



A New DOE Standard for Transuranic Waste Safety Analysis



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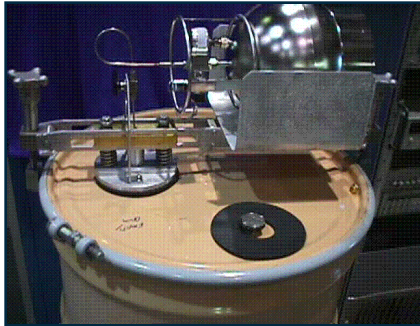
The DOE's TRU Waste Program is truly national in scope . . .



- More than 100,000 cubic meters of legacy TRU waste
- More than 20 transuranic (TRU) waste storage sites located across the country
- Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico is repository for this waste



TRU waste operations at the these storage sites are very similar . . .



- **Same safety requirements and certification program for characterization and packaging**
- **Similar hazards**
- **Similar or same equipment, processes, procedures, risks, probabilities, and regulatory requirements**



Despite these similarities, there are significant variances in safety analyses across the sites . . .

Range of Safety Analysis

Ultraconservative

Overly Optimistic



- Safety analysis ranges from ultraconservative to overly optimistic
- This has had a negative impact on TRU waste operations:
 - Safety events and incidents
 - Unnecessary delays and shutdowns
 - Lax and excessive controls
 - Increased costs and reduced efficiency



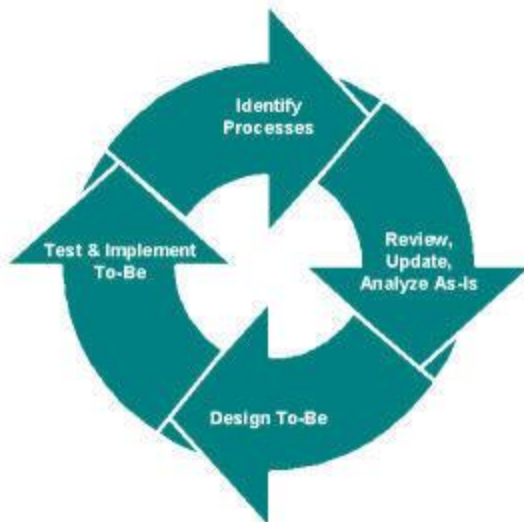
An example of this problem is deflagration of TRU waste containers . . .



- **Some sites concluded that deflagration in drums was not an issue**
- **Other sites assumed deflagration with ejection of waste**



DOE EM took the initiative to bring consistency among safety basis documents in the TRU waste complex . . .



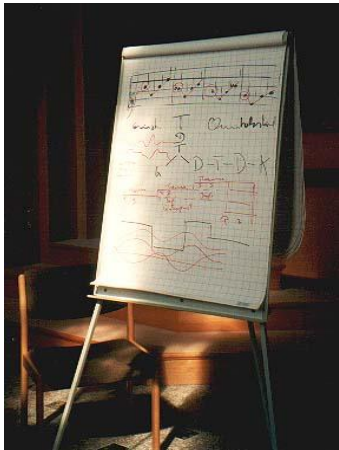
Business Process Reengineering Cycle

- **Launched an integrated reengineering effort**
- **Involved DOE Headquarters, Field Offices, and Contractors**
- **Kicked off this initiative with a two-day TRU waste nuclear safety workshop in March 2006**



TRU Waste Nuclear Safety Workshop . . .

- Attendees included DOE and contractor nuclear safety experts and operations managers from across the TRU Complex
- Key accomplishments of the workshop were the following:
 - Provided attendees the opportunity to discuss inconsistencies in TRU waste safety basis documents and their causes and potential solutions
 - Framed the problem and identified the negative impacts on TRU waste operations
 - Set in motion the TRU waste safety basis document reengineering effort:
 - Identified key areas to focus improvement efforts
 - Selected leaders for each area
 - Allowed attendees to indicate areas to which they wanted to contribute





Executive Team Meeting

- Inés Triay, Chair, DOE-EM
- Dae Chung, Co-Chair, DOE-EM
- Chris Steele, DOE-NNSA
- Mike Mikolanis, DOE-SR
- Chuan-Fu Wu, DOE-EM
- Jay Mullis, DOE-ORO
- Dick Black, DOE-EH

- **An executive team met in April 2006 to:**
 - **Finalize the working groups**
 - **Identify the products of the reengineering effort**
 - **Establish a schedule for product delivery**
- **It was determined that the final product would be a new DOE standard, which would provide guidance for the preparation of TRU waste safety basis documentation**



Working Groups

Working Groups

- General Issues
- Hazard Analysis and Controls
- Review Guidance and Implementation
- Testing and Experiments
- Writing

- Each of the working groups established an action plan and communicated regularly
- The working groups produced a series of issues papers:
 - **General Issues:** Technical Basis for Modeling Drum Deflagrations; Damage Ratios for Drum Drops and other Accidents; Definition of Drum Inspection and Integrity; Clarification of DOE Evaluation Guideline of 25 Rem; Airborne Release Fractions; and Methods for Defining Accident Material at Risk
 - **Hazard Analysis and Controls:** Definition of Unmitigated Analysis; Standardization of Hazard Controls; Definition of Standard Industrial Hazards; Minimum Set of TRU Waste Accidents; Definition of Expected Events vs. Accidents
 - **Review Guidance and Implementation:** EM Policy on Implementation of the Standard; Implementation Verification Review Process
- A workshop on Hazard Controls was conducted in Oak Ridge in **July 2006**



