From this data the JCO establishes the criteria for determination of non-flammability when using the HSGA analyzer as follows:

1. The HSGA results must be within the flammable compounds' calibrated range or the measurement equipment checked for a linear response and a revised upper value established. Measured compounds in this category are referred to as TAL.
2. The HSGA results for flammable compounds for which the unit is not calibrated (TICs) shall total less than 500 ppm or the measurement equipment checked for response and an acceptable upper value for the flammable compound established (per WIPP characterization requirements).
3. Drums meeting criteria 1 and 2 must meet the following: the total of all flammable compounds shall have a total flammable VOC compounds less than 8000 ppm or a Composite Lower Flammability Limit (CLFL) less than 1 using LeChatelier's principle.

CLFL may only be used for a drum with reported values within the extended calibration range and the contributions of TICs are less than 500 ppm. Use 8000 ppm to represent the LFL for each TIC. The source of compound LFL values should be from Sax's Dangerous Properties of Industrial Materials.

Use of 8000 ppm is conservative as follows: The LFL of the flammable VOCs for the calibrated TALs are above 10,000 ppm. Contribution from a single compound would be reviewed in item 1. Contribution from flammable TICs without a revised upper value would be limited to 500 ppm therefore minimizing the uncertainty.

The criteria described are acceptable due to the linearity check which verifies VOCs operability up to extended range of 8000 ppm. It is also identified that DOE accepts the less than 500 ppm value for TICs that may be incurred during processing, which is embedded in WIPP Characterization requirements.

(3) Drum Impacts of PISA PI-05-0002 (Pad 6 Operations) and Previously Vented

Within the DOE Solid Waste Management Facilities Safety Evaluation Report (SER) Appendix 11 section 5.2.6, the acceptance of the calibration frequency for the Gas Chromatograph (GC) on the DVS is discussed. This is imperative to ensure that the system is giving accurate analysis so that TSR requirements for drum exit from the DVS system are met. In the previous revision of the TSR, the GC was required to be calibrated prior to the first drum being processed that day. The JCO (Rev. 2) addressed this and stated interrupting the middle of purging was not the appropriate practice since calibrating the GC would require the DVS operator to access a potentially flammable drum if the purging took longer than a shift. This led to the revision of the JCO and TSRs to require a calibration to be performed prior to and within 24 hours of any measurement used to confirm that the headspace gas in a TRU drum is less than LFL for $H_2$ and less than 10,000 ppmv for VOCs. DOE review concluded this change was appropriate and did not reduce any reliability in the GC performing its safety functions.

Though the adequacies of this approval statement or the revision have not been challenged, a recent facility event has challenged the adequacy of the GC on pad 6 to give an accurate reading. An NI, NI-SWMF-05-001 (Reference 27), titled Potential for Indeterminate TRU Pad 6 DVS Gas Chromatograph Total VOC Analysis was written on February 2, 2005. A review of gas chromatography (GC) results from the TRU Pad 6 Drum Venting System (DVS) has shown that drum headspace total Volatile Organic Compound (VOC) analytical result in some instances may be indeterminate due to the methodology used to calculate the VOC background level. The analysis is used to determine when a drum is less than 10,000 ppmv total VOCs which is a TSR criterion for removing a TRU drum from the DVS. Release analyses for some drums that were purged prior to removal from the DVS displayed evidence of the calculation anomaly. None of the release analyses reviewed so far for drums removed from the DVS without prior purging show evidence of the anomaly. However, release analyses for all drums removed from the DVS without purging are to be performed.

Per the PI-05-0002, there is one compensatory measure identified that the facility meets currently. TRU vented drums that are processed in the DVS and did not require a VOC purge

will not be moved unless it has already been shown to be nonflammable by analysis in the TRU Pad 4 HSGA unit.

Per the March 4th meeting with TRU Program Recovery Manager and WSMS, Principal, Safety Analysis Engineer, it was explained that in the instance of an indeterminate drum that had an analysis anomalies; the drum would be classified as a SD until further verification with a GC expert (SME) could be performed to verify the data to release the drum from SD controls to compliant drum measures. Procedurally per SW 15.3 SOP-V&P-01, before a drum may be released, criteria for releasing must be verified per two consecutive GC readings. DOE agrees with the controls specified per the meeting to address the anomaly issue identified in the PISA, as well as, the procedure in place to verify GC's readings.

As referenced within this SER, new V&P purge criteria have been established for processing. Due to the lowering of these values it was questioned by DOE how the facility's earlier drums that fell under the Rev.2 release limits could be viewed as compliant drums. JCO Rev.3 documents that OBU-TRU-2005-00003, discusses that these drums are able to be handled as compliant drums because the former limits (Rev. 2) had margin against the actual flammability for the compounds as calculated seen during historical SRS processing. The facility has documented that it is appropriate to apply the uncertainties on a forward-fit basis because of the potential, although unlikely, for encountering other volatile components with continued expansion of operation activities Rev. 3 and higher of the JCOs (i.e. culvert unloading, remediation of drums, for example).

As a result of developing and applying the uncertainty to the measurement of the GC, setpoints currently are lower than historical limits used to process. In review of OBU-TRU-2005-00003, the measurement uncertainty of 30% conforms to WIPP certification requirement of 70-130% reference standards recovery and measured verification values. The earlier release values took into account the % relative standard deviations for the repetitive measurements, standard deviations in reference to the calibration gases, the linearity fits and sampling error estimates to arrive at the various earlier release values. An assessment of the setpoints at that time and the technical basis which supported the values for the DVS was performed which concluded that the values in place were acceptable for implementation (documented in SIMTAS Assessment # 202368). DOE documented that the appropriate level of conservatism was present to cover the uncertainty calculation and believes the analysis is satisfactory for those drums handled under the release criteria of Rev. 2.

## 6.0 Conditions of Approval

None

## 7.0 Conclusion

The DOE has reviewed the JCO and the supporting analyses and concluded that the JCO meets the review criteria. The comments identified by DOE (Reference 17) on the earlier version of the JCO were properly addressed. The potential consequences to the offsite and co-located workers due to the required actions to restore unvented drums to a safe status as described in the

JCO are bounded by the current SWMF DSA. The JCO identifies a newly established single Pad inventory limit for Pad 4 of 650 drums. The consequence of this inventory limit of 650 drums of up to 130 PEC per drum is bounded by the SRS Evaluation Guideline. DOE review of the JCO found that the hazards involved with each processing step of the unvented and vented drums, and the controls to afford facility worker protection related to these hazards, were properly and adequately analyzed, evaluated, and implementable. Thus, the JCO Rev. 3 submitted via References 28 and 29 approved.

## 8.0 References


1. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00006, 2/15/2005.
2. Justification for Continue Operation, "Handling and Processing of Flammable Drums on SWMF TRU Waste Pads," WSRC-TR-2004-00618, Rev. 3, February 2005.
3. Potential Inadequacy Safety Analysis, "NI-SWMF-04-007: Potential Bounce-back of VOCs in a Purged TRU Waste Drum," PI-04-0011, December 7, 2004.
4. Response Plan, "Response Plan for Handling Flammable Drums Found on the TRU Pads," WSRC-TR-2004-00414, Rev. 1, August 2004.
5. Justification for Continue Operation, "VOC Flammable Drums on TRU Waste Pads Justification for Continued Operation," WSRC-TR-2004-00513, Rev.0, October 2004.
6. Letter, Kelly to Hansen, "Explanation of LFL Reading Differences Between TRU Pad 4 Headspace Gas Analysis Unit and TRU Pad 6 Vent and Purge Unit," OBU-TRU-2004-00027, 12/21/2004
7. Potential Inadequacy Safety Analysis, "NI-SWMF-04-007: Potential Bounce-back of VOCs in a purged TRU Waste Drum," PI-04-0011, December 2004.
8. Justification for Continue Operation, "Handling and Processing of Flammable TRU Drums on SWMF TRU Pads," WSRC-TR-2004-00618, Rev. 2, January 2005.
9. Basis for Interim Operation, "BIO for the WIPP Mobile Characterization Unit (MCU)," EM-24 Approval, November 30, 2004.
10. R. Haddock and J. Soares, "TRU Pad 4 Documentation Review Results," WSMS-LIC-M-05-0009, February 15, 2005.
11. B. R. Kerr, "Inputs and Assumptions Review for SWMF JCO Revision 3," WSMS-CRT-05-0011, February 15, 2005.
12. J. Myers, "Statistical Analysis of VOC Flammable Drums," WSMS-LIC-M-05-0007, February 2005.
13. J. Myers, "Statistical Analysis of Hydrogen-Flammable Drums," WSMS-LIC-M-05-0006, February 2005
14. Consolidated Hazard Analysis, "Handling Potentially Flammable Drums On the SWMF TRU Pads," WSRC-TR-2004-00587, February 2005.
15. "Assessment Package for the 55-Gallon, TRU Waste Drums," G-BFA-E-00001, 03/09/2005
16. M. R Yeung and J. A. Radder, "Evaluation of Drum Breach Potential for Different Types of Volatile Organic Compound (VOCs) in TRU Drums at the Solid Waste Management Facility," S-CLC-F-00533, Rev 5, March 2005.
17. Letter, Hansen to Kelly, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," WDED-05-031, 3/2/2005

18. Justification for Continue Operation, "VOC Flammable Drums on TRU Waste Pads Justification for Continued Operation," WSRC-TR-2004-00513, Rev.0, October 2004.
19. WSRC Manual 1Q Section 12-2, "Control of Installed Process Instrumentation", rev. 11
20. Solid Waste and Infrastructure Vent and Purge Operations Training Qualification Plan, ZROI003.Q0102
21. NFT Vent and Purge Calibration and Verification Procedure, DVS1-CV-01 rev.4
22. OBU-TRU-2005-00003, Measurement Uncertainties on Vent and Purge Instrument Results, rev. 1
23. DOE/CBFO CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and analysis Methods and Equipment Calibration, rev.14
24. Temple, Thomas, SIMTAS Assessment # #202368 "Engineering Design Review Assessment on Validation Review to support implementation of SWMF JCO WSRC-TR-2004-00618
25. OBU-TRU-2005-00010, Evaluation of the Vent and Purge Operating Limits, rev. 1
26. OBU-TRU-2005-00027, Results of Experiment to Determine Linearity range Possible for GC/MS Analytical Results When out of Range of Calibrations
27. Potential Inadequacy Safety Analysis, "NI-SWMF-05-001: Potential for Indeterminate TRU Pad 6 DVS Gas Chromatograph Total VOC Analysis" PI-05-0002, February 2, 2005
28. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00017, 3/18/2005.
29. Letter, Spencer to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-2005-00024, 3/24/2005.

FEB 26 2005

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, South Carolina 29808

Dear Mr. Pedde:

SUBJECT: Response Plan for Returning Overturned Drums on TRU Pad 17 to an Upright Position (Letter, Kelly to Hansen, OBU-SWI-2005-00012, 2/25/2005)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of Response Plan WSRC-TR-2005-00115, Revision 0, transmitted in the referenced letter. Based on the review, DOE-SR approves the submitted Response Plan as a safety basis document. The enclosed Safety Evaluation Report (SER) documents the results of the DOE-SR evaluation and provides the basis for approval.

It is expected that Response Plan WSRC-TR-2005-00115 will be added to the Solid Waste Management Facility (SWMF) Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 30 days. Additionally, DOE-SR concurs with the conclusion in the referenced letter that adding Response Plan WSRC-TR-2005-00115 to the SWMF Authorization Agreement is unnecessary.

The items in this letter have been discussed with Keith Stone of your staff.

The action directed herein is considered to be within the scope of work of the existing contract. If the Contractor considers that carrying out this direction will increase contract costs or delay any delivery, the Contractor shall promptly notify me orally, confirming and explaining the notification in writing as soon as possible, but within no more than five (5) working days. Following oral notification and submission of the written notice of impacts, the Contractor shall await further direction from me.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Original Signed By
Jeffrey M. Allison

Jeffrey M. Allison
Manager

WDED:TCT:joh

WDED-05-30

Enclosure:
SWMF SER, Rev. 0, Appendix 13

cc w/Enclosure:
W. J. Johnson, WSRC, 730-1B
H. T. Conner, Jr., WSRC, 730-1B
J. C. DeVine, WSRC, 766-H
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S. Crook, WSRC, 704-60E
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bcc w/o enclosure:
WDED Rdg File
Mgr's Reading File
AMWDP Rdg File
ECATS, 730-B (MC # )

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 13

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

## RESPONSE PLAN FOR RETURNING OVERTURNED DRUMS ON TRU PAD 17 TO AN UPRIGHT POSITION
**WSRC-TR-2005-00115 , REVISION 0**

February 2005

TA Prepared by : _____
Tam Tran

Reviewed by: _____
Jean M. Ridley

Approved by: _____
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

Enclosure: Letter, Allison to Pedde, subject: Response Plan for Returning Overturned Drums on TRU Pad 17 to an Upright Position, dated 4/25/05

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 13**

## 1.0 Introduction

By letter OBU-SWI-2005-00012, dated 02/25/2005, WSRC requested DOE-SR approval of the TSR Response Plan (WSRC-TR-2005-00115, Rev. 0). This Response Plan is needed to restore 4 drums with suspected flammable condition to an upright configuration after they have been dropped. This proposed activity has not been specifically addressed in the current JCO Rev. 2 technical basis (Reference 1). Approval of this response plan authorizes the use of safety controls in the response plan to restore safe status of these 4 suspected flammable drums to an upright configuration

This SER appendix documents the basis for approval of the submitted Response Plan and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Review Process

This SER appendix (Appendix 13) is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1B, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

## 3.0 Review Criteria

The response plan was reviewed to ensure:

- The proposed activities are identified accurately and defined adequately
- The risks associated with safe-status restoration actions are adequately identified and justified
- The appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public in restoring the condition to safe status.

## 4.0 Evaluation

4.1 The proposed activities are identified accurately and defined adequately

The response plan indicated that on February 23, 2005, a pallet of four vented drums being moved by forklift were dropped on TRU Pad 17. These drums are on their sides and are required to be restored to a safe upright configuration to be consistent with reference 1. Suspected flammable drums can only be transported via remote mechanical mean such as a fork-lift. As such, these drums are banded and upright on a pallet as the normal condition. Although the current drum configuration is not a JCO noncompliant condition, the action to return the drums to an upright configuration is considered to be outside the technical basis of the JCO since the JCO does not address specifically this activity. A response plan for this abnormal condition with DOE approval is needed for safe status restoration. DOE concluded that the proposed activities are identified accurately and defined adequately.

4.2 The risk associated with safe-status restoration actions are adequately identified and justified

The response plan identifies 4 drums that are involved with this response plan. The four vented drums are SR127970, SR235765, SR87286, and SR514575. These drums contain less than 1.3 Plutonium Equivalent Curie (PEC) Pu-239. These PEC contents are well bounded by the consequence risk of 450 PEC per drum as credited by the JCO. As such, the risk associated with this proposed activity is bounded by the JCO and therefore is adequate and justified.

4.3 Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public in restoring the condition to safe status.

The response plan establishes compensatory measures for restoring suspected flammable drums as follow:

1. Only the four drums that have overturned shall be moved or handled on TRU Waste Pad 17 while corrective actions are underway.

   Technical basis: this proposed activity is authorized for one time use only, commensurate with the risk posed by the contents and the conditions of these 4 drums.

2. Only one of the four vented drums that are overturned shall be repositioned at a time.

   Technical basis: the JCO credits only essential personnel will be allowed inside the stand-off area to minimize workers' risk associated with air-borne release. As such restricting the proposed activity to only one drum at a time to minimize required essential personnel is appropriate and consistent with the JCO.

3. The drums that are overturned shall be upright and stationary when approached for surveys and inspections.

Technical basis: the JCO credits workers position shall be away from the lid-trajectory during postulated deflagration. As such, it is necessary for the drums to be upright during close-inspections of drum integrity prior to drum movement on pad or between pads. This proposed activity of up-righting the drums is appropriate and consistent with the JCO.

4. Access to TRU Waste Pad 17 shall be restricted to essential personnel during the movement and handling of the overturned drums.

Technical Basis: the JCO credits only essential personnel (e.g., only 1 spotter and 1 fork-lift operator) will be allowed inside the stand-off area to minimize workers' risk associated with air-borne exposure. Designating only essential personnel by the appropriate authority (e.g. facility manager) for this proposed activity is appropriate and consistent with the JCO.

5. Personnel in the access-restricted area shall wear hardhats and safety glasses during the movement and handling of the overturned drums.

Technical basis: Industrial hazard personnel protective equipment such as safety glasses and hardhats during operation associated with energetic sources such as this proposed activity is appropriate and consistent with the JCO.

6. No vehicle operations will be allowed on TRU Waste Pad 17, other than repositioning the current forklift on TRU Pad 17.

Technical Basis: the JCO credits bulging (which are assumed flammable) drums to be isolated under barricades or roped-off areas away from fork-lift operation to avoid inadvertent entry of the fork-lift. This compensatory action of moving the current fork-lift prior to the proposed activity of manually up-righting the drums is appropriate and conservatively consistent with the JCO.

7. The pre-job brief shall address safe drum handling techniques that minimize the worker from placing the upper body (i.e., head and torso) within the line of fire of a potential drum lid ejection.

Technical basis: JCO rev. 2 credits the integrity of the drum so that in the event of a deflagration, the lid failure is postulated to fail first. These drums have been assessed as part of this response plan to conclude that no damage has occurred, which would invalidate the drum integrity. As such, a pre-job briefing to address safe drum handling techniques prohibiting head and torso exposure is appropriate and consistent with the JCO.

8. The Radiation Protection Program shall establish a safe standoff distance on TRU Waste Pad 17. When inside this area respiratory protection is required with the exception of the forklift driver who has a respirator readily available in the cab.

Technical basis: The JCO rev. 2 credits a radiation standoff area to protect workers from air-borne release postulated by the deflagration accident scenario. As such, the standoff area perimeter determined by Rad-Con is required commensurate with the dispersion of the air-borne concern. Consistent with Rad-Con operational practice relative to air-borne releases, workers inside the standoff area require Personnel Protective Equipment (PPE) such as respirators. The establishment of the standoff area prior to personnel entry authorization (e.g. via job permits) is appropriate and consistent with the JCO.

9. The drums will be shored up using sand bags or cribbing to minimize rolling.

Technical basis: The JCO rev. 2 credits the workers position to be away from the postulated lid-ejection trajectory during manual handling. Therefore, fixing the positions of the drums by means of sand bags or cribbing is appropriate and consistent with the JCO.

DOE review of these compensatory measures found them appropriate, implementable, and consistent with the supporting analyses discussed above.

**5.0 Conditions of Approval**

None

**6.0 Conclusion**

The DOE-SR has reviewed the Response Plan and the analyses contained in the plan. The DOE-SR review concludes that the Response Plan meets the review criteria. The risk of required actions to restore the four suspected flammable drums to safe status as described in the Response Plan is bounded by the JCO Rev. 2 and is appropriate for use. Additionally, the compensatory measures identified were found appropriate and adequate. Thus, the Response Plan submitted via letter OBU-SWI-2005-00012, dated 02/25/2005, is approved.

**7.0 References**

1. Justification for Continued Operation Handling and Processing of Flammable Drums on SWMF TRU Waste Pads. WSRC-TR-2004-00618, Revision 2, Westinghouse Savannah River Company, Aiken, SC, January 2005.

FEB 2 4 2005

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Revision to Solid Waste Management Facility Technical Safety Requirements (TSR) (Letter, Kelly to Hansen, OBU-SWI-2005-00010, 2/22/05)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of the TSR Administrative Control change, WSRC-TS-95-16, Revision 8, transmitted in the referenced letter. Based on the review, DOE-SR conditionally approves the submitted TSR as a safety basis document. The enclosed Safety Evaluation Report (SER) documents the results of the DOE-SR evaluation and provides the basis for approval subject to the Condition of Approval stated in the enclosed SER being incorporated into the TSR prior to implementation.

It is expected that the TSR will be added to the Solid Waste Management Facility (SWMF) Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 30 days.

The items in this letter have been discussed with Keith Stone of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tom Temple at 208-8772.

Sincerely,

Original Signed By
Jeffrey M. Allison

Jeffrey M. Allison
Manager

WDED:JMR:joh

WDED-05-029

Enclosure:
SWMF SER, Rev. 0, Appendix 12

cc w/o Enclosure:
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W. J. Johnson, WSRC, 730-1B
L. J. Simmons, WSRC, 730-1B
W. S. Shingler, WSRC, 730-1B
J. C. DeVine, WSRC, 766-H
W. S. J. Kelly, BNFL, 705-3C
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bcc w/Enclosure:
K. Stone, WSRC, 704-60E
S. Crook, WSRC, 704-60E
M. A. Kokovich, WSRC, 704-56E
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bcc w/o Enclosure:
WDED Rdg File / AMWDP Rdg File
Mgr's Reading File
ECATS, 730-B (MC # 0502240)

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 12

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

## SWMF TECHNICAL SAFETY REQUIREMENTS (TSRs)
**WSRC-TS-95-16, REVISION 8**

February 2005

Prepared by : Jean M. Ridley
Jean M. Ridley, P.E.

Reviewed by: Tom Temple
Tom Temple

Approved by:
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

Enclosure: Letter, Allison to Pedde, subject: Revision to Solid Waste Management Facility Technical Safety Requirements, dated

FEB 2 4 2005

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 12**

## 1.0 Introduction

By letter OBU-SWI-2005-00010, dated 2/22/05 (Reference 1), WSRC requested DOE-SR approval of TSR, WSRC-TS-95-16, Revision 8, to allow extraction of potentially flammable drums from the Drum Venting System (DVS) in the event of DVS equipment failure. This TSR Administrative Control (AC) change is necessary in order to handle and process any drum that has not completed all the exit criteria required in AC 5.5.2.6.3k and 5.5.2.6.3m. Removal, management, and storage of the drum at the DVS staging area, while the DVS is being repaired, will be controlled as specified in the Justification for Continued Operations, WSRC-TR-2004-00618 (Reference 2).

This SER appendix documents the basis for approval of the submitted TSR change (WSRC-TS-95-16, Revision 8) and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Background

In mid-February, during normal operations of venting and purging a drum, the DVS equipment failed. No controls are identified in the current DSA, TSRs or JCO to address removal of a drum which has not completed the TSR AC exit criteria except for a VOC drum which exceeds 8 hours purge/sample time. The JCO (Reference 2) governs the movement and processing (vent and purging in the DVS) of the unvented TRU drums.

## 3.0 Review Process

This SER appendix is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1B, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

## 4.0 Review Criteria

The TSR change was reviewed to ensure compliance with appropriate DOE criteria: 10CFR830, DOE-STD-3009, and DOE Guide G 423.1-1. In particular, the TSR was reviewed to ensure:

- the scope of authorized activities under the AC was clear,
- the hazards associated with authorized activities were covered under the existing JCO (Reference 2),
- the appropriate controls were identified to ensure the workers and the public were adequately protected, and
- the TSR AC was consistent with the pending JCO revision (Reference 3).

**5.0 Evaluation**

The new TSR AC (5.5.2.6.3.o) recognizes that the DVS equipment may fail during the purging and venting of a drum. The AC allows the removal of the drum from the DVS such that repairs can be made. A TRU drum which is removed from the DVS due to DVS failure will be managed and stored at the DVS staging area in accordance with the controls specified in the JCO. However, the JCO is currently under revision (Reference 3). DOE-SR has determined that the TSR AC will be inconsistent with the pending JCO revision 3 (Reference 3). The new AC states that "a drum removed from the DVS under this control shall be managed and stored at the DVS staging area as 'potentially flammable.'" This term is defined in Rev. 2 of the JCO to include unvented, undervented and VOC drums. The pending JCO (Revision 3) does not use the term, "potentially flammable." Therefore, to preclude a TSR revision as a result of the approval of the pending JCO revision, this SER will include a Condition of Approval: The TSR will be required to be revised to remove the term "potentially flammable" and replace it with the term, "unvented" to be consistent with the existing JCO Revision 2 and the pending JCO Revision 3.

The controls that are in place under the JCO have already been reviewed under SER Appendix 11 (Reference 4) and found to be appropriate, implementable, and adequate to ensure the risk to workers is minimal. The TSR AC to remove the drums from the DVS presents no additional hazards than those already analyzed under the current DSA and JCO.

**6.0 Conditions of Approval**

WSRC-TS-95-16, Solid Waste Management Facility Technical Safety Requirements, Administrative Control 5.5.2.6.3.o, Revision 8, shall be revised to replace the term "potentially flammable" and with the term, "unvented" prior to implementation.

**7.0 Conclusion**

The DOE has reviewed the TSR Administrative Control change and concluded that the TSR change meets the review criteria except as noted with the pending JCO Revision 3. The potential consequences to the offsite public and on-site workers are the same as those described in the JCO and approved in SER Appendix 11. Thus, the TSR, WSRC-TS-95-16, Rev. 8 submitted via Reference 1 (letter, OBU-SWI-2005-00010, dated 2/22/2005) is conditionally approved.

## 8.0 References


1. Letter, Kelly to Hansen, "Revision to Solid Waste Management Facility Technical Safety Requirements," OBU-SWI-2005-00010, 2/22/2005.
2. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00005, 1/27/2005
3. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00006, 2/15/2005.
4. Letter, Allison to Pedde, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation", WDED-05-24, 1/31/2005.

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JAN 3 1 2005

Mr. R. A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation (Letter, Kelly to Hansen, OBU-SWI-2005-00005, 1/27/05)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of Justification for Continued Operation (JCO) WSRC-TR-2004-00618, Revision 2, transmitted in the referenced letter. Based on the review, DOE-SR approves the submitted JCO as a safety basis document. The enclosed Safety Evaluation Report (SER) documents the results of the DOE-SR evaluation and provides the basis for approval. The enclosed SER (Appendix 11) supersedes SER Appendix 10 approved January 16, 2005, which addressed JCO Revision 0 (the enclosed SER Appendix 11 discusses this in detail).

It is expected that the JCO will be added to the Solid Waste Management Facility (SWMF) Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 30 days. Prior to this, however, you are requested to submit for my approval a revision to the SWMF Authorization Agreement (AA) to incorporate JCO WSRC-TR-2004-00618, Revision 2, in accordance with Manual 11Q, procedure 1.08. As indicated in the referenced letter, existing Response Plan WSRC-TR-2004-00414, Revision 1, is to be removed from WSRC-IM-95-28 as well as the SWMF AA concurrent with adding JCO WSRC-TR-2004-00618.

Finally, until the issuance of the SWMF Documented Safety Analysis Revision 6, it is expected that your staff immediately notify the DOE-SR SWMF Facility Representatives when vapor space data for any drum at either the Drum Venting System or the Head Space Gas Analysis unit exceeds 10,000 ppm volatile organic compounds or 40,000 ppm hydrogen.

The items in this letter have been discussed with Keith Stone of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following

submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tom Temple at 208-8772.

Sincerely,

Jeffrey M. Allison
Manager

WDED-05-24

Enclosure:
SWMF SER, Rev. 0, Appendix 11

cc w/o encl:
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L. J. Simmons, WSRC, 730-1B
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# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 11

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

# JUSTIFICATION FOR CONTINUED OPERATION (JCO) FOR HANDLING AND PROCESSING OF FLAMMABLE TRU DRUMS ON SWMF TRU PADS
**WSRC-TR-2004-00618, REVISION 2**
**and**
## SWMF TECHNICAL SAFETY REQUIREMENTS (TSRs)
**WSRC-TS-95-16, REVISION 7**

January 2005

Prepared by : Tom Temple
Tom Temple

Reviewed by: Donald J. Blake
Don Blake

Approved by: Michael A. Mikolanis for
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 11**

## 1.0 Introduction

By letter OBU-SWI-2005-00005, dated 1/27/2005 (Reference 1), WSRC requested DOE-SR approval of JCO WSRC-TR-2004-00618, Revision 2, and TSRs WSRC-TS-95-16, Revision 7, to allow handling of certain drums on TRU pads. This JCO was necessary in order to handle and process certain drums to reduce the risk posed by the unvented drums identified in a Discovery Unreviewed Safety Question (USQ, Reference 2). This JCO will expire when a subsequent SWMF safety basis change is made and implemented which supersedes this JCO.

This SER appendix documents the basis for approval of the submitted JCO (WSRC-TR-2004-00618, Revision 2), TSRs (WSRC-TS-95-16, Revision 7), and their inclusion as part of the Solid Waste Management Facility (SWMF) safety basis. This SER appendix supersedes SER Appendix 10 issued January 16, 2005.

## 2.0 Background

Reference 3 (PISA) identified the fact that there can be unvented TRU drums that have sufficient hydrogen concentrations along with sufficient oxygen concentrations to represent a flammability concern. Compensatory measures were put in place which prevented movement of unvented drums. This discovery was determined to be an USQ in Reference 2. Additionally, another PISA (Reference 4) was identified concerning TRU drums potentially flammable due to Volatile Organic Compounds (VOCs). Compensatory measures were put in place preventing movement of these VOC drums. [Note that the unvented drums in References 2 and 3 could also have high concentrations of VOCs.] Finally, there are some TRU drums out on the TRU pads that are vented, but the number of vents installed are not adequate to ensure the hydrogen concentration stays below its Lower Flammability Limit (LFL). These drums are considered "undervented." In order to reduce the risk of the unvented drums addressed in References 2 and 3, as well as the undervented drums, movement and processing of the unvented/undervented drums (herein collectively referred to as "unvented drums") is required. Due to the configuration of the TRU pad storage arrangements, movement of the potentially flammable VOC drums identified in Reference 4 is also required in order to access, move, and process the unvented drums. Therefore, in accordance with References 5 and 6, prior to removing these restrictions, the JCO (Reference 1) was submitted to DOE for approval to provide the safety analysis and controls necessary to address:

1. the movement and processing (vent and purging in the Drum Venting System (DVS)) of the unvented TRU drums out on the TRU pads (JCO does not authorize unvented drum movement within culverts)
2. the movement of potentially flammable VOC drums out on the TRU pads (i.e., not within culverts) to support movement and processing of unvented TRU drums

3. the movement of potentially flammable VOC drums out on the TRU pads (i.e., not within culverts) to enable access to fully characterized drums

None of the authorized activities under the JCO (e.g., moving drums with forklifts, transporting drums from one TRU pad to another, loading drums into the DVS, etc.) are different than the types of activities described in the SWMF DSA (WSRC-SA-22) nor do these activities change the function and purpose of the SWMF.

Revision 0 of JCO WSRC-TR-2004-00618 was approved by DOE via SER Appendix 10 via Reference 7. Subsequent to this approval, in the course of facility readiness activities, several changes were identified as necessary for the JCO to be effectively and efficiently implemented. WSRC submitted Revision 1 of the JCO via Reference 8, but subsequently withdrew Revision 1 and replaced it with Revision 2 in Reference 1. This DOE SER Appendix 11 evaluates and forms the basis for approval of JCO Revision 2 submitted in Reference 1. The changes made between JCO Revision 0 and Revision 2 are described in Attachment 1 of Reference 1; the significant changes are:

1. Recognized and addressed impact of having Undetermined Drums (indeterminant quantity of curies in drum) moved or potentially affected by activities authorized by the JCO
2. Credited robustness of Control Room at the DVS area on Pad 6 to provide sufficient protection such that hard hats, safety glasses, and respirator protection is not required for operators in this Control Room.
3. Modified forklift mast design requirement from having to be higher than cab to sufficiently high to provide adequate protection to the forklift operator
4. Modified calibration frequency for the Gas Chromatograph (GC) on the DVS
5. Provided for removing drums from the DVS if the purge time to lower the VOC concentration exceeds 8 hours

Changes 4 and 5 above required the SWMF TSRs to be revised for consistency. Thus, Reference 1 also submitted changes to the TSRs, WSRC-TS-95-16, to be consistent with the requirements in the JCO.

**3.0 Review Process**

This SER appendix is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1A, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

The process used in preparing this SER appendix also involved and factored in the results from:

1. conducting visits to the Idaho and Hanford sites to discuss their analysis and controls for potentially flammable TRU drums

2. reviewing selected safety basis documents from Hanford related to analysis and controls for potentially flammable TRU drums
3. reviewing the report prepared by an independent Assessment Team appointed by the President, WSRC, tasked with investigating the causes or potentially inadequate worker protection controls for handling TRU waste drums with possible explosive conditions
4. coordinating with the Team Leader of the DOE-SR sponsored independent Assessment Team investigating similar issues as the Team in item 3.

The findings from the above efforts applicable to the contractor development and DOE review and approval of the JCO have been factored into this SER appendix. In particular, DOE ensured the controls specified were consistent with or conservative to those specified in the Idaho and Hanford safety basis.

**4.0 Review Criteria**

The JCO was reviewed to ensure compliance with appropriate DOE criteria: 10CFR830, DOE-STD-3009, and DOE Guide G 424.1-1. In particular, the JCO was reviewed to ensure:

- the scope of authorized activities under the JCO was clear,
- the hazards associated with authorized activities were properly analyzed, and
- the appropriate controls were identified to ensure the workers and the public were adequately protected.

Reference 9 had submitted an earlier version of the JCO to DOE for approval. DOE review of the JCO in Reference 9 identified several comments which required resolution prior to approval. These comments were formally transmitted to WSRC in Reference 10. Thus, the review in this SER appendix also ensured that the comments in Reference 10 were properly addressed. Additionally, DOE identified several minor inconsistencies in JCO Revision 0 as documented in SER Appendix 10 (Reference 7); e.g., use of "unvented drums" versus "potentially flammable drums" in JCO section 1.3 (see SER Appendix 10, section 5.1). Revision 2 of the JCO corrected these minor inconsistencies as well so this SER Appendix (Appendix 11) removed the discussion on these issues.

The TSR changes necessary to be consistent with the requirements in the JCO were relatively minor and no fundamental change in functions were involved. The TSR changes were both in the Administrative Control section. Thus, the DOE review consisted of ensuring the TSR changes were clear and fully consistent with the JCO basis.

**5.0 Evaluation**

*5.1 Scope of Authorized Activities*

The scope of activities authorized is described in section 1.3 of the JCO. DOE review of this scope found it to fully address the activities addressed in the Background section above. Additionally, section 1.3 of the JCO appropriately noted where the authorized activities superseded the restrictions in the VOC drum PISA (Reference 4). DOE concluded this review criteria was satisfied.

*5.2 Hazards and Controls Associated With Authorized Activities*

*5.2.1 Basis for Allowing Drum Movements Versus Leaving Drums in Place*

The JCO identifies the fact that the unvented TRU drums as well as the potentially flammable VOC drums represent a significant deflagration hazard. Both sets of drums are assumed to contain sufficient flammable gas concentration to cause the drum lid to blow off if the internal gas is ignited. The unvented drums stored out on the TRU pads represent a risk to facility workers, co-located workers, as well as potentially the public, even if not moved since a natural phenomenon hazard (NPH) event like an earthquake or high winds/tornado could cause multiple drums to shake, slide, or topple (since some are on the second or third tier in the storage arrays). Although these natural phenomenon events are unlikely, the potential to cause multiple drum explosions represents a potential for significant consequences. To reduce this risk, the JCO authorizes restricted movements of the unvented and potentially flammable VOC drums to remove hydrogen deflagration potential (by installing vent(s) on the drum and adequately purging the drum of hydrogen) and reduce the VOC deflagration potential (vent installation and purging of unvented drums reduces VOC risk, as well as the JCO commitment to not replace VOC drums onto the third tier (fall height from second tier or shaking/sliding on floor level less likely to initiate deflagration than from third tier)). It is expected to take only weeks (versus months) to properly process the approximately 295 unvented drums, assuming that these unvented drums do not have significant quantities of VOCs requiring excessive purge times. Also, calculation S-CLC-E-00146 (Reference 11) documents, and SWMF experience has shown, that many handling activities of unvented and VOC drums have occurred without initiating a drum deflagration. Similar conclusion was reached in the Hanford safety basis (HNF-14741). Thus, DOE review concurred that the appropriate action is to move and process the TRU drums under the JCO versus leaving these drums in place.

