NRC FORM 367
(10-93)
NRCMD 11.7

U.S. NUCLEAR REGULATORY COMMISSION

1. JOB CODE

DOE SOURCE SELECTION JUSTIFICATION

2. JOB CODE TITLE

Transportation Safety and Risk Assessment

3. SELECTED SOURCE

DOE/Sandia National Laboratories

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.)*

Sandia National Laboratories (SNL) possess unique qualifications that are essential to the successful completion of this task.

The principal investigator needs to be a nationally and internationally recognized radioactive material transportation package testing expert, with in-depth experience in the application of structual and thermal computer codes to evaluate package response to historical and hypothetical accident conditions. The principal investigator must also have demonstrated experience with International Atomic Energy Agency (IAEA), NRC, and industry standards organization codes that apply to the certification of Type B packages. This experience can only be demonstrated by having designed and conducted partial- and full-scale physical package testing programs, including package instrumentation, collection and analysis of data, and assessment of package containment, shielding, thermal, and subcriticality performance under historical and hypothetical accident conditions.

These credentials are necessary to establish the credibility needed to support NRC outreach effort to convey the level of safety provided by the transportation safety regulations to the public. SNL can provide a principal investigator who is a nationally and internationally recognized radioactive material packaging expert, and has worked specifically with assessing and demonstrating the safety afforded by NRC transportation safety regulations. Dr. Douglas Ammerman, SNL, is the only person to demonstrate these qualifications by having both performed detailed finite-element based analytical predictions of Type B pakcage behavior, as well as having designed and conducted confirmatory partial- and full-scale physical Type B package testing.

The unique expertise of DOE/SNL personnel, and the importance of that expertise in the completion of this task, justifies DOE source selection.

5. PROJECT MANAGER *(Typed name and title)*	ORGANIZATION *(Office/Division/Branch)*	SIGNATURE	DATE
John R. Cook, Sr Tran Safety Sci	NMSS/SFPO	John R. Cook	03/24/2005
6. RECOMMENDED -- ASSOCIATE COMPETITION ADVOCATE *(Typed name)*		SIGNATURE	DATE
7. APPROVAL -- OFFICE DIRECTOR OR DESIGNEE *(Typed name)*		SIGNATURE	DATE

Statement of Work

Project Title:	Transport Safety and Risk Assessment
Job Code Number:	
B&R No.:	
Technical Project Manager (TPM):	John Cook, SFPO, (301) 415-8521
Technical Assistance Project Manager (TAPM):	Penny Kinney, PMDA, (301) 415-7805
Performing Organization:	Sandia National Laboratories (SNL)
Fee Recoverable:	No

1.0 Background

Transportation Safety Visualizations

SFPO frequently engages in outreach activities in meetings with state, local and Indian officials in order to explain NRC's safety role in the transport of radioactive material, especially with regard to spent fuel transport. Often, these meetings include presentations by individuals that focus on highlighting transport routine and accident consequences, without providing the balancing perspective of the probabilities of those consequences. It then falls to NRC representatives to reassure the public regarding the adequacy of NRC's transportation safety regulations to provide protection of public health and safety. The NRC has produced many technical studies that establish the adequacy of its regulations. However, these studies are based on engineering and probabilistic risk evaluations that can be difficult to convey to the public without overly complicated discussions.

Evaluation of spent fuel canisters in transport risk assessments

Several current and proposed spent fuel transportation package designs include inner thin-walled canisters to facilitate spent fuel handling and loading. These structures are not considered in the safety evaluation of the package design, i.e., no credit is given to the canister with respect to containment of package contents under either routine or accident conditions. Packages will be certified as satisfying the regulatory requirements regardless of the presence of canisters. Thus the canister has no bearing on safety determinations.

