

**From:** Mahendra Shah  
**To:** Bernard White; Daniel Huang; Robert Shewmaker; Ron Parkhill  
**Date:** 10/21/02 4:28PM  
**Subject:** OOU Comments - Sandia Report

Attached please find Comments related to the Chapter 2 OOU sections of the report, for your information.

Thanks.

**CC:** Jack Guttman

Portions of attachment- Ex 2 E/50

Official Use Only Comments on the Sandia Draft report, dated 10-3-2002

**Specific Comments:**

1. Include "Table of Contents" for the report.
2. Table 1-1 Cask Data:
  - a. Change title to "Spent Fuel Cask Data".
  - b. Complete the table, e.g. the weights.
  - c. Delete "Aluminum honeycomb" in the Storage cask column.
3. Page 1-2, section 1.3, paragraph 1:
  - a. Line 1: Change "done" to "performed".
  - b. Line 5: Clarify the term "heat transport correlations" and identify the computer code used for the analysis.
  - c. Line 6: Add "Lagrangian" after "transient-dynamic".
  - d. Line 7: Add a reference to "DYNA-3D" code.
  - e. Line 9: Spell out "CFD" as Computational Fluid Dynamics.
  - f. Line 9: Use all caps for "Vulcan".
4. Page 1-2, section 1.3, paragraph 2:
  - a. Lines 1,2: Delete "Although....cask failure", and revise the 2<sup>nd</sup> line as "If a cask fails due to a jetliner crash.....need to be determined."
  - b. Lines 7-9: Revise as follows: "Fission Product transport through the canisters of the two casks can be examined using the MELCOR, a thermal-hydraulic compartment code [1-4] because the MELCOR implements a full suite of fission product transport models".
5. Page 1-3, First paragraph, Line 3:

Delete "depressurization flow of helium" and add "fuel rods".
6. Page 1-3, section 1.4:
  - a. Revise the first two sentences as follows:

"Section 2 of this report describes the CTH calculations performed to determine the transportation cask or the storage cask damage due to a jetliner impact. Section 2 also describes the damage to these casks, including the canister and the spent fuel, due to impact of a landing gear strut onto the cask shell or the lid."
  - b. Revise the sentence " Section 4...either cask" as follows:

"Section 4 describes the MELCOR, MACCS2, and RADTRAN analyses of fission product release from casks, and the consequences of the release, should the impact and fire calculations indicate that the cask damage may results in release of radioactivity."
7. Page 1-3, section 1.5:
  - a. Ref. 1-3: Add "Sandia National Laboratories, Albuquerque, NM", and the date of the report.
  - b. Ref. 1-8: Change date shown as "11/1987" to "November 1987" for format consistency.

8. Chapter 2: Change "radioactive material (RAM) storage casks" to "spent fuel storage casks" at all locations within the report.
9. Chapter 2: Change "hard-points" to "hard components" or "rigid components" at all locations within the report.
10. Page 2-3, section 2.1.1:
  - a. Line 8: Add ", CTH" after "The computer code".
  - b. Line 9: Define "hypervelocity" magnitude, e.g. greater than 1 km/sec, to give the reader an understanding of the relative magnitude, when compared to the jetliner velocity of approx. *Ex 2*
11. Figure 2.1.2-1: Revise the vertical cask spacing from 15' to 16', and diagonal distance from 10' to 10.9'.
12. Page 2-3, second paragraph, line 6: Explain the basis of the 40 feet distance, and revise if necessary, considering the change in the cask spacing, stated in comment 11.
13. Page 2-4, First paragraph, line 2: Change "eulerian" to "Eulerian".
14. Page 2-4, Third paragraph, line 1: Change "examining" to "examine".
15. Page 2-8, section 2.2.3.2, line 3: Change "Figure 3-1" to Figure 2.2.3-1".
16. Page 2-6, Table 2.2.2-1: The mass data for various components appear to be for the Weight of the fuel tanks (center and wings) for the *Ex 2*  
(Ref. Boeing 1989), while the Table 2.2.2-1 has the fuel weight of *Ex 2* which is in the range of *Ex 2*  
) Please verify that the other data such as length of the fuselage and location of the wings, fuel tanks etc. in the CTH aircraft model are consistent with the mass data for the selected plane.
17. General Comment: Verify that the references cited in the text are consistent with list of references in section 2.4. For example, the reference on page 2-6, second line, Boeing reference should be Boeing 1989 and not Boeing 1979.
18. Page 2-7, third paragraph:
  - a. Line 5: Change "no" to "not".
  - b. Line 8: Add a reference for SMYRA.
19. Page 2-9, third paragraph, line 8: Refer to section 2.2.3.5 for the impact of using the coarse mesh on the CTH analyses results.
20. Page 2-10, second paragraph:  
Revise the last part of the paragraph to state that the main landing gear, in its retracted position on the sides, would not be as damaging as the front landing gear, which is retracted in the axial direction of the plane, and is modeled in the CTH analysis.
21. Page 2-11, Table 2.2.3-1:
  - a. Fourth row: Specify the size and mass of the solid steel block, and the boundary

