

April 24, 2007

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**Subject: CSSG Review of Fluor-Hanford Draft Criticality Safety Evaluation Report 07-004**

**Introduction**

As specified in the Attachment A, this memo provides final observations and recommendations regarding the assessment of the 13 April 2007 draft of the Criticality Safety Evaluation Report (CSER) 07-004, *Storage and Handling of Waste Drums in the Solid Waste Operations Complex*, that was prepared by Fluor Hanford personnel and received by two members of the NCSP CSSG, Mr. Fitz Trumble and Mr. Calvin Hopper, 13 April 2007. This assessment of the CSER was precipitated by the cessation of waste operations due to concerns with the assumptions and analysis of the previous CSER that provided the bases for drum handling and storage operations.

**Review activities**

Trumble and Hopper reviewed the draft CSER prior to their in-briefing by the Hanford DOE and Fluor personnel the afternoon of April 16 during which they were provided supplemental information which is provided in Attachment B. April 17, they toured the Low-Level Burial Grounds (LLBG) and the Waste Receiving and Process (WRAP) facilities (Bldg 2404WB and WC storage pads (SWB, TDOP, and Drum Storage) and 233GW (WRAP). During the tour they interviewed the WRAP Facility Mgr, LLBG operations manager, Criticality Safety Representatives (CSR) and technical support personnel regarding operations, historic and current NDA data acquisition, operations and methods, data reduction/conversion, statistical trending, supporting HAZOP analyses, the Solid Waste Inventory and Tracking System (SWITS) and sample records. Following the tour they met with the primary authors and peer reviewers of the CSER to discuss general model drum storage configuration assumptions that were used within CSER 07-004. Persons interviewed are provided in Attachment C. The team provided daily out-briefs about observations, issues, and suggestions as well as a formal out-brief on 18 April 2007. On 19 April further clarifications were provided to various members of Fluor Hanford and DOE RL concerning information from the out-briefs. A draft of this report was provided to the Fluor and DOE RL staff to review for technical accuracy.

The resource of time did not permit an in-depth and thorough examination of the technical, nor administrative, bases for the

- “PU FGE versus AK PU FGE” relationships and uncertainties provided in the CSER
- Quality of the MCNP inputs and outputs
- Validation and area of applicability documentation
- Evaluation of facility need for criticality accident alarms (e.g., WRAP)

## Conclusion

Based upon the review and evaluation of the information, documentation (Attachment D), and operations it is judged by the team that there is sufficient justification for concurring with the CSER 07-004, Rev.0 analyses and conclusions that a criticality is incredible for the storage of drums provided the applicable controls and limits are implemented.

Specific observations and recommendations are provided in Attachment E associated with portraying a realistic risk perspective relative to the incredibility arguments and for minimizing operational and regulatory risks.

The team commends both Fluor Hanford and DOE RL staff for their support and availability during this review.

Submitted by:

original signed by  
Fitz Trumble

4/24/07  
Date

original signed by  
Calvin M. Hopper

4/24/07  
Date

## **Attachment A**

CSSG TASKING 2007-04

Date Issued 4/10/07

Task Title: CSSG Review of Fluor-Hanford Draft Criticality Safety Evaluation Report

Task Statement: The assigned CSSG members (Hopper and Trumble) are requested to review a draft of CSER 07-004, "Storage and Handling of Waste Drums in the Solid Waste Operations Complex." The CSSG members are requested to focus their review on the following elements of the CSER:

- Assignment of fissile mass loadings to drums based on NDA data on approximately 25% of drums. Historically, fissile mass loading assignments were based on "acceptable knowledge" derived for waste receipt records and other sources known to Solid Waste Operations Complex (SWOC) (recommendation on approach);
- General model assumptions used in calculations for different drum storage configurations (level of conservatism); and
- Overall CSER strategy to demonstrate incredibility.

The CSSG members are requested to travel to Hanford the week starting April 16, 2007 and spend three days in communicating with appropriate SWOC and Criticality Safety staff. The CSSG members are requested to provide their preliminary observations by April 19, 2007, and follow up with a letter documenting their observations and recommendations by April 26, 2007. All time and travel costs for the two CSSG members for this task will be covered by Fluor-Hanford not the NCSP.