However, when performing risk assessments, the presence of canisters could affect risk-informed assessment of impacts from transporting spent fuel under accident conditions. The basic consideration is that a thin-walled canister is likely to readily deform during severe accidents. In some severe accidents, a leak path for fuel volatiles or particulates that might otherwise be generated could be blocked if the inner canister did not fail. If the canister does fail, the additional time required for materials to escape from the canister to the cask interior and then from the cask interior to the environment is likely to increase the amount of deposition on interior cask and canister surfaces, thus reducing the quantity of material released from the cask to the environment. This effect could lower risk estimates for impact accidents.

Similarly, under fire conditions, an inner canister would have to heated to the point of failure before any fuel material could be released to the interior of the cask, whose seals would also have to fail before material could be released outside the cask. Heating the canister to this

point could require more severe thermal conditions than that needed to fail the cask seals alone. The more severe the thermal conditions for release are, the less likely it is that an accident will generate those conditions. Thus canisters may lower the already low risks for release from casks involved in accidents with fires.

2.0 Objectives

The objectives of this agreement are delineated below.

A. Provide technical support in the preparation of materials, including animations and graphics, to better inform the public on the level of safety provided by NRC's transportation safety regulations.

B. Perform supplemental analyses to address issues related to spent fuel transportation risk assessments, including the impact of the use of spent fuel canisters on spent fuel shipment risk estimates.

C. Provide other technical support as assigned.

3.0 Purpose

The purpose of this agreement is to obtain explanatory materials to enhance NRC's outreach efforts, and to evaluate spent fuel canister use in spent fuel shipment risk estimates (see background). Specific needs in terms of these subject areas cannot be completely forecast in advance. Therefore work may be identified or clarified under tasks as the needs develop or are refined.

4.0 Expertise and Disciplines Required

The performing organization shall assure that the principal investigator is a nationally and internationally recognized radioactive material packaging expert. The principal investigator shall be a scientist or engineer with in-depth experience package design and testing, and who has recently worked in package performance assessment under impact and thermal accident conditions. In particular, the principal investigator shall have experience in conducting physical package testing, in the pre- and post-test evaluation of containment systems, and in the application of package structural integrity evaluations to spent fuel shipment risk estimates.

The principal investigator shall be recognized for outstanding oral and written communication skills. The principal investigator shall either perform or provide technical oversight and continuity over all work performed on this project.

5.0 Work to be Performed

Task 1. Transport Safety Visualizations

SFPO staff have identified a need for visualizations, including graphics and animations, that could be used in public meetings, websites, and other venues to facilitate explanation of the public health and safety protection afforded by current transportation safety system. The visualizations are needed in the areas of regulatory provisions and risk assessment.

The regulatory provision and risk assessment visualizations must be effective, i.e., they must convey the safety information in a fashion that is easy to grasp by the intended audience. The visualizations must be factual, rigorously accurate and without promotional aspect. The visualizations will be subject to close scrutiny and critique by governmental and non-governmental organizations alike.

Subtask 1a. Regulatory Provision Visualizations

With regard to regulatory provisions, the visualizations need to translate for the public what the 10 CFR Part 71 hypothetical accident conditions mean to safety in terms with which the public can readily identify and understand. Animations may be particularly well suited for these visualization needs.

The point of these visualizations is to convey how rigorous and challenging the hypothetical accident test conditions are when compared to real world (historical) transport accident conditions. In other words, why do we believe the regulations provide adequate safety when some real world accident conditions (e.g., accident speed or fire duration) exceed those specified in the regulations?

A large part of the answer involves explaining those aspects of the test conditions and acceptance criteria that are not obvious (e.g., unyielding surfaces, engulfing fires, activity release rates). Another part of the answer includes the assumptions used in the assessing package performance that impart additional forces to the package but that are unlikely to occur in real world accidents (e.g., worst case orientations, orthogonal impacts, etc.), and also includes ignoring factors that provide additional protection for the package that are likely to occur in real world accidents (e.g., collapse of vehicle structures prior to package impact, contact with the ground and other heat sinks, etc.) The performing organization shall consider and recommend the extent to which these considerations should be addressed in the visualizations.