*5.2.2 General Hazards and Controls*

Movement of TRU drums presents various hazards already adequately covered in the SWMF DSA, such as dropping drums off forklifts, vehicle impacts causing release of TRU drum contents, internal and external fires involving TRU drums, etc. The analyses and controls for these types of hazards remain in place while under this JCO. However, the deflagration potential while moving the unvented and VOC drums represents hazards that require additional controls. A hazards analysis (WSRC-TR-2004-00587, Reference 12) was completed for the activities authorized under the JCO, which DOE reviewed and found consistent with the guidance for hazards analyses in DOE-STD-1027 and DOE-STD-3009. DOE review concluded that the controls identified in this hazard analysis were appropriately incorporated into the JCO. One issue was noted which deserves some clarification. In Appendix B, under Event UV-3, the engineered steel box is described as confining the release to the immediate vicinity of the deflagration. The "release" is not clarified to mean just the radiological contents of the drum(s) or if "release" includes both the radiological contents as well as the drum lid(s) too. The JCO, section 4.0 and compensatory measure 17, indicates the function of the engineered steel box is to "ensure waste ejected during a deflagration is not widely dispersed" and states the design is such that it is "capable of deflecting expelled waste resulting from a drum deflagration." DOE discussions with SWMF personnel indicated that to accomplish the designated safety function the engineered steel box must be designed to withstand the force from a drum lid ejection. DOE reviewed the Technical Task Request given to the SRS organization designing/fabricating the box (TTR SWI-TTR-2005-001, 1/15/2005) which specifically states the box is to deflect both the

lid and waste contents. This design is appropriate and consistent with intent of the hazards analysis and JCO.

Two inventory controls are specified in the JCO. The first is that drums with a reported value of 450 Plutonium$^{239}$ Equivalent Curies (PEC) or greater shall not be handled. If a drum were to have 450 PEC and deflagrated, the resulting consequences would be less than 0.1 rem offsite and less than 20 rem onsite (100m). Another control specified in the JCO limits the inventory on pallets which can be moved to 520 PEC. Even if all four TRU drums on the pallet were to deflagrate (which is a very conservative assumption), the resulting offsite consequence would be below 0.1 rem and the co-located (100m) worker dose consequence would be less than 25 rem. Additionally, the hazards analysis postulated a pallet containing 520 PEC causing damage to other pallets in the array during movement, resulting in a total of 1170 PEC being involved in a deflagration. DOE reviewed the derivation of this material at risk (1170 PEC), which assumed all four drums on the pallet being moved, all four drums on the pallet on the third tier, and a fraction of the drums on the first and second tiers, were all at 130 PEC and all deflagrated. This scenario resulted in an offsite dose less than 0.1 rem and a co-located (100m) dose less than 50 rem. These consequences are bounded by accidents in the current SWMF DSA.

DOE reviewed the calculations supporting the derivation of these consequences (References 12 and 13) and found the results to be conservative:

1. Material at Risk (MAR) – most drums and pallets handled under this JCO will be much less than the 450 and 520 PEC limits
2. MAR – assuming all four drums on the pallet being moved, all four drums on the pallet on the third tier, and a fraction of the drums on the first and second tiers, were all at 130 PEC, all have flammable concentrations of gases, and all deflagrate is very conservative
3. Damage Ratio (DR) – conservatively assumed to be 1.0
4. Airborne Release Fraction (ARF)*Respirable Fraction (RF) – assumed to be 1E-3 consistent with DOE-HDBK-3010, section 5.0. [This is conservative to results derived at Hanford (HNF-19492 and HNF-14741) – combined DR*ARF*RF was 5.5E-4.]
5. Leak Path Factor (LPF) – conservatively assumed to be 1.0
6. Atmospheric Dispersion factor –
    a. used appropriate 3-minute puff model
    b. assumed ground level release even though deflagration could cause some degree of elevation
    c. used 100 cm surface roughness for offsite consequence and used conservative 30 cm surface roughness for onsite
    d. used 95$^{th}$ percentile meteorology for offsite consequence per DOE-STD-3009 and used worst case 50$^{th}$ percentile meteorology from 1987 through 1991 data set consistent with SRS practice described in Reference 14 for onsite (100m) worker consequence.
7. Dose Conversion Factor
    a. assumed all Pu was worst case form (Lung Adsorption Class M)
    b. used 1 micron size particle for offsite consequence per ICRP-72 and used 5 micron particle for onsite consequence per ICRP-68.

c. Calculated the 50-year Total Effective Dose Equivalent (TEDE)

Calculation S-CLC-G-00298 (Reference 15) shows that the difference between using the 50$^{th}$ percentile and using 95$^{th}$ percentile meteorology for onsite (100m) doses is a reduction in dose of approximately 5 times. Using the 95$^{th}$ percentile meteorology would result in an onsite dose of ~250 rem for the worst case above (i.e., with a MAR of 1170 PEC), but this is a 50-year TEDE. Since most of this dose is from TRU waste, less than ~10% of this is received the first year, and less percentage each subsequent year. Additionally, even with these inventory limitations specified, controls/features are in place to further reduce co-located worker doses. Moving and handling steps where the lid restraining device is not in place are conducted on TRU pads with an enclosure which would reduce the amount of waste ejected from the drum reaching co-located workers. Likewise, during transport between pads the lid restraining device (a steel box) is provided housing the drums/pallet which would reduce the amount of waste ejected from the drum reaching co-located workers. Given the conservatisms above as well as the physical layout of the TRU storage pads and surrounding SWMF areas, the inventory restrictions are appropriate and adequate. Finally, these inventory restrictions were not used to eliminate any facility worker (i.e., those in the immediate vicinity of the potentially flammable drums) controls, nor were these inventory limits used to exclude certain unvented or VOC drums from having the engineered steel box.

The JCO recognizes that some drums on the TRU pads have suspect or unknown quantities of PEC (termed Undetermined Drums (UDs)). The JCO refers to documents OBU-TRU-2004-00012, Rev. 11, and OBU-TRU-2005-00006, Rev. 0 (References 16 and 17, respectively) to support the fact that these UDs will not jeopardize the 450 PEC/drum and 520 PEC/pallet controls in the JCO. DOE reviewed References 16 and 17 and concluded that, based on data from over 2500 similar drums recently assayed as well as PEC data shown on drum data sheets assigned by the generator but not matched to a particular drum, there is a high level of confidence that the PEC limitations in the JCO will not be jeopardized (only two drums from the initial assayed 2500+ drums were over 130 PEC (one at 320 and one at 177) and none of the un-matched drum data sheets are above 130 PEC).

As mentioned earlier, one of the activities allowed under the JCO would be to move VOC drums on TRU Pads in order to gain access to fully characterized TRU drums. In some cases, these fully characterized drums are located on a pad with unvented and/or VOC drums, but the unvented/VOC drums do not have to be moved to access these fully characterized drums. However, given the proximity of the drums on TRU pads, if unvented and/or VOC drums exist on a pad, then the controls specified in the JCO apply, even if the only activity is to move fully characterized drums. Once the required unvented and VOC drum movements are completed and/or once the fully characterized drum(s) is/are moved off a pad containing unvented or VOC drums (under the controls of the JCO), the movement of these fully characterized drums is covered by the analysis and controls in the SWMF DSA/TSRs and not the JCO in Reference 1. Thus, the hazards, risks, and controls for moving of these fully characterized drums are not addressed any further in this SER appendix.

The JCO analysis assumes that a drum deflagration, if occurred, would cause the drum lid to be ejected vertically. This is based on past explosion tests using standard DOT-7A 55 gallon

galvanized steel drums, which are the same type drums used in SWMF. This drum failure mechanism is based on the presumption that the drum wall and bottom is sound such that the "weak link" is the drum lid. To protect this general assumption, the JCO requires a drum inspection program to be in place to ensure drums being moved and processed under the JCO are visually inspected for signs of excessive corrosion, impact damage, or internal pressurization. These signs could indicate that the assumed integrity of the drum wall and/or lid area is suspect. If drums are judged to be suspect (i.e., fail the inspection), then the JCO requires these drums to be overpacked, segregated and isolated awaiting further evaluation/disposition, or taken to the DVS staging area and processed on a priority basis, depending on the condition of the drum encountered.

The JCO concludes that stationary drums (not being moved, jostled (any physical contact is assumed to jostle the drum contents, including the actual drilling process within the DVS), or handled) pose minimal risk of deflagrating. Thus, the JCO allows stationary drums to be approached without respiratory protection, hard hats, etc. The JCO does require potentially flammable drums to be lowered to the ground (e.g., from an array) and the forklift to be secured before approaching the drum to ensure an operating forklift does not inadvertently jostle/move the drum. The only exception to this is at the DVS dolly where the drum is being positioned (section 5.2.6 below addresses this). DOE reviewed the JCO, calculation S-CLC-E-00146 (Reference 11), and Hanford document HNF-14741, and concurred that stationary drums pose minimal risk of deflagrating and approaching these drums without respiratory protection, hard hats, etc. was acceptable.

Since a primary purpose of the activities authorized by this JCO is to process the 295 unvented drums though the DVS unit to remove the hydrogen deflagration risk they pose, another general control in the JCO prohibits unvented drums from being replaced in a stacked configuration.

*5.2.3 Movement of Drums on Pads Other than on Pad 6*

Some of the unvented drums are located in storage arrays on TRU pads other than Pad 6 (e.g., on Pad 15). None of these unvented drums, or any surrounding VOC drums, have lid restraining devices and putting lid restraining devices while in the storage array puts workers at risk. The JCO properly assumes that either type of drum (unvented or VOC) could blow its lid off if the internal gas is ignited. Thus, the JCO requires the following protective features during drum movement/handling:

1. Personnel access to the area (TRU pad) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab. The forklift operator is protected from physical injury by the forklift/mast.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator who must have respirators readily available inside the cab..

4. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over potentially flammable drums.
5. Only a single potentially flammable drum or single pallet of potentially flammable drums can be moved at a time within the restricted area.
6. Only one vehicle (forklift) can be operated at a time within the restricted area.
7. Unvented and VOC drums must be moved with a forklift.
8. Forklift must have an enclosed cab.
9. Once unvented and VOC drums are moved out of array and on floor level, the forklift must be secured prior to approaching the drum(s).
10. Once unvented and VOC drums are moved out of array and on floor level, unvented and VOC drums to be transported to Pad 6 must have lid restraining device installed and transferred to Pad 6 immediately (i.e., without undue delay).
11. VOC drums moved as part of the execution of this JCO must be placed in safe storage location or within an array (per TSR AC 5.5.2.6.3.i) on the same pad or another pad if needed for proper implementation of the JCO, but not put on third tier. If these VOC drums are transported to another pad, controls associated with pad-to-pad transfers in section 5.2.4 would apply.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement as well as afterwards if NPH event occurred, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.4 Movement of Unvented and VOC Drums from TRU Pads to Pad 6*

Once the unvented and VOC drums are ready for transport to TRU Pad 6 (which means they have a lid restraining device installed), the following controls are specified in the JCO:

1. All traffic along the travel route (other than the forklift used to transport the unvented and VOC drum(s)) during the transfer is prohibited.
2. Personnel access to the area (travel route) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
3. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab and personnel in the DVS Control Room while in the DVS Control Room. The forklift operator is protected from physical injury by the forklift/mast and the robustness of DVS Control Room provides equivalent protection as hard hats and safety glasses.
4. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator and personnel in the DVS Control Room who must have respirators readily available inside the cab and DVS Control Room.
5. Only a single potentially flammable drum or single pallet of potentially flammable drums can be moved at a time within the restricted area.
6. Only one vehicle (forklift) can be operated at a time within the restricted area.

7. Unvented and VOC drums must be moved with a forklift.
8. The forklift must be secured prior to approaching the drum(s).
9. Transport vehicle (forklift) must have an enclosed cab.
10. Unvented drums coming from another TRU pad will not be stacked on Pad 6.

These drums will be transported directly to Pad 6 for vent and purging. Once the drum/pallet is placed on the pad, the lid restraining device can be removed.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.5 Movement of Unvented and VOC Drums Already on Pad 6 to the DVS Staging Area on Pad 6*

Some unvented and VOC drums already exist on Pad 6 (some within storage arrays), none of which have lid restraint devices installed. The unvented drums also need to be moved to the DVS staging area and undergo vent and purge operation. However, given the short distance between their current location and the DVS staging area, and the increased risk due to multiple handling/lid restraint installation activities, the JCO concludes that it is appropriate for these drums to be mechanically moved from their current Pad 6 storage location over to the DVS staging area without a lid restraining device. DOE review of the Pad 6 configuration concluded this was reasonable and appropriate. Thus, the controls specified in the JCO for movement of these drums are similar to those in Section 5.2.3 above except for the lid restraining device:

1. Personnel access to the area (TRU pad) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab and personnel in the DVS Control Room while in the DVS Control Room. The forklift operator is protected from physical injury by the forklift/mast and the robustness of DVS Control Room provides equivalent protection as hard hats and safety glasses.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator and personnel in the DVS Control Room who must have respirators readily available inside the cab and DVS Control Room.
4. Only a single potentially flammable drum or single pallet of drums can be moved at a time within the restricted area.
5. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over potentially flammable drums.
6. Only one vehicle can be operated at a time within the restricted area.
7. Unvented and VOC drums must be moved with a forklift.

8. Once unvented and VOC drums are moved out of array and on floor level, the forklift must be secured prior to approaching the drum(s).
9. Forklift must have an enclosed cab.
10. VOC drums moved as part of the execution of this JCO must be placed in a safe storage location or within an array (per TSR AC 5.5.2.6.3.i) on Pad 6 or another pad if needed for proper implementation of the JCO, but not put on third tier. If these VOC drums are transported to another pad, controls associated with pad-to-pad transfers in section 5.2.4 would apply.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.6 Moving/Processing Drums at the DVS on Pad 6*

VOC drums which were transported to the DVS staging area along with the unvented drums are not being processed into the DVS since the JCO requires the DVS to be dedicated to venting and purging of the unvented drums. Thus, these "VOC traveler drums" will be staged at the DVS area until ready for transport to a storage location (whether individually or on a pallet). These "VOC traveler drums" are handled per the controls in the JCO for potentially flammable drums. As such, if these "VOC traveler drums" are transported to another pad, the pad-to-pad transfer controls in section 5.2.4 would apply. Prior to moving the unvented drums placed at the DVS staging area into the DVS, the lid restraining device will be removed (if one was installed – see section 5.2.4). This creates the potential for the unvented drums, as well as any VOC drums on the same pallet, to eject their lid if a deflagration occurred. Thus, the JCO specifies the following controls for the movement/processing of drums at the DVS:

1. Personnel access to the area (Pad 6) is restricted to those involved with the activity in progress while potentially flammable drum operations are underway.
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab and personnel in the DVS Control Room while in the DVS Control Room. The forklift operator is protected from physical injury by the forklift/mast and the robustness of DVS Control Room provides equivalent protection as hard hats and safety glasses.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator and personnel in the DVS Control Room who must have respirators readily available inside the cab and DVS Control Room.
4. Only a single potentially flammable drum or single pallet of drums can be moved at a time within the restricted area.
5. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over potentially flammable drums.

6. Only one vehicle (forklift) can be operated at a time within the restricted area.
7. Forklift must have an enclosed cab.
8. The spotter will assist the forklift operator in properly seating the drum on the DVS dolly. Once properly seated and before the maxi-grabber (forklift attachment) completely releases control of the drum, the spotter will exit to the defined standoff area (established in item 3 above).
9. Unvented and VOC drums must be moved with a forklift.

Once properly positioned in the DVS (which has blast protection for worker protection – see SWMF DSA section 4.4.3), the unvented drums will be vented and will be purged, if necessary, until the TSR limits for hydrogen as well as VOC concentrations are met. Prior to purging the drum, once a vent is installed, a vapor space sample is drawn and analyzed. If the sample results show the drum vapor space was less than LFL for hydrogen and less than 10,000 ppm VOC, the drum is deemed to be non-flammable. This drum can be removed from the DVS and moved manually using existing safe handling techniques to place back in pad storage under the existing DSA/TSR requirements unless this drum is moved with VOC drums or onto a TRU pad housing potentially flammable drums, in which case the controls in the JCO are also applicable. The basis for handling this drum under the existing DSA/TSR requirements is that a review of data from the recent (2003-2004) Vent and Purge campaign was conducted by SWMF Engineering and did not identify any unvented drums which entered the DVS below LFL for hydrogen and below 10,000 ppm VOC subsequently became flammable so long as the drum did not undergo remediation or internal visual examination. The compensatory measures within the VOC PISA (Reference 4) still apply which prevent these drums from being remediated or internally visually inspected (instrusive activities which could cause VOCs inside the bags to be released into the drum vapor space and cause a flammability hazard).

The current SWMF DSA/TSR recognizes that, for a drum in the DVS whose initial hydrogen concentration was above LFL (i.e., prior to purging), a phenomenon known as "bounce back" has been observed wherein the hydrogen concentration inside the drum "bounces back" above LFL after being purged below its LFL, then subsequently returns and stays below the hydrogen LFL. If the initial hydrogen concentration (i.e., prior to purging) is above the hydrogen LFL but the initial VOC concentration is below 10,000 ppm, the drum exiting the DVS will be handled in accordance with the existing SWMF DSA/TSRs related to the hydrogen "bounce back" controls (moved to and maintained within an isolated area within/for the timeframe determined by calculations based on the number of vents installed – given in calculation S-CLC-E-00159) and the requirements in the JCO for this particular drum would no longer apply (except as discussed above, if applicable). Similar to the discussion above, the compensatory measures within the VOC PISA (Reference 4) still apply which prevent these drums from being remediated or internally visually inspected (instrusive activities which could cause VOCs inside the bags to be released into the drum vapor space and cause a flammability hazard).

Reference 4 identifies the fact that a similar phenomenon can occur relative to VOCs, except that it is possible the VOC concentration may not return and stay below the VOC LFL. Thus, the JCO recognizes this and conservatively considers the drum to be potentially flammable after exiting the DVS if the initial drum vapor concentration (i.e., prior to purging) was $\geq$ 10,000 ppm VOC. Thus, the controls for potentially flammable VOC drums specified in the JCO apply for

moving this drum to its storage location (whether that is on Pad 6 or moved to another TRU pad). Revision 0 of the JCO and the existing SWMF TSRs (Revision 6) would require a drum whose initial (i.e., prior to purging) VOC concentration was $\geq$ 10,000 ppm to be purged to less than 10,000 ppm prior to release from the DVS. At times, this can take many hours or even days. Thus, JCO Revision 2 and the accompanying TSRs (Revision 7) submitted in Reference 1 modified this requirement to allow a drum whose initial VOC concentration was $\geq$ 10,000 ppm to be removed from the DVS if greater than 8 hours of purge/sample time in the DVS was unable to reduce the VOC concentration to < 10,000 ppm. The 8 hour limitation was based on DVS experience which showed that a vast number (90%+) of drums requiring purging for VOCs were able to be reduced to < 10,000 ppm within 8 hours. DOE reviewed this change in the JCO/TSR strategy and concluded it was appropriate and reasonable. Since these drums had an initial VOC concentration $\geq$ 10,000 ppm, they are considered as potentially flammable drums and the controls in the JCO would apply to their handling and movement.

Another change made in the JCO/TSR package submitted in Reference 1 concerned the calibration frequency for the Gas Chromatograph (GC) on the DVS. Previously, this GC was required to be calibrated prior to the first drum being processed that day. This, in essence, required calibrations to be done each day drums were being processed. If a drum took longer than 24 hours to be purged below the $H_2$ or VOC limits (see discussion in previous paragraph), the purging would have to be stopped so the GC could be calibrated. The JCO addressed this and concluded that stopping in the middle of purging was not the appropriate practice since calibrating the GC would require the DVS operator to access a potentially flammable drum to reconfigure the DVS. Thus, the JCO and TSRs were revised to require a calibration to be performed prior to and within 24 hours of any measurement used to confirm that the headspace gas in a TRU drum is less than LFL for $H_2$ and less than 10,000 ppm for VOCs. This ensures that the initial (i.e., prior to purging) GC reading as well as the final GC reading after purging (if purging was required) used to confirm the drum is less than LFL for $H_2$ and less than 10,000 ppm for VOCs is made with a GC that was calibrated within the last 24 hours. DOE review concluded this change was appropriate and did not reduce any reliability in the GC performing its safety functions.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

It is recognized that the controls in Section 5.2.6 do not require a lid restraint device to be put on those newly vented potentially flammable VOC drums exiting the DVS if they are to be kept on Pad 6. These drums do not represent any more of a risk than the VOC drums currently on Pad 6 which are allowed to be moved to the DVS without a lid restraint device installed (see section 5.2.5). Thus, as in section 5.2.5, DOE concludes allowing these drums exiting the DVS to be moved to another location on Pad 6 without a lid restraint device is acceptable.

*5.2.7 Impact on Existing SWMF Response Plan*

Reference 1 identifies the fact that concurrent with implementation of the JCO, existing Response Plan WSRC-TR-2004-00414, Revision 1, will be cancelled. The basis given for this action is that the controls in the JCO are more conservative than the Response Plan and implementing the JCO does not increase the risk. DOE reviewed the allowed operations and the controls in the Response Plan and concurred that the allowed operations under the JCO are more restrictive than or equivalent to those under the Response Plan. Either the controls in the JCO are the same (restricting single drum inventory to 450 PEC, mechanical handling of drums, etc.) or more conservative (use of respiratory protection, use of engineered steel box for movements between pads, etc.) or no longer applicable (Response Plan addressed handling of potentially flammable VOC drums at the Head Space Gas Analysis unit, whereas the JCO and PISA PI-2004-0011 will prevent potentially flammable VOC drums from reaching the Head Space Gas Analysis unit until another safety basis document is developed and approved). The one relaxation between the Response Plan and the JCO/TSR in Reference 1 is that the Response Plan required drums to be purged below LFL in the DVS, whereas the JCO/TSR would allow some VOC drums to be removed from the DVS without purging down below 10,000 ppm. However, given the small number of drums expected to not be able to meet the 10,000 ppm limit within the 8 hours (see Section 5.2.6), the fact that 10,000 ppm is a conservative indication of VOC flammability for most VOCs (Reference 18), the fact that the DVS GC measures total VOCs, some of which are not flammable (Reference 19), and the fact that these drums will be considered potentially flammable and moved/handled as such under the JCO controls, DOE concluded this difference provided equivalent risk mitigation.

## 6.0 Conditions of Approval

None

## 7.0 Conclusion

The DOE has reviewed the JCO and the supporting analyses and concluded that the JCO meets the review criteria. The comments identified by DOE on the earlier version of the JCO (Reference 10) were properly addressed. The potential consequences to the offsite and co-located workers due to the required actions to restore unvented drums to a safe status as described in the JCO are bounded by the current SWMF DSA. DOE review of the JCO found that the hazards involved with each processing step of the unvented and VOC drums, and the controls to afford facility worker protection related to these hazards, were properly and adequately identified. Additionally, DOE concluded that the controls in the JCO were conservative to the controls specified in the Hanford and Idaho safety basis. Thus, the JCO (WSRC-TR-2004-00618, Rev. 2) submitted via Reference 1 (letter, OBU-SWI-2005-00005, dated 1/27/2005) is approved.

## 8.0 References


1. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00005, 1/27/2005
2. Letter, Kelly to Hansen, "Discovery Unreviewed Safety Question for Flammable TRU Drums in the Solid Waste Management Facility," OBU-SWI-2004-00040, 12/14/2004
3. Potential Inadequacy in the Safety Analysis (PISA), PI-04-0009, "Discovery of Hydrogen-flammable Unvented TRU Waste Drum," SR-WSRC-SW&I-2004-0015, 11/17/2004
4. Potential Inadequacy in the Safety Analysis (PISA), PI-04-0011, "Potential Bounceback of VOCs in a Purged TRU Waste Drum," 12/9/2004
5. DOE Guide G 424.1-1, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements," Rev. 0
6. WSRC Manual 11Q, Procedure 1.05, "Unreviewed Safety Questions," Rev. 5
7. Letter, Allison to Pedde, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," WDED-05-21, 1/16/2005
8. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-TRU-2005-00006, 1/21/2005
9. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2004-00041, 12/16/2004
10. Letter, Hansen to Kelly, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," WDED-05-018, 12/22/2004
11. S-CLC-E-00146, "Frequency of a Drum Breach in SWMF," Rev. 0
12. WSRC-TR-2004-00587, "Consolidated Hazards Analysis for Handling Potentially Flammable Drums on the SWMF TRU Pads," Rev. 0, 1/14/2005
13. S-CLC-E-00165, "Consequence Analysis for Unit Curie Release of Pu-239," Rev. 0
14. Letter, Shingler to Hansen, "Bases for 50 Percent Meteorology in the Savannah River Site (SRS) Safety Basis Calculations for Worker Analyses," FSS-2000-00018, 11/11/2004.
15. S-CLC-G-00298, "Downwind Dilution Factor Determination for Various SRS Areas," Rev. 0
16. Memo, Mentrup to Kokovich, "Listing of 'UD Drums' for 724-8E Characterization," OBU-TRU-2004-00012, Rev. 11, 1/26/2005
17. Memo, Mentrup to Burns, "Summary of Indeterminate Drums on TRU Pads," OBU-TRU-2005-00006, Rev. 0, 1/21/2005
18. Memo, Gibbs to Shappell, "Measurement Uncertainties on Vent & Purge Instrument Results," OBU-TRU-2005-00003, 1/18/2005
19. Letter, Kelly to Hansen, "Explanation of LFL Reading Differences Between TRU Pad 4 Headspace Gas Analysis Unit and TRU Pad 6 Vent and Purge Unit," OBU-TRU-2004-00027, 12/21/2004

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JAN 16 2005

Mr. R. A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation (Letter, Kelly to Hansen, OBU-SWI-2005-00001, 1/14/05)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of Justification for Continued Operation (JCO) WSRC-TR-2004-00618, Revision 0, transmitted in the referenced letter. Based on the review, DOE-SR approves the submitted JCO as a safety basis document. The enclosed Safety Evaluation Report (SER) documents the results of the DOE-SR evaluation and provides the basis for approval.

It is expected that the JCO will be added to the Solid Waste Management Facility (SWMF) Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 30 days. Prior to this, however, you are requested to submit for my approval a revision to the SWMF Authorization Agreement (AA) to incorporate JCO WSRC-TR-2004-00618 in accordance with Manual 11Q, procedure 1.08. As indicated in the referenced letter, existing Response Plan WSRC-TR-2004-00414, Revision 1, is to be removed from WSRC-IM-95-28 as well as the SWMF AA concurrent with adding JCO WSRC-TR-2004-00618.

Finally, until the issuance of the SWMF Documented Safety Analysis Revision 6, it is expected that your staff immediately notify the DOE-SR SWMF Facility Representatives when vapor space data for any drum at either the Drum Venting System or the Head Space Gas Analysis unit exceeds 10,000 ppm volatile organic compounds or 40,000 ppm hydrogen.

The items in this letter have been discussed with Keith Stone of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following

JAN 16 2005

submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tom Temple at 208-8772.

Sincerely,

Jeffrey M. Allison
Manager

WDED-05-21

Enclosure:
SWMF SER, Rev. 0, Appendix 10

cc w/o encl:
H. T. Conner, Jr., WSRC, 730-1B
W. J. Johnson, WSRC, 730-1B
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# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 10

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

# JUSTIFICATION FOR CONTINUED OPERATION (JCO) FOR HANDLING AND PROCESSING OF FLAMMABLE TRU DRUMS ON SWMF TRU PADS
**WSRC-TR-2004-00618, REVISION 0**

January 2005

Prepared by : Tom Temple
Tom Temple

Reviewed by: Tom Temple / for DJB via telecon
Don Blake

Approved by: Tom Temple / for MAM via telecon
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 10**

## 1.0 Introduction

By letter OBU-SWI-2005-00001, dated 1/14/2005 (Reference 1), WSRC requested DOE-SR approval of JCO WSRC-TR-2004-00618 to allow handling of certain drums on TRU pads. This JCO was necessary in order to handle and process certain drums to reduce the risk posed by the unvented drums identified in a Discovery Unreviewed Safety Question (USQ, Reference 2). This JCO will expire when a subsequent SWMF safety basis change is made and implemented which supersedes this JCO.

This SER appendix documents the basis for approval of the submitted JCO (WSRC-TR-2004-00618, Revision 0) and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Background

Reference 3 (PISA) identified the fact that there can be unvented TRU drums that have sufficient hydrogen concentrations along with sufficient oxygen concentrations to represent a flammability concern. Compensatory measures were put in place which prevented movement of unvented drums. This discovery was determined to be an USQ in Reference 2. Additionally, another PISA (Reference 4) was identified concerning TRU drums potentially flammable due to Volatile Organic Compounds (VOCs). Compensatory measures were put in place preventing movement of these VOC drums. [Note that the unvented drums in References 2 and 3 could also have high concentrations of VOCs.] Finally, there are some TRU drums out on the TRU pads that are vented, but the number of vents installed are not adequate to ensure the hydrogen concentration stays below its Lower Flammability Limit (LFL). These drums are considered "undervented." In order to reduce the risk of the unvented drums addressed in References 2 and 3, as well as the undervented drums, movement and processing of the unvented/undervented drums (herein collectively referred to as "unvented drums") is required. Due to the configuration of the TRU pad storage arrangements, movement of the potentially flammable VOC drums identified in Reference 4 is also required in order to access, move, and process the unvented drums. Therefore, in accordance with References 5 and 6, prior to removing these restrictions, the JCO (Reference 1) was submitted to DOE for approval to provide the safety analysis and controls necessary to address:

1. the movement and processing (vent and purging in the Drum Venting System (DVS)) of the unvented TRU drums out on the TRU pads (JCO does not authorize unvented drum movement within culverts)
2. the movement of potentially flammable VOC drums out on the TRU pads (i.e., not within culverts) to support movement and processing of unvented TRU drums
3. the movement of potentially flammable VOC drums out on the TRU pads (i.e., not within culverts) to enable access to fully characterized drums

None of the authorized activities under the JCO (e.g., moving drums with forklifts, transporting drums from one TRU pad to another, loading drums into the DVS, etc.) are different than the types of activities described in the SWMF DSA (WSRC-SA-22) nor do these activities change the function and purpose of the SWMF.

**3.0 Review Process**

This SER appendix is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1A, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

The process used in preparing this SER appendix also involved and factored in the results from:

1. conducting visits to the Idaho and Hanford sites to discuss their analysis and controls for potentially flammable TRU drums
2. reviewing selected safety basis documents from Hanford related to analysis and controls for potentially flammable TRU drums
3. reviewing the report prepared by an independent Assessment Team appointed by the President, WSRC, tasked with investigating the causes or potentially inadequate worker protection controls for handling TRU waste drums with possible explosive conditions
4. coordinating with the Team Leader of the DOE-SR sponsored independent Assessment Team investigating similar issues as the Team in item 3.

The findings from the above efforts applicable to the contractor development and DOE review and approval of the JCO have been factored into this SER appendix. In particular, DOE ensured the controls specified were consistent with or conservative to those specified in the Idaho and Hanford safety basis.

**4.0 Review Criteria**

The JCO was reviewed to ensure compliance with appropriate DOE criteria: 10CFR830, DOE-STD-3009, and DOE Guide G 424.1-1. In particular, the JCO was reviewed to ensure:

- the scope of authorized activities under the JCO was clear,
- the hazards associated with authorized activities were properly analyzed, and
- the appropriate controls were identified to ensure the workers and the public were adequately protected.

Reference 7 had submitted an earlier version of the JCO to DOE for approval. DOE review of the JCO in Reference 7 identified several comments which required resolution prior to approval. These comments were formally transmitted to WSRC in Reference 8. Thus, the review in this SER appendix also ensured that the comments in Reference 8 were properly addressed.

## 5.0 Evaluation

*5.1 Scope of Authorized Activities*

The scope of activities authorized is described in section 1.3 of the JCO. DOE review of this scope found it to fully address the activities addressed in the Background section above. Additionally, section 1.3 of the JCO appropriately noted where the authorized activities superseded the restrictions in the VOC drum PISA (Reference 4). Section 1.3 states that there could be compensatory measures in the JCO that conflict with existing TSR controls, and that this would be noted in the compensatory measure (implying the JCO would take precedence over the TSRs). Having conflicting controls between the JCO and TSRs would not be appropriate. However, DOE review of the JCO compensatory measures concluded no such "note" was indicated in the JCO compensatory measures and no conflicts were identified. One statement in Section 1.3 was noted as being inconsistent with the Compensatory Measure section (5.0) of the JCO. Section 1.3 states that the "compensatory measures are applicable to drum handling and movement operations on all TRU Waste Pads housing unvented drums." The compensatory measures make it clear that these controls are applicable to handling and movement operations associated with potentially flammable drums. Potentially flammable drums are defined in section 1.2 of the JCO as unvented and VOC drums. Thus, the compensatory measures identified in this JCO apply to drum handling and movement operations on all TRU Waste Pads housing potentially flammable drums as defined in the JCO. With this clarification, DOE concluded this review criteria was satisfied.

*5.2 Hazards and Controls Associated With Authorized Activities*

*5.2.1 Basis for Allowing Drum Movements Versus Leaving Drums in Place*

The JCO identifies the fact that the unvented TRU drums as well as the potentially flammable VOC drums represent a significant deflagration hazard. Both sets of drums are assumed to contain sufficient flammable gas concentration to cause the drum lid to blow off if the internal gas is ignited. The unvented drums stored out on the TRU pads represent a risk to facility workers, co-located workers, as well as potentially the public, even if not moved since a natural phenomenon hazard (NPH) event like an earthquake or high winds/tornado could cause multiple drums to shake, slide, or topple (since some are on the second or third tier in the storage arrays). Although these natural phenomenon events are unlikely, the potential to cause multiple drum explosions represents a potential for significant consequences. To reduce this risk, the JCO authorizes restricted movements of the unvented and potentially flammable VOC drums to remove hydrogen deflagration potential (by installing vent(s) on the drum and adequately purging the drum of hydrogen) and reduce the VOC deflagration potential (vent installation and purging of unvented drums reduces VOC risk, as well as the JCO commitment to not replace VOC drums onto the third tier (fall height from second tier or shaking/sliding on floor level less likely to initiate deflagration than from third tier)). It is expected to take only weeks (versus months) to properly process the approximately 295 unvented drums, assuming that these unvented drums do not have significant quantities of VOCs requiring excessive purge times. Also, calculation S-CLC-E-00146 (Reference 9) documents, and SWMF experience has shown, that many handling activities of unvented and VOC drums have occurred without initiating a drum deflagration. Similar conclusion was reached in the Hanford safety basis (HNF-14741).

Thus, DOE review concurred that the appropriate action is to move and process the TRU drums under the JCO versus leaving these drums in place.

