

Vulnerability Assessment for Transportation & Storage of Radioactive Materials

Status as of 8-22-2002

Task No.	Analyses Performed	Computer Code for the Analyses	Results	Comments/Observations
1.1	<p>A. Global response of the HI-STORM storage cask for the</p> <p>Cask is free to slide on a frictionless surface.</p> <p>Analysis performed for 140 ms.</p>	CTH (Hydrocode)	<p>1. However, the cask slides with a velocity of approximately. The damage to the</p> <p>2. The maximum force on the cask is approx. 10 percent of the force which may occur for a rigid target.</p>	<p>Fix2</p> <ul style="list-style-type: none"> <li>Aircraft speed and the angle of strike require review. The aircraft speed may be more than ( ) Ex2</li> <li>The analyses need to be revised to properly model the pad/cask interface.</li> <li>The analyses may not be conservative for the cask damage because of the assumptions of the frictionless cask and pad interface. Additional analyses using non-sliding cask/pad interface are planned.</li> <li>Review of the aircraft model and the material behavior at high strains and strain rates require review by Boeing and the staff. Boeing-Sandia contract approved.</li> <li><b>Limitation of the CTH:</b> Strains in cask cannot be determined accurately. Therefore, PRONTO analyses is required for local strains.</li> <li>ZAPOTEC code combines the PRONTO and CTH codes, but is not working properly. RES is experiencing similar problems.</li> </ul>

Portions Ex2

ER39

1.1	B. Cask to cask impact for the <sup>Ex2</sup>	PRONTO (Lagrangian Code)	The <sup>Ex2</sup> Since the material modeled is of lower strength, the conclusion may not be valid.	The analyses do not consider the mass and stiffness of the basket and the fuel. This may not be conservative.
1.1	C. Local penetration analyses performed for the landing gear impacting the HI-STORM cask at <sup>Ex2</sup>	PRONTO	Damage to the cask <sup>Ex2</sup> confirming the global analyses results. For/	The analyses do not consider the mass and stiffness of the basket and the fuel. This may not be conservative.  The Landing gear model is conservative. The mass of the gear may be less. Boeing needs to review the Landing Gear model.  The cask/pad interface should include friction.
1.2	Database of the small planes prepared.	N/A	The database appears to be complete.	The potential small plane used for the evaluation may be Single turboprop (in <sup>Ex2</sup> ) conjunction with/

Portions Ex2

**OTHER ACTIVITIES:**

1. Verify that the Computer codes PRONTO and CTH are validated for the present application.
2. SANDIA needs to determine the best estimate behavior and the potential variation in results.
3. Effect of the aircraft impact on the fuel tank and the amount of the fuel which may cause fire.
4. Develop unified Agency position on aircraft speed & trajectory. Meeting with RES scheduled on 8-29-2002.
5. Staff is interacting continuously with SANDIA on technical and contract aspects to ensure quality products.
6. Meeting with the Boeing and the Air-force (for Simulator) planned in the near future.
7. Meeting with HOLTEC on the Rail Car analytical model planned for September 19<sup>th</sup> in Rockville, MD.

Ex2

Analysis Topic	Cask					
	Independent	Hi-Storm	NUHOMS	NAC-UMS	NAC NLI 1/2	CNS
Jetliner PRONTO Models	X					
Landing Gear	X					
Engine						
Center Fuel Tank						
Jetliner Impact PRONTO Cask Model		X				
Zapotek Calculations		X				
CTH Calculations		X				
Jetliner Component Impact PRONTO						
Cask Model Development		X	X	X		
Canister Modal Development		X				
Calculations		X				
Small Plane with	X					
				X		
SCAP						
CTH				X	X	X
Cask /Canister Thermal Response						
Fire Model		X				
Canister Failure (JAZ3D Calcs)		X				
Heat Transfer Analysis						
Hand Calculations		X				
Computer Calculations						
Model Development (ANSYS)				X		
Calculations						
Source Terms						
Container-to-Package Release	X					
6672 Spent Fuel Models						
ST Guidance Document	X					
Scenario Methodology	X					
Form Panel	X					
Report						
Fission Product Transport		X	X			
MELCOR Model						
Undamaged						
Damaged		X				
MELCOR Calculations						
Undamaged						
Damaged						
Consequences						
MACCS						
Pool Fire Model						
Add	X					
Validate	X					
Comparison to Hotspot, HPAC	X					

