

4.0 Expertise and Disciplines Required

The performing organization shall assure that the project team has the proper mix of nationally and internationally recognized technical experts, i.e., scientists and engineers with training and experience in dynamic structural analysis, source term assessments resulting from terrorist events, and radiological consequence assessments from those events. Specific disciplines required include, but are not limited to, structural and thermal engineering, and health physics. The principal, and other senior investigators shall have the professional credentials to qualify as expert witnesses at public hearings.

Personnel conducting safeguards work shall have technical experience in determining radiological source terms and in performing radiological impact analyses for adverse conditions. The personnel conducting this work must have experience in using structural computer models, such as Pronto (detailed analyses) and ANSYS/LS-DYNA (simplified analyses), MELCOR and MACCS computer codes (or equivalent) and experience in estimating the fuel performance for the conditions under consideration. The personnel working on this project part must have, as a minimum, a Department of Energy L-clearance or equivalent (Department of Defense).

The principal investigator shall provide technical oversight and continuity over all work performed on this project.

5.0 Work to be Performed

Initial work to be performed is identified under the task below and is focused on activities designed to respond to Congressional inquiries, in specific, aircraft crashes into storage and transportation casks. Once Commission guidance is received, new design basis threat requirements will be defined and a revised statement of work (SOW) will be transmitted to SNL for review and preparing an updated proposal

For tasks that involve safeguards information, such as theoretical safeguards scenarios that simulate dynamic loading on spent fuel storage casks (SFSC), those tasks should be handled in accordance with the security requirements for unclassified safeguards information discussed in Section 17.0 of this agreement and Part XI of Handbook 11.7 - NRC Procedures for Placement and Monitoring of Work with the U.S. Department of Energy (DOE). Aircraft crashes should be handled in accordance with proprietary information requirements discussed in Section 18.0 and in Part XI of Handbook 11.7.

The following tasks and subtasks, which shall be completed by the performing organization, are grouped in terms of technical specialties. Each subtask event is comprised of a structural analysis, fuel performance analysis and resulting radiological consequences. The deliverables required with anticipated dates for submission to each TPM have also been indicated under each subtask.

Task 1 - Terrorist Events and Consequence Analyses from Aircraft Crashes

Subtask 1.1: Crashing Into an ISFSI

Ex 2

Develop computer models that simulate the consequences of an aircraft crashing into an independent spent fuel storage installation (ISFSI) of a 100 by 100 cask array. Two

Ex 2 portions

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Ex 2

structural computer models shall be developed for the ^{Ex 2} one model is a detailed model requiring a super computer and the second model is a simplified model (on ANSYS/LS-DYNA) that can be executed on a desktop computer. Dimensions and cask design should be consistent with the HI-STORM safety evaluation report (SER). Since SNL has readily available structural and MELCOR models of the HI-STORM cask, these models shall be applied in the following analyses.

1.1.a. Structural Analyses (TPM - - Mahendra Shah (301) 415-8537)

Jeff

- i. Provide a description of the structural model for staff approval prior to performing calculations. [Deliverable Date: February 28, 2002.]
- ii. Prior to performing the calculations, provide, for staff review and approval, recommendations for angle of trajectory and speed of plane crashing into the cask. [Deliverable Date: March 15, 2002.]
- iii. Following staff approval of the analytic assumptions, perform the specific analyses.
- iv. Provide detailed documentation of the analysis and all structural behaviors of the cask and plane. [Deliverable Date: June 14, 2002] April 21, 2002
- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task may be modified to perform up to two additional threat assessments. [Deliverable Date: to be determined]
- vi. Provide training for two to three SFPO staff personnel on performing the structural analyses. (Schedule to be coordinated between SNL and the SFPO TPM.)

1.1.b. Fuel Canister Performance (Source Term) Analyses - - (TPM: Kenneth Erwin (301)415-2443)

- i. Provide a description of the MELCOR model for staff approval prior to performing calculations. [Deliverable Date: April 15, 2002]
- ii. Prior to performing the calculations, provide, for staff review and approval, recommendations for modeling the fuel, source term calculations, and property damage estimates. [Deliverable Date: May 1, 2002]
- iii. Following staff approval of the analytic assumptions, perform the specific analyses. [Deliverable Date: June 14, 2002]
- iv. Provide detailed documentation of the analysis and all structural source terms within and exiting the cask. [Deliverable Date: June July 31, 2002]

Portion Ex 2

- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task may be modified to perform up to two additional threat assessments.