*5.2.2 General Hazards and Controls*

Movement of TRU drums presents various hazards already adequately covered in the SWMF DSA, such as dropping drums off forklifts, vehicle impacts causing release of TRU drum contents, internal and external fires involving TRU drums, etc. The analyses and controls for these types of hazards remain in place while under this JCO. However, the deflagration potential while moving the unvented and VOC drums represents hazards that require additional controls. A hazards analysis (WSRC-TR-2004-00587, Reference 10) was completed for the activities authorized under the JCO, which DOE reviewed and found consistent with the guidance for hazards analyses in DOE-STD-1027 and DOE-STD-3009. DOE review concluded that the controls identified in this hazard analysis were appropriately incorporated into the JCO. One issue was noted which deserves some clarification. In Appendix B, under Event UV-3, the engineered steel box is described as confining the release to the immediate vicinity of the deflagration. The "release" is not clarified to mean just the radiological contents of the drum(s) or if "release" includes both the radiological contents as well as the drum lid(s) too. The JCO, section 4.0 and compensatory measure 17, indicates the function of the engineered steel box is to "ensure waste ejected during a deflagration is not widely dispersed" and states the design is such that it is "capable of deflecting expelled waste resulting from a drum deflagration." DOE discussions with SWMF personnel indicated that to accomplish the designated safety function the engineered steel box must be designed to withstand the force from a drum lid ejection. DOE reviewed the Technical Task Request given to the SRS organization designing/fabricating the box (TTR SWI-TTR-2005-001, 1/15/2005) which specifically states the box is to deflect both the lid and waste contents. This design is appropriate and consistent with intent of the hazards analysis and JCO.

Two inventory controls are specified in the JCO. The first is that drums with a reported value of 450 Plutonium$^{239}$ Equivalent Curies (PEC) or greater shall not be handled. If a drum were to have 450 PEC and deflagrated, the resulting consequences would be less than 0.1 rem offsite and less than 20 rem onsite (100m). Another control specified in the JCO limits the inventory on pallets which can be moved to 520 PEC. Even if all four TRU drums on the pallet were to deflagrate (which is a very conservative assumption), the resulting offsite consequence would be below 0.1 rem and the co-located (100m) worker dose consequence would be less than 25 rem. Additionally, the hazards analysis postulated a pallet containing 520 PEC causing damage to other pallets in the array during movement, resulting in a total of 1170 PEC being involved in a deflagration. DOE reviewed the derivation of this material at risk (1170 PEC), which assumed all four drums on the pallet being moved, all four drums on the pallet on the third tier, and a fraction of the drums on the first and second tiers, were all at 130 PEC and all deflagrated. This scenario resulted in an offsite dose less than 0.1 rem and a co-located (100m) dose less than 50 rem. These consequences are bounded by accidents in the current SWMF DSA.

DOE reviewed the calculations supporting the derivation of these consequences (References 10 and 11) and found the results to be conservative:

1. Material at Risk (MAR) – most drums and pallets handled under this JCO will be much less than the 450 and 520 PEC limits

2. MAR – assuming all four drums on the pallet being moved, all four drums on the pallet on the third tier, and a fraction of the drums on the first and second tiers, were all at 130 PEC, all have flammable concentrations of gases, and all deflagrate is very conservative
3. Damage Ratio (DR) – conservatively assumed to be 1.0
4. Airborne Release Fraction (ARF)*Respirable Fraction (RF) – assumed to be 1E-3 consistent with DOE-HDBK-3010, section 5.0. [This is conservative to results derived at Hanford (HNF-19492 and HNF-14741) – combined DR*ARF*RF was 5.5E-4.]
5. Leak Path Factor (LPF) – conservatively assumed to be 1.0
6. Atmospheric Dispersion factor –
    a. used appropriate 3-minute puff model
    b. assumed ground level release even though deflagration could cause some degree of elevation
    c. used 100 cm surface roughness for offsite consequence and used conservative 30 cm surface roughness for onsite
    d. used 95$^{th}$ percentile meteorology for offsite consequence per DOE-STD-3009 and used worst case 50$^{th}$ percentile meteorology from 1987 through 1991 data set consistent with SRS practice described in Reference 12 for onsite (100m) worker consequence.

6. Dose Conversion Factor
    a. assumed all Pu was worst case form (Lung Adsorption Class M)
    b. used 1 micron size particle for offsite consequence per ICRP-72 and used 5 micron particle for onsite consequence per ICRP-68.
    c. Calculated the 50-year Total Effective Dose Equivalent (TEDE)

Calculation S-CLC-G-00298 (Reference 13) shows that the difference between using the 50$^{th}$ percentile and using 95$^{th}$ percentile meteorology for onsite (100m) doses is a reduction in dose of approximately 5 times. Using the 95$^{th}$ percentile meteorology would result in an onsite dose of ~250 rem for the worst case above (i.e., with a MAR of 1170 PEC), but this is a 50-year TEDE. Since most of this dose is from TRU waste, less than ~10% of this is received the first year, and less percentage each subsequent year. Additionally, even with these inventory limitations specified, controls/features are in place to further reduce co-located worker doses. Moving and handling steps where the lid restraining device is not in place are conducted on TRU pads with a RUBB enclosure which would reduce the amount of waste ejected from the drum reaching co-located workers. Likewise, during transport between pads the lid restraining device (a steel box) is provided housing the drums/pallet which would reduce the amount of waste ejected from the drum reaching co-located workers. Given the conservatisms above as well as the physical layout of the TRU storage pads and surrounding SWMF areas, the inventory restrictions are appropriate and adequate. Finally, these inventory restrictions were not used to eliminate any facility worker (i.e., those in the immediate vicinity of the potentially flammable drums) controls, nor were these inventory limits used to exclude certain unvented or VOC drums from having the engineered steel box.

As mentioned earlier, one of the activities allowed under the JCO would be to move VOC drums on a TRU Pad in order to gain access to fully characterized TRU drums. In some cases, these

fully characterized drums are located on a pad with unvented and/or VOC drums, but the unvented/VOC drums do not have to be moved to access these fully characterized drums. However, given the proximity of the drums on TRU pads, if unvented and/or VOC drums exist on a pad, then the controls specified in the JCO apply, even if the only activity is to move fully characterized drums. Once the required unvented and VOC drum movements are completed and/or once the fully characterized drum(s) is/are moved off a pad containing unvented or VOC drums (under the controls of the JCO), the movement of these fully characterized drums is covered by the analysis and controls in the SWMF DSA/TSRs and not the JCO in Reference 1. Thus, the hazards, risks, and controls for moving of these fully characterized drums are not addressed any further in this SER appendix.

The JCO analysis assumes that a drum deflagration, if occurred, would cause the drum lid to be ejected vertically. This is based on past explosion tests using standard DOT-7A 55 gallon galvanized steel drums, which are the same type drums used in SWMF. This drum failure mechanism is based on the presumption that the drum wall and bottom is sound such that the "weak link" is the drum lid. To protect this general assumption, the JCO requires drums being moved and processed under the JCO to be visually inspected for signs of excessive corrosion, impact damage, or internal pressurization. These signs could indicate that the assumed integrity of the drum wall and/or lid area is suspect. If drums are judged to be suspect (i.e., fail the inspection), then the JCO requires these drums to be overpacked, segregated and isolated awaiting further evaluation/disposition, or taken to the DVS staging area and processed on a priority basis, depending on the condition of the drum encountered.

The JCO concludes that stationary drums (not being moved, jostled (any physical contact is assumed to jostle the drum contents), or handled) pose minimal risk of deflagrating. Thus, the JCO allows stationary drums to be approached without respiratory protection, hard hats, etc. The JCO does require potentially flammable drums to be lowered to the ground (e.g., from an array) and the forklift to be secured before approaching the drum to ensure an operating forklift does not inadvertently jostle/move the drum. The only exception to this is at the DVS dolly where the drum is being positioned (section 5.2.6 below addresses this). DOE reviewed the JCO, calculation S-CLC-E-00146 (Reference 9), and Hanford document HNF-14741, and concurred that stationary drums pose minimal risk of deflagrating and approaching these drums without respiratory protection, hard hats, etc. was acceptable.

Since a primary purpose of the activities authorized by this JCO is to process the 295 unvented drums though the DVS unit to remove the hydrogen deflagration risk they pose, another general control in the JCO prohibits unvented drums from being replaced in a stacked configuration.

*5.2.3 Movement of Drums on Pads Other than on Pad 6*

Some of the unvented drums are located in storage arrays on TRU pads other than Pad 6 (e.g., on Pad 15). None of these unvented drums, or any surrounding VOC drums, have lid restraining devices and putting lid restraining devices while in the storage array puts workers at risk. The JCO properly assumes that either type of drum (unvented or VOC) could blow its lid off if the internal gas is ignited. Thus, the JCO requires the following protective features during drum movement/handling:

1. Personnel access to the area (TRU pad) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab. The forklift operator is protected from physical injury by the forklift/mast.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator who must have a respirator readily available inside the cab.
4. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over the top of the drums. As a defense in depth measure, the JCO specifies the use of remote handling tools to contact potentially flammable drums.
5. Only a single potentially flammable drum or single pallet of potentially flammable drums can be moved at a time within the restricted area.
6. Only one vehicle can be operated at a time within the restricted area.
7. Unvented and VOC drums must be transported by mechanical means using a forklift.
8. Forklift must have an enclosed cab.
9. Once unvented and VOC drums are moved out of array and on floor level, the forklift must be secured prior to approaching the drum(s).
10. Once unvented and VOC drums are moved out of array and on floor level, unvented and VOC drums to be transported to Pad 6 must have lid restraining device installed immediately.
11. Once unvented and VOC drums are moved out of array and on floor level, VOC drums not to be transported to Pad 6 must be immediately (i.e., without undue delay) placed in safe storage location on same pad or returned to storage array, but not put on third tier.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement as well as afterwards if NPH event occurred, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.4 Movement of Unvented and VOC Drums from TRU Pads to Pad 6*

Once the unvented and VOC drums are ready for transport to TRU Pad 6 (which means they have a lid restraining device installed), the following controls are specified in the JCO:

1. All traffic along the travel route (other than the forklift used to transport the unvented and VOC drum(s)) during the transfer is prohibited.
2. Personnel access to the area (travel route) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
3. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift

operator while in the cab. The forklift operator is protected from physical injury by the forklift/mast.

4. The Radiation Protection Program will establish a safe standoff distance on the TRU pads during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator who must have a respirator readily available inside the cab.
5. Only a single potentially flammable drum or single pallet of drums can be moved at a time within the restricted area.
6. Only one vehicle can be operated at a time within the restricted area.
7. Unvented and VOC drums must be transported by mechanical means using a forklift.
8. The forklift must be secured prior to approaching the drum(s).
9. Transport vehicle (forklift) must have an enclosed cab.
10. Unvented and VOC drums coming from another TRU pad will not be stacked on Pad 6.

These drums will be transported directly to the DVS staging area on Pad 6 for vent and purging. Once the drum/pallet is placed at the DVS staging area for vent and purge processing, the lid restraining device can be removed.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.5 Movement of Unvented and VOC Drums Already on Pad 6 to the DVS on Pad 6*

Some unvented and VOC drums already exist on Pad 6 (some within storage arrays), none of which have lid restraint devices installed. The unvented drums also need to be moved to the DVS staging area and undergo vent and purge operation. However, given the short distance between their current location and the DVS, and the increased risk due to multiple handling/lid restraint installation activities, the JCO concludes that it is appropriate for these drums to be mechanically moved from their current Pad 6 storage location over to the DVS without a lid restraining device. DOE review of the Pad 6 configuration concluded this was reasonable and appropriate. Thus, the controls specified in the JCO for movement of these drums are similar to those in Section 5.2.3 above except for the lid restraining device:

1. Personnel access to the area (TRU pad) is restricted to those involved with moving the unvented and VOC drums (e.g., fork lift operator, spotter, RCO).
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab. The forklift operator is protected from physical injury by the forklift/mast.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pad during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is

required, except the forklift operator who must have a respirator readily available inside the cab.

4. Only a single potentially flammable drum or single pallet of drums can be moved at a time within the restricted area.
5. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over the top of the drums. As a defense in depth measure, the JCO specifies the use of remote handling tools to contact potentially flammable drums.
6. Only one vehicle can be operated at a time within the restricted area.
7. Unvented and VOC drums must be transported by mechanical means using a forklift.
8. Once unvented and VOC drums are moved out of array and on floor level, the forklift must be secured prior to approaching the drum(s).
9. Forklift must have an enclosed cab.
10. Any pallet of VOC drums that is moved out of the array to gain access to the unvented drums (or any fully characterized drums), the pallet of VOC drums must be immediately placed in safe storage location on Pad 6 or returned to storage array, but not put on third tier.

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

*5.2.6 Moving/Processing Drums at the DVS on Pad 6*

Prior to moving the unvented drums placed at the DVS into the DVS, the lid restraining device will be removed (if one was installed – see section 5.2.4). This creates the potential for the unvented drums, as well as any VOC drums on the same pallet, to eject their lid if a deflagration occurred. Thus, the JCO specifies the following controls for the movement/processing of drums at the DVS:

1. Personnel access to the area (Pad 6) is restricted to those involved with moving the unvented and VOC drums.
2. Personnel within the access restricted area must wear hardhats and safety glasses during handling and movement of potentially flammable drums, except the forklift operator while in the cab. The forklift operator is protected from physical injury by the forklift/mast.
3. The Radiation Protection Program will establish a safe standoff distance on the TRU pad during potentially flammable drum processing. When inside this area during handling and movement of potentially flammable drums, respiratory protection is required, except the forklift operator who must have a respirator readily available inside the cab.
4. Only a single potentially flammable drum or single pallet of drums can be moved at a time within the restricted area.

5. Personnel involved with moving the unvented and VOC drums are trained to not place their upper body (head and torso) over the top of the drums. As a defense in depth measure, the JCO specifies the use of remote handling tools to contact potentially flammable drums.
6. Only one vehicle can be operated at a time within the restricted area.
7. Forklift must have an enclosed cab.
8. The spotter will assist the forklift operator in properly seating the drum on the DVS dolly. Once properly seated and before the maxi-grabber (forklift attachment) completely releases control of the drum, the spotter will exit to the defined standoff area (established in item 3 above).
9. Unvented and VOC drums must be transported by mechanical means.

Once properly positioned in the DVS (which has blast protection for worker protection – see SWMF DSA section 4.4.3), the unvented drums will be purged until the existing TSR limits for hydrogen as well as VOC concentrations are met. Prior to purging the drum, once a vent is installed, a vapor space sample is drawn and analyzed. If the sample results show the drum vapor space was less than LFL for hydrogen and less than 10,000 ppm VOC, the drum is deemed to be non-flammable. This drum can be removed from the DVS and moved manually using existing safe handling techniques under the existing DSA/TSR requirements to place back in pad storage (i.e., the compensatory measures in the JCO would not apply). The basis for handling this drum under the existing DSA/TSR requirements is that a review of data from the recent (2003-2004) Vent and Purge campaign was conducted by SWMF Engineering and did not identify any unvented drums which entered the DVS below LFL for hydrogen and below 10,000 ppm VOC subsequently became flammable so long as the drum did not undergo remediation or internal visual examination. The compensatory measures within the VOC PISA (Reference 4) still apply which prevent these drums from being remediated or internally visually inspected (instrusive activities which could cause VOCs inside the bags to be released into the drum vapor space and cause a flammability hazard).

The current SWMF DSA/TSR recognizes that, for a drum in the DVS whose initial hydrogen concentration was above LFL (i.e., prior to purging), a phenomenon known as "bounce back" has been observed wherein the hydrogen concentration inside the drum "bounces back" above LFL after being purged below its LFL, then subsequently returns and stays below the hydrogen LFL. If the initial hydrogen concentration (i.e., prior to purging) is above the hydrogen LFL but the initial VOC concentration is below 10,000 ppm, the drum exiting the DVS will be handled in accordance with the existing SWMF DSA/TSRs related to the hydrogen "bounce back" controls (moved to and maintained within an isolated area within/for the timeframe determined by calculations based on the number of vents installed) and the requirements in the JCO for this particular drum would no longer apply. Similar to the discussion above, the compensatory measures within the VOC PISA (Reference 4) still apply which prevent these drums from being remediated or internally visually inspected (instrusive activities which could cause VOCs inside the bags to be released into the drum vapor space and cause a flammability hazard).

Reference 4 identifies the fact that a similar phenomenon can occur relative to VOCs, except that it is possible the VOC concentration may not return and stay below the VOC LFL. Thus, the JCO recognizes this and conservatively considers the drum to be potentially flammable after

exiting the DVS if the initial drum vapor concentration (i.e., prior to purging) exceeds 10,000 ppm VOC. Thus, the controls for potentially flammable VOC drums specified in the JCO apply for moving this drum to its storage location (whether that is on Pad 6 or moved to another TRU pad).

Collectively, these controls are aimed at: reducing the number of workers at risk, reducing the number of drums at risk, reducing the likelihood of drum damage during movement, reducing the potential radiological exposure to the workers moving the drums, and reducing the potential for/severity of physical injury due to drum lid ejection. DOE review of these compensatory measures found them appropriate, implementable, and adequate to ensure the risk to workers is minimal.

It is recognized that the controls in Section 5.2.6 do not require a lid restraint device to be put on those newly vented potentially flammable VOC drums exiting the DVS if they are to be kept on Pad 6. These drums do not represent any more of a risk than the VOC drums currently on Pad 6 which are allowed to be moved to the DVS without a lid restraint device installed (see section 5.2.5). Thus, as in section 5.2.5, DOE concludes allowing these drums exiting the DVS to be moved to another location on Pad 6 without a lid restraint device is acceptable.

*5.2.7 Impact on Existing SWMF Response Plan*
Reference 1 identifies the fact that concurrent with implementation of the JCO, existing Response Plan WSRC-TR-2004-00414, Revision 1, will be cancelled. The basis given for this action is that the controls in the JCO are more conservative than the Response Plan and implementing the JCO does not increase the risk. DOE reviewed the allowed operations and the controls in the Response Plan and concurred that the allowed operations under the JCO are more restrictive than those under the Response Plan. Either the controls in the JCO are the same (restricting single drum inventory to 450 PEC, mechanical handling of drums, purging drums such that VOCs are less than LFL in the DVS, etc.) or more conservative (use of respiratory protection, use of engineered steel box for movements between pads, etc.) or no longer applicable (Response Plan addressed handling of potentially flammable VOC drums at the Head Space Gas Analysis unit, whereas the JCO and PISA PI-2004-0011 will prevent potentially flammable VOC drums from reaching the Head Space Gas Analysis unit until another safety basis document is developed and approved).

**6.0 Conditions of Approval**

None

**7.0 Conclusion**

The DOE has reviewed the JCO and the supporting analyses and concluded that the JCO meets the review criteria. The comments identified by DOE on the earlier version of the JCO (Reference 8) were properly addressed. The potential consequences to the offsite and co-located workers due to the required actions to restore unvented drums to a safe status as described in the JCO are bounded by the current SWMF DSA. DOE review of the JCO found that the hazards involved with each processing step of the unvented and VOC drums, and the controls to afford

facility worker protection related to these hazards, were properly and adequately identified. Additionally, DOE concluded that the controls in the JCO were conservative to the controls specified in the Hanford and Idaho safety basis. Thus, the JCO (WSRC-TR-2004-00618, Rev. 0) submitted via Reference 1 (letter, OBU-SWI-2004-00001, dated 1/14/2005) is approved.

## 8.0 References


1. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2005-00001, 1/14/2005
2. Letter, Kelly to Hansen, "Discovery Unreviewed Safety Question for Flammable TRU Drums in the Solid Waste Management Facility," OBU-SWI-2004-00040, 12/14/2004
3. Potential Inadequacy in the Safety Analysis (PISA), PI-04-0009, "Discovery of Hydrogen-flammable Unvented TRU Waste Drum," SR-WSRC-SW&I-2004-0015, 11/17/2004
4. Potential Inadequacy in the Safety Analysis (PISA), PI-04-0011, "Potential Bounceback of VOCs in a Purged TRU Waste Drum," 12/9/2004
5. DOE Guide G 424.1-1, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements," Rev. 0
6. WSRC Manual 11Q, Procedure 1.05, "Unreviewed Safety Questions," Rev. 5
7. Letter, Kelly to Hansen, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," OBU-SWI-2004-00041, 12/16/2004
8. Letter, Hansen to Kelly, "Hydrogen Flammable Drum Processing on TRU Waste Pads Justification for Continued Operation," WDED-05-018, 12/22/2004
9. S-CLC-E-00146, "Frequency of a Drum Breach in SWMF," Rev. 0
10. WSRC-TR-2004-00587, "Consolidated Hazards Analysis for Handling Potentially Flammable Drums on the SWMF TRU Pads," Rev. 0, 1/14/2005
11. S-CLC-E-00165, "Consequence Analysis for Unit Curie Release of Pu-239," Rev. 0
12. Letter, Shingler to Hansen, "Bases for 50 Percent Meteorology in the Savannah River Site (SRS) Safety Basis Calculations for Worker Analyses," FSS-2000-00018, 11/11/2004.
13. S-CLC-G-00298, "Downwind Dilution Factor Determination for Various SRS Areas," Rev. 0

DEC 30 2004

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, South Carolina 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) DSA and TSR Revision DOE Approval Copy Submittal and Authorization Agreement for the E-Area TRU Facilities

References:
1. Letter, Kelly to Hansen, "DSA and TSR Revision DOE Approval Copy Submittal," (OBU-SWI-2004-00039, 12/14/04)
2. Letter, Your Letter, "Authorization Agreement for the E-Area TRU Facilities," (WSR-2004-00252, 12/16/04)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of the SWMF Documented Safety Analysis (DSA) Revision 5A and Technical Safety Requirement (TSR) Revision 6A (Reference 1) and the Authorization Agreement (AA) Revision 3 (Reference 2). These revisions address the removal of the Waste Certification Facility (Building 724-8E) from the SWMF AA and safety basis. The Waste Certification Facility has been de-inventoried and is no longer required for operations. The DOE-SR review of the submitted AA identified an editorial error in section 3.C. This error has been corrected in the enclosed AA. Based on the review, DOE-SR approves the submitted DSA and TSR revisions and the enclosed AA revision to declare the Waste Certification Facility as a surplus facility. The enclosed Safety Evaluation Report documents the results of the DOE-SR evaluation and provides the basis for the approval.

It is expected that the implementation of these DSA, TSR, and AA revisions will be implemented approximately 10 days after receipt of this DOE approval. The items in this letter have been discussed with Steve Crook and Gene Helmich of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Original Signed By
Jeffrey M. Allison

Jeffrey M. Allison
Manager

WDED:TCT:kl

WDED-05-19

2 Enclosures
1. SWMF SER, Rev. 0, Appendix 9
2. AA for E-Area TRU Pads

cc w/encls:
K. Stone, WSRC, 724-7E
S. Crook, WSRC, 724-35E

cc w/o encls: H. T. Conner, Jr., WSRC, 730-1B
W. J. Johnson, WSRC, 730-1B
J. C. DeVine, WSRC, 766-H
L. J. Simmons, WSRC, 730-1B
W. S. Shingler, WSRC, 730-1B
W. S. J. Kelly, BNFL, 705-3C

bcc w/encls:
M. A. Kokovich, WSRC, 724-7E
J. Smartt, SRPD, 730-B
R. J. Hardwick (EH-2), HQ
T. C. Temple, WDED, 707-H
T. Tran, WDED, 707-H

bcc w/o encls:
WDED Rdg File / AMWDP Rdg File
Mgr's Rdg File
ECAT, 730-B (MC #041831, 041858)

Enclosure 1: Letter, Allison to Pedde, SUBJECT: SWMF DSA and TSR Revision DOE Approval Copy Submittal and Authorization Agreement for E-Area TRU Facilities. Dated:

DEC 30 2004

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 9

**FOR THE**
**SAVANNAH RIVER SITE**

# SOLID WASTE MANAGEMENT FACILITY (SWMF)

**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

## SOLID WASTE MANAGEMENT FACILITY DOCUMENTED SAFETY ANALYSIS, WSRC-SA-22, REVISION 5A, TECHNICAL SAFETY REQUIREMENT, WSRC-TS-95-16, REVISION 6A, AND AUTHORIZATION AGREEMENT FOR THE E-AREA TRU PADS, WSRC-RP-2002-00557, REVISION 3 FOR THE PURPOSE OF TURNING 724-8E OVER TO D&D

December, 2004

Prepared by: _____
Tam Tran

Reviewed by: _____
Tom Temple

Approved by: _____
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 9**

## 1.0 Introduction

By letter OBU-SWI-2004-00039, dated 12/14/2004, WSRC requested DOE-SR approval of the SWMF DSA, Revision 5A and TSR, Revision 6A. By letter WSR-2004-00252, dated 12/16/2004, WSRC requested DOE-SR approval of the E-Area TRU Facilities Authorization Agreement (AA). These revisions are needed to remove 724-8E information from the DSA and TSR, and are appropriate given that the 724-8E building has been downgraded from a Hazard Category 3 nuclear facility to an Other Industrial facility. As stated in WSRC letter WSR-2004-00252, 724-8E status is changed from an operating Hazard Category 3 facility to that of a Surplus facility, consistent with Other Industrial Hazard Category. 724-8E has been de-inventoried and is no longer needed for operations. Given that 724-8E is no longer a Hazard Category 3 nuclear facility, and is now being declared as Surplus facility and being turned over to D&D, removal of 724-8E information from the SWMF DSA, TSR, and AA is necessary and appropriate. This approval is separate from the current review and approval of the DSA and TSR annual updates, which are ongoing in addressing DOE technical comments. Henceforth, the status of the 724-8E facility will change from operation to that of Surplus and will be provided with the oversight by the appropriate DOE-SR Assistant Manager for Closure Projects organization consistent with DOE-SR Human Capital Management Systems Manual Chapter 1, "Functions, Responsibilities, and Authorities Procedures" and Integrated Safety Management (ISM) requirements.

The submitted revisions do not add or replace technical information in the DSA and TSR; therefore, these revisions do not change the risk or the safety controls of SWMF operating facilities. This SER appendix documents the basis for approval of the submitted revisions to remove 724-8E information from the Solid Waste Management Facility (SWMF) safety basis and the AA.

## 2.0 Review Process

This SER Appendix 9 is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1B, "U.S. Department of Energy Savannah River Operations Office Human Capital Management Systems Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

## 3.0 Review Criteria

- Valid/acceptable change of facility mission to that of surplus (D&D) activities consistent with program needs

- Adequate coordination provided for facility transition to D&D for safety assurance purpose
- Appropriate safety measures have been implemented for D&D transition in a safe manner, to protect the workers and the public

**4.0 Evaluation**

4.1 Valid/acceptable change of facility mission to that of surplus (D&D) activities consistent with program needs

724-8E has been used by SWMF as an assaying facility to provide characterization information of TRU drums (radioactivity and fissile content as well as radiography of the drums). In 2004, under a Justification for Continued Operation (JCO, WSRC-TR-2004-00128, Rev. 0) and the associated Authorization Agreement (AA) approval, 724-8E was upgraded from Hazard Category 3 to Hazard Category 2, to be used for assaying suspect high-activity drums. This operation was discontinued in October 2004, and 724-8E reverted back to being a Hazard Category 3 facility. The JCO has an expiration date of December 31, 2004.

In letter OBU-SWI-2004-00039, WSRC submitted a revision to the SWMF DSA and TSR for the purpose of downgrading/changing the 724-8E from a Hazard Category 3 operating facility to that of an Other Industrial facility being turned over to D&D. As noted by this letter, the 724-8E has been de-inventoried and is no longer needed for operations supporting the SRS Solid Waste mission. Validation of this change in facility mission of the 724-8E by DOE-SR AMWDP Program Division indicates that this is consistent with SRS schedule needs, as outlined in SRS Performance Management Plan and the Experimental TRU Waste Assay Facility/Waste Certification Facility 724-8E Closure Certification Report. The D&D of 724-8E is a part of SRS overall commitment for closure of the E-area burial ground. The change of 724-8E mission to that of being turned over to D&D is valid and consistent with SRS program needs.

4.2 Adequate coordination provided for facility transition to D&D for safety assurance purposes

WSRC provided a Memorandum of Agreement (MOA) between the Soil and Groundwater Closure Projects (SGCP) and Solid Waste Management Facility (SWMF) and Site Decommissioning and Dismantlement (SDD) to support the transition of E-Area facilities from operations to that of being turned over to D&D consistent with SRS Performance Management Plan. This MOA, WSRC-RP-2001-4223, Rev. 3, was issued in October 2004. The MOA outlines the targeted schedule for D&D transitioning activities and the agreed upon responsibilities and authority by the appropriate SGCP, SWMF, and SDD organizations to ensure worker and public safety. As documented in this MOA, SWMF will be responsible for obtaining government approval of the 724-8E Closure Plan in compliance with the state RCRA regulations; however, the closure plan, which provides the scope and schedule of the D&D activities, is not included with this removal of 724-8E from SWMF DSA and TSR. The closure plan approval is a separate submittal from the approval of these DSA/TSA and AA revisions.

DOE review, in coordination with DOE-SR Decommissioning Project Division, indicates that adequate transition coordination has been provided for changing the status of 724-8E from operation to that of D&D to ensure worker and public safety.

4.3 Appropriate safety measures have been implemented for D&D transition in a safe manner, to protect the workers and the public

As indicated in the letter OBU-TRU-2004-00025, "Closure of Waste Certification Facility 724-8E," dated November 16, 2004, in addition to de-inventory of materials, all equipment has been removed from the 724-8E. The process areas, sump, and stack sampling have been washed. Radiological Surveys have been conducted which shows no detectable residual contamination. DOE-SR has conducted a facility walk down of the 724-8E by the cognizant Facility Representatives (documented in SIMTAS assessment report # 200558). In addition, the Radiological Surveys records have been reviewed by the Facility Representatives and found to be adequate. At present, the 724-8E has been locked-out and tagged-out to prevent inadvertent intrusion. Based on this, the radiological inventory in the 724-8E building now satisfies a category of being an Other Industrial facility.

Review of the DSA and TSR revision indicates that 724-8E information was removed without affecting a change in the technical basis of the remaining SWMF operating facilities. The submitted revisions do not add or replace technical information in the DSA and TSR. These revisions do not change the risk or the safety controls of SWMF operating facilities.

DOE review indicates that appropriate safety measures have been implemented for D&D transition in a safe manner to protect the workers and the public.

**5.0 Conditions of Approval**

None

**6.0 Conclusion**

The staffs have reviewed SWMF DSA, Revision 5A and TSR, Revision 6A to remove 724-8E information as well as the information to support downgrading the 724-8E building from a Hazard Category 3 nuclear facility to an Other Industrial facility. The DOE review concludes that the revisions meet the review criteria. Therefore, approval of the affected DSA, TSR, and the AA revisions to declare 724-8E as Surplus facility, consistent with the Hazard Category of Other Industrial, is recommended. This approval is separate from the current review and approval of the DSA and TSR annual updates, which are ongoing to address DOE technical comments.

## 7.0 References


7.1 "Savannah River Site Solid Waste Management Facility Documented Safety Analysis," WSRC-SA-22, Rev. 5A DOE Approval Draft, December 2004.

7.2 "Technical Safety Requirements, Savannah River Site, Solid Waste Management Facility," WSRC-TS-95-16, Rev. 6A, December 2004.

7.3 "Memorandum of Agreement Between the SGCP, SWMF, and SDD for SGCP and SDD Activities Within the SWMF," WSRC-RP-2001-4223, Rev. 3, October 2004.

7.4 "Closure of Waste Certification Facility 724-8E," OBU-TRU-2004-00025, November 2004.

7.5 "Authorization Agreement for the E-Area TRU Facilities," WSR-2004-00252, RSM Track # 10667, December 2004.

WSRC-RP-2002-00557
Revision 3
December 14, 2004



# U. S. Department of Energy
# Savannah River Operations Office
# and
# Westinghouse Savannah River Company

# Authorization Agreement
# for the
# E-Area TRU Pads

# U. S. Department of Energy Savannah River Operations Office
# And
# Westinghouse Savannah River Company

# Authorization Agreement for the E-Area TRU Pads

## Section 1. Facility Name, Function, and Location

This Authorization Agreement (AA) applies to the E-Area TRU Pads 1-19 and 23-25 located at the Department Of Energy (DOE) Savannah River Site near Aiken, South Carolina. The E-Area TRU Pads are used to store and process transuranic (TRU) waste prior to shipment offsite for disposal. The E-Area TRU Pads, including major functions, subsystems and support facilities, are described in the facility's DOE-SR-approved Safety Basis documentation listed in Attachment 1 to this AA.

## Section 2. Authorized Scope of Operations

This AA authorizes the entire scope of E-Area TRU Pad operations as described in the DOE-SR-approved Safety Basis documentation listed in Attachment 1, Records of Decision (ROD), Annual Operating Plan (AOP), and Work Control and Change Control documents, with no additional restrictions.

## Section 3. Bases

The Department of Energy has determined:

A. Through a series of comprehensive reviews under the Technical Assessment Program, the facility will be operated in compliance with the Standards/Requirements Identification Document (S/RID), WSRC-RP-94-1268 (as amended), and this AA as specified by Contract DE-AC09-96SR18500 (as amended). The S/RID has a separate review and approval process and may be amended without need to revise and re-approve this AA.

B. The facility hazards have been adequately analyzed and appropriate operational controls have been employed as properly documented in the DOE-SR-approved Safety Basis documents listed in Attachment 1 of this AA. The basis for this determination is documented in the DOE Safety Evaluation Report (SER), as amended, listed in Attachment 1. Each Safety Basis document has a separate review and approval process, thus each may be amended without need to revise and re-approve this AA. This AA serves to document the complete set of DOE-SR-approved Safety Basis documents tailored for use by the facility and specifically approved by the DOE as the basis for safe operations. Solid Waste Management Facility Safety Basis List WSRC-IM-95-28 (as

amended) identifies the latest revision of the Safety Basis documents applicable to the E-Area TRU Pads.

C. In accordance with National Environmental Policy Act regulations, the environmental impacts of facility construction and operation have been evaluated and documented in the Savannah River Site Waste Management Environmental Impact Statement (DOE/EIS-0217, as amended). DOE has issued Records of Decision (60 FR 55249, October 30, 1995 and 62 FR 27241, May 19, 1997), and the scope of the activity contained in this AA is consistent with the selected alternative. NEPA documentation has a separate review and approval process and may be amended without necessarily requiring revision and re-approval of this AA. The E-Area TRU Pads are currently permitted and operated under an Interim Status, RCRA Part A Permit listed in Attachment 1. A Part B permit application was submitted in September 2003. Attachment 1 lists the full set of environmental basis documents.

D. The E-Area TRU Pads have been continuously operated prior to and since the requirement for Operational Readiness Reviews was established. Further, facility activities have not triggered the criteria to conduct an ORR since the requirement was established. Through DOE authorization of continued operations in January 1998, and ongoing Technical Assessments, there is reasonable assurance that the facility can be operated without endangering the health and safety of the public, workers, or the environment.

E. Through DOE's adherence to Federal Acquisition Regulations (FAR), Department of Energy Acquisition Regulations (DEARs) regarding selection of competent contractors, and the WSRC contractual commitment to an Integrated Safety Management System (ISMS) and S/RID requirements for personnel selection, training, and qualification, DOE is assured that WSRC is technically qualified to engage in the activities authorized by this AA.

F. Through DOE's review and approval of the facility Radioactive Waste Management Basis (as amended) listed in Attachment 1 of this AA, DOE is assured that the facility's handling, documentation and control of radioactive waste complies with all federal, state and local radioactive waste management regulatory requirements.

G. Through DOE's review of an approved and current Emergency Preparedness Basis, primarily the SRS Emergency Plan, WSRC-SCD-7 (latest revision), DOE is assured that the facility's response to and notification of accidents adequately protects workers and the public. DOE review of the facility Emergency Preparedness Hazards Assessment listed in Attachment 1 is sufficient to satisfy the facility-specific aspects of the Emergency Preparedness Basis.