Draft Standard



- **The working groups and executive team worked together to draft a new DOE Standard**
- **The key topics of the Standard are as follows:**
 - **Identification and Evaluation of TRU Waste Events**
 - **TRU Waste Source Term Analysis**
 - **TRU Waste Hazard Controls Selection and Standardization**
 - **Safety Basis Review and DOE Risk Acceptance**
 - **Verification of Safety Basis Implementation**



Key Issues Addressed in Standard: Hazard Controls Inconsistencies

Minimal Set of Hazardous Events

1. Fuel Pool Fires
2. Small Fire
3. Enclosure Fire
4. Large Fire
5. Ignition of Fumes Results in a Deflagration/Detonation
6. Waste Container Deflagration
7. Multiple Waste Container Deflagration
8. Enclosure Deflagration
9. Vehicle/Equipment Impacts Waste/Waste Containers
10. Drop/Impact/Spill Due to Improperly Handled Container
11. Collapse of Stacked Containers
12. Waste Container Over-Pressurization
13. Direct Exposure to Radiation Events
14. Criticality Events
15. Aircraft Impact with/Fire
16. External Vehicle Accident
17. External Vehicle Accident with Fire
18. External Deflagration/Detonation
19. External Fire
20. Lightning
21. High Wind
22. Tornado
23. Snow/Ice/Volcanic Ash Build-up
24. Seismic Event
25. Seismic Event with/Fire

- **Standardization of deflagration analysis (Hanford results validated)**
- **Establish minimal set of hazardous events (based on review of sizeable population of events across DOE)**
- **Provide screening guidance for standard industrial hazards**
- **Adopts Risk Ranking/Control Selection Guidelines from STD-1120**
- **Guidance does not specify SS or SC pedigree for controls**



Key Issues Addressed in Standard: Material-At-Risk (MAR) Assumptions

Sample from Table, “Recommended Bounding
MAR Limits for TRU Waste Operations”

MAR Description	Limited Characterization ¹	Fully Characterized ²
Single Container	Maximum container +20%	Maximum container
Two Containers	One at Maximum container, one at 99 th percentile	One at Maximum container, one at 95 th percentile
Three Containers	One at Maximum container, one at 99 th percentile, one at 95 th percentile	One at Maximum container, one at 95 th percentile, one at mean or median ⁴
Four Containers	One at Maximum container, one at 99 th percentile, two at 95 th percentile	One at Maximum container, one at 95 th percentile, two at mean

- Underestimating MAR has led to operations shutdown/delays, PISA, etc.
- Working group looked at statistical breakdown of inventory data at all DOE TRU waste sites
- MAR approach accounts for characterization uncertainties and based on number of containers involved in an accident



Key Issues Addressed in Standard: Damage Ratios (DRs)

Sample from Table, *Drum Deflagration Damage Ratios*

Number of Drums Involved	Waste Form Percent age	Release Phenome non DR	Fraction Burned Outside DR
1. Single, Bounding Drum – assumed all combustible			
1.A. Ejected flexing in air	n/a	0.4	n/a
1.B. Ejected combustible waste burning outside	100%	0.4	0.05
1.C. Combustible waste burning inside drum	100%	0.6	n/a
2. Two Drums – unknown waste form distribution; assumed combustible			
2.A. First drum – model as single, bounding drum			
2.B. Second drum:			
2.B.1. Ejected flexing in air	n/a	0.25	n/a
2.B.2. Ejected combustible waste burning outside	100%	0.25	0.07
2.B.3. Combustible waste burning inside drum	100%	0.75	n/a

- DRs can significantly affect consequence analysis
- STD presents a summary of DRs according to type of container and accident stress (deflagration, fire, drops, impacts)
- Basis of data is drum testing at various sites (e.g, ID, Sandia, Hanford fire tests)
- DR=1 assumed for containers that don't meet container integrity criteria



DOE-STD-SAFT-
5506-2007

April 2007

DOE STANDARD

Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities

U.S. Department of Energy
Washington, D.C. 20585

- Issued draft Standard for REVCOM— November 2006
- RevCom comment period closed January 2007
 - 89 Essential and 62 Suggested Comments
 - Comments received from
 - Headquarters Organizations (HS, NNSA, GC, EM, NE, SC)
 - Sites including Oak Ridge, Idaho, Richland and Livermore
 - Defense Board Comments
 - 14 Essential and 14 Suggested Comments
- Responses to comments were submitted February 2007
- Concurrence period completed April 2007



Summary

- **In early 2006, DOE EM launched a reengineering effort to bring consistency among safety basis documents in the TRU waste complex**
- **This effort has involved teams composed of DOE Headquarters, Field Offices and Contractor personnel**
- **Now that the new Standard is issued, all TRU waste generator sites will begin a gap analysis**
- **Implementation of the new Standard should help accomplish the following:**
 - **Decrease related delays and shutdowns**
 - **Bring standardization to controls**
 - **Reduce costs and increase efficiency**