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Monthly Letter Status Report.

Reporting Period	July 2002
Name and Address	Organization 6141, Mail Stop 0718 Sandia National Laboratories P. O. Box 5800 Albuquerque, NM 87185-0718
JCN	J5412
Title	Vulnerability Assessments for Transportation and Storage of Radioactive Materials
Principal Investigator	Ken B. Sorenson
Project Period of Performance	March 2002 through September 2004

Technical Progress

Program Review Meeting. NRC staff reviewed the RAM package vulnerability study during a one-day meeting held at SNL on 9 July 2002.

Task 1.1: Jetliner Crash into an ISFSI.

CTH and Zapotec Analyses. A simplified aircraft impact study was conducted using both CTH and Zapotec as the analysis tools. Comparison of results indicated that the momentum imparted to the cask in the Zapotec analysis was significantly less than the amount imparted to the cask in the CTH analysis. Further review of the data indicated that during the Zapotek calculation the P-alpha equation of state model used by CTH to represent the fuselage material was not getting correctly initialized following donation of mass and momentum to the CTH Eulerian grid from the PRONTO Lagrangian grid. This leads to significant pressure and velocity gradients in the portions of the aircraft fuselage that have been donated by PRONTO to CTH. In turn, this leads to( )which decreases the momentum transfer predicted by Zapotek. Because the P-alpha model is correctly initialized in stand-alone CTH, this behavior was not seen in the CTH calculation. Steps are being taken to correct this problem in Zapotec.

Ex2

PRONTO Analyses. Modeling of the NAC-UMS cask canister was begun. When completed the canister model will allow the resistence to overpack collapse during impact accidents to be treated during the PRONTO calculations.

Boeing Contract. During a conference call, SNL and NRC lawyers told Boeing's lawyer that any suits against Boeing related to advice provided to SNL to support the SNL RAM package vulnerability study would be covered by Price-Anderson.

Information in this record was deleted
In accordance with the Freedom of Information
Act, exemptions 2
FOIA- 2003-084

Portion Ex 2

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Computational Support. ARA contractor personnel began supporting the RAM package vulnerability study by comparing the predictions to CTH predictions. Ex 2

Jet Fuel Fire Modeling. The three-dimensional, quarter symmetry Vulcan CFD code calculation that models a JP8 jet fuel fire that engulfs a Hi-Storm storage cask was continued. The code input for this calculation was modified to allow mass flux through the vents of the Hi-Storm cask to be calculated. At the three-minute time point, cask surface temperatures range from 800 to 1300K and the highest cask internal temperatures range from 500 to 600K. The heat flux results obtained from this simulation are being used in the heat transfer analysis of the Hi-Storm cask's MPC canister. In addition, two additional calculations were begun. The first of these calculations repeats the base case calculation using a reduced fire pool size. The second examines changes the orientation in the fire of the Hi-Storm cask from vertical to lying on its side (tipped over) with the four vent paths in the cask oriented at 45° to the ground which should promote maximum buoyant flow of gases through these vents. Finally, a version of Vulcan that allows parallel processing should soon become available, which will substantially decrease computational times.

Cask Response to Thermal Loads. Sandia has continued to develop their model for the thermal response of the Hi-Storm container and the UMS transport cask. Results have shown that both can sustain a 1500 K fire for one hour. This fire is greater than the fire specified by the NRC for the abnormal thermal environment (1/2 hour 1075 K). The 1500 K fire with a duration of at most a few hours is shown to be an upper bound on credible airplane accident fires.

Fission Product Transport. Work developing a MELCOR model of an undamaged NAC-UMS cask, canister, basket and PWR fuel assemblies continued. Preliminary, course models of these structures were completed. Steady-state calculations were begun with this model. Based on the results of these calculations, the level of detail of these models will be increased as required to properly capture important thermal-hydraulic phenomena.

Consequence Modeling. Coding of the Mills pool fire plume rise model in the NRC version of MACCS2 was completed. Validation of this model by comparison of its predictions to those of other models and also of hand calculations continued. Modified MACCS2 output matches independent Mills model calculations.