H. Through DOE's review of the Safeguards and Security Basis, primarily the General Site Security Plan, WSRC-RP-2000-00968 (latest revision), including the facility-specific Appendix applicable to the E-Area TRU Pads, DOE is assured that the facility will maintain an adequate security posture.

DEC 30 2004

## Section 4. Requirements and Conditions

Operation of the E-Area TRU Pads is subject to the following requirements and conditions:

A. Requirement that WSRC operate the facility in compliance with the S/RID WSRC-RP-94-1268 (latest revision).

B. Requirement that WSRC operate the facility in accordance with the operational controls specified in the Safety Basis documents (latest revision) listed in Attachment 1.

C. Requirement that WSRC shall operate the facility in accordance with the Hazardous Waste Permit Application, Part A, submitted 6/30/87 for Pads 1-13, 4/10/90 for Pads 14-17, and 5/3/94 for Pads 18-19.

D. Requirement that WSRC shall operate the facility in accordance with the DOE-SR-approved Radioactive Waste Management Basis (latest revision) listed in Attachment 1.

## Section 5. Contractual Citation, Effective Dates and Approval Signatures

This AA is subject to the conditions specified in Contract Number DE-AC09-96SR18500 (as amended) between DOE and WSRC. DOE and WSRC agree to the conditions and limitations contained herein. The conditions and limitations within this AA are effective on the date both parties have signed this AA and shall expire upon expiration or termination of DE-AC09-96SR18500 (as amended).

12/16/04

Robert A. Pedde, President Date
Westinghouse Savannah River Company

12/30/04

Jeffrey M. Allison, Manager Date
Savannah River Site (SRS) Office-Department fo Energy

# Attachment 1
# To the
# Authorization Agreement for the E-Area TRU Pads

## Safety Basis Documents

Savannah River Site Solid Waste Management Facility Safety Analysis Report, WSRC-SA-22 (latest revision)

Technical Safety Requirements Savannah River Site Solid Waste Management Facility, WSRC-TS-95-16 (latest revision)

Safety Evaluation Report for the Savannah River Site Solid Waste Management Facility, Revision 0 (latest appendix)

## Environmental Regulatory Basis Documents

Interim Status, RCRA Part A Permit, submitted 6/30/87 for Pads 1-13, 4/10/90 for Pads 14-17, and 5/3/94 for Pads 18-19.

Savannah River Site Waste Management Final Environmental Impact Statement, DOE-EIS-0217, July, 1995

Record of Decision (60 FR 55249, October 30, 1995)

Record of Decision (62 FR 27241, May 19, 1997)

## Radioactive Waste Management Basis Documents

Westinghouse Savannah River Company (WSRC) Solid Waste and Infrastructure (SWI) Radioactive Waste Management Basis (U), WSRC-IM-99-00030 (latest revision)

## Emergency Preparedness Basis Documents

Emergency Preparedness Hazards Assessment for Transuranic Waste Pads (U), S-EHA-G-00006 (latest revision)

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

AUG 1 2 2004

Mr. R. A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Response Plan for Handling Flammable Drums Found on the TRU Pads (Letter, Kelly to Hansen, OBU-SWI-2004-00026, 08/11/04)

The Department of Energy Savannah River Operations Office (DOE-SR) has completed its review of Response Plan WSRC-TR-2004-00414, Revision 1, transmitted in the referenced letter. Based on the review, DOE-SR approves the submitted Response Plan as a safety basis document. The enclosed Safety Evaluation Report (SER) documents the results of the DOE evaluation and provides the basis for approval.

It is expected that the Response Plan will be added to the Solid Waste Management Facility (SWMF) Safety Basis Document List, WSRC-IM-95-28, as a safety basis document within the next 7 days. It is recognized that this Response Plan only addresses recovery of identified drums which are potentially flammable due to volatile organic compounds. It is expected that the new information identified as a result of the discovery that drums in this condition exist be pursued and additional compensatory measures, if warranted, be put in place to ensure adequate worker protection.

Consistent with the conclusion reached in the referenced letter, the SWMF Authorization Agreement does not require revision to incorporate Response Plan WSRC-TR-2004-00414.

The items in this letter have been discussed with Keith Stone of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following

submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Jeffrey M. Allison
Manager

DC-04-050

Enclosure:
SWMF SER, Rev. 0, Appendix 8

cc w/o encl:
H. T. Conner, Jr., WSRC, 730-1B
W. J. Johnson, WSRC, 730-1B
W. S. Elkins, 730-1B
W. S. Shingler, WSRC, 730-1B
J. C. DeVine, WSRC, 766-H
W. S. J. Kelly, BNFL, 705-3C

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 8

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)
**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

# HANDLING OF VOLATILE ORGANIC COMPOUND (VOC) FLAMMABLE TRU DRUMS TSR RESPONSE PLAN
## WSRC-TR-2004-00414, REVISION 1

August 2004

Prepared by : _____
Tam Tran

Reviewed by: _____
Tom Temple

Approved by: _____
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 8**

## 1.0 Introduction

By letter OBU-SWI-2004-00026, dated 08/11/2004, WSRC requested DOE-SR approval of the TSR Response Plan (WSRC-TR-2004-00414, Rev. 1). This Response Plan is needed to restore 2 drums with VOC flammable condition, which are outside of current TSR technical basis, to safe status according to the safety controls specified by the Response Plan. Approval of this Response Plan also authorizes the use of these same safety controls to restore safe status of future VOC flammable drums if/when found on TRU pads. This Response Plan will expire when the annual update of SWMF Documented Safety Analysis (DSA) and Technical Safety Requirements (TSR) is approved and implemented, addressing safety control for VOC flammable conditions.

This SER appendix documents the basis for approval of the submitted Response Plan (WSRC-TR-2004-00414, Revision 1) and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Review Process

This SER appendix is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1A, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

## 3.0 Review Criteria

- The TSR violation conditions are identified accurately and defined adequately
- The risk associated with safe-status restoration actions are adequately identified and justified
- Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public, in restoring the VOC flammable condition of identified TRU drums to safe status.

## 4.0 Evaluation

4.1 The TSR violation conditions are identified accurately and defined adequately.

The Response Plan indicates that two drums, SR235165 and FBL03143, were found on a TRU pad to contain concentrations of isopropyl alcohol slightly above the Lower Flammability Limit (LFL), contrary to current TSR requirement (TSR, Rev. 4). These two drums were identified to contain isopropyl alcohol concentration of 21,836 ppm and 21,017 ppm which are greater than the LFL concentration for this chemical. TSR requirements indicate that drums stored on TRU pads shall not generate Volatile Organic Compound (VOC) concentration exceeding the materials Lower Flammability Limit, and that adequate vent installation must be maintained to prevent build-up of flammable gases. However, for dense VOC, installation of vent would not prevent build-up of the VOC. As such, the condition for these two drums is outside of TSR specifications for operation. The condition of these two TRU drums is a TSR violation. As such, according to TSR, Rev. 4, a Response Plan is needed to restore the conditions of these drums to safe-status, requiring DOE approval. The TSR violation condition of VOC flammable drums is identified accurately and defined adequately.

4.2 The risk associated with safe-status restoration actions are adequately identified and justified

The Response Plan identified the probability of any given drum to be flammable is 1.5E-4 and the probability of having an explosion for any given comparable flammable drum is 6E-5. Since TRU drums are processed as a part of the ship-to-WIPP campaign at the rate of approximately 7,000-to-8000 drums a year, the probability of an explosion associated with handling of potential flammable drums is estimated to be approximately 8E-5 per year. The Response Plan estimates this to be 1.7E-3, "unlikely," which is conservative and appropriate.

To ensure the radiological consequences from a drum explosion do not challenge the onsite guidelines, thus requiring new safety significant controls (including staying within Hazard Category quantities of released material), the Response Plan limits drum handling activities to drums less than or equal to 450 Plutonium-239 Equivalent Curies (PEC) (i.e., drums containing greater than 450 PEC must stay within concrete culverts). An onsite and off-site dose calculation for a 450 PEC drum explosion shows that the dose to a 100 meter co-located worker is 19 rem which is well within the facility hazard evaluation guideline of 100 rem. The calculation assumes a bounding 3 minute release associated with the explosion, 30 cm terrain roughness (deposition consideration), and M-class Pu-239 (a conservative form of Pu to use in establishing the dose conversion factor of Pu-239 for inhalation). These are appropriate assumptions to be used for the TRU drum explosion scenario.

The Response Plan also properly identified that physical injury (including fatality) could occur from an explosion in a drum with a flammable VOC condition while restoring the drum to a safe status. Adequate worker safety compensatory measures were identified associated with handling VOC flammable drums in restoring safe status.

DOE review found the risk associated with safe-status restoration actions is adequately identified and justified.

4.3 Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public, in restoring the condition to safe status.

The Response Plan establishes compensatory measures for restoring VOC flammable drums as follow:

1. Drums containing radiological inventories greater than 450 PEC shall remain in concrete culverts.

   Technical Basis: Ensures radiological consequences, if an explosion occurred in a drum being restored under this Response Plan, are within the risk envelope discussed in section 4.2 above.

2. If LFL measurement (chemical analysis) shows result greater than 8000 ppm VOC, the drum is immediately safely staged in a barricaded buffer area.

   Technical Basis: The safe total VOC allowed in the current SWMF TSR Rev. 4 is 10,000 ppm. The minimum individual LFL for a target analytical compound for shipping to WIPP is 8,000 ppm, which is for ethylbenzene. Since installation of a vent may not prevent build-up of flammable VOC concentration, the use of the WIPP LFL criteria of 8,000 ppm VOC (ethylbenzene) is appropriate and conservative instead of TSR Rev. 4 criteria of 10,000 ppm total VOC.

   DOE expectation as to "immediately" used here is the same as used in other SRS TSRs (e.g., CSTF, DWPF, etc.) for Limiting Conditions for Operation, that is the action "must be initiated without delay and continued until completed." For the action of immediately staging the VOC flammable drums in a barricaded buffer area, it is expected to be minutes to hours, not hours to days.

3. The greater-than-8000 ppm drum will be restored to safe status by the following methods:

   (a) The drum will be transferred and processed in Vent & Purge (V&P) unless the drum is determined to be nonflammable, which is less than 8000 ppm, by LFL calculation using the sum of fractions approach.

   Technical Basis: No time limit is imposed on this requirement but the intent is to place the drum into a known safe condition *expeditiously*. Accumulating potentially flammable drums in a barricaded buffer area is an undesirable condition from a safety perspective. Potentially flammable drums are expected to be processed through the V&P machine on a priority bases (e.g., the greater-than-8000 ppm drum will be processed in V&P before processing any non-flammable drum) unless the drum is determined to be nonflammable by LFL calculation.

(b) Potentially flammable drums will be mechanically handled while transporting from head space gas analysis to the barricaded buffer area and from the barricaded buffer area to the V&P machine. Examples of mechanical handling devices include maxi-grip drum grapplers, forklifts, or other mechanical devices that keep the operator from physically contacting the drum or leaning over the drum lid. Manual handling of the drum is required to remove the drum from head space gas analysis and to place the drum into the V&P machine. However, safe drum handling techniques will be employed when manually handling the drum as specified by procedure. Discussions were held with SWMF staff to clarify the expectations for these procedural controls and will include such practices as minimizing manual handling, not leaning over lid, not rolling the drum on its edge with the lid tilted toward the worker, etc.

(c) Potentially flammable drums, which are greater than 8000 ppm VOCs, can be classified as nonflammable when determined to be nonflammable by LFL calculation, or as measured by calibrated LFL/LEL meter (calibrated for specific-targeted flammable chemicals).

DOE review of these compensatory measures found them appropriate, implementable, and consistent with the supporting analyses discussed above.

**5.0 Conditions of Approval**

None

**6.0 Conclusion**

The DOE-SR has reviewed the Response Plan and the analyses contained in the plan. The DOE-SR review concludes that the Response Plan meets the review criteria. The risk of required actions to restore VOC flammable drums to a safe status as described in the Response Plan is bounded by the facility hazard evaluation guideline and is appropriate for the TRU pads facility. Additionally, the compensatory measures identified were found appropriate and adequate. Thus, the Response Plan (WSRC-TR-2004-00414, Rev. 1) submitted via letter OBU-SWI-2004-00026, dated 08/11/2004, is approved.

JUL 2 2004

Mr. R. A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) Technical Safety Requirements (TSR), Revision 5, Department of Energy (DOE) Draft Copy Submittal

REFERENCES: (1) Letter, Kelly to Hansen, OBU-SWI-2004-00021, 06/09/04
(2) Problem Identification Report (PIR) (2004-PIR-26-0046, TSR Criticality Safety Limit)

The subject letter submitted SWMF TSR Revision 5, DOE Draft Copy for DOE review and approval. The subject revision constitutes a necessary correction in the Documented Safety Analysis (DSA) and TSR development process, which was a result of a Quality Assurance problem outlined in the referenced PIR. The change replaces the incorrect criticality safety value of 910 Fissile Gram Equivalent (FGE) with the correct value of 390 FGE from criticality safety evaluation. DOE approval of the criticality safety value change is documented in the enclosed Safety Evaluation Report. DOE requests Westinghouse Savannah River Company to implement this TSR correction within 90 days of this approval.

The subject TSR Revision contained additional changes that are not included in this DOE evaluation and approval. The additional changes in the subject letter shall be addressed in the ongoing annual update of the DSA and TSR for 2004 (OBU-SWI-2004-00014), which is separate from the DOE approval of this TSR correction. The annual update is currently being revised for re-submittal to DOE.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Original Signed By
Jeffrey M. Allison
Manager

WDED:TMT:kl

DC-04-042

Enclosure
Safety Evaluation Report

cc w/o encl: W. J. Johnson, WSRC, 730-1B
H. T. Conner, WSRC, 730-1B
J. C. DeVine, Jr., WSRC, 766-H
W. S. Elkins, WSRC, 730-1B
W. S. Shingler, WSRC, 730-1B

bcc w/encl: T. M. Tran, WDED
J. M. Simmons, WDPD
T. L. Montgomery, WDED

bcc w/encl:
W. S. J. Kelly, WSRC, 705-3C
E. H. Helmich, WSRC, 724-35E
S. E. Crook, WSRC, 724-35E

bcc w/o encl:
WDED/AMWDP Rdg File
MNGR/DMC Rdg File
ECAT 040863

Enclosure: Ltr, Allison to Pedde, Subj: SWMF TSR Rev 5, DOE Draft Copy Submittal, dated JUL 02 2004

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 7

**FOR THE**
**SAVANNAH RIVER SITE**

# SOLID WASTE MANAGEMENT FACILITY (SWMF)

**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

## Correction to Solid Waste Technical Safety Requirement Rev. 4

June 2004

Prepared by: _____
Tam M. Tran, ~~General~~ Engineer
Engineering Division

Reviewed by: _____
Donald J. Blake, General Engineer
Engineering Division

Approved by: _____ for
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

## Safety Evaluation Report, Appendix 7
## Correction to Solid Waste Technical Safety Requirement Rev. 4

### 1.0 Introduction

The Department of Energy (DOE) approval of the SWMF Technical Safety Requirements (TSR) Revision 5, DOE Draft Copy has been requested via letter OBU-SWI-2004-00021, dated 06/10/2004. The DOE approval of this TSR change is separate from the review and approval of the annual update of the Documented Safety Analysis (DSA) and Technical Safety Requirement (TSR) for 2004 (submitted via letter OBU-SWI-2004-00014, received 05/20/2004).

The approval of this subject revision constitutes a necessary correction discovered in the DSA and TSR development process. The error was determined to be the result of a Quality Assurance problem outlined in the Problem Identification Report (2004-PIR-26-0046, TSR Technical Safety Limit). The change replaces an incorrect criticality safety value of 910 FGE for concrete culverts (loose waste) with the correct value of 390 FGE from criticality safety evaluation (N-NCS-E-00006, Mixed Container Types on the TRU Storage Pads in Solid Waste Management Facility dated December 1996).

### 2.0 Evaluation

The current Solid Waste TSR Rev. 4, Table 5.5.2.7-1 Item 2,b, Concrete Culverts, contains an erroneous criticality safety value for loose waste of 910 Fissile Gram Equivalent (FGE). The correct value, as documented in the criticality safety evaluation N-NCS-E-00006, is 390 FGE. The PIR 2004-2-0046 reported this error and for corrective action WSRC submitted an approval request to change the TSR Rev. 4 to replace the erroneous value of 910 FGE with the correct value of 390 FGE. DOE reviewed the PIR and found this corrective action to be appropriate. DOE also reviewed the associated criticality safety evaluation (N-NCS-E-00006) and found that the 390 FGE is the correct value reported in this evaluation. The analysis supporting this value is not in question and does not require any change. The value documented in the TSR Table 5.5.2.7-1 was transcribed incorrectly from the supporting analysis for the concrete culverts (loose waste). In the letter OBU-SWI-2004-00021, SWMF confirmed that the correct value 390 FGE has not been challenged by the facility.

The TSR Draft Revision submitted via OBU-SWI-2004-00021 contained changes other than the FGE limit discussed above (e.g., descriptive wording change in item 2.a of table 5.5.2.7-1; and new criticality safety evaluation for item 2.a). These other changes are not evaluated and therefore are not approved by this SER. The revised TSR table 5.5.2.7-1 (page 5.5-15 and below) contains the change approved by this SER, i.e. inventory limit for Concrete Culvert (loose waste) changed from 910FGE to 390FGE.

TSR Table 5.5.2.7-1: Criticality Safety Limit for TRU Waste Storage Pads

| Facility | SWMF Approved Containers | Criticality Safety Basis | Criticality Safety Limits (inventory per container) |
|---|---|---|---|
| E-Area TRU Waste Storage Pads (within 643-7E) | Concrete culvert (loose waste) | N-NCS-E-00006 | 390 g FGE Pu-239 per culvert |

## 3.0 Conclusion

This change does not result in any new accidents, does not increase the frequency or consequences of any existing accidents, and therefore does not result in an increase in the previously accepted risk. Approval of revision to the SWMF Technical Safety Requirement, Rev. 4, to correct the erroneous criticality safety value of 910 FGE for loose waste with the correct value of 390 FGE is therefore recommended.

5.5 Procedures and Programs

5.5.2.7 Nuclear Criticality Safety Program (continued)

Table 5.5.2.7-1 Criticality Safety Limits for TRU Waste Storage Pads

| Facility | Item No. | SWMF Approved Containers | Criticality Safety Basis | Criticality Safety Limits | |
|---|---|---|---|---|---|
| | | | | Inventory per Container | Configuration Restrictions |
| E-Area TRU Waste Storage Pads (within 643-7E) | 1a | 55-gallon drums | N-NCS-E-00008 | 485 g FGE Pu-239 per container | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | 1b | Steel boxes | | | |
| | 1c | Concrete culverts (55-gallon drummed waste and polyethylene boxed waste) | | | |
| | 1d | Concrete casks | | | |
| | 2a | Five polyethylene boxes containing failed HEPAs >195 g FGE Pu-239 stored as loose waste in culverts | DPSPU-85-272-121 and N-NCS-E-00006 | 910 g FGE Pu-239 per culvert | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | 2b | Concrete culverts (loose waste) | N-NCS-E-00006 | 390 FGE | |
| | 3 | FB-Line special big black steel boxes | N-NCS-E-00016 | Less than 656 g FGE Pu-239 | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | 4 | SWBs | N-NCS-E-00017 | Less than 650 g FGE Pu-239 | 3-foot spacing of fissionable material from fissionable material in non-approved containers |

APR 2 3 2004

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) Authorization Agreement (AA) Revision 2 and Safety Evaluation Report (SER), Revision 0, Appendix 6

References: 1. Letter, Kelly to Hansen, "Waste Certification Facility (Building 724-8E) Justification for Continued Operation," OBU-SWI-2004-00011, 3/26/2004

2. Letter, Pedde to Allison, "Authorization Agreement for the E-Area TRU Facilities," WSR-2004-00086, 3/29/2004

Reference 1 requested the Department of Energy (DOE) approval of the Waste Certification Facility (Building 724-8E) Justification for Continued Operation (JCO) (WSRC-TR-2004-00128, Rev. 0). Reference 2 requested DOE approval of the E-Area Transuranic (TRU) Facilities AA (WSRC-RP-2002-00557, Rev. 2), to incorporate this JCO and to clarify the Waste Certification Facility was a support facility for the Hazard Category 2 TRU Facilities. DOE-Savannah River Operations Office (SR) has reviewed the JCO submitted in Reference 1. DOE-SR approves this new safety basis document, but identified two Conditions of Approval which must be implemented by revising the JCO prior to implementation. The enclosed SWMF SER, Revision 0, Appendix 6, documents the basis for approval and the specific Conditions of Approval. Additionally, the AA revision is hereby approved, and is also enclosed.

You are requested to take action, once the JCO has been revised to incorporate the two Conditions of Approval, to add the safety basis document (JCO) to the SWMF Safety Basis Document List (WSRC-IM-95-28) upon implementation of the changes within 90 days from the date of this letter. This action has been discussed with Steve Crook of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5)

working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or have your staff contact Tam Tran at 208-3525.

Sincerely,

Original Signed By
Jeffrey M. Allison

Jeffrey M. Allison
Manager

WDED:TT:kl

DC-04-029

2 Enclosures:
1. SWMF SER Rev. 0, Appendix 6
2. E-Area TRU Facilities AA, Rev. 2

cc w/o encls:
W. J. Johnson, WSRC, 730-1B
H. T. Conner, Jr., WSRC, 730-1B
J. C. DeVine, WSRC, 766H
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bc w/o encls:
WDED Rdg File
AMWDP Rdg File
MGR Rdg File
DMC & DMB Rdg File
ECAT

# SAFETY EVALUATION REPORT
# REVISION 0, APPENDIX 6

**FOR THE**
**SAVANNAH RIVER SITE**

## SOLID WASTE MANAGEMENT FACILITY (SWMF)

**OPERATED BY WESTINGHOUSE SAVANNAH RIVER COMPANY UNDER CONTRACT NO. DE-AC09-96SR18500**

## WASTE CERTIFICATION FACILITY 724-8E
## JUSTIFICATION FOR CONTINUED OPERATION
**WSRC-TR-2004-00128, REVISION 0**

April 2004

Prepared by: _____
Tam Tran and Tom Temple

Reviewed by: _____
Dave Faubert

Approved by: _____
Michael A. Mikolanis, Director
Engineering Division

THE OFFICE OF THE ASSISTANT MANAGER FOR WASTE DISPOSITION
SAVANNAH RIVER OPERATIONS OFFICE
U.S. DEPARTMENT OF ENERGY

**SOLID WASTE MANAGEMENT FACILITY**
**SAFETY EVALUATION REPORT**
**Revision 0, Appendix 6**

## 1.0 Introduction

By letter OBU-SWI-2004-00011, dated 03/26/2004, WSRC requested DOE-SR approval of the Waste Certification Facility (Building 724-8E) Justification for Continued Operation (JCO, WSRC-TR-2004-00128, Rev. 0). This JCO is needed to allow 724-8E to process certain legacy Transuranic (TRU) waste drums whose inventories are indeterminant. To support the activity of processing these legacy TRU waste drums, the JCO recognizes and justifies that the radionuclide inventory within the 724-8E building could be greater than hazard category 3 radionuclide inventory while processing these drums. Approval of this JCO allows the continued usage of this facility at a hazard designation of category 2 for the pre-screening of these TRU waste drums as a part of Waste Isolation Pilot Project (WIPP) certification. The JCO has the expiration date of December 31, 2004.

This SER appendix documents the basis for approval of the submitted JCO and its inclusion as part of the Solid Waste Management Facility (SWMF) safety basis.

## 2.0 Review Process

This SER appendix (Appendix 6) is prepared by the DOE Savannah River Operations Office (SR) in accordance with guidance from DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," and Savannah River Implementing Procedure (SRIP) 421.1, "Nuclear Safety Oversight". The Manager, SR is the approval authority for this SER appendix based on Savannah River Manual (SRM) 300.1.1A, "U.S. Department of Energy Savannah River Operations Office Human Resources Program Management Manual," Chapter 1, "Functions, Responsibilities, and Authorities Procedure."

## 3.0 Review Criteria

- Valid/acceptable reason for the continued use of the facility (i.e., the need for JCO) and the duration of use
- The risk for continued operation is adequately identified and justified
- Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public.

## 4.0 Evaluation

4.1 Valid/acceptable reason for the continued use of the facility (i.e. the need for JCO) and the duration of use

As described in the SWMF Safety Analysis Report (SAR, WSRC-SA-22), the 8E facility is currently classified and controlled as a hazard category 3 nuclear facility, which has an inventory limit of 56 Plutonium Equivalent Curies (PEC). The SWMF currently has stored a population of legacy TRU waste drums for which the generator declared had negligible PEC. Upon assaying, however, some of these drums were determined to have high activity (i.e., greater than 0.9 PEC), and one had activity greater than 56 PEC which is the limit for a hazard category 3 facility. Thus, the actual inventory of these drums is suspect and judged to be indeterminant. These suspected high activity drums are identified in Reference 1 to be 2,589 drums of "zero-zero" identification. Changing the 8E facility to hazard category 2 would allow this facility to be operated at a higher inventory limit (JCO limits to 3,900 PEC), for which the suspected high activity drums can be moved into and processed in this building. The 8E facility is scheduled to be Decontaminated & Decommissioned as a part of Environmental Management accelerated cleanup. The JCO has an expiration date of December 31, 2004, based on the program need for the 8E building and the estimated time to process the suspect legacy drums.

DOE review of the need and the schedule concludes there is an adequate reason for the JCO and its proposed schedule limitation to process these suspected high activity drums.

4.2 The risk for continued operation is adequately identified and justified

WSRC identified the risk of operation of this facility in two statistical analyses: "Statistical Analysis" (Ref. 1) and "Statistical Analysis of FGE [Fissile Gram Equivalent] in Un-assayed Drums" (Ref. 2). In these references, existing assayed data from drums with similar origin was used to construct a statistical distribution of TRU drums to calculate the probability of encountering high activity or high fissile-content drums in the unassayed population of the aforementioned suspect legacy drums. The analysis in Reference 1 indicated that 16 total drums out of the remaining population of suspect legacy drums would be expected to be over 50 PEC (99.9% confidence), in comparison to 56 PEC for hazard category 3 facility. In addition, per Reference 1, the number of suspect drums which could be greater than 130 PEC were identified to be 4 or 5 drums at confidence levels of 97.7 % and 99.9% respectively. The associated Upper Bound Tolerance Limit at 95% certainty and 95% confidence level for a single drum was calculated to be 706 PEC. The maximum inventory limit, based on the premise of up to 5 drums of high activity, is conservatively assigned a value of 3,900 PEC, consistent with the limit for a single Temporary Storage Area (TSA) TRU pad facility. The SWMF SAR assumes that the maximum inventory of any single TSA is less than 3,900 PEC when a single drum in the TSA exceeds 130 PEC. The SWMF SAR analyzed 3,900 PEC and concluded the mitigated accident scenarios were within the evaluation guidelines for the hazard category 2 TRU pad facility. The existing Site Emergency Response Program ensures that the onsite workers are protected and any adverse consequences are mitigated below evaluation guidelines. This is consistent with DOE Standard for facility hazard categorization (DOE-STD-1027-92).

Of the legacy indeterminant drums remaining to be assayed, Reference 2 states there are 550 drums which are expected to have some fissile material (Pu-239 and/or U-235) based on where these drums were generated. Assay data from 9709 similar drums show an average of 0.41 Fissile Gram Equivalent (FGE) and one drum had a maximum of 63.8 FGE. Statistical analysis (Ref. 2), based on existing assay data from these 9709 drums, indicates that it is unlikely to encounter a drum that has a fissile content of greater than 63.8 FGE. Thus, it is no more likely to encounter a drum within the 550 unassayed drums having greater than 63.8 FGE. Reference 2 also concluded that it is even more unlikely that a drum could exist with a fissile content greater than the WIPP Waste Acceptance Criteria of 195 FGE. Finally, Reference 2 showed that the probability of having three drums greater than 20 FGE within a 25 drum configuration was one in 75 million (i.e., beyond extremely unlikely).

DOE review of References 1 and 2 concluded the use of statistical analysis and the corresponding 95%/99% confidence values to form the basis of this JCO is appropriate and adequate.

4.3 Appropriate compensatory measures for safety control are analyzed, evaluated, and implementable to protect the workers and the public.

The SWMF Safety Analysis Report (Ref. 3) postulates staging high activity drums in a concrete culvert (or comparable container) or in a designated Temporary Storage Area (TSA). A TSA is analyzed by accident analysis with high concentration of radioactivity that could be dispersed in a postulated accident. The individual TSA inventory limit used in the SAR is 3,900 PEC, which is consistent with the JCO limit for the 8E building. The SWMF SAR analyzed 3,900 PEC and concludes the resulting mitigated consequences to be within the evaluation guidelines for the workers and the public for the hazard category 2 TRU facility. The existing Site Emergency Response Program ensures that the onsite workers are protected and any adverse consequences are mitigated below evaluation guidelines. This is consistent with DOE Standard for facility hazard categorization (DOE-STD-1027-92). The features and controls in place for the TRU pads given in the SAR (combustible loading, traffic controls, Radiological Control Program, Emergency Response Program, etc.) are also applicable to the 724-8E building. Thus, the conclusion reached in the SWMF SAR for the TRU pads bounds the operation of the 724-8E building while under the JCO.

For emergency response considerations to protect the workers and the public:

- The maximum inventory limit for 724-8E operation is 3,900 PEC. This is a technically adequate limit for the 8E building since it is consistent with the limit for a single TSA. The SWMF Technical Safety Requirement for TSA states: "The total inventory of drums or other containers located in a given TSA, while outside the culverts or other compatible containers, shall not contain more than 3,900 Pu-239 PEC for the case where any one container located outside the culvert exceeds 130 PEC."
- At 3,900 PEC, the maximum drum count limit for 724-8E operation is 30 drums, based on the assumption that each drum could contain up to 130 PEC. This is a technically adequate drum count limit since only 13 to 16 drums are expected to exceed 50 PEC and only 4 to 5 drums are expected to exceed 130 PEC, out of 2,589 drums.

[As a very conservative example, assume that a batch of 30 drums within 724-8E included 1 drum at 706 PEC, four drums at 200 PEC each, and 11 drums at 100 PEC each, even if all of the remaining 14 drums had 90 PEC each, this would total to 3866 PEC which is < 3900 PEC. Based on the statistical distribution derived above, having a batch of 30 drums with these PEC values is judged to be extremely unlikely.]

Criticality analysis (Ref. 4) indicates that at 195 FGE, an optimized triangular-pitch three drum arrangement and intact fissile inner-content can be stored with a k-effective less than 0.85 (sub-critical). At higher fissile content, separation distance would be warranted to preclude criticality. Based on Reference 2, having a triangular-pitch three drum configuration each with FGE greater than 195 is incredible. Reference 4 shows 485 FGE to be an adequate limit for the case where the fissile inner-content of a single drum is intact or no longer intact. Similar to the above conclusion, it is judged that having a drum of greater than 485 FGE stored in 724-8E in close proximity of other drum(s) with significant FGE is incredible.

The JCO identified the following compensatory measures as specific administrative controls for 724-8E operation (Section 5, Compensatory Measures, and Section 6, Deviations):

(1) "The total number of drums located in the Waste Certification Facility shall be controlled such that the maximum number in the building at any one time does not exceed thirty. If the total number of drums in the facility is discovered to be greater than thirty, the excess drums beyond that number shall be removed within 72 hours".

(2) "The criticality Safety Limits that are outlined for the TRU Waste Storage Pads in Table 5.5.2.7-1 of the TSR shall also apply to the Waste Certification Facility 724-8E. Any drum in building 724-8E that is found to contain greater than 195 grams Pu-239 FGE by assay shall immediately be separated from all other drums by a minimum distance of three feet as analyzed in the criticality analysis Reference [4]. If the inventory of any single drum is found to be greater than 485 grams Pu-239 FGE, all drum related activities shall stop until a response plan is developed to restore Building 724-8E into TSR compliance."

DOE review of these compensatory measures found them appropriate, implementable, and consistent with the supporting analyses discussed above. However, no basis was provided in the JCO or supporting references to justify the allowed time of 72 hours to restore the total number of drums to within 30. DOE review concluded that, based on the rationale presented in the JCO, should more than 30 drums exist within the 724-8E building, the safety analysis value of 3900 PEC is potentially jeopardized. Considering the fact that 724-8E operations is expected to process approximately 15-20+ drums per day, there is no rationale for a 3-day delay of removing excess drums. Thus, immediate action should be taken to restore compliance to the 30 drum limit. Changing "72 hours" to "Immediately" is identified as a Condition of Approval in section 5.0 below. DOE expectation as to "Immediate" used here is the same as used in other SRS TSRs (e.g., CSTF, DWPF, etc.) for Limiting Conditions for Operation, that is the action "must be initiated without delay and continued until completed." For the action of removing excess drums from 724-8E, this is expected to be minutes to hours, not hours to days.

Additionally, JCO section 6.0 states 724-8E will remain classified as a HC-3 facility and no deviation from current TSR Administrative Control 5.5.2.6.16 (which requires 724-8E to operate as a HC-3 facility) was recognized. To be consistent with the purpose and scope of the JCO, section 6.0 should clearly recognize that, while under this JCO, the 724-8E building is operated as a HC-2 facility. This is identified as a Condition of Approval in section 5.0 below.

**5.0 Conditions of Approval**

1. Revise JCO WSRC-TR-2004-00128, prior to implementation, to replace "within 72 hours" with "Immediately" in Compensatory Measure 1.
2. Revise JCO WSRC-TR-2004-00128, prior to implementation, to correct the statement in section 6.0 as follows: "The Waste Certification Facility at 724-8E is classified as a HC-2 facility while under this JCO." Related, add a Deviation to section 6.0 to address deviation from current TSR Administrative Control 5.5.2.6.16 (which currently requires 724-8E to operate as a HC-3 facility).

**6.0 Conclusion**

The staff has reviewed JCO WSRC-TR-2004-00128, Rev. 0, and the associated safety calculations listed as references. The DOE review concludes that the JCO, as amended by the two Conditions of Approval above, meets the review criteria. The risk of operating the 724-8E building as described in the JCO is bounded by the DOE-approved safety basis for the TRU pads. Additionally, the compensatory measures identified, as amended by the Conditions of Approval, were found appropriate and adequate. Thus, the JCO submitted via letter OBU-SWI-2004-00011, dated 03/26/2004, assuming proper implementation of the Conditions of Approval, is approved.

**7.0 References**


1. Memo: Myers, J.C. to Burns, R.D., "Statistical Analysis," WSMS-LIC-M-04-0004, February 21, 2004
2. Memo: Myers, J.C. to Radder, J.A., "Statistical Analysis for FGE in Unassayed Drums," WSMS-LIC-M-04-0010, March 25, 2004
3. "Savannah River Site – Solid Waste Management Facility Safety Analysis Report," WSRC-SA-22, Rev. 4, May 2003
4. "Nuclear Criticality Safety Evaluation: Criticality Safety Envelope for Receipt, Handling, and Storage of Transuranic Waste (U)," N-NCS-E-00008, November 6, 1997

JUL 2 4 2003

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) Safety Evaluation Report (SER), Revision 0, Appendix 5 (Letter, Kelly to Doswell, "SWMF SAR and TSR Revision 4 DOE Approval Copy Submittal," OBU-SWI-2003-00014, 6/5/03)

The Department of Energy (DOE), Savannah River Operations Office (SR) has reviewed the SWMF Safety Analysis Report (SAR) and Technical Safety Requirement (TSR) revisions submitted in the referenced letter. DOE-SR approves these safety basis document changes. The enclosed SWMF SER, Revision 0, Appendix 5, documents the basis for approval. You are requested to take action to add these safety basis documents (SAR Revision 4 and TSR Revision 4) to the SWMF Safety Basis Document List (WSRC-IM-95-28) upon implementation of the changes within 90 days from the date of this letter. This action has been discussed with Steve Crook of your staff.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or your staff may contact Tom Temple at 208-8772.