Specific example topics for visualizations include:

- Free drop through a distance of 30 ft. onto an essentially unyielding surface: The public may often focus only on the impact speed condition. Visualize protection afforded by certified packages during real world, higher speed, but onto yielding surface, accident impacts.

- Fully engulfing fire test: The public may often focus only on the fire temperature condition, or the fire duration condition. Visualize protection afforded by certified packages during real world higher temperature, longer duration, but non-engulfing, accident fires.

- Test acceptance criteria: The public often overlooks the stringent post-hypothetical accident test activity release and radiation level limits that must be satisfied for package certification. Visualize minimum post-test releases/radiation levels that would result in rejection of package design.

In addition to considering the examples above, the performing organization will review all the hypothetical accident test conditions and acceptance criteria and will provide and discuss alternatives as to how best to clearly and simply depict and convey the real world safety afforded by the regulatory provisions to the public. This review will include discussions with NRC TAPM and NRC staff on difficulties that have been encountered in public meetings related to this and related topics.

Subtask 1b. Risk Assessment Visualizations

With regard to risk assessment, the visualizations need to define what risk means in the context of spent fuel shipments, with equal weighting to the consequence and probability components. We believe that risk comparisons should be avoided in the visualizations. For example, perhaps some form of progressive consideration of risk could be illustrated:

- What portion of expected shipments will be involved in an accident?
- What portion of accidents will be severe?
- What portion of severe accidents will be protected against by the package?
- What portion of severe accidents will be severe enough to cause any release?
- How long between such accidents at expected shipping rates?
- What is the chance of still more severe accidents, and how frequently might they occur?
- How does the magnitude of these latter transport risks compare with the risks of operating facilities also regulated by NRC?
- Why do we believe that, on balance, likely actual risks are less than the (small) estimated risks?
- When does NRC conclude that risks are acceptably small?

The performing organization will consider this and other examples, and provide alternatives for visualizations for spent fuel shipment risk assessments, such as those presented in previous risk assessment studies and in environmental impact statements.

Actual topics for the regulatory provision and risk assessment visualizations will be selected by the NRC TPM, and may include topics other than examples provided above. The performing organization will obtain approval of the NRC TPM of visualization content before production of final visualizations commences.

Task 2. Evaluation of spent fuel canisters in transport risk assessments

Assess the additional protection under impact and thermal transport accident conditions that might be afforded by spent fuel canisters. The work is to be performed in two Phases:

Phase I includes collecting data and performing supplemental analyses as needed to ascertain the impact of the use of inner spent fuel canisters on potential leak paths under various transport impact and fire accident conditions.

Phase II includes providing an estimate of the impact of the use of inner spent fuel canisters (e.g., what would be the minimal reduction in the risk estimates) on previous spent fuel shipment risk estimates (e.g., Reexamination of Spent Fuel Shipment Risk Estimates, NUREG/CR-6672, March 2000). Identify any assumptions and caveats regarding the assessment of impacts from the use of inner spent fuel canisters, and describe the overall confidence in the estimate of impacts presented.

6.0 Deliverables and Schedule (including meetings)

The deliverables required under each subtask with the anticipated time for delivery are provided below. All deliverables shall be provided to the NRC TPM.

Deliverables:

Task 1.

It is anticipated that the deliverables from Task 1 will include both animations and static graphics, with supporting text and documentation. These deliverables will be provided to NRC in a letter report. The format for animation deliverables should be amenable both for PowerPoint presentations and webpages, with selected stills useable for printed output. Static graphics should be a format suitable for these applications as well.

Task 2.

The deliverable for Task 2 will be a comparative analysis the describes the impact that the use of inner spent fuel canisters would have on spent fuel shipment risk estimates, including a the assumptions used, any caveats that may apply, and an overall assessment of the confidence in the results provided. This deliverable will be provided to NRC in a letter report (separate from that for Task 1).

Schedule:

Tasks 1 and 2 are to proceed concurrently, although work may initially focus on Task 1. Task 1 will require interactions to develop alternative visualizations, provide for revisions, and obtain approvals to produce the final deliverables. Note that this schedule, and the distribution of the level of effort, may be revised based on discussions with the contractor at the kick-off meeting.