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- conditions at the contact between the concrete pad and the steel block.
- b. Tenth row: Delete "modeling issues....the underlying", and substitute with the "increased concrete strength for the".
  - c. Ninth row: Describe briefly MIX5 option.
  - d. Third row: Describe briefly the "tuned" concrete.
  - e. Second row: Add "(e) EOS for fuselage material"
22. Page 2-13, first paragraph: Address the effect of the lower strength concrete, and refer to section 2.2.3.5 for further discussion of the effects on the CTH analyses results.
  23. Page 2-13, line 4: Change "Mpa" to "MPa".
  24. General Comment: Verify that the units are given in British units with Metric units in parentheses. For example, on Page 2-13, last paragraph, the yield and ultimate strengths are given in Metric units only.
  25. Page 2-14, last paragraph: Provide more details for the AMR 2D CTH run. The reference to Attaway 2002 in section 2.4 does not provide sufficient information to be able to locate the reference.
  26. Page 2-16, Table 2.2.3-2:
    - a. Clarify the intent of the "original" in Note 1.
    - b. Since the note 2 applies only to "pfrac" property only, the superscript in the Table should be on the "pfrac" property in the last column.
    - c. Provide references for the material data shown in the Table. References to "Kipp" and "Crawford" are personal communications without supporting information.
  27. Page 2-17, table 2,2,2-3:
    - a. Clarify the intent of the "original" in Note 1.
  28. Page 2-19, first paragraph, the last sentence:

The statement regarding the clockwise cask rotation being non-physical is not true for the case being analyzed. If the load is sufficiently low on the cask and if there is no friction at the cask base, the cask would rotate in the direction of the load, and may even tip over depending on the load magnitude.
  29. Page 2-20, last line:

This statement is not clear regarding the adverse effects of the concrete strength being lower than what is modeled in the analysis. Please state explicitly whether we expect the effects to be significant or not.
  30. Page 2-26, third paragraph, last sentence:

The sentence should be revised to state that the global results such as the cask sliding velocity and the cask rotation angle are not affected adversely by the material model changes, as shown in Figures 2.2.3.6 and 2.2.3.7, and that the coarse mesh used in the modeling is reasonable.
  31. Page 2-26, last paragraph:

This paragraph relates to jetliner crash scenario at an angle, and should be moved to section 1.2 Jetliner Crash Scenarios. The paragraph should be revised to explain how this

scenario is bound by the scenarios we have considered for the global and local analyses.

32. Page 2-27:  
Add a section on the conclusions for the CTH analyses, and a section on the future analyses to address uncertainties in analyses, such as friction between the cask and the pad. The future analyses must address the plans for addressing the jetliner impacting the transportation cask.
33. Page 2-37, first paragraph, line 5:  
Change "figure" to "Figure 2.3-1".
34. Page 2-36, section 2.3.2:
  - a. Add a statement that the MPC mass and stiffness are not included in the model.
  - b. State the boundary conditions at the base of the cask, the friction coefficient, free, or anchored.
35. Page 2-39, Table 2.3-1:  
Provide the basis for using yield stress of 52200 psi for A516, grade 70 steel, instead of 38000 psi, stated in the ASTM specifications.
36. Page 2-39, last paragraph:  
Delete the sentence "Existing data for the .....test data is available." Presently, there are no plans for testing concrete.
37. Page 2-40, Table 2.3-2:  
Add a reference for the concrete properties listed in the table.
38. Page 2-44, Table 2.3-4:  
Verify the pressures due to Riera method. The maximum pressure is 998 psi acting on an impact area of 16 ft diameter. This would yield the maximum force of approximately 28 million pounds, which appear to be significantly lower than what is shown in Fig. 2.4-3a, when adjusted for the velocity of (approximately 100 million pounds). Ex 2
39. Page 2-45, Section 2.3.5 Analyses Results:  
Show the movement of the impacted cask (sliding and/or rotation) due to cask side impact, and landing gear/engine impacts.
40. Page 2-53, second paragraph:  
Explain the statement that the 8% to 9% bolt strains are high by comparing them with the failure strains of the material SA-564-630, age-hardened at 1075 deg F.
41. Page 2-57:  
Add a section on future plans for the local analyses. This should include local analyses for the jetliner impacting the transportation cask.
42. Pages 2-59 through 2-61:
  - a. Revise the "ASCE Pentagon BPS report" to include the exact title and the publishing organization.
  - b. Revise the "Topical Safety Analysis Report" to include the exact title, the report number, publishing organization and the date of publication.

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- c. Revise the references to "Personal Communication" for Crawford, Hessheimer, Kipp and Smith, to include more specific bases for the information.