Sincerely,

Original Signed By
Jeffrey M. Allison

Jeffrey M. Allison
Manager

WDED:TCT:kl

DC-03-005

Enclosure:
SWMF SER Rev. 0, Appendix 5

cc w/encl:
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L. J. Hollick, WSRC, 730-1B
W. S. Elkins, WSRC, 730-1B

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WDED Rdg File
AMWDP Rdg File
MGR Rdg File
ECAT

U. S. DEPARTMENT OF ENERGY

# SAFETY EVALUATION REPORT
REVISION 0
APPENDIX 5

FOR THE SAVANNAH RIVER SITE

## SOLID WASTE MANAGEMENT FACILITY

SAFETY ANALYSIS REPORT
WSRC-SA-22, REVISION 4
MAY 2003

TECHNICAL SAFETY REQUIREMENTS
WSRC-TS-95-16, REVISION 4
MAY 2003

Prepared by Westinghouse Savannah River Company
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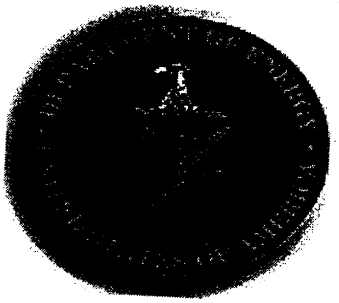

**July 2003**

SER Prepared: _____ 7/16/03
J. M. Simmons, Review Team Leader — Date

SER Reviewed: _____ 7/16/03
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SER Approved: _____ 7/18/03
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## Executive Summary

10 CFR 830, *Nuclear Safety Management*, Subpart B requires Documented Safety Analyses (DSAs) to be reviewed, updated as necessary, and submitted annually to DOE to ensure that the information therein is current and remains applicable. The DSA is called a Safety Analysis Report (SAR), but is referred to herein as the DSA for consistency with 10CFR830, Subpart B. This Solid Waste Management Facility (SWMF) Safety Evaluation Report (SER) was prepared utilizing the guidance delineated in Attachment A of SRIP 400 Chapter 421.1, Revision 2, *Nuclear Safety Oversight*. It documents the basis for DOE approval of changes delineated in Revision 4 (Updates) to both the SWMF DSA (Reference 1) and TSRs (Reference 2).

Review drafts of Revision 4 to both the SWMF DSA and TSRs were submitted[1] by the Savannah River Site (SRS) operating contractor, Westinghouse Savannah River Company (WSRC), to the DOE Savannah River Operations Office (DOE-SR) on March 27, 2003 in accordance with the annual update process. The DSA was developed utilizing the "safe harbor" method specified in Code of Federal Regulations 10 CFR 830. Specifically, DOE-STD-3009-94, Change Notice No. 2, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*. The SWMF TSRs were reviewed utilizing DOE Guide G423.1-1, *Implementing Guide for Use in Developing Technical Safety Requirements*. A DOE review team provided comments to WSRC on April 17, 2003[2]. Comments were satisfactorily incorporated and the DSA was resubmitted[3] to DOE on June 05, 2003.

In summary, changes to the DSA primarily consisted of incorporating Unreviewed Safety Question (USQ) determinations conducted since the last update. Specifically:

- Addition of additional non-destructive assay (NDA) equipment on Transuranic (TRU) Pad 4
- Addition of additional (NDA) equipment in Building 724-8E Waste Certification Facility
- Management of high activity TRU containers in Temporary Storage Areas (TSAs)
- Increase of total fissile inventory allowed in Engineered Trench (ET) by utilizing a single container limit
- Allowing polyurethane foam as a container void space filler for trench disposal

In addition to the above changes, segmentation within the Naval Reactor Component Storage Areas (NRCSAs) and culverts in Mixed Waste Storage Areas were eliminated

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[1] SWMF DSA and TSR Revision 4 DOE Approval Draft Copy Submittal, OBU-SWI-2003-00011, dated March 27, 2003

[2] DOE Review of the DOE Approval Draft Revision 4 to the SWMF DSA and TSR, OC-03-04, dated April 17, 2003

[3] SWMF DSA and TSR Revision 4 DOE Approval Copy Submittal, OBU-SWI-2003-00014, dated June 05, 2003

and text modifications were made as necessary to reflect the new organizational structure. There were no changes that affected existing accident scenarios, equipment, controls, or programs.

In summary, the changes to the TSR consist of additional administrative controls to protect assumptions supporting TRU container TSAs and the deletion of administrative controls for segmentation within the NRCSAs. Additionally, the TSR administrative control for criticality safety for Hazard Category 3 facilities removed the specific limits and stipulated the requirement to meet the limits derived in DSA chapter 6.

There were no Conditions of Approval identified during DOE review.

The overall conclusion of this SER is that the mitigative and preventive measures derived in the DSA continue to provide adequate controls to ensure that the Solid Waste Management Facility can operate safely without undue risks to the public, the workers, or the environment. This position is based upon review of the bounding accidents and the consequences associated with these bounding accidents for the site workers and the public are a small fraction of evaluation guidelines. Additional safety class or safety significant structures, systems and components would not be expected to reduce the consequences. The Defense in Depth analysis described in the DSA ensures the consequences of all postulated accidents are minimal or non-operational events have been determined to be beyond extremely unlikely. Approval of revisions to the WSRC-approved SWMF DSA (WSRC-SA-22, Rev. 4, May 2003) and TSRs (WSRC-TS-95-16, Rev. 4, May 2003) is therefore recommended.

## 1.0 Introduction

WSRC, in accordance with 10 CFR 830.202 for annual updates, prepared and submitted a revision to the existing DSA and TSR. This SER documents the basis for DOE approval of changes delineated in SRS Solid Waste Management Facility Safety Analysis Report, WSRC-SA-22, Rev. 4, May 2003, and Technical Safety Requirements, SRS, Solid Waste Management Facility, WSRC-TS-95-16, Rev. 4, May 2003.

The updated documents primarily incorporate analyses and descriptive material relevant to activities which have been added at SWMF, each of which was previously evaluated and found to be within the existing safety envelope via the Unreviewed Safety Question (USQ) process and submitted to DOE by Reference 3. These activities are:

- Addition of additional NDA equipment on TRU Pad 4
- Addition of additional NDA equipment in Building 724-8E Waste Certification Facility
- Management of high activity TRU containers in TSAs
- Increase of total fissile inventory (Reference 4) allowed in ET by utilizing a single container limit
- Allowing polyurethane foam as a container void space filler for trench disposal

In addition to the above changes, segmentation within the NRCSAs and culverts in mixed waste storage areas were eliminated. Text modifications were also made as necessary to

reflect the new Solid Waste organizational structure. Descriptive and technical changes are largely found in Chapters 2, 3, 5, and 6 of the DSA. Changes to the TSR consist of additional administrative controls to protect assumptions supporting TRU container TSAs and the deletion of administrative controls for segmentation within the NRCSAs. Additionally, the TSR administrative control for criticality safety for Hazard Category 3 facilities removed the specific limits and stipulated the requirement to meet the limits derived in DSA chapter 6.

The only new controls pertained to TRU waste drum TSAs. There were new inventory limits specified in the DSA and TSR for TSAs in order protect the existing bounding accident scenarios. These are not safety limits but rather administrative controls implemented through the Inventory Control Program. There was no new safety significant or safety class equipment identified as result of this update. None of the changes resulted in any clearly discernible increases in frequency, consequence and/or risk.

## 2.0 Background

There were no changes to the purpose and mission of the SWMF as result of this annual update. The facility hazard categorization and hazards in the facility are the same as those delineated in the original SER and as appended in Revision 0, Appendix 4.

## 3.0 Review Process

Review drafts of Revision 4 to both the SWMF DSA and TSRs were submitted[4] by the SRS operating contractor, WSRC, to DOE-SR on March 27, 2003 in accordance with the annual update process. A multidisciplinary technical review team was formed and led by the SR Waste and Operations Division (WOD). The DOE review team as shown in Table-1, consisted of the following:

| Name | Organization | Areas Reviewed |
|---|---|---|
| Mike Simmons (Team Leader) | Waste & Operations Division (Mixed/Hazardous Waste Program Manager and Nuclear Safety) | All page changes |
| Howard Pope | Waste & Operations Division (Low-level Waste Program Manager) | All page changes |
| Moses Villanueva | Waste & Operations Division (Facility Representative) | All page changes |
| Bert Crapse | Waste & Operations Division (TRU Waste Program Manager) | All page changes |
| Winchester Smith | Waste & Operations Division (Low-level Waste Storage/Disposal ) | All page changes |
| Norm Shepard | Nuclear Materials Engineering Division | NCSE for Engineered Trench |
| Tom Temple | Waste Disposition Engineering Division | All page changes |

Table-1

[4] SWMF DSA and TSR Revision 4 DOE Approval Draft Copy Submittal, SWD-2003-00011, dated March 27, 2003

The team conducted the review in accordance with the guidance provided in DOE-STD-1104-96, *Review and Approval of Non-reactor Nuclear Facility Safety Analysis Reports*. The results of the review and the approval basis have been documented in this SER. The DOE team members reviewed the DSA and TSR updated draft pages, the SWMF Annual USQ Summary Report, and additional documents as required to support the review. The SR team reviewed the documents for technical content and accuracy; evaluated calculations for reasonable assumptions, technical accuracy and justification for the conclusions; interviewed key facility personnel, and performed facility walk-downs as applicable. Since the DSA and TSR were previously approved by DOE, the SR team focused its review on the document revisions. However, the team did a review on other portions of the documents to assess their adequacy. Documents that were reviewed during this process are listed in the reference section of this report. The review team provided comments to WSRC on April 17, 2003[5]. The Review Criteria Evaluations and the comments and resolutions document the decisions and judgments made by the DOE-SR review team to conclude the revisions are acceptable. Changes in the updated documents primarily incorporate analyses and descriptive material relevant to activities which have been added at SWMF, each of which was previously evaluated and found to be within the existing safety envelope via the USQ process. Activities added included, addition of NDA equipment on TRU Pad 4, addition of additional NDA equipment in Building 724-8E Waste Certification Facility, management of high activity TRU containers in TSAs, increase of total fissile inventory allowed in an Engineered Trench by utilizing a single container limit, and allowing polyurethane foam as a container void space filler for trench disposal. DOE/WOD, in its oversight role of WSRC, monitors the contractor's USQ process in an on-going basis through the Facility Operations Safety Committee. In this capacity, WOD has reviewed, both prior to and during this DSA update review, most all USQ determinations and other documents associated with changes discussed in this SER.

There was one technical change not previously evaluated through the USQ process. Specifically, the elimination of segmentation for some stored components on the NRCSAs and concrete culverts within the mixed/hazardous waste facilities. This change was evaluated and will be further discussed in the following sections of this SER.

Throughout the DSA and TSR, changes have been made to reflect the organizational changes. All such changes have been reviewed and found to be accurate and acceptable. These administrative changes will not be addressed further in this SER.

This SWMF SER was prepared utilizing the guidance delineated in Attachment A of SRIP 400 Chapter 421.1, Revision 2, *Nuclear Safety Oversight*.

## 4.0 Review Criteria/ Safety Evaluation

This section of the SER documents the bases for approving the changes within the base information from that previously approved in the original SER and subsequent appendices. This section also documents the evaluation of changes against previously approved hazard and accident analyses by focusing on the completeness of the analyses

[5] DOE Review of the DOE Approval Draft Revision 4 to the SWMF DSA and TSR, OC-03-04, dated April 17, 2003

and the consistency of the logic used through the process. Specific details and bases for the approval for each of the changes are listed below.

**Review Criteria:** The review criteria for the DSA revision is derived from DOE-STD-3009-94, DOE-STD-1104-96, 10 CFR 830, DOE Guide G423.1-1, and supplemented by applicable DOE guides.

- For any changes, ensure the base information contains sufficient background and fundamental information to support the technical aspects of the DSA and that the facility/activities currently exist as described in the DSA.

- Changes are evaluated against approved qualitative or semi-quantitative analysis of the dominant accidents from the hazard analysis (HA) in each category as well as Natural Phenomenon Hazard (NPH) events. Ensure the changes are bounded ~~or not~~ by existing approved analyses, ensure source term estimates and their basis are discussed including: the initial material at risk, release rates and/or release fractions, and release pathways. Frequencies are to be established by estimating the frequency of the initiating event along with the conditional probability of all other necessary events leading to a release of hazardous material. Accident consequences are estimated and compared to established Evaluation Guidelines (EGs). Analytical methods are described, referencing controlled source documentation as appropriate. Consequences are to be established based on parameters such as bounding material estimates, the release mechanism, and release pathway. Impacts on workers, including facility workers, and the public are presented.

**Evaluations:**

4.1 Changes within the TRU Waste Program

4.1.1 ADDITION OF IQ3 GAMMA SCANNER TRAILER ON TRU PAD 4

In order to accelerate the TRU Ship-to-WIPP program, additional capability was needed for NDA of Pu238 and some Pu239 drums. Installation of the NDA-IQ3 system, to provide this capability, was previously evaluated through the USQ process (Reference 5) and found to be negative.

The NDA-IQ3 system is a gamma-spectroscopy-based NDA system that determines the TRU content of bulk waste. Using high-sensitivity shielded germanium detectors and additional low-energy germanium detectors, the NDA-IQ3 assays bulk waste containers for isotopes of plutonium, americium, neptunium and uranium as well as other gamma-emitting nuclides. The NDA-IQ3 system is housed in a trailer and includes a conveyor system for loading 55- and 85-gallon drums onto a turntable located within the shielded assay chamber. Evaluation of this additional activity concluded the following:

The previously approved DSA evaluated accidents for the TRU Pads including fires, explosions, transfer and handling events, NPH events, and external events (e.g., aircraft and external vehicle impacts). The addition of this activity does not affect the frequency of external and NPH events. External events are not associated with the operation of the TRU Pad and originate external to the pad. Likewise, NPH events such as tornado and

seismic events are independent of the activities on the pad. The last classes of evaluated accidents in the approved DSA are fires/explosions. This activity does not impact the frequency of internal waste container fires/explosions because there are no changes to the internal conditions of waste containers. However, the new activity could impact external fires/explosions. There are no explosive materials associated with the IQ3 trailer. Therefore, explosions can be ruled out. However, the trailer does have combustible materials and potential fire initiators such as electrical wiring. A review of WSMS-TR-02-0020 and the TRU Pad #4 Fire Hazard Analysis concluded the IQ3 trailer has a relatively light combustible loading and does not significantly increase the combustible loading on TRU Pad 4. Locating the IQ3 trailer on TRU Pad 4 is thus qualitatively estimated not to have a significant impact on the frequency of an external fire that impacts multiple waste containers.

This activity does not increase the "process" radiological inventory, change the form of the radiological inventory, or change the energy sources capable of interacting with TRU Pad #4 inventories. Therefore, it can be concluded there is no increase in the consequences of evaluated accidents. This activity is nearly identical to that performed in the NDA-Imaging Passive/Active Neutron assay trailer, also located on TRU Pad 4. Therefore, no new accident types are introduced by this new activity and the only necessary changes are descriptive in nature.

Based on review of the DSA against previously stated review criteria, the DOE review team has concluded that this change to the base information adequately reflects the actual facility arrangements/operations and that sufficient background material exists to support the major elements of the safety analysis.

### 4.1.2 ADDITION OF TRANSURANIC OPTIMIZED SYSTEM (TOMS) IN BUILDING 724-8E

A non-intrusive method for prescreening TRU waste drums or polyboxes, for prohibitive items, was added in the Waste Characterization Facility (Building 724-8E). This is achieved by the use of TOMS, a passive gamma spectroscopy system which can be used to assay waste contained in 55-gallon drums and other waste package configurations. Key elements of the system include a high purity germanium detector with electronic cooling, a sodium iodide detector, processing electronics, a drum rotate/translate device, and a control computer. The unit contains a sealed propane refrigerant charge which is used in the unit cooling system. The total amount of refrigerant charge is 45.1 grams. A sealed radioactive check source is also part of the unit. Total activity for the check source is 2.639 uCi. Installation and operations of TOMS was previously evaluated through the USQ process (Reference 6) and found to be negative. Evaluation of this additional activity concluded the following:

Chapter 3 of the approved SWMF DSA discusses the accident analysis for Building 724-8E. This facility is classified as a Hazard Category 3 facility. The analyzed event in this section is a maximum consequence event (fire releases entire inventory) used to demonstrate a complete release of the facility inventory will not challenge a public evaluation guideline.

Operation of TOMS will have no effect upon the TSR inventory requirement for 724-8E. The implementing procedures, for the inventory TSR, presently control the number of containers that can be placed into 724-8E to maintain the building below Hazard Category 2 threshold quantity as defined by DOE-STD-1027-92. The unit does have a radioactive sealed source of 2.639 uCi used as a check source which has been factored into the inventory. Adding this source to the 724-8E inventory does not alter the Inventory Control Program for the building. In conclusion, only the "Base" information in the previously approved DSA was changed to accurately reflect existing conditions/operations.

Based on review of the DSA against previously stated review criteria, the DOE review team has concluded that this change to the base information adequately reflect the actual facility arrangements/operations and that sufficient background material exists to support the major elements of the safety analysis.

### 4.1.3 MANAGEMENT OF HIGH ACTIVITY TRU CONTAINERS IN TEMPORARY STORAGE AREAS (TSAs)

Typically, TRU waste containers with greater than 0.9 plutonium equivalent curies (PEC) are loaded and stored in concrete culverts on the TRU pads. A mobile crane is used to handle culvert lids and emplace waste containers. The culvert lids are normally removed only for loading and unloading operations, and are replaced at the completion of each day's waste handling activities. However, when high-activity waste drums (containing greater than 0.9 PEC Pu-239) are being processed for shipment to WIPP, these drums need to be located outside of a culvert in a TSA in order to assay or package the drums for shipment. The DSA and TSRs have been revised to reflect this new operational option. The DOE evaluation concluded the following:

The revised base information in Chapter 2 of the DSA incorporating TSAs accurately reflects operational processes and facility arrangements. Chapter 3 of the DSA was revised to analyze the source term associated with TSAs. Specifically, drums in TSAs are managed as follows:

- The total activity within all TSAs combined is to be limited to 30,000 PEC Pu-239, or
- If any one of the staged drums contains more than 130 PEC Pu-239 in a given TSA, then the total activity staged in that TSA shall not exceed 3,900 PEC Pu-239

There were no new accidents identified, therefore, the above source term assumptions were utilized for evaluation against existing design base accidents (DBAs). The worst-case grouping of high-activity drums where all of the drums are just below 130 PEC Pu-239 was assumed as the source term. Analyses performed using this source term and the same methodology utilized for previous DOE approved DBAs, as shown in Table-2, concluded the following:

| Accident Type | Results |
|---|---|
| 1. Fire /Explosion – External Fire (High Activity Drums) | Bounded by previous analysis |
| 2. Fire /Explosion – Culvert Drum Internal Fire | Bounded by previous analysis |

| | |
|---|---|
| 3. Fire /Explosion – Culvert Explosion | Bounded by previous analysis |
| 4. Transfer/Handling – Dropped High Activity Drum | Bounded by previous analysis |
| 5. Transfer/Handling – Dropped Culvert | Bounded by previous analysis |
| 6. Transfer/Handling – Low-Energy Vehicle Impact | Bounded by previous analysis |
| 7. Tornado | Increase in offsite dose from 260 mrem to 340 mrem |
| 8. Seismic | Increase in offsite dose from 130 mrem to 225 mrem |
| 9. High Energy Vehicle Impact – Container Rupture and Fire | Bounded by previous analysis |
| 10. Small Aircraft/Helicopter Crash | Bounded by previous analysis |

Table - 2

Calculations supporting the above conclusions were documented in Reference 7. The calculations were reviewed and found to be adequately conservative and the methodology consistent with previously approved calculations (Reference 8). In general, all but the NPH events are localized in nature where analysis concluded that postulated events resulted in calculated consequences less than those contained in the previously approved DSA. However, NPH events are global where a greater potential exists for impacting all TSA's. Specifically, the average drum inventory that could be vulnerable during a NPH event increased over what was previously analyzed.

To preserve assumptions of analyses, administrative controls were added in the TSR specifying allowable TSA inventories. The TSR changes were reviewed and found to be acceptable.

In summary, the implementation of TSAs for high activity TRU drums only slightly increase consequences for two postulated accidents, seismic and tornado. Both consequence increases are less than one-hundred millirem over previous accident analyzes and are still within a small fraction of site EGs.

DOE-SR concludes that the "Review Criteria" for this activity/process has been met. Specifically, changes in the base information accurately reflect the existing facility arrangements/operations and that sufficient background material exists to support the major elements of the safety analysis. The activity has been adequately analyzed and controls are in place to mitigate or prevent identified accidents based on review of the documents, calculations, walkdowns, and comparison of calculated consequences against EGs.

## 4.2 Changes within the Low-level Waste Program

### 4.2.1 INCREASE OF TOTAL FISSILE INVENTORY ALLOWED IN ENGINEERED TRENCH (ET) BY UTILIZING A SINGLE CONTAINER LIMIT

The ET was previously limited to an inherently safe 700 fissile gram equivalent (FGE) U-235 total for the entire trench. This significantly reduced the operational capacity and was inconsistent with management of the adjacent low activity waste vaults. As result, a Nuclear Criticality Safety Evaluation (NCSE) (Reference 9) evaluated an increase of total inventory by evaluating four scenarios:

- Fissile material accumulation due to leakage of a six high drum array,

- Fissile material accumulation in an ET sump,
- Fissile material accumulation on the bottom of an ET, and
- Fissile material accumulation in the soil surrounding an ET

Fissile material accumulation due to leakage of drums was evaluated by assuming the proposed WAC limit is double batched to 100 FGE U-235 per container for conservatism. The WAC limit of 50 FGE is specified in Chapter 6 of the DSA and is implemented by reference via the TSR. The smallest container currently permitted in an ET is an approved 55-gallon drum (22 inches in diameter) providing the densest positioning of fissile material. The depth of the trench allows drums to be stacked five high; however, for conservatism six high stacking is assumed. When 55-gallon drums, which are cylindrical, are placed in proximity with one another, a small void is present between the cylinders. This void, upon drum deterioration, could collect fissile material. For conservatism, this void is assumed to contain 100 percent of the fissile material from the stacked containers. The most reflective condition was determined to be soil with eleven percent interstitial water content fully reflecting the cylinder array. The outer cylinder of soil was set with a radius and height of at least 60 cm greater than the outer dimensions of the fissile material cylinder array to approximate an infinite reflective system. Utilizing the above assumptions in the most reactive configuration resulted in an adjusted $k_{eff}$ of 0.938 which is below the $k_{safe}$ value of 0.954. Therefore, the most reactive configuration of fissile material for an ET in a double batched stacked array will remain sub-critical; concluding a WAC fissile material limit of 50 FGE U-235 is safe.

Fissile material accumulation in an ET sump was evaluated for a critical configuration due to leakage from containers prior to backfilling. It was determined that for sufficient fissile material to accumulate in the trench sump five independent operational failures would have to occur. As result, this scenario has been deemed incredible.

Fissile material accumulation in the bottom of an ET without the risk of a critical configuration was evaluated by utilizing the assumptions for the double batched six high array discussed above. These assumptions resulted in a spatial density of 227.3 grams/$ft^2$ which is well below the ANSI/ANS-8.1 limit of 371 grams/$ft^2$.

Fissile material accumulation in the soil surrounding an ET was evaluated and determined that the maximum fissile loading capacity of the soil would be 32 g/l. At this concentration, the sub critical diameter of an infinite cylinder is 24 cm. Limiting the length of the cylinder to 46 feet, at 32 g/l, would limit an ET total fissile material inventory to 20 kg FGE U-235. In order to accumulate enough fissile material (20 kg FGE U-235) to cause a criticality concern, multiple conditions would have to occur. First, the entire bottom of the trench would have to be covered with polyethylene or other impenetrable barrier to facilitate horizontal flow. Second, all approved containers would have to fail simultaneously and all fissile material would have to escape. Third, lateral water flow would be required to displace the fissile material to only the smallest side of the trench and the soil would have to retain the maximum loading fissile capacity. With all above conditions required, accumulating 20 kg FGE U-235 in the trench soil within the minimum dimensions of the evaluated cylinder is incredible.

In conclusion, the chance for criticality is incredible as long as all containers placed in the ET have a minimum dimension (diameter, width, or length) of 22 inches, maximum fissile inventory limit of 50g FGE U-235, the total ET inventory limit is maintained no greater than 20 kg FGE U-235, and the design dimensions of the ET are maintained within the dimensions analyzed in the NCSE. As result of the NCSE, Chapter 6 of the DSA has been revised to recognize the new ET limit. This new operational limit is protected by a TSR Administrative Control invoking the inventory limit delineated in Chapter 6.

The DOE review team evaluated the bounding assumptions, credited design features, and calculations. The review determined that the analysis was thorough, appropriately conservative, and consistent with the methodology in DOE-STD-3007. Assumptions utilized in the NCSE have been evaluated and determined to be actively in place and protected by appropriate procedures including the Inventory Control Program for the ET. Additionally, changes within Chapter 6 are appropriately protected by a TSR Administrative Control.

Even though the change to DSA Chapter 6 and to TSR Administrative Control 5.5.2.7.7.b (discussed below in section 4.3.2) allows more FGE, TSR Administrative Control 5.5.2.6 still ensures the total inventory in each Hazard Category 3 Process Area is maintained below the Hazard Category 2 thresholds (i.e., these Process Areas are maintained Hazard Category 3). For example, the increased allowable FGE of 20 kg of U-235 in the Engineered Trench (ET) is still far less than the criteria requiring designation as Hazard Category 2 in DOE-STD-1027 (1.11E+8 grams of U-235). However, 20 kg of FGE U-235 could allow approximately 9 kg of Pu-239 in the ET (Pu-239 is equivalent to 2.25 U-235 per WSMS-CRT-02-0087, Rev. 2). This would be within the bounds of the NCSE but would exceed the Hazard Category 2 criteria of 900 grams given in DOE-STD-1027, Attachment 1, Table A.1. However, TSR AC 5.5.2.6.15 commits the ET to be maintained as a Hazard Category 3 facility, thus it is limited to no more than 900 grams of Pu-239.

### 4.2.2 ALLOWING POLYURETHANE FOAM AS A CONTAINER VOID SPACE FILLER FOR TRENCH DISPOSAL

Previously, excess void space in waste components such as waste tanks, tankers, process vessels, and oversized containers were filled with job control or other waste materials when practical. When this is not possible or when sufficient excess void space still remained, this void space was filled with grout or grout like materials. The need to fill excess void space results from a DOE Order 435.1 requirement to minimize long term settlement of the trench disposal unit after closure. In most cases, these grout materials are heavy and require in-place filling while the component or container is in the trench. Use of light weight polyurethane foam is more cost effective and would allow waste generators to fill and ship the waste component pre-filled allowing compliance with the waste acceptance criteria without the need for a waste acceptance criteria deviation allowing SWMF receipt with excess void space. This new activity was evaluated through the USQ process (Reference 10) and found to be negative.

The foam filling will be applicable to components and containers disposed in all three types of trenches: Component-in-Grout (CIG), Slit and Engineered trenches. In accordance with Reference 10, the foam will be applied in layers, to minimize chances of overfilling and temperature increases due to any exothermic reaction from curing. Also, in accordance with Reference 10, the polyurethane foam to be used will have a nonflammable propellant and have a flame retardant additive. The foam material will generally decompose under direct flame contact or prolonged exposure to UV. Even though the polyurethane foam only has a Hazardous Material Information System Fire Rating of 1 (very low) it is still slightly combustible. Therefore, in accordance with Reference 10, the foam product will have to be used to fill only metal containers and vessels for the purpose of trench disposal.

All disposal trenches are individually maintained below a Hazard Category 2 threshold quantity as defined by DOE-STD-1027-92. A bounding radiological accident (fire) analysis was previously performed and approved for all trenches utilizing the entire potential inventory. This analysis resulted in a calculated 0.04 rem to a hypothetical offsite receptor, well below any EGs. Since this change does not affect the quantity of material at risk or the likelihood of a fire in the trench, the only change necessary in the annual update was to revise the base information in Chapter 2,

Based on review of the DSA against previously stated review criteria, the DOE review team has concluded that changes to the base information adequately reflect the actual facility arrangements/operations and that sufficient background material exists to support the major elements of the safety analysis.

## 4.3 Miscellaneous Changes

### 4.3.1 ELIMINATION OF COMPONENT SEGMENTATION IN MIXED WASTE FACILITIES AND NRCSAs

The DSA and TSR were revised to reflect that each NRCSA, not individual components within a NRCSA, are managed below a Hazard Category 2 threshold quantity as defined by DOE-STD-1027-92. Operationally, it has been determined that the additional segmentation is not needed for individual Naval Reactor components such as irradiated core barrels. The Inventory Control Program for low-level waste is implemented by the Waste Information Tracking System (WITS), which has previously been determined to be acceptable. Additionally, consistent with DOE-STD-1027, Attachment A, TSR Administrative Control 5.5.2.6 allows radioactive inventory within shipping containers with a current DOT Type B Certificate of Compliance to be excluded from the summation of the segment inventory. No additional review criteria were necessary.

Additionally with regard to segmentation, the DSA and TSR were revised to reflect that culverts within the N, E and B-Area Hazardous/Mixed Waste Storage Areas are no longer used for segmentation. Each N, E, and B-Area sub-facility per this revision will now be maintained below a Hazard Category 2 threshold quantity as defined by DOE-STD-1027-92, with no segmentation credited by culverts. Concrete culverts were previously utilized for segmentation within the mixed waste storage buildings for storage of waste with significant levels of tritium. A calculation (Reference 11) was performed and determined

that, due to radioactive decay, the tritium activity levels are now such that segmentation is no longer necessary. The calculation was reviewed and determined to be accurate. All applicable sections of the DSA and TSR have been accurately revised to reflect the above changes. No additional review criteria were necessary.

### 4.3.2 ELIMINATION OF SPECIFIC CRITICALITY SAFETY LIMITS FOR HAZARD CATEGORY 3 PROCESS AREAS

The TSR, AC 5.5.2.7.7.b, was revised to remove specific limits of fissile material (mass) for Hazard Category 3 Process Areas and stipulated the requirement to meet the limits derived in DSA chapter 6. This allows new/revised limits derived in new/revised NCSEs to be incorporated into the DSA without revising the TSR. This provides additional Contractor flexibility (since changes to the DSA can be made without DOE approval via the USQ process, versus all TSR changes requiring DOE approval) yet the commitment to maintain criticality safety is not jeopardized. DOE review found this approach acceptable and adequate since TSR AC 5.5.2.6 still maintains the commitment that each of these Process Areas be maintained as a Hazard Category 3 facility per DOE-STD-1027. This commitment ensures that criticality does not pose a safety concern since the criteria given in DOE-STD-1027 ensures the quantity of fissile material is limited to the safe critical mass or the nature of the process must be shown that criticality is not credible (e.g., as in the case of the ET discussed above in section 4.2.1).

Based on review of the DSA and TSR against the above stated review criteria, the DOE review team has concluded that the changes discussed in this section are acceptable.

## 5.0 Conditions of Approval

There were no conditions of approval identified as result of the DSA and TSR review.

## 6.0 Conclusions

Thorough review of these documents concludes that the changes made to the DSA and TSR have been developed per the "safe harbor" method delineated in 10 CFR 830, *Nuclear Safety Management*. All review comments and issues were verified appropriately resolved. Appropriate review criteria were established and, upon incorporation of comments, the safety basis documentation adequately met all review criteria.

The overall conclusion of this SER is that these revisions will ensure that the DSA and TSR, along with the mitigative and preventive measures in place, continue to provide adequate controls to ensure that the Solid Waste Management Facility can operate safely without undue risks to the public, the workers, or the environment. This position is based upon review of the bounding accidents. The consequences associated with these bounding accidents for the site workers and the public are a small fraction of evaluation guidelines. Additional safety class or safety significant structures, systems and components would not be expected to reduce the consequences. The Defense in Depth analysis described in the DSA ensures the consequences of all postulated accidents are minimal or non-operational events have been determined to be beyond extremely

unlikely. Approval of revisions to the WSRC-approved SWMF DSA (WSRC-SA-22, Rev. 4, May 2003) and TSRs (WSRC-TS-95-16, Rev. 4, May 2003) is therefore recommended.

## 7.0 References


1. Savannah River Site Solid Waste Management Facility Safety Analysis Report, WSRC-SA-22, Rev. 4, May 2003

2. Technical Safety Requirements, Savannah River Site Solid Waste Management Facility, WSRC-TS-95-16, Rev. 4, May 2003

3. Annual Unreviewed Safety Question Summary Report of the Solid Waste Management Facility Safety Analysis Report and Technical Safety Requirements, SWD-2002-00036, dated September 26, 2002

4. N-NCS-E-00018, Rev. 0, Nuclear Criticality Safety Evaluation For an Engineered Trench (U), dated July 26,

5. USQ-SWE-2002-0109, Placement of the IQ3 Gamma Scanner on TRU Pad #4, September 18, 2002

6. USQ-SWE-2002-0082, Locating Transuranic Optimized Measurement System Unit in 724, July 11, 2002

7. USQ-SWE-2002-0089, Culvert Drum Removal and Handling/Processing in Temporary Storage Areas, August 8, 2002

8. S-CLC-E-00145, Rev. 0, Consequence analysis for Hypothetical SWMF Accidents, January 8, 2002

9. N-NCS-E-00018, Rev. 0, Nuclear Criticality Safety Evaluation for an Engineered Trench, July 26, 2002

10. USQ-SWE-2002-0091, Use of Polyurethane Foam as a Container Void Space Filler, July 30, 2002

11. N-CLC-E-00086, Consolidation of E14 Segments in Building 643-9E, December 2002

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

AUG 08 2002

Mr. Robert A. Pedde, President
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Mr. Pedde:

SUBJECT: Solid Waste Management Facility (SWMF) Safety Evaluation Report (SER) Revision 0, Appendix 4

Reference: Letter, Kelly to Heenan, "SWMF Safety Analysis Report (SAR) and Technical Safety Requirements (TSRs) Revision 3 Department of Energy (DOE) Approval Copy Submittal, SWD-2002-00029, 8/08/02

The Department of Energy - Savannah River Operations Office (DOE-SR) has evaluated the Authorization Basis (AB) Changes, submitted in the referenced letter, associated with the SWMF SAR and TSR Revision 3 Annual Update. DOE-SR approves the AB Changes. The enclosed SWMF SER Revision 0, Appendix 4 documents the basis for approval. There are no Conditions of Approval associated with the enclosed SER. However, there is one Revision Issue.

You are requested to incorporate the SWMF SAR and TSR submitted via the referenced letter into the AB defined in Manual WSRC-IM-95-28 upon implementation.

The action taken herein is considered to be within the scope of the existing contract and does not authorize the Contractor to incur any additional costs (either direct or indirect) or delay delivery to the Government. If the Contractor considers that carrying out this action will increase contract costs or delay any delivery, the Contractor shall promptly notify the Contracting Officer orally, confirming and explaining the notification in writing within five (5) working days. Following submission of the written notice of impacts, the Contractor shall await further direction from the Contracting Officer.

