

From: Mahendra Shah
To: Bernard White; Daniel Huang; Robert Shewmaker; Ron Parkhill
Date: 10/23/02 5:45PM
Subject: OUO comments on Chapters 1, 2 and 5 of Sandia report

Attached please find the OUO comments on chapters 1, 2 and 5 of the Sandia report. I have incorporated comments from Dan, Bob and Bernie. Thanks.

Mahendra

CC: Jack Guttmann

Portions of attachment -Ex 2

E/51

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

1. Include "Table of Contents" and "Executive Summary" for the report.
2. Page 1-1:
 - A. 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.
 - d. Change number of assemblies for storage cask to 32P
 - e. Note "none" under "Closure seals" for storage cask.
 - B. First paragraph:
 - a. Change "examine" to re-examine".
 - b. Fourth line: Add "of actions including a number" after "number".
 - c. Fifth line: Add "a large commercial" after "a study of".
 - C. Second paragraph:
 - a. Second line: Add "studied" after "The Transportation cask".
 - b. Third line: Add "first generation" after "most other".
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 2nd 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 result 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 2-1, 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*
 - c. Line 3: The CTH global analyses should be performed at the same speed as the PRONTO local analyses, which is performed *Ex 2*
 - d. Third paragraph, line 1: Delete "global" at the end of the line.
 - e. First paragraph: Describe what we mean by the "global" and "local" analyses.
 - f. First paragraph: The paragraph appears to imply that the analyses results and conclusions from the state-of-the-art analyses may not be correct.
11. Page 2-2:
 - a. Third paragraph, eleventh line: Add "gear" after "The nose landing".
 - b. Third paragraph, seventeenth line: Change "site" to "cite".
12. Page 2-3:
 - a. Figure 2.1.2-1: Revise the vertical cask spacing from 15' to 16', and diagonal distance from 10' to 10.9'. Please note that in other arrangements of the HI-STORM casks, the spacing could be as much as 18.667 feet in a square pattern.
 - b. Second paragraph, second line: Delete "rows...length direction." and add "as shown in Figure 2.1.1-1.
13. 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.
14. Page 2-4, First paragraph, line 2: Change "eulerian" to "Eulerian".
15. Page 2-4, Third paragraph, line 1: Change "examining" to "examine".
16. Page 2-8, section 2.2.3.2, line 3: Change "Figure 3-1" to Figure 2.2.3-1".
17. Page 2-6:
 - a. Table 2.2.2-1: The mass data for various components appear to be for the Boeing

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- Weight of the fuel tanks (center and wings) for the (Ref. Boeing 1989), while the
Table 2.2.2-1 has the fuel weight of , which is in the range of
) Please verify that the other data such as length or 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.
- b. Section 2.2.3.1, fourth line: Change "pr" to "or".
 - c. Section 2.2.3.1, seventh line: Keep the Number 1 and units m/s together.
18. 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.
19. Page 2-7, third paragraph:
 - a. Line 5: Change "no" to "not".
 - b. Line 8: Add a reference for SMYRA.
20. Page 2-9:
 - a. Third paragraph, line 8: Refer to section 2.2.3.5 for the impact of using the coarse mesh on the CTH analyses results.
 - b. Second paragraph, third line: Define "Ids".
 - c. Second paragraph, fourth line: Change "steel shell" to "steel overpack shells".
 - d. Third paragraph, first line: Change "on" to "of".
21. Page 2-10, second paragraph:
 - a. Revise the last part of the paragraph to state that the main wing-mounted 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.
 - b. Revise the sentence on seventh line starting with "Its mass is small" to be more definitive.
 - c. Second paragraph: The last two sentences seem contradictory regarding the effect of the main landing gear. If we are concerned about the underprediction, then we should address the issue.
 - d. First paragraph, second line: Define "side-on velocity".
22. Page 2-11, Table 2.2.3-1:
 - a. Third row: Specify the size and mass of the solid steel block, and the boundary conditions at the contact between the concrete pad and the steel block.
 - b. Ninth row: Delete "modeling issues....the underlying", and substitute with the "increased concrete strength for the".
 - c. Eighth row: Describe briefly MIX5 option.
 - d. Second row: Describe briefly the "tuned" concrete.
 - e. First row: Add "(e) EOS for fuselage material"
23. 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.
24. Page 2-13:
 - a. line 4: Change "Mpa" to "MPa".