[Deliverable Date: to be determined]

- vi. Provide training for two to three SFPO staff personnel on performing MELCOR calculations for the above event. (Schedule to be coordinated between SNL and the SFPO TPM.)

1.1.c. Thermal Analyses -- (TPM: Christopher Bajwa (301)415-1237)

- vii. Provide a description of the thermal model for staff approval prior to performing calculations.

[Deliverable Date: April 15, 2002]

- viii. Prior to performing the calculations, provide, for staff review and approval, recommendations for modeling the thermal response to the accident.

[Deliverable Date: May 1, 2002]

- ix. Following staff approval of the analytic assumptions, perform the specific analyses.

- x. Provide detailed documentation of the analysis and all thermal system responses.

[Deliverable Date: July 31, 2002]

- xi. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task may be modified to perform up to two additional threat assessments.

[Deliverable Date: to be determined]

- xii. Provide training for two to three SFPO staff personnel on performing thermal calculations for the above event. (Schedule to be coordinated between SNL and the SFPO TPM.)

1.1.d. Radiological Consequence Analyses -- (TPM: Adelaide Giantelli (301)415-3521)

- i. Provide a description of the radiological consequence model for staff approval prior to performing calculations.

[Deliverable Date: April 15, 2002]

- ii. Prior to performing the calculations, provide for staff review and approval, recommendations for modeling the radiological responses to the accident. Include, among other considerations, the assumed meteorology conditions, release height, particle distribution, particle settling (both within and outside the cask), population probability distribution, decontamination and clean-up costs, uptake pathways, uptake fractions, health effects of uptake and inhalation, ground shine, sky shine, etc.

[Deliverable Date: May 1, 2002]

- iii. Following staff approval of the analytic assumptions, perform the specific analyses.
- iv. Provide detailed documentation of the analysis and all radiological consequences as a function of distance. The documentation should include, among other information, the extent of the fuel damage, release fraction from the fuel (including the size distribution of the radionuclide particles), migration of isotope out of the fuel matrix, the thermal effects on the fuel, thermal driving forces, plate-out and settling.

[Deliverable Date: July 31, 2002]

- v. Following Commission identification of the new design basis threats and lessons learned from the above analysis, this sub-task may be modified to perform up to two additional threat assessments.

[Deliverable Date: to be determined]

- vi. Provide training for two to three SFPO staff personnel on performing radiological consequence analyses for the above event. (Schedule to be coordinated between SNL and the SFPO TPM.)

Subtask 1.2:

Ex2

Crashing Into an ISFSI

(TPM: Mahendra Shah (301)415-8537)

- 1.2.a. Provide, for staff approval, an analytic approach for a model to use in determining the consequences of a crashing into an ISFSI. Research the various plane designs for hazards (being projected to the front, side, etc.) for various scenarios. Pros and cons should be provided on the need to model the dynamics of the plane, its projected and the effect of neglecting the dynamic contributions of the plane (e.g. Ex2)

[Deliverable Date: May 10, 2002]

- 1.2.b. Following the staff's review and approval of the proposed guideline developed above, develop computer models for assessing the consequences of crashing a (amount to be provided by the SFPO TPM) onto the ISFSI identified in Task 1.1, above.

[Deliverable Date: October 21, 2002]

Subtask 1.3 Simplified Computer model (desktop model running on ANSY/LS-DYNA) Structural Analyses (TPM -- Mahendra Shah (301)415-8537) Ex2

- 1.3.a. Provide a description of the simplified structural model for staff approval prior to developing the analytic model.

[Deliverable Date: May 10, 2002.]

Portions Ex2

6.0 Deliverables and Schedule (including meetings)

The deliverables required for each task are indicated under each subtask with an anticipated time for delivery under section 5.0 above. In addition to the task deliverables, a draft report, a final report, and notes summarizing all meetings are required under this project. The reports are discussed below. The meeting notes are addressed under section 9.0.

The performing organization shall prepare both a draft and comprehensive final report in NUREG/CR format, summarizing all work performed under this project. The report shall include an executive summary of the findings of this project. It shall also include a complete description of the models developed and rationale for the use of data and assumptions.