If you have any questions, please contact me or Virgil Sauls at 725-4505.

Sincerely,

Jeffrey M. Allison
Acting Manager

OC -02-062

Enclosure:
SWMF SER, Rev. 0,Appendix 4

cc w/encl:
H. Conner, WSRC
D. Swale, WSRC
S. Crook, WSRC

# SAFETY EVALUATION REPORT

REVISION 0

APPENDIX 4

FOR THE SAVANNAH RIVER SITE

# SOLID WASTE MANAGEMENT FACILITY

SAFETY ANALYSIS REPORT

WSRC-SA-22, REVISION 3

JULY 2002

TECHNICAL SAFETY REQUIREMENTS

WSRC-TS-95-16, REVISION 3

JULY 2002

Prepared by Westinghouse Savannah River Company


## JULY 2002

OFFICE OF ENVIRONMENT, SCIENCE, AND TECHNOLOGY
SAVANNAH RIVER OPERATIONS OFFICE

# APPROVAL

J. Michael Simmons
Review Team Leader/SER Preparer

7/31/02
Date

Virgil W. Sauls
Director, Waste and Operation Division

7/31/02
Date

Thomas F. Heenan, Assistant Manager
Environment, Science and Technology

7/31/02
Date

Jeffrey M. Allison, Acting Manager
Savannah River Operations Office

N/A
Date

# DOE-SR
# TECHNICAL REVIEWERS' CONCURRENCE

| | |
|---|---|
| Mike Simmons, WOD | 7/25/02 Date |
| Howard Pope, WOD | 7/25/02 Date |
| Winchester Smith, WOD | 7/30/02 Date |
| Russ Kelly, WOD | 7/30/02 Date |
| Bert Crapse, WOD | 7-25-02 Date |
| Robert Baker, ERD | 7-30-02 Date |
| Augie Manez, SD | 7-31-02 Date |
| John Merrick, SD | 7-30-02 Date |

## Table of Contents

# SOLID WASTE MANAGEMENT FACILITY SAFETY EVALUATION REPORT Revision 0, *Appendix 4*

## 1.0 Executive Summary

10 CFR 830, "*Nuclear Safety Management*", Subpart B requires Documented Safety Analyzes (DSAs) to be reviewed, updated as necessary, and submitted annually to DOE to ensure that the information therein is current and remains applicable. In this report the DSA consists of a Safety Analysis Report (SAR) and Technical Safety Requirements (TSR). This Solid Waste Management Facility (SWMF) Safety Evaluation Report (SER) was prepared utilizing DOE-STD-1104-96, *Review and Approval of Non reactor Nuclear Facility Safety Analysis Reports.* It documents the basis for DOE approval of changes delineated in Revision 3 (Updates) to both the SWMF SAR[1] and TSRs [2].

Review drafts of Revision 3 to both the SWMF SAR and TSRs were submitted[3] by the Savannah River Site (SRS) operating contractor, Westinghouse Savannah River Company (WSRC), to the DOE Savannah River Operations Office (DOE-SR) on March 20, 2002 in accordance with the annual update process. It was developed utilizing the "safe harbor" method specified in Code of Federal Regulations 10 CFR 830. Specifically, DOE-STD-3009-94, Change Notice No. 1, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.* A DOE review team provided comments (Appendix B) to WSRC on April 30, 2002. Comments were satisfactorily incorporated and the DSA was resubmitted[4] to DOE on July 15, 2002. Approval of this SER constitutes DOE approval of the SAR and TSR updates.

The SWMF consists of multiple waste treatment, storage, handling, and disposal facilities. In the SAR they are referred to as subfacilities. The majority of the waste management activities conducted are located in E Area, however, there are several subfacilities located in H, N, and B Areas which are also considered to be part of the SWMF. The subfacilities, active and inactive, evaluated in the revised SWMF SAR are as follows:

---

[1] SRS Solid Waste Management Facility Safety Analysis Report, WSRC-SA-22, Rev. 3, July 2002

[2] Technical Safety Requirements, SRS, Solid Waste Management Facility, WSRC-TS-95-16, Rev. 3, July 2002

[3] SWMF SAR and TSR Revision 3 DOE Approval Draft Copy Submittal, SWD-2002-00016, dated March 20, 2002

[4] SWMF SAR and TSR Revision 3 DOE Approval Draft Copy and DOE Comments Submittal, SWD-SWE-2002-00092, dated July 15, 2002

| Facility | Facility Hazard Classification |
|---|---|
| Old Burial Grounds - includes Solvent Storage Tanks S1-S22 and Burial Trenches (Trenches under interim cap and tanks are in closure) | 2 |
| Low-level Radioactive Waste Disposal Facility Closure Cap | 2 |
| Mixed Waste Management Facility Closure Cap | 2 |
| Slit Trench (one, covered but not under final closure cap) | 2 |
| TRU Waste Storage Pads 1-19 & 23-25 (includes TVEF/MWPF on Pad 6) | 2 |
| Used Equipment Storage Areas (643-7E & 643-26E) | 3 |
| Naval Reactor Component Storage Areas (643-7E & 643-26E) | 3 |
| New Solvent Storage Tanks (607-33H thru 607-36H) | 3 |
| Mixed Waste Storage Buildings (643-29E & 643-43E) | 3 |
| Low-level Waste Storage Pads 20-22 | 3 |
| Waste Certification Facility (724-8E) | 3 |
| B Area Mixed Waste/Hazardous Waste Storage Bldg. (710-B) | 3 |
| N-Area Hazardous & Mixed Waste Storage Buildings (645-N, 645-2N, & 645-4N), 741-1N and Storage Pads 1 thru 3 | 3 |
| E-Area Low-Activity Waste Vaults (LAWV) (661-6E) | 3 |
| E-Area Intermediate-Level Vaults | 3 |
| EAV Trenches | 3 |

As shown above, the SWMF includes both Hazard Category 2 facilities and Hazard Category 3 facilities. Presently, the only active Hazard Category 2 subfacilities are the transuranic (TRU) pads. The remaining Hazard Category 2 facilities have or are undergoing closure and no longer receive waste. All remaining subfacilities are Hazard Category 3. The present mission of the SWMF is to continue providing characterization, treatment, sorting, compaction, as well as storage and disposal of radioactive wastes. Facility operations for each sub-facility are described in Chapter 2 of the SAR. The major facility hazards of fissile, radioactive materials, hazardous chemicals, and normal industrial hazards encountered during handling and storage of waste have not changed from the previous SAR revision. Fire, explosion, external hazards (such as vehicle or handling accidents), and natural phenomena (seismic and wind) are still the credible dominant accident scenarios for the Hazard Category 2 subfacilities. However, tornado and high-speed culvert impact accidents were quantitatively reanalyzed in Revision 3 utilizing an updated computer code, MELCOR Accident Analysis Computer System (MACCS). The resulting calculated offsite consequences are still within Evaluation Guidelines (EG) of 25 rem at .26 and .66 rem respectively. Greater detail is presented in Section 4.0 of this SER.

Other technical changes addressed in the revised DSA are as follows:

- Base information, hazard/accident analysis, and subsequent SAR chapters for the Hazard Category 2 sub-facility, Low-level Radioactive Waste Disposal Facility (LLRDF), was modified to reflect final closure and current post closure status.
- New processes previously evaluated per the Unreviewed Safety Question (USQ) process were incorporated into the SAR. Specifically, the Mixed Waste Process Facility (MWPF), TRU Pad 4 drum assay, TRU Pad 3 TRUPACT II loading activities, E-Area component-in-grout, and engineered trench.
- The functional classification discussion in Chapter 3 was updated to more firmly link functional classification with plausible accidents. Specific safety attributes of culverts and standard waste boxes (SWBs) were explicitly identified.
- Culverts and SWBs were downgraded from safety class to safety significant.
- Criticality safety limits for the TRU Waste Storage Pads were added to the TSRs.
- Passive design feature section has been added to the TSRs.
- Incorporation of minor descriptive changes previously evaluated via the USQ process.

Administratively the entire document was modified to reflect updated references, specifically those referencing 10 CFR 830. Limited simplification and streamlining of the programmatic chapters was performed but not to the extent that altered the original content.

DOE did not identify conditions of approval as a result of this review.

**Conclusion:** The overall conclusion of this SER is that these revisions will ensure that the DSA documents, along with the mitigative and preventive measures in place, continue to provide adequate controls to ensure that the Solid Waste Management Facility can continue to operate safely without undue risks to the public, the workers, or the environment. This position is based upon review of the bounding accidents. The consequences associated with these bounding accidents for the site workers and the public are well below evaluation guidelines. Additional safety class or safety significant structures, systems and components would not be expected to reduce the consequences. The Defense in Depth analysis described in the SAR ensures the consequences of all postulated accidents are minimal or non-operational events have been determined to be beyond extremely unlikely. Approval of revisions to the WSRC-approved SWMF SAR (WSRC-SA-22, Rev. 3, July 2002) and TSRs (WSRC-TS-95-16, Rev. 3, July 2002) is recommended.

## 2.0 Review Process

WSRC initially delivered drafts of the SAR and TSR updates (dated 4/02) for DOE review on March 20, 2002. A multidisciplinary technical review team was formed and led by the SR Waste and Operations Division (WOD). The DOE review team consisted of the following:

| Name | Organization | Areas Reviewed |
|---|---|---|
| Mike Simmons (Team Leader) | Waste & Operations Division (Mixed Waste and Nuclear Safety) | SAR (All), TSR, USQ Reports |
| Howard Pope /Win Smith | Waste & Operations Division (Low-level Waste) | Executive Summary, Chapters 2, 3, 4, 5, 9, 12, 16, 17; TSR, USQ Reports |
| Russ Kelly | Waste & Operations Division (Senior Facility Representative) | Executive Summary, Chapters 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16, 17; TSR, USQ Reports |
| Bert Crapse | Waste & Operations Division (TRU and Hazardous Waste) | Executive Summary, Chapters 2, 3, 4, 5, 9, 12, 16, 17; TSR, USQ Reports |
| Robert Baker | Environmental Restoration Division | Executive Summary, Chapter 2, USQ Reports |
| Augie Maniez | Safety Division | Executive Summary, Chapters 2, 3, 4, 5, 8, 11, 13, 17 |
| John Merrick | Radiation Protection and Emergency Management Division | Executive Summary, Chapters 1, 2, 15 |

WSRC provided an overview presentation of the document updates for the DOE team before the review began. A review criteria checklist, *"DSA/TSR Adequacy Review Criteria"*, previously provided by EM-5 was provided to team members as a review guide. The checklist supplemented by DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports,* DOE G 421-2, *Implementation Guide for Use in Developing Documented Safety Analysis*, and DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements* formed the criteria from which the DSA revision was evaluated. All review criteria cited in this SER is based on the information provided in these documents.

The team conducted the review in accordance with the guidance provided in DOE-STD-1104-96, *Review and Approval of Non-reactor Nuclear Facility Safety Analysis Reports.* The results of the review and the approval basis have been documented in this SER. The

DOE team members reviewed the SAR and TSR update drafts, the SWMF Annual USQ Summary Reports, and additional documents as required to support assigned areas of review. The SR team reviewed the documents for technical content and accuracy; evaluated calculations for reasonable assumptions, technical accuracy and justified conclusions; interviewed key facility personnel, and performed facility walk-downs as applicable. Since the SAR and TSR were previously approved by DOE, the SR team focused its review on the document revisions. However, the team did review other portions of the documents to assess their adequacy. Documents that were reviewed during this process are listed in Appendix A. Comments generated during the review, as well as their resolutions are listed in Appendix B. The Review Criteria Evaluations and the comments and resolutions document the decisions and judgments made by the DOE-SR review team to conclude the revisions are acceptable. Changes in the updated documents primarily incorporate analyses and descriptive material relevant to activities which have been added at SWMF, each of which was previously evaluated and found to be within the existing safety envelope via the USQ process. Activities added included, construction of the MWPF, TRU Pad 4 drum assay, TRU Pad 3 TRUPACT II loading activities, low-level waste component-in-grout, and low-level waste Engineered Trench disposal. DOE/ WOD, in its oversight role of WSRC, monitors the contractor USQ process in an on-going basis through the Facility Operations Safety Committee. In this capacity, WOD has reviewed, both prior to and during this SAR update review, most all USQ screenings/evaluations and other documents associated with changes discussed in this SER.

Throughout the SAR and TSR, minor administrative changes have been made in order to improve the documents (e.g. wording clarifications or additions that do not change the meaning or requirements). All such changes have been reviewed and found acceptable. These administrative changes will not be addressed further in this SER.

## 3.0 Base Information

This section of the SER documents the bases for approving the adequacy of changes within the base information from that previously approved in the original SER and subsequent appendices.

**Review Criteria:** For any changes, ensure the base information contains sufficient background and fundamental information to support the technical aspects of the DSA. Specific detailed review criteria were developed in accordance with Section 2.0 of this SER.

**Evaluation:** A number of significant changes have been made to the SAR base information. Specifically, five new processes were added. The changes are as follows:

3.1 Mixed Waste Process Facility (MWPF)

The MWPF is located on TRU Pad 6, a reinforced concrete pad covered by a grounded, steel-framed weather-protection enclosure. The MWPF consists of an outer metal structure designed to provide secondary confinement and a hood arrangement to provide primary confinement. The MWPF's outer confinement structure and ventilation system is shared with the TRU Visual Exam Facility (TVEF). The ventilated hood in the MWPF provides primary confinement for unpackaging, characterization, and repackaging mixed low-level waste (MLLW). There are no Safety Class or Safety Significant structures, systems, and components (SSCs) identified for this structure. As previously stated, the TRU and MLLW process areas share a common ventilation system. The ventilation system is designed for ALARA controls by preventing the spread of contamination within the facility. This is accomplished by maintaining a lower differential pressure between contaminated versus uncontaminated areas and filtering the exhaust through high efficiency particulate air (HEPA) filters just upstream of the system fans. The MWPF is considered to be a new process on an existing Hazard Category 2 facility, TRU Pad 6. Although not segmented from the TRU pad, the inventory within the TVEF/MWPF will, at all times, be maintained at a Hazard Category 3 or less.

The Mixed Waste (MW) section of the facility unpackages MLLW in the hood enclosure, remove noncompliant items, characterize if necessary, and repackage to meet the waste acceptance criteria (WAC) of the applicable offsite treatment and/or disposal facility. The waste streams to be processed are typically lead and debris wastes. The MW operation is contained using a hooded enclosure for proper ventilation and contamination control during processing. Waste containers are loaded into the enclosure where hydraulic equipment tilts boxes and drums for ease of unloading onto a sort table. An overhead hoist and grappling equipment/sling on a rail is used to lift and move heavy lead sheets, bulky equipment or other heavy items inside the hooded enclosure. Sorted waste is loaded into load out containers that mate to the workstation preventing excessive air in-leakage into the hood enclosure. Once the waste is sorted and loaded into containers, it is removed from the facility for final disposition.

3.2 TRU Pad #4 drum sampling and conditioning activities

TRU Pad 4 has been reconfigured for WIPP TRU Waste Characterization. Several WIPP contractor-supplied components are in operation on TRU Pad 4. These include:

- Nondestructive Examination (NDE)- Real-time Radiography (RTR) trailer
- Nondestructive Assay (NDA) – Imaging Passive/Active Neutron (IPAN) trailer
- Headspace Gas Analysis (HSGA) equipment skid
- Heated SeaLand containers
- Drum Venting System (DVS)

There are, however, no permanent structures associated with the characterization process. The NDE-RTR process is used to x-ray TRU waste drums, up to 83 gallons in volume, to determine content attributes. The system is used to verify that the physical form matches the waste stream description and that the waste matrix code assigned to the waste container is consistent with the acceptable knowledge of the waste. The NDE-RTR process can detect prohibited items such as liquid wastes and containerized gases, which are prohibited for WIPP disposal.

The NDA-IPAN process uses a high-purity germanium detector for gamma energy detection, and neutron detectors for passive neutron detection from spontaneous fission or alpha neutron generation. There is a neutron generator for creating fissions in Pu-239 and other fissionable isotopes. Information from these detectors is used to determine the radionuclidic characterization and quantification of the SRS TRU Waste.

The SeaLand storage containers store, and heat drums if necessary, based on ambient temperatures, prior to HSGA. HSGA is an intrusive drum process. Drums are typically sampled in the DVS Cabinet but may be sampled in other locations such as the SeaLand storage containers. The HSGA automatically collects a representative sample of the headspace gas through a piping manifold connected to a gas chromatograph (GC) with a flame ionization detector, thermal conductivity detector, and mass spectrometer. The system has the capability to also perform multiple functions of venting, purging, headspace gas analysis and the installation of filter vents on 55-gallon TRU waste drums. Drums failing RTR, IPAN assay, or HSGA are set aside, placed in a safe condition, and returned to storage.

The characterization activities performed on TRU Pad 4 essentially mirrors those previously described and analyzed for 643-8E. Building 643-8E is a permanent facility supporting both TRU ship-to-WIPP characterization and loading activities.

### 3.3 TRU Pad #3 TRUPACT II Loading Activities

TRU Pad 3 has been reconfigured to support loading of WIPP-compliant 55-gallon TRU drums into TRUPACT II containers and/or store TRU drums. TRU Pad 3 is covered by a weather enclosure and is equipped with an electric, overhead crane. The pad area beneath the crane, the first 80 feet on the opposite end from the sump, is level to support TRUPACT II shipping container handling operations. The back of the pad is sloped to the sump. TRUPACT II containers are typically brought to and from the facility on a flatbed trailer. The level area of the pad is used to load waste containers into TRUPACT II containers. A plastic wrap machine (for wrapping 14-drum packs) and lifting fixtures are also located on TRU Pad 3.

As stated for the TRU Pad 4, activities performed on TRU Pad 3 are the same as those previously analyzed for 643-8E.

## 3.4 E-Area Components-in-Grout (CIG) Trenches

Five CIG trenches are located within the E-Area Vaults (643-26E) in the approximate footprint of Low-Activity Waste Vault (LAWV) No. 4. Each CIG Trench is sized to accommodate specific components to be buried. The base of each CIG Trench lies approximately 30 feet above the permanent ground water table. The top 4 feet of space in each trench will be filled with clean soil when the trench has been filled. The CIG Trenches only receive and accept waste that meets the requirements of Manual 1S Waste Acceptance Criteria (WAC) or an approved WAC deviation.

The CIG Trenches are classified as an Hazard Category 3 facility, and the radionuclide inventory of the entire set of CIG Trenches is maintained below Hazard Category 2 Threshold Quantities as defined by DOE-STD-1027-92. Upon waste receipt, Solid Waste Operations using the Waste Inventory Tracking System (WITS) verifies the additional inventory will not exceed the Hazard Category 2 Threshold Quantities.

Prior to emplacement of waste into the CIG Trench, each waste container or component and its accompanying documentation is examined by SWO personnel to verify the generator packaging and documentation. Any waste container that does not meet the WAC is treated as a nonconformance and is not accepted for disposal without a deviation approved by the facility manager. Waste components are loaded into the CIG Trenches in accordance with approved operating procedures. Component emplacement and the size of the trench are dependent upon the size of the component. After placement and grouting operations have been completed, the top portion of the trench is backfilled to grade level with clean soil to a depth needed to provide a maintainable interim soil cap.

## 3.5 E-Area Engineered Trench

The Engineered Trench is located near the LAWV No. 11 footprint. The base of the Engineered Trench is sloped to move water runoff to a low point sump for collection and pumping (using a portable pump on an elevated surface). The sloped walls will incorporate erosion control features for keeping the walls intact. The Engineered Trench, at the base, occupies the approximate area of a LAWV footprint.

The Engineered Trench is classified as a Hazard Category 3 facility, and the radionuclide inventory is maintained below Hazard Category 2 Threshold Quantities. Upon waste receipt, Solid Waste Operations using the Waste Inventory Tracking System (WITS) verifies the additional inventory will not exceed the Hazard Category 2 Threshold Quantities as defined by DOE-STD-1027-92.

Waste is loaded into the Engineered Trench in accordance with operating procedures. The Engineered Trench allows for drive-in of flatbed trucks, forklifts, and cranes to facilitate handling of waste containers. Upon closure, the top portion of the trench will be

backfilled to grade level with clean soil to a depth needed to provide a maintainable interim soil cap.

Based on review of the SAR against previously stated review criteria, the DOE review team has concluded that changes to the base information adequately reflect the actual facility arrangements/operations and that sufficient background material exists to support the major elements of the safety analysis.

## 4.0 Hazard and Accident Analysis

This section of the SER documents the changes to the bases for approving the hazard and accident analyses, and focuses on the completeness of the analyses and the consistency of the logic used through the process. The major changes to the Safety Analysis section of the SAR are the addition of new processes discussed in the Section 3.0 of this SER; deletion of operational accident scenarios for buried waste, and reanalysis of two culvert accident scenarios. Specific details and bases for the approval for each of the changes are listed below.

Specific detailed review criteria were developed in accordance with Section 2.0 of this SER.

**Review Criteria:** A qualitative or semi-quantitative analysis of the dominant accidents from the hazard analysis (HA) in each category as well as Natural Phenomenon Hazard (NPH) events is provided. The accident progression is described linking initiating events with preventative and mitigative features. Source term estimates and their basis are discussed including, the initial material at risk, release rates and/or release fractions, and release pathways used to establish the source term. Frequencies are to be established by estimating the frequency of the initiating event along with the conditional probability of all other necessary events leading to a release of hazardous material. Accident consequences are estimated and compared to established Evaluation Guidelines. Analytical methods are described, referencing controlled source documentation as appropriate. Consequences are to be established based on parameters such as bounding material estimates, the release mechanism, and release pathway. Impacts on workers, including facility workers and the public are presented.

**Evaluation:**

4.1 New Processes

This subsection discusses the new processes that were added to hazards/accident analysis portion (Chapter 3) of the SAR. DOE determined that the hazard analysis logically and consistently:

- Identified and assessed the hazards

- Evaluated the potential for hazards to become accidents
- Identified lines of defense and basis for defense in depth

Systems, structures, components, and administrative controls that made up the lines of defense were considered in the analysis as candidates for Safety Significant or Safety Class items. Additionally, the hazard analysis postulated bounding accident scenarios resulting from these hazards and evaluated their frequencies of occurrence and consequences in a qualitative/semi-quantitative, conservative manner. Deriving the source term was done using conservative inputs. The Material at Risk (MAR) was determined on an event by event basis utilizing input values consistent with those used for previous conservative SAR accident analysis assumptions. A Damage Ratio (DR) value and Release Fraction (RF), and Leak Path Factor (LPF) of 1.0 were typically used. Airborne Release Fractions (ARF) were selected from DOE-HDBK-3010-94. The airborne source term was estimated by the following linear equation:

$$\text{Source Term} = \text{MAR} \times \text{DR} \times \text{ARF} \times \text{RF} \times \text{LPF}$$

Radiological consequences were calculated using MACCS computer code.

Defense in depth features to prevent or mitigate accidents was identified in the SAR as part of the hazards evaluation. These items serve to build layers of defense against the undesired interaction between hazards and receptors so that no single layer comprises an entire system of protection. These features, brought about by facility design or administrative controls, protect the public, the facility worker, and the environment

Hazards that would impact worker safety are addressed in the hazard evaluation, and are carried through to the accident analysis and TSR, as appropriate.

However, review of the hazard tables resulted in a DOE comment concerning format. Specifically, two different formats for HA tables exists and the review team questioned whether the HA tables should be revised for consistency. The new format, utilized for Revisions 2 and 3, contains both unmitigated and mitigated frequency, consequences, and risk rankings whereas the older tables only address unmitigated consequences. The updated format establishes the effects that credited controls have on event consequences and frequency. However, the SAR specifically discusses this difference and further explains that as new HAs are performed or old HAs are updated, the new format will typically be used. The SAR further iterates that the advantage to the new format is primarily to aid in the performance of USQs and the development of other safety-related documents that rely on the HAs as an input. However, the criteria used to develop each format are identical and all tables meet minimum requirements. Changes in table format and other portions of the document, in general, results from the continuous feedback/improvement element of the Integrated Safety Management (ISM) process. It was agreed, even if perceived to be a significant improvement, not to pursue a major revision to older HA tables at this time.

The specific hazard and accident analyzes and consequences for new processes are discussed in the following subsections.

### 4.1.1 Mixed Waste Process Facility (MWPF)

The hazard assessment for the MWPF was performed by an ISM team providing an integrated comprehensive approach for identifying hazards down to and including the industrial hazard level. The objective was to identify all hazards and hazardous situations and then identify strategies to preferably remove the hazard or if not feasible to develop defense in depth controls to prevent and mitigate potential hazardous situations. The relevant nuclear safety elements of this assessment were incorporated into Revision 3 of the SWMF SAR. The hazard categories identified and evaluated were as follows:

- Fire
- Explosion
- Loss of Containment or Confinement
- Direct Radiological Exposure
- External Hazards
- Natural Phenomena
- Industrial Hazards (Equipment Damage, Loss of Production, and Personnel Injuries)

The inventory of radionuclides present in the MWPF will be maintained below Hazard Category 2 Threshold Quantities as defined by DOE-STD-1027-92. However, a bounding semi-quantitative accident analysis was performed assuming that most of the entire mixed/hazardous waste inventory (>99%) was released from this facility with negligible consequences to the public and onsite receptors at 1.02E-02 and 4.39E+00 rem respectively. This is an extremely conservative assumption since this inventory is presently located in multiple segments precluding interaction. In reality, to minimize combustible loading, as dictated by results of a fire hazards analysis, the MWPF should never contain more than a few boxes of waste at any given time. Therefore, the worst case (bounding) accident scenario clearly demonstrated consequences to be well below (a small fraction) the site EGs. Additionally, the frequency and consequences associated with the bounding accident for the MWPF fall far below those previously identified in the SAR for TRU Pad 6.

An unmitigated chemical accident analysis, utilizing benzene as the bounding constituent, concluded low consequence to the onsite worker, moderate consequence to the facility worker, and negligible consequences to the public. This analysis is also extremely conservative since TRU Pad 6, on which the MWPU is located, is not permitted for liquids. Any liquids would be low volumes incidental to the process.

Defense in depth features identified in the SAR as part of the hazards evaluation for the MWPF are:

- Fire protection features
- Ventilation system
- Emergency response procedures
- Radiological control program
- Procedures limiting combustibles

DOE-SR concludes that the "Review Criteria" for this activity/process has been met. The activity has been adequately analyzed and controls are in place to mitigate or prevent identified accidents based on review of the documents, calculations, walkdowns, and comparison of calculated consequences against EGs.

4.1.2 TRU Pad 3 Loading and TRU Pad 4 Drum Sampling and Conditioning Activities

A broad range of hazard categories were evaluated for TRU Pad 3 and 4 activities where hazards were identified, assessed, evaluated for the potential to become accidents, and defense in depth measures developed. The hazard categories evaluated were as follows:

- Fire
- Explosion
- Loss of Containment or Confinement
- Direct Radiological Exposure
- Nuclear Criticality
- External Hazards
- Natural Phenomena

A bounding analysis was performed for each event. There were no increases in frequency or consequences for the TRU pads over those previously analyzed in the SAR. The following Tables 1 and 2 summarize postulated accidents and calculated results. The calculated unmitigated offsite radiological consequences does not in any event challenge either the new straight line EG of 25 rem or the old style frequency based EGs of 0.5, 5.0, or 25 rem. In regard to the Onsite Worker receptor, no unmitigated events exceeded or challenged onsite goals.

In summary, no new events were identified that challenged site EGs. Therefore, no additional Safety Class or Safety Significant controls are required to implement the new TRU Pad 3 or TRU Pad 4 activities. However, events were identified, which although below site EGs, could impact the facility worker. These are addressed utilizing defense in depth features as follows:

- Nitrogen inerting
- Head Space Gas Sampling Chamber
- Vented drums
- Drum liners
- Crane design and safety features (interlocks/stops)
- Inspections/procedures
- Airborne radioactivity monitors

Table – 1

| ACCIDENT ANALYSIS AND CONSEQUENCES FOR TRU PAD 4 ACTIVITIES | | | | |
|---|---|---|---|---|
| **Event** | **Frequency** | **Exposure in rem to facility worker** | **Exposure in rem to onsite worker** | **Exposure in rem to offsite individual** |
| **Heated Sealand Container** | | | | |
| Fire | A | 1.07E+01 | 2.15E-01 | 5.06E-03 |
| Explosion | U | 2.15E+01 | 4.29E-01 | 1.01E-02 |
| **RTR Trailer** | | | | |
| Fire | A | 7.95E+00 | 1.59E-01 | 1.01E-02 |
| RTR lift damages drum | A | 1.59E+00 | 3.18E-02 | 7.50E-04 |
| **IPAN Trailer** | | | | |
| Fire | A | 7.95E+00 | 1.59E-01 | 3.75E-03 |
| Drum drop (conveyor) | A | 1.59E+00 | 3.18E-02 | 7.50E-04 |
| Criticality during interrogation | BEU | 1.59E+02 | 3.18E+00 | 7.50E-02 |
| **HSGS Trailer** | | | | |
| Fire in HSGS system | A | 3.58E-01 | 7.16E-03 | 1.69E-04 |
| Fire during drum drilling | A | 3.58E-01 | 7.16E-03 | 1.69E-04 |
| Explosion during drum drilling | A | 7.16E-01 | 1.43E-02 | 3.83E-04 |
| Explosion in GC/MS cabinet | U | 1.43E+00 | 2.86E-02 | 6.76E-04 |
| Drilling contamination release | A | 7.16E-03 | 1.43E-04 | 3.38E-06 |
| **Common Events** | | | | |
| Fire in vented waste drum | U | 7.95E+00 | 1.59E-01 | 3.75E-03 |
| Full facility fire | U | 2.54E+02 | 5.07E+00 | 1.20E-01 |
| Overpressurization in drum | A | 1.59E+01 | 3.18E-01 | 7.50E-03 |
| Staged drum leak | A | 1.59E+01 | 3.18E-01 | 7.50E-03 |
| Forklift drops drum | A | 4.49E+00 | 8.97E-02 | 2.12E-03 |
| Forklift punctures drum | A | 4.49E+00 | 8.97E-02 | 2.12E-03 |
| Gas bottle missile | EU | 4.49E+00 | 8.97E-02 | 2.12E-03 |
| Criticality in waste drum | BEU | 4.77E+02 | 9.55E+00 | 2.25E-01 |
| Forklift impacts drum | A | 6.49E+00 | 1.30E-01 | 3.06E-03 |
| Vehicle impacts drum – no fire | A | 1.19E+01 | 2.39E-01 | 5.63E-03 |
| Vehicle impacts drum with fire | A | 1.37E+02 | 2.75E+00 | 6.48E-02 |
| Wildfire | A | 1.37E+02 | 2.75E+00 | 6.48E-02 |
| Helicopter Impact | EU | 5.07E+02 | 1.01E+01 | 2.39E-01 |
| Aircraft Impact | BEU | 5.07E+02 | 1.01E+01 | 2.39E-01 |
| External mobile crane | U | 9.35E+00 | 1.87E-01 | 4.41E-03 |
| Earthquake | U | 1.24E+01 | 2.47E-01 | 5.83E-03 |
| Earthquake with fire | U | 1.37E+02 | 2.75E+00 | 6.48E-02 |
| High winds | A | 8.85E+00 | 1.77E-01 | 4.18E-03 |
| Tornado | U | 2.75E+02 | 5.49E+00 | 1.30E-01 |
| Flash flooding | BEU | 1.24E+01 | 2.47E-01 | 5.83E-03 |
| Lightening Strike | EU | 6.78E+01 | 1.36E+00 | 3.20E-02 |
| Snow/Ice collapse roof | U | 5.08E+00 | 1.01E-01 | 2.39E-03 |

Table – 2

| ACCIDENT ANALYSIS AND CONSEQUENCES FOR TRU PAD 3 ACTIVITIES | | | | |
|---|---|---|---|---|
| Event | Frequency | Exposure in rem to facility worker | Exposure in rem to onsite worker | Exposure in rem to offsite individual |
| Spontaneous drum fire | U | 3.90E-02 | 3.85E-03 | 1.13E-04 |
| Propogated fire | A | 3.10E+01 | 3.06E+00 | 8.93E-02 |
| Forklift fire | A | 1.50E-01 | 1.54E-02 | 4.50E-04 |
| Stretch wrap machine fire | A | 5.40E-01 | 5.39E-02 | 1.58E-03 |
| ACGFL fire during handling | A | 5.40E-01 | 5.39E-02 | 1.58E-03 |
| Internal drum explosion | U | 7.70E-02 | 7.70E-03 | 2.25E-04 |
| Forklift battery explosion | A | 3.10E-01 | 3.08E-02 | 9.00E-04 |
| Dropped drum | A | 3.10E-02 | 3.08E-03 | 9.00E-05 |
| Punctured drum | A | 3.10E-02 | 3.08E-03 | 9.00E-05 |
| Forklift impact multiple drums | A | 1.10E-01 | 1.08E-02 | 3.15E-04 |
| Crane drop/swing load on plate | A | 1.10E-01 | 1.08E-02 | 3.15E-04 |
| Crane drop full plate | A | 1.10E-01 | 1.08E-02 | 3.15E-04 |
| Drum failure during TRUPACT pressure test | A | 1.10E-01 | 1.08E-02 | 3.15E-04 |
| Vehicle crash | A | 3.20E-01 | 3.24E-02 | 9.45E-04 |
| Vehicle fire | A | 1.60E+00 | 1.62E-01 | 4.73E-03 |
| Aircraft crash and fire | BEU | 6.10E+01 | 6.12E+00 | 1.70E-01 |
| Helicopter crash and fire | EU | 3.10E+01 | 3.06E+00 | 8.93E-02 |
| External fire | U | 3.10E+01 | 3.06E+00 | 8.93E-02 |
| Seismic - no fire | U | 6.10E+00 | 6.12E-01 | 1.79E-02 |
| Seismic with fire | U | 3.10E+01 | 3.06E+00 | 8.93E-02 |
| High Winds | U | 6.10E+00 | 6.12E-01 | 1.79E-02 |
| Lightning induced fire | EU | 6.10E+01 | 6.12E+00 | 1.70E-01 |
| Snow/ice | A | 6.10E+00 | 6.12E-01 | 1.79E-02 |
| Flood | BEU | 6.10E+00 | 6.12E-01 | 1.79E-02 |

DOE-SR concludes that the "Review Criteria" for this activity/process has been met. The activity has been adequately and conservatively analyzed and controls are in place to mitigate or prevent identified accidents based on review of the documents, calculations, walkdowns, and comparison of calculated consequences against EGs.

### 4.1.3 E-Area Components-in-Grout (CIG) Trenches and E-Area Engineered Trench

The CIG Trenches and E-Area Engineered Trench are maintained below a Hazard Category 2 threshold quantity as defined by DOE-STD-1027-92. These activities have been determined to be commensurate with Slit Trench disposal analysis and no new hazards or accidents were identified. Therefore, the HA previously approved by DOE for the Slit Trench activities are applicable for the above activities. For the Slit Trenches, no accidents needing a detailed quantitative assessment were identified. A bounding radiological assessment was performed for all trenches utilizing the entire potential inventory. This analysis resulted in a calculated 0.04 rem to a hypothetical offsite receptor, which is well below any EGs.

DOE-SR concludes that the "Review Criteria" for this activity/process has been met. The activity has been adequately analyzed and controls are in place to mitigate or prevent identified accidents based on review of the documents, calculations, walkdowns, and comparison of calculated consequences against EGs.