In preparation for the cleanup cost estimates, a literature search was performed by the SNL Tech Library and two reports were ordered and received, bringing us up to date on changes since publication of SAND96-0957 in 1996. These reports are: Restoration of Environments with Radioactive Residues," Proceedings of a 1999 IAEA conference, and "ICRP 82: Protection of the Public in Situations of Prolonged Radiation Exposure (1999)." After studying these books and discussing the subject with Dr. John Till, President of Radiological Assessments Corp., we have come to the conclusion that it would be impossible to come up with a best-estimate (or any single point estimate) of cleanup costs after a sabotage event, because we have no way of knowing what the authorities and the public would choose as an acceptable cleanup level. The ICRP says that if doses were at the 10,000 mrem/yr level in the affected area that measures would surely be necessary. They also say that measures would be unwarranted if the annual dose to a resident was 10 mrem or less. For intermediate dose levels, they say that the decision of what constitutes acceptable safety would be impossible to predict in advance. Since cleanup

costs depend strongly on the chosen cleanup level, we believe that cleanup costs that would result from two bounding levels of projected dose should be estimated. Our current thinking is that the conservative (highest dollar cost) estimate would result from a cleanup to the 25-mrem/yr level of the Decommissioning Rule in 10 CFR 20. A low-bound cost estimate could be based on the EPA's Protective Action Guide of 1 rem (after 4 days of groundshine) to a resident individual (see EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents):

Task 1.2: Small Plane Crash into an ISFSI.

Small Plane Survey. SNL selected a representative small plane, the ( )for use in the sabotage scenarios where a small plane(,is crashed into a RAM package. The maximum cargo volume and cargo weight of this plane are( ) Ex 2

Task 1.3: ANSYS/LS-DYNA Jetliner Model. The Software/Hardware problems encountered when the HI-STORM model provided to SNL by the NRC was run with ANSYS/LS-DYNA were discussed with PADT (our ANSYS/LS-DYNA vendor) and ANSYS staff. The discussions did not identify the cause of the problems. ANSYS staff requested the input file. However, the input file is labeled as Safeguards Information. Therefore, the current plan is to develop our own LS-DYNA structural jetliner model, which should make it easier to establish the nature of the problems we are encountering. In addition, a SOLIDWORKS model of the HI-STORM cask is under development. It will be used to generate the SNL LS-DYNA finite element jetliner model.

Task 1.4: Jetliner Crash into a Spent Fuel Rail Cask. No work done this month.

Task 1.5: Small Plane Crash into a Spent Fuel Rail Cask. No work done this month.

Task 1.6: Small Plane Crash into Other Radioactive Material Packages. No work done this month.

Task 2.0: Weapons, Radioactive Materials, Consequences.

Weapons Versus Consequences Spreadsheet. Work on the classified spreadsheet continued during the month of July. Bookmarks to references and hyperlinks to different files in the spreadsheet were completed. Several additions will be made per requests of Francis Young of NRC.

Expert Panel - Source Term Guidance Document. A meeting with Charles Interrante was held on July 8 to discuss planning for the Expert Panel. The preliminary draft of the planning document and schedule were reviewed and several modifications were recommended. Additional names for experts were suggested in the area of spent fuel material properties. Contracts will be placed to cover their participation and travel expenses.

Ex 2 portions

8/10/02

Property Acquired

No equipment with a value greater than $500 was purchased during the current month.

Travel

J. L. Sprung traveled to NRC headquarters to attend a meeting of Volpe staff and NRC staff at which the DOT Volpe Rail Accident Vulnerability Study was discussed.

Budget Status

The following table presents program costs ($K) by task for the current month and for the fiscal year to date:

Task	Title	Current Month	Fiscal Year to Date
1.1	Jetliner Crash into an ISFSI	99.2	393.7
1.2	Small Plane Crash into an ISFSI	0.0	18.3
1.3	ANSYS/LS-DYNA Jetliner Model	8.2	93.1
1.4	Jetliner Crash into a Spent Fuel Rail Cask	0.0	0.0
1.5	Small Plane Crash into a Spent Fuel Rail Cask	0.0	0.0
1.6	Small Plane Crash into Other Radioactive Material Packages	0.0	0.0
2.0	Weapons, Radioactive Materials, Consequences	7.2	51.6
3.0	Models for Other Spent Fuel Transportation Casks	0.7	0.7
4.0	Models for Other Spent Fuel Storage Casks	0.0	0.0
5.0	Threat Assessment for Sabotage Scenarios Involving Storage Casks	0.0	0.0
6.0	Threat Assessment for Sabotage Scenarios Involving Transportation Casks	23.9	23.9
7.0	Models for Transportation Packages for Other Radioactive Materials	0.0	0.0
8.0	Threat Assessment for Sabotage Scenarios Involving Other Packages	0.0	0.0
	Code Demonstrations	0.0	0.0
	NRC Support	8.9	99.6
	NISAC	4.9	21.9
	DOE Added Factor [a]	0.0	4.8
	TOTAL	152.9	707.6

a. DOE waived this load beginning the month of May 2002.

The financial reporting for this month is based on the 189 submitted at the end of February of 2002. $152.9 K was spent during July of FY2002. Total FY2002 spending to date is $707.6 K.