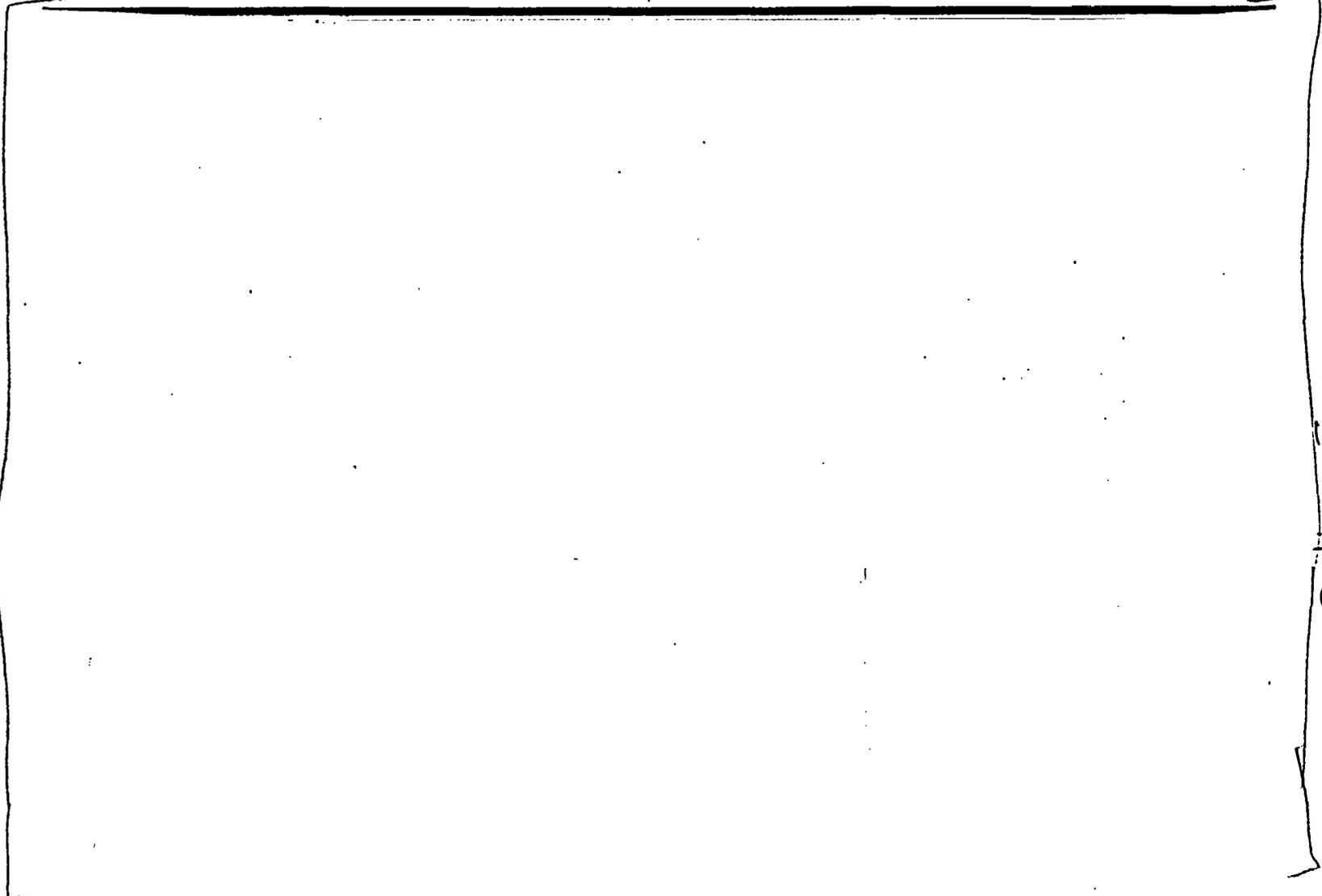
Ex2

Portions Ex2

# Results at 5 msec of analysis time Concrete Cells



Sandia  
National  
Laboratories



Portions Exd