## 4.2 Updated Analysis for Tornado and High Speed Culvert Impact Accidents

The existing approved SAR credits concrete culverts and SWBs as a Safety Class SSCs when utilized for storage of TRU waste containers with greater than 0.9 Pu-239 plutonium equivalent curies (PEC). The credited attributes are generally weight, non-combustibility, and strength. Specifically, in the previous culvert tornado and high-energy vehicle impact scenarios, strength was credited as an important safety attribute. Minor surface defects on culverts such as chipping from movement activities or spalling from exposure to the elements presented an unquantifiable concern. It was determined that a reevaluation specifically addressing the strength attribute for culverts was needed.

The radiological consequences for these accidents were originally reported in the SWMF SAR, having been calculated with the AXAIR89Q computer code. AXAIR89Q, a code developed at SRS and specific to operations at Savannah River, is no longer the preferred dose assessment code for safety analysis at SRS. Instead, presently MACCS is most widely used because of its ability to analyze a broader range of accident conditions, more realistic treatment of site parameters, and a larger library of radioactive isotopes. The above events were reanalyzed where it was demonstrated that not only is the strength attribute for culverts not required but that culverts and SWBs should more appropriately be classified as Safety Significant in lieu of Safety Class, which is further discussed in Section 5.0 of this SER. In the analysis the source term was actually increased by raising the available material at risk but by imputing actual site specific meteorological information, appropriate dose conversions, and dispersion factors the radiological consequences actually decreased. The old and revised consequences are as follows:

| Subfacility | Event Description | Specific Container or Scenario | Offsite Dose in rem (SAR Rev 2) | Offsite Dose in rem (SAR Rev 3) |
|---|---|---|---|---|
| TRU Pads | Tornado | Low Activity Drums<br>SWBs<br>Culverts * | 0.48 | 0.26 |
| TRU Pads | High-Energy Automobile Vehicle Impact | Container Rupture & Fire (15 culverts) | 4.71 | 0.66 |

* SAR Revision 2 assumed no release from culvert whereas Revision 3 assumed a damage ratio of 1.0

DOE-SR concludes that the "Review Criteria" for this change has been met. The hypothetical events have been adequately and conservatively reanalyzed based on review of the documents, calculations, and comparison of calculated consequences against EGs.

## 4.3 Additional Changes to Chapter 3 of the SAR

In addition to the above changes, the following additions or deletions to Revision 3 of the SWMF SAR, were evaluated by the DOE review team and found to be acceptable:

a. Operational accident scenarios for subfacilities no longer receiving waste and in closure status has been deleted. Only accidents appropriate for post-closure activities have been retained.

b. The functional classification discussion in Chapter 3 was updated to more firmly link functional classification with plausible accidents. Specific safety attributes of culverts and SWBs were explicitly identified.

## 5.0 Safety Structures, Systems, and Components

This section documents the bases for approving the designation of safety SSCs and their associated safety functions, functional requirements and potential TSR coverage. Focus is on the consistency of the logic developed in hazard and accident analyses being carried through to the identification of safety SSCs.

**Review Criteria:** Specific detailed review criteria were developed in accordance with Section 2.0 of this SER.

**Evaluation:** As previously discussed, culverts and SWBs have been downgraded to safety significant. The Hazard Analysis of the SAR adequately details the safety function of the culverts and SWBs. The unmitigated accident reanalysis, discussed in Section 4.0 of this SER, addressed two scenarios, the first being a runaway vehicle impacting containers on a TRU pad, initiating a release and a potential fire. It was concluded that a maximum of nine SWBs containing drums may be impacted by this event. The analysis assumed that the SWBs meet DOT-7A requirements (4-foot drop test). For concrete culverts no credit is taken for any container strength. Analysis based on the nominal 16,000 pound weight of the culvert shows that, neglecting friction and other losses to the system, a runaway truck would impart kinetic energy that would consume the equivalent of 12.2 culvert masses before coming to rest. Adding additional conservatism, the analysis assumed that 15 culverts may be involved. The analyzed consequences for automotive vehicle accident (for culverts) are 6.65E-01 rem to an offsite receptor. A "what if" or back calculation analysis determined that in order to exceed the offsite EG of 25 rem, more than 500 culverts must be impacted in this event. A pad contains a maximum of 160 culverts. Culvert attributes of weight and non-combustibility and the SWB design features of noncombustible construction and DOT-7A 4-foot drop test qualification are credited for worker protection only.

The second scenario analyzed was a tornado event. The analysis assumed 636 SWBs and 29 culverts are affected by the tornado. The analyzed consequence for a tornado event impacting culverts is 1.52E-01 rem to an offsite receptor. The analyzed consequence for a tornado impacting SWBs is 9.8E-02 rem to an offsite receptor. The unmitigated consequences for are well below the EGs; therefore, no Safety Class controls are selected. A back calculation analysis for this event demonstrated that in order to exceed the offsite EG of 25 rem, at least 5,667 culverts or 8,119 SWBs must be affected during a tornado

event. Similarly, to exceed the onsite EGs, at least 11,340 culverts or 16,239 SWBs must be affected. The number of containers required to exceed the EGs far exceeds the total of culverts and SWBs that could be placed on all the waste storage pads. The analyses for both the high-energy vehicle impact and tornado event conclude that for onsite and worker protection, Safety Significant is the appropriate classification for both culverts and SWBs.

The following administrative controls were credited in the preceding accident analyses and are identified as serving Safety Class functions and are preserved as such by carrying them into the TSRs:

- Inventory Control Program. This is needed to limit the total inventory that can be released due to damage of containers by a tornado.
- WAC to limit the type and form of waste received.
- Program to segregate high-activity waste (waste containing greater than 0.9 Pu-239 PEC of TRU).
- Program to limit stack configuration of unculverted containers.
- Maintaining a drainage system to control fire fighting water runoff.

The DOE review team assessed the changes made to the safety SSCs described in the SAR. All changes to controls made in the SAR have been appropriately reflected in the TSR. Through document reviews, discussions with system engineers, and walkdown of the facility systems, the DOE review team determined that the changes made to Chapter 4 of the SAR were acceptable and concluded that the "Review Criteria" were satisfactorily met.

## 6.0 Derivation of Technical Safety Requirements

This section traditionally documents the bases for approving the derivation of TSRs ensuring the logic developed in the hazard and accident analyses and safety SSC chapters are carried through to the derivation of TSRs. However, derivation of TSRs were addressed in the original SER and has not significantly changed other than minor administrative changes. For this SER, review and evaluation of ***changes*** to the actual TSRs will be discussed.

Specific detailed review criteria were developed in accordance with Section 2.0 of this SER.

**Review Criteria:** The TSRs include applicable Safety Limits (SLs), Limiting Control Settings (LCSs), Limiting Condition for Operation (LCOs), Surveillances Requirements and Administrative Controls that are derived from SAR requirements to maintain postulated accident frequencies and the consequences of facility operations at or below

that established in the SAR. Passive design features should also be discussed. Operating modes are defined and explained. The TSRs provide the bases for SLs, LCSs, LCOs, Surveillances, and Administrative Controls.

**Evaluation:** The relevant changes in the SAR have all been appropriately reflected in the TSR. The following discussion details specific technical changes.

Clarification was added to address conditions for staging TRU waste containers outside of culverts with radioactivity contents greater than 0.9 Pu-239 PEC. The existing TSRs were not explicit on controls for activities such movement or characterization of drums normally stored within culverts. Criteria has been added to specify that the total activity of drums or other containers located outside culverts or comparable containers shall not contain more than 1250 Pu-239 PEC, for the case where any one container located outside of the culvert exceeds 130 Pu-239 PEC. These criteria allow operational flexibility while preserving assumptions of the accident analysis.

Criticality controls where added for both Hazard Category 2 and 3 areas. For Hazard Category 3 areas controls are in the form of inventory control. The TSRs require inventories of less than 700 g fissile gram equivalent (FGE) U-235 or 450 FGE Pu-239 in any one segment and a single container limit as specified in Chapter 6 (Prevention of Inadvertent Criticality) of the SAR. These parameters are established and maintained per Nuclear Criticality Safety Evaluations. Criticality Safety Limits were added for Hazard Category 2 facilities are as follows

| Facility | SWMF Approved Containers | Criticality Safety Basis | Criticality Safety Limits | |
|---|---|---|---|---|
| | | | Inventory per Container | Configuration Restrictions |
| E-Area TRU Waste Storage Pads (within 643-7E) | 55-gallon drums<br>Steel boxes<br>Concrete culverts<br>Concrete casks | N-NCS-E-00008 | 485 g FGE Pu-239 per container | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | Five polyethylene boxes containing failed HEPAs >195 g FGE Pu-239 stored as loose waste in culverts<br>Concrete culverts (loose waste) | DPSPU-85-272-121 and N-NCS-E-00006 | 910 g FGE Pu-239 per culvert | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | FB-Line special big black steel boxes | N-NCS-E-00016 | Less than 656 g FGE Pu-239 | 3-foot spacing of fissionable material from fissionable material in non-approved containers |
| | SWBs | N-NCS-E-00017 | Less than 650 g FGE Pu-239 | 3-foot spacing of fissionable material from fissionable material in non-approved containers |

A new section was added to the TSRs delineating passive design features for the SWMF. This section (6.0) identifies the passive design features of the facility, which, if altered or modified, could have an effect on safe operation. The areas addressed are; passive components, and configuration and physical arrangement.

The feature and/or function being controlled is the actual design or function of the equipment, component, system, or structure. All the design features are being controlled to the existing design drawings, design specifications, and Code of Record. The actual equipment, system, structure, or component itself is not being controlled since the function or feature is passive. The design feature or function is being controlled to ensure that if the equipment, system, structure, or component is modified or replaced that the modification or new equipment has essentially the same feature, form, fit, and function as the original equipment. Typically, the material or construction or the actual physical dimensions of the item are controlled as a design feature.

Design features will have a safety class or safety significant functional classification per current procedures. However, the SC/SS designation will apply only to the feature or function credited in the safety analysis. The actual equipment, systems, structures, or components may be classified as general service or production support rather than the higher level functional classification of the design feature or function.

Passive attributes for the SWMF are the Culverts, SWBs, and the Drum Venting System is addressed in this section.

The DOE review team assessed the changes made to the TSRs. All changes to controls made in the SAR have been appropriately reflected in the TSR. Through document reviews, facility walk-downs as applicable, discussions with facility personnel, and knowledge of the facility, the DOE review team determined that the changes made to the TSR were acceptable and concluded that the "Review Criteria" were satisfactorily met.

## 7.0 Programmatic Controls

This section documents the bases for approving programmatic controls. These bases are not related to compliance with regulatory requirements, but rather identification of the basic capability and awareness of fundamental provisions needed for maintaining the adequacy of the facility safety basis. Approval of programmatic controls simply documents that the basic elements of the programs depended on for ensuring the safety basis is maintained and are adequate.

Only minor editorial or administrative changes were made to the programmatic sections in the SAR, therefore no further discussion is warranted.

## 8.0 Conclusion

Thorough review of these documents concludes that the changes made to the SAR and TSR have been developed per the "safe harbor" method delineated in 10 CFR 830, *Nuclear Safety Management.* This SER documents the basis for these changes, and provides the basis for which DOE will approve the changes to the SAR and TSR. The SER for this DSA update was prepared in accordance with the guidance provided in DOE-STD-1104, *"Review and Approval of Nonreactor Nuclear Facility Safety Analysis Report".*

The overall conclusion of this SER is that these revisions will ensure that the DSA documents, along with the mitigative and preventive measures in place, continue to provide adequate controls to ensure that the Solid Waste Management Facility can continue to operate safely without undue risks to the public, the workers, or the environment. This position is based upon review of the bounding accidents. The consequences associated with these bounding accidents for the site workers and the public are a small fraction of evaluation guidelines. Additional safety class or safety significant structures, systems and components would not be expected to reduce the consequences. The Defense in Depth analysis described in the SAR ensures the consequences of all postulated accidents are minimal or non-operational events have been determined to be beyond extremely unlikely. Approval of revisions to the WSRC-approved SWMF SAR (WSRC-SA-22, Rev.3, July 2002) and TSRs (WSRC-TS-95-16, Rev.3, July 2002) is recommended.

## 9.0 Records

The following attachments contain essential records, documentation and information generated throughout the review process.

- Appendix A – Documents Reviewed
- Appendix B - SR Review Team Comments and WSRC Responses

# *Appendix A*

# Documents Reviewed

1. Savannah River Site Solid Waste Management Facility Safety Analysis Report, WSRC-SA 22, Rev. 3, July 2002

2. Technical Safety Requirements, Savannah River Site Solid Waste Management Facility, WSRC-TS-95-16, Rev. 3, July 2002

3. SWMF Annual USQ Summary Report (1/1/99 – 7/31/00), October 2000

4. SWMF Annual USQ Summary Report (8/1/00 – 9/30/01), September 2001

5. WSRC-TR-2001-00607, Rev. 0, Non SC/SS Defense-in-Depth Evaluation of the Solid Waste Management Facility

6. S-CLC-E-00067, Rev. 0, Frequency of Aircraft Crash in the Burial Grounds

7. S-CLC-E-00145, Rev. 0, Consequence Analysis for Hypothetical SWMF Accidents

8. S-CLC-E-00141, Rev. 0, Hazards Analysis for the Pad 3 Waste loading Facility

9. WSRC-TR-2001-00045, Rev. 1, Hazards Analysis for the SWMF Mobile Vendor Assay Equipment on TRU Pad 4

10. WSRC-TR-2001-00120, Rev. 0, Integrated Safety Review for the Mixed Waste Processing Facility

11. N-NCS-E-00017, Rev. 0, Storage Configuration for Standard Waste Boxes

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

SEP 2 9 1999

Dr. W. S. J. Kelly, Vice President
and General Manager
Solid Waste Division
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Dr. Kelly:

SUBJECT: Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR) and Technical Safety Requirements (TSRs) Revision 2 Department of Energy (DOE) Approval (Your letter, SWD-99-0064 dated 7/27/99)

DOE Savannah River Operations Office (SR) has reviewed the subject SAR and TSR revisions. Following iterations with your Safety Compliance staff, our questions and concerns have been resolved. On this basis, DOE concludes that continued operations at SWMF are acceptable since these operations cause no undue risk to workers, the public, or the environment. Therefore, the Manager, SR, has approved the enclosed Safety Evaluation Report (SER) Appendix 3, which documents the DOE/SR review and basis for approval of the revisions.

Please note the DOE Conditions of Approval specified in Section 5.0 of SER Appendix 3.

You may direct any questions to me or to Stan Massingill, of my staff, at 725-3974.

The action taken in this letter is considered by the Government to be within the scope of the existing contract and does not authorize any delay in delivery or additional costs to the Government either direct or indirect. If the contractor considers that any action taken by this letter will result in a contract price increase or delay in delivery, the contractor shall promptly notify the government orally and confirm the notification in writing within 5 working days of the basis for the notification and await further direction from the Government.

Sincerely,

William L. Noll, Director
Solid Waste Division

SWD:SFM:scm

OC 99-101

Enclosure
SER Appendix 3

cc w/encl:
D. Swale, WSRC, 724-7E
Andrew Vincent, WSRC, 724-21E

# SAFETY EVALUATION REPORT

**REVISION 0**

**APPENDIX 3**

**FOR THE SAVANNAH RIVER SITE**

# SOLID WASTE MANAGEMENT FACILITY SAFETY ANALYSIS REPORT

**WSRC-SA-22, REVISION 2**

**JULY 1999**

**Prepared by Westinghouse Savannah River Company**


## SEPTEMBER 1999

**OFFICE OF ENVIRONMENTAL PROGRAMS**
**SAVANNAH RIVER OPERATIONS OFFICE**

# APPROVAL

S. F. Massingill — 8-6-99
Review Team Leader — Date

William L. Noll — 8-11-99
Director, Solid Waste Division — Date

Thomas F. Heenan, Assistant Manager — 8/25/99
Office of Environmental Programs — Date

Gregory P. Rudy, Manager — 9/22/99
Savannah River Operations Office — Date

# DOE-SR
# TECHNICAL REVIEWERS' CONCURRENCE

| | |
|---|---|
| Stan Massingill, SWD | 8/6/99 Date |
| Virgil Sauls | 8/6/99 Date |
| Dale Ormond, SWD | 8/6/99 Date |
| Mildred Keith, SWD | 8/6/99 Date |
| Maxcine Miles, SWD | 8/6/99 Date |
| Russ Kelly, PMCD | 8/9/99 Date |
| Mike McDerment, PMCD | 8-10-99 Date |
| Bert Crapse, SWD/ERD | 8-6-99 Date |
| Augie Maniez, SD | 8-10-99 Date |
| John Merrick, SD | 8/10/99 Date |
| Jim O'Connor, RPD | 8/10/99 Date |

# SOLID WASTE MANAGEMENT FACILITY SAFETY EVALUATION REPORT Revision 0, *Appendix 3*

## 1.0 Background/Introduction

Department of Energy (DOE) Order 5480.23, Nuclear Safety Analysis Reports (SARs) requires that SARs be reviewed, updated as necessary, and submitted annually to DOE to ensure that the information therein is current and remains applicable. This Solid Waste Management Facility (SWMF) SER Appendix (3), was prepared using the guidance from References 7.4 and 7.5, and documents the basis for DOE approval of Revision 2 (Updates) to both the SWMF SAR and Technical Safety Requirements (TSRs) (References 7.1 and 7.2). The updates were approved by Westinghouse Savannah River Company (WSRC) and submitted to DOE by letter (Reference 7.3). Approval of this SER also constitutes DOE approval of the SAR and TSR updates.

## 2.0 Document Content and Conclusions

Revision 2 to the SWMF SAR and TSRs constitutes the first update since initial issue of these DOE Order 5480.23/5480.22 compliant Authorization Basis documents. The updated documents primarily incorporate analyses and descriptive material relevant to activities which have been added at SWMF, each of which was previously evaluated and found within the existing safety envelope via the Unreviewed Safety Question (USQ) process (Reference 7.7). Activities added include low level waste sort and segregation and super compactor, both physically located within the Low Activity Waste (LAW) Vault as well as TRU Ship-to-WIPP activities, including drum headspace gas analysis, TRU visual examination, and TRUPACT II loading. The update also deleted information on the closed 253H Compactor and the Long Lived Waste Storage Building (now used for Green Is Clean waste processing). Other Revision 2 changes include addition of information on the use of Standard Waste Boxes for storage on TRU pads, change to annual review only for chemical inventory control, inclusion of additional Nuclear Criticality Safety Evaluations regarding TRU pad and LAWV fissile material controls, addition of solvent storage tank controls to ensure maintenance of segmentation, addition of EP Hazard Assessment results to provide quick reference to potential source terms, and changes to align with GSAR, Rev.3. Changes are largely found in Chapters two through six and fifteen, with the most complete re-write being Chapter 2, FACILITY DESCRIPTION.

Analyses to address the additional SWMF activities and other updated material did not alter SWMF Safety Analysis conclusions as previously stated in the initial issue of the SAR. That is, quantitative risk assessment results from the highest risk postulated accident scenarios do not exceed established accident evaluation guidelines (EGs).

## 3.0 DOE Review Chronology/Methodology/Criteria

WSRC initially delivered drafts of the SAR and TSR updates (dated 11/98) for DOE review on November 30, 1998, as an AOP Milestone deliverable (Reference 7.6). A multidisciplinary technical review team was formed and led by the SR Solid Waste Division (SWD). The DOE

team consisted of a total of eleven reviewers, including SWD staff, Facility Representatives, and matrix support staff from the SR Safety and Radiation Protection Divisions, each with specific expertise and assigned areas/sections for review (See Appendix A to this SER). WSRC provided an overview presentation of the document updates for the DOE team before the review began. The documents were reviewed in accordance with References 7.5 and 7.8. Specific review criteria guidance provided in Attachment B of Reference 7.4 for "Conduct of Technical Reviews for Authorization Basis Documents" was utilized, as applicable, along with professional engineering judgement and reference to the site Generic Safety Analysis Report (GSAR).

The DOE team members reviewed the SAR and TSR update drafts, the SWMF Annual USQ Summary Report (Reference 7.7), and additional documents as required, according to assigned areas of review. As stated in section 2.0 above, the updated documents primarily incorporate analyses and descriptive material relevant to activities which have been added at SWMF, each of which was previously evaluated and found within the existing safety envelope via the Unreviewed Safety Question (USQ) process. Activities added included low level waste sort and segregation and super compactor, both physically located within the Low Activity Waste (LAW) Vault; as well as TRU Ship-to-WIPP activities, including drum headspace gas analysis, TRU visual examination, and TRUPACT II loading, which have commenced operations over a period of time since the initial issue of the SWMF SAR. Contractor and DOE readiness reviews performed prior to startup of each activity included reviews of USQs, calc. notes, and other associated documents to confirm adequate technical bases existed for safe operations. Multidisciplined DOE teams similar to this SAR update review team performed the readiness reviews, all concerns were resolved prior to startup, and each review was documented. Additionally, DOE/SWD, in its oversight role of WSRC/BNFL, monitors the contractor USQ process on an on-going basis. In this capacity, SWD has reviewed, both prior to and during this SAR update review, many USQs and other documents associated with other activities noted in section 2.0 of the SER, such as use of standard waste boxes, chemical inventory control, fissile material controls, and solvent storage tank controls. Examples of USQs and Calc notes involved in the foregoing reviews are included as References 7.11 through 7.18 of this SER. The SAR/TSR update review concluded that information from USQs listed in the SWMF Annual USQ Summary Report was adequately folded into the updated documents.

The overall results of the DOE review (documented in Reference 7.9) however, found the draft updated documents to fall short of DOE expectations and resulted in 270 comments being forwarded to the contractor for resolution. Following exchange of written comments and proposed resolutions, meetings were held involving DOE, WSRC, and Westinghouse Safety Management Solutions (WSMS) subcontractor personnel to ensure agreement on specifics of comment incorporation. The comment resolution period was protracted, exacerbated by the concurrent handling of the issue of Revision 1 to the SAR and TSRs (incorporating the TRU waste drum high hydrogen content JCO), as well as developing safety documentation for the Super Compactor startup and the upcoming startup of Ship-to-WIPP activities in SWMF.

**4.0 DOE Comment Resolution and Document Status**

As stated above, the DOE review of the SAR and TSR updates found the documents to fall short of expectations, primarily with regard to administrative quality. While there were also technical comments, the review team concluded that the technical/safety bases, as expressed in the documents at hand, remained valid for continued safe operations at SWMF. There were comments, for example, on hazard evaluation details and human factors coverage of new activities such as waste sort and the super compactor, and on the yet to be closed solvent tanks in the old burial ground. However, the primary theme of the 270 comments forwarded to the contractor for resolution was on incorrect/incomplete/out-of-date descriptions of facilities /activities and on administrative and editorial shortcomings.

DOE concluded that insufficient involvement by WSRC in preparation of the documents, including inadequate communications with the WSMS subcontractor preparer/writers regarding current facility configurations/processes, was a primary cause of these deficiencies, and impacted document credibility. After admonishment via the DOE comment transmittal, WSRC responsively established a deliberate and methodical process that resolved the DOE comments/concerns via close interaction with WSMS preparers and DOE reviewers. DOE expects, and WSRC has committed, that this deliberate interactive process shall be used in future document preparation efforts to avoid such insufficiencies in submittals for DOE approval. As stated above, all DOE comments were resolved/agreed to by DOE reviewers. All changes are now incorporated into the documents and are contractor-approved. The complete record of comments/resolutions (Reference 7.10) is documented and on file at DOE/SR/SWD.

**5.0 DOE Conditions of Approval**

- Update TSR Implementation Report no later than the issue date(s) of the SAR/TSR updates.
- Update Solid Waste AB Manual no later than 30 days following issue of SAR/TSR updates.

**6.0 Basis for DOE Approval**

Based on review of the SAR and TSR updates by the DOE-SR review team, as documented in sections 3.0 and 4.0 of this SER, and the satisfactory resolution and incorporation of resulting comments as documented above, DOE concludes that the WSRC-approved SWMF SAR (WSRC-SA-22, Rev.2, July 1999) and TSRs (WSRC-TS-95-16, Rev.2, July 1999) accurately address current operations at SWMF and demonstrate that operations can continue without undue risk to the public, workers, or the environment.

**7.0 References**

**7.1** SAVANNAH RIVER SITE SOLID WASTE MANAGEMENT FACILITY SAFETY ANALYSIS REPORT, WSRC-SA-22, REV.2, JULY 1999

**7.2** TECHNICAL SAFETY REQUIREMENTS, SAVANNAH RIVER SITE, SOLID WASTE MANAGEMENT FACILITY, WSRC-TS-95-16, REV.2, JULY 1999

**7.3** SWMF SAR AND TSR REVISION 2 DOE APPROVAL COPY SUBMITTAL, SWD-99-0064, dated July 27, 1999

**7.4** SRIP 400, Chapter 421.1, Rev. 1, NUCLEAR SAFETY OVERSIGHT

**7.5** DOE-STD-1104-96, REVIEW AND APPROVAL OF NONREACTOR NUCLEAR FACILITY SAFETY ANALYSIS REPORTS

**7.6** COMPLETION OF MILESTONE SWC13-SUBMIT SAR UPDATE FOR DOE REVIEW,SWD-98-0064, dated November 30, 1998

**7.7** SOLID WASTE MANAGEMENT FACILITY ANNUAL USQ SUMMARY REPORT (5/1/97 THROUGH 11/1/98), SWD-98-0074, dated February 3, 1999

**7.8** SRIP 200, Chapter 253.3, REVIEW AND APPROVAL OF DOCUMENTS

**7.9** DOE Review of SWMF SAR and TSR Updates (Rev 2, 11/98) (Letter, Noll to Kelly, dated Feb 4, 1999)

**7.10** SWMF SAR AND TSR REVISION 2 DOE COMMENT FINAL RESOLUTIONS, SWD-99-0045, dated May 11, 1999

**7.11** USQ-SWE-970264 – Operation of LLW Sort and Segregation Facility in LAWV Cell 12, 6/98

**7.12** USQ-SWE-980039 – Operation of LLW Compactor Facility in LAWV Cell 11, 3/98

**7.13** USQ-SWE-990059 – Operation of Selected Ship-to-WIPP Operations in SWD, 8/99

**7.14** Tracking of Chemicals in SWMF Hazardous Waste Facilities, S-CLC-G-00167, Rev. 0, WSMS, 4/98

**7.15** Nuclear Criticality Safety Evaluation N-NCS-E-00011, Low Activity Waste Vault Receipt, Handling, Storage and Closure, WSMS, 4/98

**7.16** Nuclear Criticality Safety Evaluation N-NCS-E-00008, Criticality Safety Envelope for Receipt, Handling, and Storage of Transuranic Waste.

**7.17** The Maximum NSST Tank Temperature, F-CLC-H-00071, Rev. 0, WSMS, 7/99

**7.18** Source Term Analysis for WIPP Approved Waste Containers, S-CLC-E-00099, Rev. 0, WSMS, 11/98

## REVIEWERS AND AREAS OF RESPONSIBILITY
## (SOLID WASTE MANAGEMENT FACILITY SAR/TSR UPDATE REVIEW)
(WSRC-SA-22, Rev. 2, and WSRC-TS-95-16, Rev. 2)

| Name | Technical Specialty | Division | SAR Chapters, TSRs, USQ Annual Report |
|---|---|---|---|
| Stan Massingill | Environmental Engineer (Review Team Leader) | Solid Waste Division | SAR (All), TSR, USQ Report |
| Virgil Sauls | Environmental Engineer (LLW) | Solid Waste Division | Exec. Summary, Chapters 2, 3, 4, 5, 9,12,16,17; TSR, USQ Report |
| Dale Ormond | Environmental Engineer (TRU) | Solid Waste Division | Exec. Summary, Chapters 2, 3, 4, 5, 9,12,16,17; TSR, USQ Report |
| Mildred Keith/Maxcine Miles | Environmental Engineer (Haz/Mixed) | Solid Waste Division | Exec. Summary, Chapters 2, 3, 4, 5, 8, 9,12,16,17; TSR, USQ Report |
| Russ Kelly/Mike McDerment | Facility Representative | Program Management and Coordination Division | Exec. Summary, Chapters 2, 3, 4, 5, 8, 9, 10, 11, 12, 15, 16,17; TSR, USQ Report |
| August Maniez | Safety Specialist (Industrial Safety) | Safety Division | Exec. Summary, Chapters 2, 3, 4, 5, 8, 11, 13, 17 |
| John Merrick | Emergency Preparedness | Safety Division | Exec. Summary, Chapters 1, 2, 15 |
| Jim O'Conner | RadCon Support | Radiation Protection Division | Exec. Summary, Chapters 2, 3, 7 |
| Bert Crapse | Environmental Restoration | Solid Waste Division | Exec. Summary, Chapter 2, USQ Report |

Note: Reviewers to review CHANGES made to noted SAR chapters by the update, as well as TSR changes and the USQ Annual Report, where indicated.

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JAN 20 1999

Dr. W. S. J. Kelly, Vice President
and General Manager
Solid Waste Division
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Dr. Kelly:

SUBJECT: SWMF Safety Analysis Report (SAR) and Technical Safety Requirements (TSR) Change: TRU Drum Hydrogen Issue (Your letter SWD-98-0041 dated 9/16/98).

Department of Energy (DOE) Savannah River Operations Office SR has reviewed the SAR and TSR revisions provided with your letter, including the administrative controls identified for worker protection as a result of the Transuranic (TRU) drum sampling and analysis program. Following iterations with your Safety Compliance staff, our questions and concerns have been resolved. We now agree with your conclusion that once these controls have been verified to be in place, TRU drum venting and storage can continue with acceptable risk and the Justification for Continued Operation may be removed from the Authorization Basis. Therefore, the Manager, Savannah River Operations Office, has affixed his signature, as DOE approval authority, to the enclosed Safety Evaluation Report (SER) Appendix 2, which documents the DOE/SR review and basis for approval of the revisions.

DOE conditions for approval are specified in Section 4 of SER Appendix 2. Included is the condition that the TSR Implementation Report be updated to explicitly indicate procedural implementation of the new controls.

You may direct any questions to me or to Stan Massingill, of my staff.

The action taken in this letter is considered by the Government to be within the scope of the existing contract and does not authorize any delay in delivery or additional costs to the Government either direct or indirect. If the contractor considers that any action taken by this letter will result in a contract price increase or delay in delivery, the contractor shall promptly notify the government orally and confirm the notification in writing within 5 working days of the basis for the notification and await further direction from the Government.

Sincerely,

William L. Noll, Director
Solid Waste Division

SWD: SFM: ahc

OC-99-0021

Enclosure
Safety Evaluation Report Appendix 2

cc w/encl:
D. Swale, WSRC, 724-7E Andrew Vincent, WSRC, 724-21E S. Massingill, SWD

# SAFETY EVALUATION REPORT

REVISION 0

APPENDIX 2

FOR THE SAVANNAH RIVER SITE

# SOLID WASTE MANAGEMENT FACILITY SAFETY ANALYSIS REPORT

WSRC-SA-22, REVISION 1

JANUARY 1999

Prepared by Westinghouse Savannah River Company


## JANUARY 1999

OFFICE OF ENVIRONMENTAL PROGRAMS
SAVANNAH RIVER OPERATIONS OFFICE

# APPROVAL

Dale A. Ormond
TRU Waste Senior Program Manager

1-5-99
Date

William L. Noll
Director, Solid Waste Division

1/5/99
Date

Thomas F. Heenan
Assistant Manager, OEP

1/8/99
Date

Gregory P. Rudy, Manager
Savannah River Operations Office

1/13/99 99 bfm
Date

# DOE-SR TECHNICAL REVIEWERS' CONCURRENCE

| | |
|---|---|
| S.F. Massingill, SWD | 1/4/99 Date |
| Dale A. Ormond, SWD | 1-5-99 Date |
| Russell L. Kelly, PMCD | 1-5-99 Date |
| August Maniez, SD | 1/4/99 Date |

# SOLID WASTE MANAGEMENT FACILITY
# SAFETY EVALUATION REPORT
# Revision 0, *Appendix 2*

1. Background/Introduction

In December 1997, WSRC transmitted Unreviewed Safety Question (USQ) documentation to DOE/SR regarding the discovery that drums of TRU waste have an increased potential for containing flammable gas mixtures subsequent to the vent and purge operation. DOE/SR/SWD review of the Solid Waste Management Facility (SWMF) authorization basis (AB) concluded (as did the contractor) that the discovered condition was outside the AB due to the increased frequency of flammable mixtures in drums and therefore constituted a positive USQ. In January 1998, WSRC transmitted a Justification for Continued Operations (JCO) to DOE for approval to provide an interim AB until the discovery condition could be resolved. The JCO called for a drum sampling/analysis program to better characterize the gas generation/dispersion phenomena in TRU waste drums while providing compensatory measures to guard against any possible deflagration. The JCO would remain in effect pending completion of the sampling and analysis program and appropriate modifications to the AB to allow resumption of normal drum vent and purge operations. Appendix 1 to the DOE Safety Evaluation Report (SER) for SWMF subsequently documented DOE/SR review/approval of the USQ/JCO. The SER appendix was then transmitted to the contractor by letter dated January 13, 1998 (Reference 5.a) and both the SER appendix and the JCO became interim AB documents for SWMF.

By letter dated September 16, 1998 (Reference 5.b), WSRC transmitted proposed revisions (Revision 1 to each document) to the SWMF SAR and TSRs to incorporate the conclusions of the TRU drum hydrogen gas sampling program. Safety Significant administrative controls identified to protect facility workers will supersede the JCO compensatory measures, once in place.

This Safety Evaluation Report (SER) is Appendix 2 to the SWMF Safety Analysis Report (SAR) SER, and serves to document the DOE/SR review and approval of the SAR and TSR revisions. Both this SER appendix and Revisions 1 (January 1999) to the SWMF SAR and TSRs will be added to the SWMF AB listing in the SWMF AB manual; and the JCO will be removed. The DOE review included the revisions to the SAR and TSRs, as well as the hydrogen sampling program report and associated engineering calculation (References 5.c and 5.d). Involved reviewers included Solid Waste Division staff, a SWMF Facility Representative, and SWD matrix support safety staff. Review criteria was based on professional engineering judgment and detailed knowledge of the matter at hand, and the review was performed in accordance with SRIP 400, Chapter 421.1, Nuclear Safety Oversight, and SRIP 200, Chapter 253.3, Review and Approval of Documents.

2. Evaluation

The SAR and TSR revisions reflect the results of the TRU drum headspace gas sampling/analysis program conducted under the JCO. Those results indicated that no controls need be added on behalf of the public or onsite co-located worker. The sampling/analysis program did establish, however, that certain Safety Significant administrative controls are needed for worker protection to guard against potential deflagration in drums where hydrogen concentrations may exceed lower flammability limits. These controls are essentially equivalent to the compensatory measures that have been in effect under the JCO and consist primarily of controlling drum movement within safe windows of time established via the analysis. These document revisions place the said controls formally into the SWMF Authorization Basis. Also, the DOE review raised the question of whether build up of flammable mixtures of hydrogen can occur in containers of other (than TRU) waste types. Although container construction, waste content, and handling history, considered along with known gas generation mechanisms, do not indicate an immediate risk, the contractor has committed to specifically evaluate the possibility and recommend any necessary actions.

DOE evaluated the SAR and TSR revisions and concluded that the drum sampling/analysis program has adequately characterized the gas generation/dispersion phenomena in TRU waste drums. This is based on oversight of the sampling program, review of the results documented by the contractor, and experience to date involving TRU drum retrieval, venting and purging, movement, and storage, including application of the established compensatory measures during the period under the JCO. Conditions for DOE approval (see Section 4 below) of these AB document revisions, which are the subject of this SER Appendix, include a commitment by the contractor to ensure inclusion of the worker protection administrative controls into appropriate operating procedures.