All reports shall be edited and reviewed by the performing organization and checked in accordance with the quality assurance requirements addressed under Section 13.0. The NMSS TPM will provide comments to the performing organization to be considered in the preparation of the final report. These comments will identify potential problem areas, discrepancies, and technical insights on the draft report. The comments will be for the purpose of clarification only and will not be construed as to prejudge the performing organization's work or technical findings. The draft report shall be submitted to the overall project TPM by November 30, 2003. After receipt of NRC comments, the performing organization shall revise the draft report, incorporating resolution of comments, and submit a camera-ready copy and an NRC-compatible, electronic media copy of the final report by January 18, 2004.

All deliverables shall be provided to the NRC TPM responsible for each task or subtask of this project.

7.0 Period of Performance

The period of performance for this project shall continue until January 31, 2004.

8.0 Estimated Level of Effort

The estimated level of effort for this project is identified below.

Task Number	Estimated FY-02 FTE	Estimated FY-03 FTE	Estimated FY-04 FTE
1.1 (Crash)	1.5	0	0
1.2 (Small Plane Crash)	1.0	0.2	0
1.3 (Simple Model)	0.6	0.3	0
2.1 (Table of Weapons vs Consequence)	0.1	0	0
2.2 (Guidance Document)	0.3	0	0
3 (Truck/Rail Casks Model Development)	0.6	0.6	0
4 (Storage Casks Model Development)	0.6	0.2	0

Ex 2

DOE SOURCE SELECTION JUSTIFICATION

J5412

JOB CODE TITLE

Terrorist Events Assessments for the Transportation and Storage of Radioactive Materials

3. SELECTED SOURCE

Sandia National Laboratory (SNL)

4. BASIS FOR SELECTION (Describe the basis for selection of source. Narrative must be compelling and supported by facts. See Handbook 11.7, Part I.)

The Spent Fuel Project Office (SFPO) requires assistance with assessing terrorist events on the transportation and storage of nuclear materials. In response to the nationwide alerts and Congressional inquiries following the terrorist events at the World Trade Center in New York and the Pentagon in Virginia, the NRC must assess the vulnerabilities and consequences of postulated terrorist events on the transportation and storage of nuclear materials, including spent nuclear fuel from reactor operations.

A source with specialized equipment, highly specialized experience in explosive and consequence analyses, and personnel available to perform now is required to successfully complete this project. SNL is the only source that can fulfill the requirements of this program based on the following considerations:

SNL possesses the unique experience necessary to conduct realistic computer simulation of terrorist events on spent fuel storage casks, can test SNF packages and combine the testing with design and analysis information and techniques. Since SNL has been performing these evaluations for NRC, SNL has gained knowledge from classified data experiments on structural and source term behaviors of casks and fuel assemblies. SNL also has the capabilities necessary to perform offsite cost estimates resulting from radiological contamination. SNL has experience in structural dynamic analyses, source term analyses (MELCOR), offsite radiological consequence analyses (MACCS) and offsite cost estimates for radiological releases. SNL also has the expert knowledge needed for modeling various devices and determining their consequences on radioactive casks.

Further, the NRC has expended significant resources in contracting with SNL to develop a structural computer simulation. This model is required to respond to Congressional inquiries from Senator Reid's office and Representative Markey's office. In fact, NRC's Office of Nuclear Regulatory Research (RES) is performing similar sabotage analyses using the same SNL expertise for sabotage events on reactor sites. Since this SFPO program will utilize the same expertise and share scarce resources with RES, it is imperative that this effort begins now so that recommendations can be made to the Commission by December 2003 and responses to Congress are provided timely.

Given the stringent time constraints, security requirements and expertise required to fulfill the requirements of this program, SNL is the only organization that can perform this urgent effort. The SFPO staff is not aware of another facility with existing SNF package testing, instrumentation, data collection, and analysis capabilities. Further, the financial resources and time necessary for another source to develop new capabilities to perform this testing, instrumentation, and analysis would be costly and schedule prohibitive. Therefore SNL is the only source that can perform the necessary work without expending significant time and dollars to achieve the results that are essential to the successful completion of this important project.

5. PROJECT MANAGER (Typed name and title)	ORGANIZATION (Office/Division/Branch)	SIGNATURE	DATE
D. Huang, TPMP; Kinney, TAPM	NMSS/SFPO & PMDA	<i>Daniel T. Huang</i>	1/23/02
6. RECOMMENDED - ASSOCIATE COMPETITION ADVOCATE (Typed name)	SIGNATURE		DATE
Scott Flanders			
7. APPROVAL - OFFICE DIRECTOR OR DESIGNEE (Typed name)	SIGNATURE		DATE
John J. Linellian, NMSS/PMDA			

Ex 2 portion