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- b. Paragraph 1: Address the effect of the IConcrete strength being higher than specified.
25. 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.
26. 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.
27. 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.
28. Page 2-17, table 2,2-2-3:
 - a. Clarify the intent of the "original" in Note 1.
29. 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.
30. Page 2-20, last line:
 - a. 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.
 - b. Paragraphs four and five: Revise the sentence structure to change the calculations suggesting or considering.
31. Page 2-26:
 - a. 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.
 - b. First paragraph end: State that this is being evaluated in section 2.3 local analysis.
 - c. Second paragraph, Third line: Describe the "cask details".
 - d. Second paragraph: Explain the basis for the statement that the homogenized MPC used in the analysis is expected to exhibit a stiffer response.
 - e. Fourth paragraph, seventh line: Change "shatter" to "disintegrate".
32. 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 bounded by the scenarios we have considered for the global and local analyses.

33. 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.
34. Page 2-37, first paragraph, line 5:
Change "figure" to "Figure 2.3-1".
35. Page 2-36:
 - a. Section 2.3.2: Add a statement that the MPC mass and stiffness are not included in the model.
 - b. Section 2.3.2: State the boundary conditions at the base of the cask, the friction coefficient, free, or anchored.
 - c. Section 2.3.1: Discuss more completely how these analyses fit in with the global analyses.
 - d. Section 2.3.1, Third paragraph: Explain why only two components are the only threats.
 - e. Section 2.3.2, second paragraph: Provide a reference for Holtec drawings.
36. Page 2-39, Table 2.3-1:
 - a. Provide the basis for using yield stress of 52200 psi for A516, grade 70 steel, instead of 38000 psi, stated in the ASTM specifications.
 - b. Explain the reasons for using the bolt material same as the steel shell material, even though the bolt is of higher strength.
37. Page 2-39, last paragraph:
It is not clear how the test date on reinforced concrete will be used to validate the unreinforced concrete data used for the analyses. Please explain.
38. Page 2-40, Table 2.3-2:
Add a reference for the concrete properties listed in the table.
39. 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 appropriate velocity.
40. 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.
41. Page 2-53:
 - a. Second paragraph, seventh line: 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.
 - b. Last sentence, "These strains....cannot be ruled out.": Revise this statement to be definitive, and state we anticipate bolts to fail or not fail, considering the predicted

- strains and the bolt material properties, as stated in item a. above.
- c. First paragraph, fourth line: Clarify the reference to "assembly".
42. 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.
 - Delete the second paragraph.
43. Pages 2-59 through 2-61:
- Revise the "ASCE Pentagon BPS report" to include the exact title and the publishing organization.
 - Revise the "Topical Safety Analysis Report" to include the exact title, the report number, publishing organization and the date of publication.
 - Revise the references to "Personal Communication" for Crawford, Hessheimer, Kipp and Smith, to include more specific bases for the information.
44. General: Section 2.2 for the CTH analyses and Section 2.3 for the PRONTO local analyses are not integrated to read like a single report. For example, page 2-5 first paragraph, ninth line refers to "more detailed studies", instead of referring to section 2.3 for the local analysis.
45. Page 2-8:, section 2.2.3.2, sixth line: Define "upper portion".
46. Page 2-2, second paragraph: Add hyphens between the words of "equation of state".
47. Page 2-5: Describe the Jetliner used for the CTH and PRONTO analyses in more details, including the type of the jetliner.
48. Page 2-5: Include the Cask Model in the first line.
49. Page 2-42: Figure 2.3-1: Indicate the area on the cask, for which the detailed finite-element model is shown.
50. Page 2-45, Figure 2.3-5: For the first figure of the cask, indicate the legend for the colors. Also, describe the meaning of EQPS, Von Mises.
51. Page 2-48, Figure 2.3-8: Describe the meaning of DAMAGE and Von Mises.
52. Page 2-48, Fifth line: Delete "4".
53. Page 2-49, sixth line: Revise "most certainly" to be definitive.
54. Page 2-49, first line: Refer to the Figure number.
55. Page 2-49, last line: Change "Von Mises" to "Von Mises stresses".
56. Page 2-50, fifth line: Revise "appear be" to be definitive.
57. Page 2-54, Figure 2.3-14: Describe the scale for the "DAMAGE".