3. Conclusion

Based on the evaluation above, DOE concludes that the SAR and TSR revisions, including the specified administrative controls for worker protection, provide adequate basis such that TRU waste drum venting, purging, and storage may continue with acceptable risk.

4. Conditions of Approval

- All identified worker protection administrative controls in effect; i.e. controls verified in operating procedures and TSR Implementation Report updated.
- SAR/TSR Rev. 1 and SER Appendix 2 added to AB list in Manual WSRC-IM-95-28; JCO removed.
- Contractor committed to calc note (Reference 5.d) clarifications per DOE comments by 2/1/99.
- Contractor committed to evaluate/recommend any necessary actions for addressing the potential for hydrogen generation in containers of other waste types by 2/15/99.

5. References

a) Letter, Noll to Kelly, January 13, 1998, "SWMF USQ and JCO for Increased Frequency of Flammable Mixtures in TRU Waste Drums
b) Letter, Kelly to Heenan, September 16,1998, "SWMF SAR and TSR Change: TRU Drum Hydrogen Issue" (SWD-98-0041)
c) Gibbs, Ann, "Dispersion of Hydrogen from Vented TRU Drums", WSRC-TR-98-00198, June 1998
d) Kelly, John, "The Risk of an Explosion From Drums Exiting the Vent and Purge Machine", S-CLE-E-00115, July 1998

**Department of Energy**
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JAN 13 1998

Dr. W. S. J. Kelly, Vice President
and General Manager
Solid Waste Division
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Dr. Kelly:

SUBJECT: Solid Waste Management Facility (SWMF) Unreviewed Safety Question (USQ) and Justification for Continued Operation (JCO) for Increased Frequency of Flammable Mixtures in TRU Waste Drums (Your letters SWD-97-0076 and SWD-98-0001, dated 12/29/97 and 1/12/98)

Department of Energy (DOE) Savannah River Operations Office (SR) Solid Waste Division has reviewed the USQ safety evaluation provided with your letter, and concurs that the identified discovery situation involving regeneration of flammable gases in vented TRU waste drums is a USQ based on the existing SWMF Authorization Basis (AB). Additionally, we have evaluated your JCO and concur that it provides an adequate justification for continued interim operation while the discovery USQ is being resolved. The enclosed Safety Evaluation Report (SER) appendix documents the basis for DOE/SR approval of the JCO as an interim AB document for SWMF.

You are requested to take action to include the JCO and SER Appendix into the SWMF AB defined in Manual WSRC-IM-95-28. You may direct any questions to me or to Stan Massingill, of my staff.

The action taken in this letter is considered by the Government to be within the scope of the existing contract and does not authorize any delay in delivery or additional costs to the Government either direct or indirect. If the contractor considers that any action taken by this letter will result in a contract price increase or delay in delivery, the contractor shall promptly notify the government orally and confirm the notification in writing within 5 working days of the basis for the notification and await further direction from the Government.

Sincerely,

William L. Noll, Director
Solid Waste Division

SWD:SFM:ahc

OC-98-0019

Enclosure
Safety Evaluation Report Appendix

cc w/encl:
D. Swale, WSRC, 724-7E
Andrew Vincent, WSRC, 705-3C
W. Goldston, WSRC, 705-3C

# SAFETY EVALUATION REPORT

**REVISION 0**

**APPENDIX 1**

**FOR THE SAVANNAH RIVER SITE**

# SOLID WASTE MANAGEMENT FACILITY SAFETY ANALYSIS REPORT

**WSRC-SA-22, REVISION 0**

**December 1996**

**Prepared by Westinghouse Savannah River Company**

## JANUARY 1998

**OFFICE OF ENVIRONMENTAL QUALITY**
**SAVANNAH RIVER OPERATIONS OFFICE**

# APPROVAL

Dale A. Ormond
TRU Waste Senior Program Manager

1-12-98
Date

William L. Noll
Director, Solid Waste Division

1-12-98
Date

Thomas F. Heenan
Assistant Manager, OEQ

1/12/98
Date

Gregory P. Rudy, Acting Manager
Savannah River Operations Office

1/13/98
Date

# SWMF SAFETY EVALUATION REPORT
## Revision 0, Appendix 1

1. Introduction

By letter dated December 29, 1997 (Reference 1), WSRC transmitted Unreviewed Safety Question (USQ) documentation to DOE/SR regarding the discovery that drums of TRU waste have an increased potential for containing flammable gas mixtures subsequent to the vent and purge operation. DOE/SR/SWD review of the SWMF authorization basis (AB), as defined in Manual WSRC-IM-95-28, concluded (as did the contractor) that the discovered condition is outside the AB due to the increased frequency of flammable mixtures in drums. On this basis, SWD agrees with the WSRC determination that the discovery does constitute a positive USQ.

By letter dated January 12, 1998 (Reference 2), WSRC transmitted for DOE approval, a Justification for Continued Operations (JCO) to provide an interim AB for continued operations until the discovery USQ is resolved. The JCO will remain in effect until a sampling and analysis of drum headspace gases has been completed and appropriate modifications to the AB have been approved to resume normal operations (vent/purge/handling of drums). This SER appendix (Reference 3) is written as an appendix to the SWMF SAR SER and serves to document the DOE/SR review of the discovery USQ situation as well as the WSRC JCO. Both the SER appendix and the JCO will be added to the SWMF AB listing in the SWMF AB manual noted above. The DOE review included the USQD, the JCO, and supporting documentation surrounding the discovery condition and sampling and analysis plans. Involved reviewers included Solid Waste Division, Facility Representative, and matrix support radiological control staff. Review criteria for the JCO was based on professional engineering judgment and detailed knowledge of the matter at hand, and included the suggested JCO content specified in SRIP 400, Chapter 421.1, Nuclear Safety Oversight, and SRM 5480.0.1, Nuclear Safety Document Review Manual.

2. Evaluation

The JCO relates the USQ determination which resulted from the re-sampling of several drums which had been vented and purged previously. Specifically, hydrogen concentrations were noted again to be above the 4% LFL in drums which had been purged to below LFL earlier. This then, was found to be outside the analysis of the existing SWMF AB. Vent and purge operations, as well as any movement of previously vented drums, were consequently suspended. Following considerable study into the situation, WSRC determined that the gas generation/dispersion phenomena being encountered was not understood well enough to safely resume operations. WSRC therefore is proposing a headspace gas sampling and analysis plan in an effort to gather needed data for analysis and subsequent determination of actions necessary to resume normal operations, including changes to the SWMF Authorization Basis, as appropriate. The JCO details how movements of the drums is the most likely way to create a spark that could lead to a deflagration. Therefore, in addition to design and operational precautions (such as a non-metallic sampling device and in situ sampling) for the sampling program itself, additional compensatory measures are specified to ensure stored drums are not disturbed.

DOE evaluated the JCO and concluded that the proposed drum sampling is necessary in an effort to better characterize the gas generation/dispersion phenomena in TRU waste drums. Additionally, DOE believes that activities which could lead to a deflagration during drum sampling due to the presence of flammable gases have been adequately identified and that appropriate compensatory measures are planned.

3. Conclusion

Based on the evaluation above, DOE concludes that the JCO , including the specified compensatory measures and conditions for approval (reiterated below), provides an adequate basis for interim operations until the discovery USQ is resolved.

4. Conditions of Approval

As previously stated:

- JCO and SER Appendix added to AB list in Manual WSRC-IM-95-28.
- All identified compensatory measures in effect.
- Normal operations (vent/purge/drum handling) are not to resume until the drum sampling plan has been completed, the results analyzed, and an appropriate path forward identified, including any appropriate AB changes.

5. References

a) Letter, Kelly to Heenan, December 29,1997, "Transmittal of Unreviewed Safety Question Associated with Storage of Drums with a Potential Flammable Gas Mixture" (SWD-97-0076)

b) Letter, Kelly to Heenan, January 12,1998, "Justification for Continued Operations Associated with Storage and Sampling of Drums with a Potential Flammable Gas Mixture" (SWD-98-0001)

c) DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports"

MAY 2 1 1997

Dr. W. S. J. Kelly, Vice President
and General Manager
Solid Waste Division
Westinghouse Savannah River Company
Aiken, SC 29808

Dear Dr. Kelly:

SUBJECT: U.S. Department of Energy (DOE) Approval of the Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR) (Letter, Kelly to Heenan, 2-26-97)

The DOE has concluded, via its review of the subject SAR (WSRC-SA-22, Rev 0, 12/96), that the risk of continued operations of the SWMF is acceptable. Therefore, the Manager, Savannah River Operations Office, has affixed his signature as DOE approval authority. The enclosed Safety Evaluation Report (SER) documents the DOE review and approval. The newly approved SAR supersedes the SWMF Basis for Interim Operation (BIO) and E-Area Vaults SAR Addendum; and together with the SWMF Technical Safety Requirements (TSRs) and the SER, constitutes the SWMF Authorization Basis (AB).

You may direct any questions to me or to Stan Massingill, of my staff.

The action taken in this letter is considered by the Government to be within the scope of the existing contract and does not authorize any delay in delivery or additional costs to the Government either direct or indirect. If the contractor considers that any action taken by this letter will result in a contract price increase or delay in delivery, the contractor shall promptly notify the government orally and confirm the notification in writing within 5 working days of the basis for the notification and await further direction from the Government.

Sincerely,

Original Signed by
William L. Noll

William L. Noll, Director
Solid Waste Division

SWD: SFM: ahc

OC 97-0096

Enclosure
Safety Evaluation Report

cc w/encl:
D. Zimmerman, WSRC, 724-7E
Andrew Vincent, WSRC, 724-35E

# SAFETY EVALUATION REPORT

**REVISION 0**

**FOR THE SAVANNAH RIVER SITE**

# SOLID WASTE MANAGEMENT FACILITY SAFETY ANALYSIS REPORT

**WSRC-SA-22, REVISION 0**

**December 1996**

**Prepared by Westinghouse Savannah River Company**


## MARCH 1997

**OFFICE OF ENVIRONMENTAL QUALITY**
**SAVANNAH RIVER OPERATIONS OFFICE**

# APPROVAL

S.F. Massingill
Review Team Leader

3/12/97
Date

William L. Noll
Director, Solid Waste Division

4/3/97
Date

Thomas F. Heenan
Assistant Manager, OEQ

4/22/97
Date

Mario P. Fiori, Manager
Savannah River Operations Office

5/19/97
Date

**DOE-SR**
**TECHNICAL REVIEW GROUP CONCURRENCE**

| | |
|---|---|
| S.F. Massingill, SWD | 3/12/97 Date |
| Steve Mackmull, SWD | 3/17/97 Date |
| G. Maxcine Miles, SWD | 3/14/97 Date |
| Virgil Sauls, SWD | 3/18/97 Date |
| Winchester Smith, SWD | 3/28/97 Date |
| Russ Kelly, PMCD | 3/12/97 Date |
| Perry Ward, SRD | 3/14/97 Date |
| John Eschenberg, RPD | 3/14/97 Date |
| Charles Borup, EQMD | 3/14/97 Date |
| Herbert Crapse, ERD | 3-17-97 Date |
| John Shaffer, SD | 4/2/97 Date |
| John Merrick, SD | 4/2/97 Date |
| Kenneth Picha, EM/HQ | Date |

SWMF SAR SAFETY EVALUATION REPORT

# DOE-SR
# TECHNICAL REVIEW GROUP CONCURRENCE

S.F. Massingill, SWD — Date: 3/12/97

Steve Mackmull, SWD — Date

G. Maxcine Miles, SWD — Date

Virgil Sauls, SWD — Date

Winchester Smith, SWD — Date

Russ Kelly, PMCD — Date

Perry Ward, SRD — Date

John Eschenberg, RPD — Date

Charles Borup, EQMD — Date

Herbert Crapse, ERD — Date

John Shaffer, SD — Date

John Merrick, SD — Date

Kenneth Picha, EM/HQ — Date: 3/18/97

## CONTENTS

# 1.0 EXECUTIVE SUMMARY

This Safety Evaluation Report (SER) documents the basis for U.S. Department of Energy (DOE) approval of the Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR). This SER was prepared in accordance with DOE-STD-1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports," dated February 1996.

The SWMF SAR [WSRC-SA-95-22, Rev. 0, February, 1996, DOE review draft] was submitted by the Savannah River Site (SRS) operating contractor, Westinghouse Savannah River Company (WSRC), to the DOE Savannah River Operations Office (DOE-SR) in February, 1996 in accordance with the SRS Implementation Plan for DOE Order 5480.23. It was developed as required by DOE Order 5480.23 using the format and content guidance provided by DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, dated July 1994.

The SWMF SAR (when DOE approved) will supersede the SWMF Basis for Interim Operation (BIO) [WSRC-TR-94-0113, Rev. 0, April, 1996], which was developed as required by DOE Order 5480.23 to provide an interim safety basis for continued operation of SWMF pending DOE approval of the upgraded SAR. The SAR will also supersede the existing SAR (Safety Analysis - 200 Area Savannah River Plant Burial Ground Operations, DPSTSA-200-10 Supp 8, October 1988), and the E-Area Vaults SAR Addendum, WSRC-SA-5 Addendum 1, May 1994.

The SWMF consists of multiple waste treatment, storage, handling, and disposal facilities. The majority of the waste management activities conducted at the SWMF are located in E Area, which is located in the approximate geographical center of the SRS, between the two major chemical separations process areas -- H Area and F Area. In addition, there are several storage facilities located in H, N, and B Areas that are also considered to be part of the SWMF. The waste management facilities that are covered by the SWMF SAR are listed below:

| Facility | Facility Hazard Classification |
|---|---|
| Old Burial Grounds | 2 |
| TRU Waste Storage Pads | 2 |
| Greater Confinement Disposal Facility | 3 |
| Used Equipment Storage Area | 3 |
| Naval Reactor Component Storage Area | 3 |
| Engineered Low-Level Trenches | 2 |
| Solvent Storage Tanks | 3 |
| Mixed Waste Storage Buildings | 3 |
| Mixed Waste Management Facility | 2 |
| B Area Hazardous Waste Storage Bldg. | 3 |
| N-Area Hazardous & Mixed Waste Storage Buildings & Pads | 3 |
| E-Area Low-Activity Waste Vaults | 3 |
| E-Area Intermediate-Level Non-Tritium Vaults | 3 |
| E-Area Intermediate-Level Tritium Vaults | 3 |
| E-Area Long-Lived Waste Storage Building | 3 |
| Waste Certification Facility | 2 |
| Compactor Building | 3 |
| E-Area Slit Trenches | 3 |

As shown above in the table, the SWMF includes both Hazard Category 2 facilities and Hazard Category 3 facilities. Hazard Category 2 facilities have the potential for significant radiological or chemical consequences to facility workers. Facility hazard categories were determined in accordance with U.S. Department of Energy Standard DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports. These categorizations provided an initial hazard screening used to determine the level of safety analysis that each facility warranted.

The hazard and accident analyses presented in Chapter 3 of the SAR are the bases for the engineered and administrative controls used to prevent occurrences and mitigate consequences of potential accidents involving radiological and chemical materials. The main preventors and mitigators included in the safety basis are the passive confinement systems. These include, for example, the use of closed waste containers such as metal or polyethylene drums, which are then placed inside concrete culverts to achieve defense in depth. In addition to such passive confinement systems, other features that are used to provide layers of defense in depth include raised storage pads with liquid collection sumps, angled trench floors that channel liquid to collection basins, the use of noncombustible building materials, concrete curbs around storage buildings, installation of fences and gates, and palletizing and banding waste containers. Administrative defense-in-depth is also provided. Examples include training and qualification requirements, use of facility-specific procedures, control of vehicles access, etc.

The major facility hazards include: fires that may be the result of external events such as a lightning strike or internal events such as the spontaneous combustion of organic material contained within the waste, explosions inside of steel containers caused by the generation of explosive concentrations of flammable gases as a result of radiolytic decomposition of organic materials in the waste, breech of containers or trenches as a result of material degradation, dropped loads, or improper use of process equipment such as forklifts or bulldozers, worker exposure to ionizing radiation, inadvertent criticality, breech of containers or trenches as a result of external events such as airplane, helicopter, or train crashes, and breech of containers or trenches as a result of natural phenomena events such as tornadoes, high winds, earthquakes, or floods.

The two dominant accident scenarios for the Solid Waste Management Facility are both associated with the transuranic (TRU) waste storage pads. The first accident scenario involves an explosion inside of a culvert. The second involves dropping of a large steel box onto another large steel box. The off-site dose consequences for the explosion scenario are 4.52 rem

compared to an evaluation guideline of 5.0 rem. The off-site dose consequences for the dropping scenario are 0.45 rem compared to an evaluation guideline of 0.5 rem.

The results of all postulated accident scenarios are discussed in Section 4.0 of this SER and Chapter 3 of the SAR. These results have been compared to the evaluation guidelines (EG) in WSRC's Facility Safety Document Manual (WSRC Manual 11Q), which are based on DOE Safety Goals and radiological EGs. The highest risk accident scenarios identified in the Preliminary Hazards Analysis do not exceed EGs, and are therefore acceptable.

Based on review of the SAR by the DOE-SR Technical Review Group, and the satisfactory resolution and incorporation of resulting comments, DOE concludes that the now WSRC-approved SWMF SAR (WSRC-SA-22, Rev. 0, 12/96) demonstrates that operations can continue without undue risk to on-site or off-site populations or to the environment. Sections 3.0 through 7.0 of this SER include further information/logic in support of the DOE conclusion that the SAR adequately describes how the facility is satisfactory relative to the five approval bases specified by DOE-STD- 1104-96, "Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports."

Approval of this SER also constitutes DOE approval of the aforementioned SAR. Approval authority has been delegated to the Manager, DOE-SR. The Technical Safety Requirements (TSR) for the SWMF, previously approved along with the BIO, will be completely implemented subsequent to SAR approval. The SAR along with the TSRs will then constitute the authorization basis for the SWMF.

## 2.0 REVIEW PROCESS

DOE review of the SAR (DOE review draft) commenced in mid-April 1996. An assigned review team leader from the DOE-SR Solid Waste Division (SWD) staff organized a multidisciplinary DOE-SR Technical Review Group (TRG) composed of technical

specialists/subject matter experts in multiple functional areas which included SWD staff, facility representatives, matrix support personnel from the DOE-SR AMHS&TS organization, and DOE-HQ EM staff. See Appendix A for a listing of the DOE-SR TRG, their respective areas of technical specialty, organizations that they represent, and SAR chapters that they were assigned for review.

The review team leader assigned specific portions of the SAR to each reviewer, based upon their technical specialties/areas of expertise. WSRC provided an overview of the SAR for the DOE reviewers for the purpose of familiarizing them with the scope and format of the SAR, thus facilitating the review process. The review was then conducted against the following criteria, specifically relevant to the SAR:

- DOE Order 5480.23, "Nuclear Safety Analysis Reports"
- DOE-STD-3009-94, "Preparation Guide for US DOE Nonreactor Nuclear Facility Safety Analysis Reports"

Additionally, the technical specialists/subject matter experts examined compliance with other DOE Orders, standards, guides, etc. directly related to their functional area specialties. The team members reviewed for technical accuracy, factual accuracy, clarity, and continuity, and together with engineering judgment and professional experience, used the results to make a determination that an acceptable level of safety is assured. Functional areas reviewed by the DOE-SR TRG included Radiation Protection, Industrial Safety, Quality Assurance, Environmental Protection, Emergency Preparedness, and Criticality Safety.

DOE comments on the SAR were forwarded to WSRC in early July 1996. WSRC provided proposed resolutions in writing in late August 1996. In early September 1996, the DOE review team leader distributed the proposed comment resolutions to the reviewers for evaluation. Following meetings to resolve remaining reviewer concerns, and a rather protracted period of comment incorporation, WSRC-approved copies of the SAR were delivered to DOE/SR/SWD in late February, 1997, for approval.

Approximately 300 comments were provided to WSRC for resolution. These comments sought to clarify the descriptions of facilities, operations, status and missions; and embellish information relative to referenced safety basis documentation and selection of facility limits/controls. The comments were also aimed at clarifying hazard and accident analysis methodology and ensuring complete implementation of DOE directives/guidance, as well as making editorial and other miscellaneous corrections. The complete record of comments/resolutions is on file at DOE-SR.

## 3.0 BASE INFORMATION

Although some additions and changes were made later as a result of DOE comments, DOE review determined that the base information in the draft SWMF SAR was adequate since it contained sufficient background and fundamental information to support the review of the more technical aspects of the SAR; i.e., the remaining four approval bases. Primarily, the base information in the SAR is considered to be provided in the Executive Summary, Site Characteristics (Chapter 1), Facility Description (Chapter 2), and the material generic to all SAR chapters such as statutes, rules, Orders, and principal health and safety criteria.

Solid and liquid low-level hazardous and radioactive wastes generated at SRS and some wastes from offsite are stored and disposed of at SWMF. These wastes have accumulated from operations in the production of nuclear materials for United States Defense Programs since 1953. The SWMF is primarily located in E Area between the two chemical separations areas, Areas F

and H, near the center of SRS. The SWMF lies between Upper Three Runs Creek on the north and Four Mile Creek on the south. The SWMF is primarily composed of the following:

- Old Burial Ground, Building 643-E
- Solid Waste Disposal Facility (SWDF), Building 643-7E
- E-Area Vaults (EAV), Building 643-26E

In addition, there are several disposal and storage facilities, located in other areas, which are part of the SWMF. These facilities include the following:

- H-Area: The low-level waste compactor facility (Building 253-H) is located northeast of 221-H Canyon Facility. In addition, Solvent Storage Tanks (607-33H to 36H) are located in H Area.
- N-Area: Hazardous and mixed waste storage facilities, designated as 645-N, 645-2N, and 645-4N, are located across from the Central Shops. In addition, a PCB storage area (741-1N) is located in N Area.
- B-Area: A hazardous waste storage facility, designated as 710-B, is located in B Area.

The Old Burial Ground began to receive waste in 1953 and, with the exception of monitoring, ceased operations in 1974. Operations then shifted to the SWDF, which is contiguous to the Old Burial Ground. The EAV is located on a 200-acre site immediately north of the SWDF. The bulk of low-level waste operations were shifted to the EAV beginning in mid-1995.

Prior to 1970, low-level radioactive waste at SRS, including that which contained transuranic radionuclides, was disposed of in shallow, landfill-type configurations in the Old Burial Ground. In 1970, the Atomic Energy Commission (AEC) defined TRU waste as a separate waste category and declared that it must be segregated and stored in a form that is retrievable. In 1973, the AEC issued the requirements for retrievable storage and in 1974, SRS began retrievable storage. TRU

waste is now stored in various types of containers such as steel boxes, concrete casks, drums, and concrete culverts. The containers are then placed on storage pads.

With the opening of the SWDF, disposal practices for low-level radioactive waste were changed. The Greater Confinement Disposal Area and Naval Reactor Component Storage Area were created to allow for segregation of certain waste types. Low-level waste generated at SRS was now disposed of in engineered low level trenches (ELLT). Low-level waste was typically placed inside of B-25, steel engineered storage boxes. These boxes (approximately 4 feet by 6 feet by 4 feet in size) were delivered into the ELLTs by trucks, and off-loaded and stacked in an orderly fashion. As the ELLTs were filled, the B-25s were covered with dirt to provide some degree of waste confinement and minimize the potential for personnel radiation exposures. In the mid 1980s, hazardous and mixed-waste storage buildings were also constructed to allow for the further segregation of waste and compliance with new environmental regulations.

In 1995, essentially all of the low-level waste disposal was shifted to EAV. Three different types of vaults have been designed and constructed for the disposal of low-level waste. Each of the vaults is a sub-grade concrete structure that provides for structurally sound and water-proof containment of the waste. Low-level waste with long-lived radioactive isotopes such as Carbon 14 are stored on above ground storage pads.

## 4.0 HAZARD AND ACCIDENT ANALYSIS

This section of the SER describes the hazard and accident analyses performed for the SWMF (SAR Chapter 3). This complete and logical effort systematically examined potential process-related, natural phenomena, and external hazards that can effect the public, the workers, and the environment. Both methodology and results are presented in the SAR and are summarized below.

Hazard analysis consists of hazard identification, hazard classification/categorization, and hazard evaluation. In the hazard identification step, lists of potential hazardous material and energy sources associated with the facility were developed. The major facility hazards include: fires that may be the result of external events such as a lightning strike or internal events such as the spontaneous combustion of organic material contained within the waste, explosions inside of steel containers caused by the generation of explosive concentrations of flammable gases as a result of radiolytic decomposition of organic materials in the waste, breech of containers or trenches as a result of material degradation, dropped loads, or improper use of process equipment such as forklifts or bulldozers, worker exposure to ionizing radiation, inadvertent criticality, breech of containers or trenches as a result of external events such as airplane, helicopter, or train crashes, and breech of containers or trenches as a result of natural phenomena events such as tornadoes, high winds, earthquakes, or floods. After the hazard identification phase, each of the subfacilities was assigned a hazard category based on specific quantities of radionuclides and hazardous chemicals associated with it. This hazard categorization was accomplished in accordance with guidance provided in DOE Order 5480.23, "Nuclear Safety Analysis Reports," and DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23," and WSRC-MS-92-206 for chemical hazards. Hazard evaluation (presented in SAR Chapter 3, Appendix C) began with facility design and process/activity information being introduced to allow development of specific events and scenarios associated with radioactive/hazardous material release. Following frequency determinations per DOE-STD-3011-94, "Guidance for Preparation of DOE 5480.2 (TSR) and DOE 5480.23 (SAR) Implementation Plans," and qualitative consequence estimates per DOE-STD-3009-94, "Preparation Guide for U.S. Department of Energy Non-Reactor Nuclear Facility Safety Analysis Reports," postulated events were risk-ranked in order to select/prioritize dominant scenarios for further more rigorous quantitative analysis. A risk matrix is provided in SAR Chapter 3, Table 3.3-5.

Quantitative risk assessments were performed for accident scenarios determined to be HIGH risk (pose a considerable threat to the Maximally Exposed Offsite Individual) by the hazard analysis. The two dominant accident scenarios for the Solid Waste Management Facility are both associated with the TRU waste storage pads. The first accident scenario involves an explosion inside of a culvert. The second involves dropping of a large steel box onto another large steel box. The off-site dose consequences for the explosion scenario are 4.52 rem compared to an evaluation guideline of 5.0 rem. The off-site dose consequences for the dropping scenario are 0.45 rem compared to an evaluation guideline of 0.5 rem. Risk assessment methodology involved estimation of material releases followed by dose calculations. Results were compared to WSRC EGs (consequence versus frequency) which are based on DOE guidelines. The risks associated with the postulated high risk scenarios were found to be below the EGs and therefore, acceptable.

Design and administrative features are included as preventors and mitigators. The hazard and accident analyses presented in Chapter 3 of the SAR are the bases for the engineered and administrative controls used to prevent occurrences and mitigate consequences of potential accidents involving radiological and chemical materials. The main preventors and mitigators included in the safety basis are the passive, confinement systems. These include, for example, the use of closed waste containers such as metal or polyethylene drums, which are then placed inside concrete culverts to achieve defense in depth. In addition to such passive confinement systems, other features that are used to provide layers of defense in depth include raised storage pads with liquid collection sumps, angled trench floors that channel liquid to collection basins, the use of noncombustible building materials, concrete curbs around storage buildings, installation of fences and gates, and palletizing and banding waste containers.

Administrative defense-in-depth is also provided. Examples include training and qualification requirements, use of facility-specific procedures, control of vehicles access, etc. Chapter 3

identifies and describes in detail administrative and engineered defense-in-depth measures for each facility, and specifically identifies measures enforced by the TSRs.

DOE concludes, based on its review of the SAR, that the SWMF hazard/accident analysis (iterated above) is comprehensive relative to hazards presented and is based on consistent, substantiated logic.

## 5.0 SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

One safety-class and one safety-significant structures, systems, and components (SSC) have been identified by WSRC in order to satisfy EGs, provide defense-in-depth, or contribute to worker safety.

The safety-class SSC are the concrete culverts that are used at the Waste Storage Pads and the Mixed Waste and Hazardous Waste Storage Buildings. The culverts provide off-site individuals with protection from airborne radionuclides that could exceed the off-site radiological EGs. The culverts resist fire propagation and explosion by preventing the spread of flames and are impact resistant. For the Mixed Waste and Hazardous Waste Storage Buildings, the culverts segment the facility by preventing any event from releasing the contents of more than one concrete culvert. Credit for the culverts is taken in the following accident scenarios:

- Fires and explosions
- Transfer and handling
- Vehicle crash with fire
- Helicopter crash with fire
- Seismic

- Tornado

The safety-significant SSC is the drum venting system (DVS) which is necessary to protect the worker during vent and purge operations for the TRU waste drums. The purpose of the DVS is to provide a path for venting of gases away from the workers in the unlikely event of the ignition of the drum gases.

The safety-class and safety-significant SSCs that have been identified by WSRC were determined by DOE to be consistent with the hazard and accident analysis that is documented in Chapter 3.0 of the SAR. Specifically, those SSCs that were credited in the hazard and accident analysis to prevent or mitigate the consequences of potential accidents have been properly identified by WSRC and designated as safety-class or safety-significant. In addition, DOE has found that the SAR contains sufficient documentation to conclude that the designated SSCs are capable of performing their intended safety functions.

## 6.0 DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

TSRs for the SWMF were derived by logical progression by putting controls in place associated with preventive/mitigative features (including Safety SSCs) which were identified as a result of the hazards/accident analysis. The following methodology was developed and implemented in determining the TSR limits and controls needed to ensure that the risk to the public and onsite receptors is maintained below the associated EGs and onsite criteria.

- The accident event scenarios were reviewed to identify those events with significant radiological or hazardous material consequences.
- Inherent assumptions (i.e., initial conditions, operability of Structures, Systems, and Components [SSCs] credited in maintaining the consequences associated with event scenarios within limits) were noted as requiring TSR control.

- Administrative controls were established for the assumptions identified as requiring TSR control. The SWMF analysis did not contain any credited features that met the definition of a safety limit (SL), limiting control setting (LCS) or a limiting condition of operation (LCO). Administrative controls were assigned for the programs and administrative requirements that ensure that the basic facility conditions assumed in the analysis do exist (e.g., established inventory control programs, Waste Acceptance Criteria [WAC]). Administrative controls were also assigned to procedural or programmatic controls or barriers that perform a passive function (e.g., the presence of an earthen or trench backfill for buried facilities). These controls are identified in SAR Tables 5.3-2 through 5.3-33 as serving either safety-class or safety-significant functions.

DOE has determined that the SAR contains sufficient documentation to conclude that the bases for deriving the administrative controls that are identified and result from the hazard and accident analyses and safety SSC chapters (Chapters 3 and 4) are consistent with logic and assumptions presented in the analyses.

## 7.0 PROGRAMMATIC CONTROL

Facility safety on a day-to-day basis requires the implementation of safety management programs. The safety management programs established by DOE and WSRC are meant to assure that the facilities are designed, constructed, and operated in a manner that provide:

- Facility worker safety from routine operational hazards.
- Co-located worker and public safety from normal operational releases and exposures
- Worker and public safety from postulated accidental releases of hazardous materials

The safety management programs listed below provide the framework for safe facility operation. These programs, which are documented in WSRC site/facility manuals and procedures, cover a broad spectrum of safety concerns from radiation and hazardous material protection to conduct of

operations to enhance worker and public safety. DOE concludes that the SAR contains sufficient documentation to determine that the necessary elements of institutional programs, depended on for maintaining the facility safety basis, are adequate and will be implemented. The following programs are described in the SAR:

- Configuration Management
- Fire Protection Program
- Conduct of Operations
- Testing
- Radiation Protection
- Waste Management
- Occurrence Reporting
- Experimental Review
- Hazardous Material Protection
- Procedures and Training
- Quality Assurance
- Maintenance
- Criticality Protection
- Emergency Preparedness
- D&D
- Surveillance

## 8.0 RECORDS

- Letter, Boyter to Heenan, "Transmittal of the SWMF Safety Analysis Report, DOE Review Copy," dated February 28, 1996.
- Memo, Noll to Director, PMCD, et. al., "Review of Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR)," dated April 17, 1996.
- Memo, Noll to Picha (HQ-EM32), "Review of Solid Waste management Facility (SWMF) Safety Analysis Report (SAR)," dated April 17, 1996.
- WSRC Slide Package, "Solid Waste-SAR: DOE Briefing," dated May 2, 1996.
- Letter, Noll to Hughes, "Department of Energy (DOE) Review of the Draft Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR) (WSRC-SA-95-22, Rev. 0, 2/96) (Letter, Boyter/Heenan, SWE-96-0005, 2/28/96)," dated July 10, 1996.
- Letter, Hughes to Noll, "Proposed Comment Resolutions for the Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR)," dated August 21, 1996.
- cc:Mail, Massingill to Sauls, et.al., "Evaluation of WSRC Responses to SWMF SAR Comments," dated September 4, 1996.
- Letter, Massingill to Vincent, "Proposed Comment Resolutions for the Solid Waste Management Facility (SWMF) Safety Analysis Report (SAR) (Letter, Hughes to Noll, SWE-SWD-96-0157, 8/21/96)," dated October 17, 1996.
- Letter, Kelly to Heenan, "Transmittal of the SWMF Safety Analysis Report for DOE Approval", dated February 26, 1997.

## TECHNICAL REVIEW GROUP AND AREAS OF RESPONSIBILITY (SOLID WASTE MANAGEMENT FACILITY SAR REVIEW)

| Name | Technical Specialty | Division | Chapter |
|---|---|---|---|
| Steve Mackmull | General Engineer (TRU Waste) | Solid Waste Division | Exec. Summary, Chapters 2-6, 9, 12, 17 |
| Stan Massingill | General Engineer | Solid Waste Division | Exec. Summary, Chapters 2, 3, 4, 5, 6, 9, 10, 17 |
| G. Maxcine Miles | General Engineer | Solid Waste Division | Chapter 9 |
| Virgil Sauls | General Engineer (Haz/Mixed waste) | Solid Waste Division | Exec. Summary, Chapters 2-6, 8, 9, 12, 17 |
| Winchester Smith, IV | General Engineer (Low Level Waste) | Solid Waste Division | Exec. Summary, Chapters 2-6, 9, 12, 17 |
| Russ Kelly | Facility Representative | Program Management and Coordination Division | Chapters 8, 9, 10, 11, 12, 13, 15, 17 |
| Kenneth Picha | Program Manager | DOE/HQ-EM30 | All |
| Perry Ward | Nuclear Engineer (QA) | Standards & Requirements Division | Chapter 14 |
| John Eschenberg | Health Physicist | Radiation Protection Division | Chapters 7, 8, 9, 16 |
| John Shaffer | Safety Specialist (Industrial Safety) | Safety Division | Chapters 2, 8, 11, 13 |
| John Merrick | Emergency Preparedness | Safety Division | Exec. Summary, Chapters 1, 2, 6, 15 |

## TECHNICAL REVIEW GROUP AND AREAS OF RESPONSIBILITY
## (SOLID WASTE MANAGEMENT FACILITY SAR REVIEW)

| Name | Technical Specialty | Division | Chapter |
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| Charles Borup | Environmental Scientist | Environmental Quality Management Division | Exec. Summary, Chapter 1 |
| Bert Crapse | Environmental Scientist | Environmental Restoration Division | Chapters 2, 3, 4, 5, 6 |
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| Kevin Shaw | General Engineer | PRC Environmental Management, Inc. (SWD) | Exec. Summary, Chapters 1, 6 |
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