Task Deliverables:

1. Preliminary observations and recommendations provided to DOE RL and Fluor-Hanford (email and/or exit briefing before leaving site).
2. Written letter documenting final observations and recommendations to the NNSA NCSP Manager for subsequent forwarding to DOE RL.

Task Due Dates:

1. April 19, 2007
2. April 26, 2007

## Attachment B

### Criticality Safety In brief

The following issues were identified with CSER 05-001, *Storage and Handling of Drums in Solid Waste Operations*, during the annual criticality safety assessment of Waste Management Facilities and during revision of the CSER.

1. The fissile region of each drum was analyzed in a non-conservative location within the drum, i.e. centered for all reactivity calculations. Consequently, the effect of overmass upset conditions on all criticality scenarios was not adequately analyzed for high fissile mass arrays.
2. The reactivity contribution of potentially increased moderation of fissile regions due to facility fires was not adequately analyzed.

In addition, the annual assessment found that the opportunity to compare the Acceptable Knowledge (AK) with new NDA information had been missed.

Fissile operations at affected facilities were halted on March 16, 2007. A modification to CSER 05-001 to address the above concerns was also initiated on March 16, 2007.

Two CSER's have been prepared to replace CSER 05-001. These CSER's are 07-004, *Storage and Handling of Waste Drums in the Solid Waste Operations Complex*, and CSER 07-005, *Movement and Storage of High Mass Drums in the Solid Waste Operations Complex*. CSER 07-004 has been transmitted to the CSSG members.

The CSSG has been asked to review the draft CSER's for the following.

1. General model assumptions used in calculations for drum storage configurations. The review should include the conservatism of the fissile mass/moderation region of the drums.
2. Overall CSER strategy. Does the CSER have an adequate hazard analysis? Does the CSER have an adequate contingency analysis? Does the CSER demonstrate incredibility?
3. What additional characterization information is suggested to improve the analysis?
4. Use of AK relationship to NDA data for analysis and storage of drums.

Discussion of Agenda

Questions and Answers

## **Attachment C**

### **Personnel Contacted**

Naeem Abdurrahman – SWOC NDA  
Mike Aichele – Solid Waste Storage & Disposal Project Support  
Jim Anderson – SWOC Project Support  
Greg Bash – Waste Services Engineer  
Beth Bilson – FH VP, Regulatory Compliance  
Robin Bushore – SWOC CSR  
Barry Burrow – Waste Stabilization and Disposition (WSD) Director Tech Support  
Mike Collins – DOE RL WSD Project Rep  
Dave Derosa – FH Independent Assessment Group  
David Erickson – PFP CSR/CSE  
Mark French – DOE RL WSD Program Manager  
Scott Frinfrock – Fluor CSE  
Pete Garcia – DOE RL Division Director  
Jim Geary – WRAP Facility Manager  
Mike Hackworth – FH WRAP CSR  
Dale McKenney – VP, WSD  
Ed Miller – Fluor CSE  
Blaise Mo – Fluor NCS Lead  
Greg Morgan – DOE RL NS Engineer  
Bob Nelson – DOE EM  
Joe Nelson – Fluor CSE  
Tom Nirider – DOE RL Criticality Safety Mgr  
Ray Puigh – Fluor NCS Manager  
Al Ramble – Fluor Nuclear & Criticality Safety Director  
Ruben Ramirez – LLB Operations Manager  
John Trevino – DOE RL Facility Manager  
John Weidert – WSD NCS Manager

## Attachment D

### Documents Reviewed

CSER 07-004: Storage and Handling of Waste Drums in the Solid Waste Operations Complex, 13 April 2007 Revision

Trail of SWITS information for containers Z83-A9728 and Z83-A9731 from exhumation to shipment to WIPP including:

- TRU Retrieval Acceptance Checklist, Rev. 1
- TRU Retrieval Campaign 4 Resolution Report
- Addendum to TSD Record for isotopic inventory adjustment based upon procedure WMP-370, assuming nominal 12% Pu-240
- Reference materials
  - Rockwell Hanford Operations Solid Waste Burial Record – Transuranic
  - 741 record of transfer from waste generator
  - SWITS Container Listing Report printed 04/17/2007 providing compound, elemental, and isotopic distribution for classification of waste and 741 mass transfer record
  - Revision to the Container Relocation Approval List (CRAL) guidance Memorandum (April 8, 2004 to T. A. Brown from J. D. Ahlers) for retrieval of containers
  - CRAL record
  - 8-5-83 burial map of containers
  - WRAP Data Management System Waste Container Location History Report
  - DMSS0201 – NDE and DMSS0203 – Assay Results Screens
  - WRAP Radioassay Data Sheet
    - Raw data Entry
    - MGA Raw Data Input, Review, and Data Comparisons
    - GEA Segment Transmission and Activity Review
    - Measured Isotopic and Relevant Isotopic Comparison – Uncertainty assignment
    - Normalization, Preliminary Uncertainty, TRU & Total Ci Determination, Alpha nCi, TRU Waste Determination
    - Gamma Waste Assay
    - Sum Spectrum Results
    - Segment Results Short Form
    - Combine All Results
    - Peak Analysis Report
    - Nuclide Identification Report
    - Unidentified Peaks
    - LEGE5 and LEGE6 MGA Reports
  - Subsequent evaluation from AK PU FGE to PU FGE with 1 TMU
  - Consolidation into TRUPACT package

At Fluor Hanford's request we also reviewed the BBI INTERNAL REPORT, INEEL/INT-02-00973, September 2002, *Criticality Safety Evaluation for Finite Arrays of Drums Containing up to 380 g of Pu-239 RWMC*, for comparison of methodologies and assumptions used at INEEL and Hanford.

Review of 12 radiographs associated with several "high mass" drums.

# Attachment E

## Review Outcome

### Observations

- The Solid Waste Information Tracking System (SWITS) system provides a significant historical record of waste drum burial, exhumation, processing, storage, transfers, non-destructive evaluation (NDE), non-destructive analysis (NDA), packaging, and dispatching of waste to the DOE Waste Isolation Pilot Plant (WIPP).
- There needs to be a tie between criticality safety and the DSA as 3007 is implemented at the site
- Stay away from using phrases like “incredible to exceed analyzed mass” since criticality is incredible, not an over mass situation
- Consider using phrases like “statistically estimated max credible mass” to be realistic about possibilities beyond the statistics
- Provide a more definitive justification for the validation and its applicability
- Approach to the incredibility/double-contingency is inconsistent between the Appendixes and the body of the CSER
- Credited control usages and definitions are inconsistent within and between sections of the CSER
- Arguments for “hard/incredible” to stack on 2 x 2 x 1 arrays may be invalidated by the movement of palletized drums. Statements crediting “multiple errors” should be revisited.
- Three tier and one tier array discussions have been cut and pasted into each other
- May need more discussion in the text of the document about waste matrix limitations (e.g., Be, C) as it is currently only addressed in an appendix to the CSER

### Recommendations

- Develop a “wrapper” for portraying a realistic risk perspective relative to the incredibility arguments and drum environments prior to and after exhumation. It should also provide a discussion of the modeling conservatisms relative to the expected storage and handling conditions in the facilities. Some examples of these conservatisms (no recommendation to change) are:
  - Triangular versus square pitch models – drums are handled and stored almost entirely as square pitched systems
  - Use of 100% Pu versus the expected minimum of 3-4% <sup>240</sup>Pu
  - Full water in all drums outside of fissile material contents (conservative for 1 high but may not be for 3-high) – radiographs have shown only a limited amount of free liquid over 2 liters has been found and only in a few drums
  - Effects of 1 ft of water above arrays and 1 ft of contiguous water around central units versus the potential for limited reflected by people and equipment
  - H/D=1 cylinder in all drums whereas most drums are expected to have a more uniform or settled distribution of fissile material contents
  - Optimal moderation in all drums whereas process history has shown that most drums to not approach that degree of moderation
- A risk based approach should be applied to determine the need for “mining” drums that are not in compliance with the CSER specification – leave in place versus removal upon operational evolution (i.e., remove when necessary to access subsequent drums).
- As a “defense-in-depth measure,” consider methodologies (e.g., historic practices, process knowledge, qualitative NDA, etc.) to identify and evaluate suspect drums prior to their leaving the processing area

- Evaluate the risk/benefit associated with the operational practice of placing multiple high-mass drums on a pallet for segregation.
- Per DOE-STD-3007-2007 a section summarizing the credited controls and protected assumptions should be added to the CSER