4/05	Kick-off meeting The contractor shall provide Task1 preliminary alternative ideas as to how best to clearly and simply depict and convey regulatory safety and risk assessment information. The contractor shall also describe its Task 2 plan for evaluating the impact of the use of inner spent fuel canisters on spent fuel shipment risk assessments.
6/30/05	The contractor shall provide the TPM with a preliminary markup of its Task 1 ideas as to how best to clearly and simply depict and convey regulatory safety and risk assessment information. The contractor shall also describe its planned Task 2, Phase I analyses for evaluating the impact of the use of inner spent fuel canisters on spent fuel shipment risk assessments. This information may be contained in the MLSR (see Section 10).
7/05	Review meeting 1 The contractor shall present and discuss its Task 1 progress, identify any issues, and describe its plans for obtaining external review and input on the effectiveness of its proposed visualizations. The contractor will also describe its Task 2 progress on the canister assessment task, and any issues regarding that work.

9/30/05	The contractor shall provide the TPM with a revised markup of its Task 1 ideas as to how best to clearly and simply depict and convey regulatory safety and risk assessment information. The contractor shall also provide Task 2 preliminary results from its analyses and plans for Task 2, Phase II computer code runs for evaluating the impact of the use of inner spent fuel canisters on spent fuel shipment risk assessments. This information may be contained in the MLSR.
10/05	Review meeting 2 The contractor shall present and discuss its Task 1 progress, identify any issues, and describe its plans for preparing the first draft of its proposed visualizations. The contractor will also describe its Task 2 progress on the canister assessment task, and any issues regarding that work.
3/30/06	The contractor shall provide the TPM with a first draft of Task 1 visualizations that clearly and simply depict and convey regulatory safety and risk assessment information. The contractor shall also provide a draft of Task 2 results from its analyses and computer code runs for evaluating the impact of the use of inner spent fuel canisters on spent fuel shipment risk assessments. This information may be contained in the MLSR.
4/06	Review meeting 3 The contractor shall present and discuss its Task 1 draft visualizations and Task 2 draft canister risk assessment impacts in detail. The contractor shall also describe its plan for identifying and resolving comments on the drafts, and any difficulties in obtaining the necessary approvals to prepare final deliverables. The contractor will provide at the meeting a written detailed schedule leading to on time production of all deliverables.
6/30/06	The contractor shall provide the TPM with a second draft of Task 1 visualizations that clearly and simply depict and convey regulatory safety and risk assessment information. The contractor shall also provide a second draft of Task 2 results from its analyses and computer code runs for evaluating the impact of the use of inner spent fuel canisters on spent fuel shipment risk assessments. This information may be contained in the MLSR.
(as needed)	Review meeting 4
9/30/06	Final deliverables provided to NRC.

The NMSS TPM will provide comments to the performing organization to be considered in the preparation of the draft and final task reports. These comments will identify potential problem areas, discrepancies, and technical insights on the draft materials and reports. 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. 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. Within the above schedule and after receipt of NRC comments, the performing organization shall revise the interim materials, results and draft

reports, incorporating resolution of comments, and submit an NRC-compatible, electronic media copy of the final materials and reports.

7.0 Period of Performance

The period of performance for this project shall continue until November 15, 2006.

8.0 Estimated Level of Effort

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

Task 1. 16 staff-weeks

Task 2. 15 staff-weeks

9.0 Meetings and Travel

It is estimated that one trip to Rockville, MD to consult with NRC technical staff during FY 06 will be required.

NRC personnel may meet at the performing organization's facilities, as mutually agreed, to review interim progress on tasks throughout the period of performance. Meeting notes shall be taken and distributed in accordance with Section 11.0 of this SOW.

10.0 Project Status Reports

The performing organization shall submit a Monthly Letter Status Report (MLSR) by the 20th day of each month with distribution as shown below. The MLSR should contain, at a minimum, all of the required information as shown MD 11.7, Exhibit 12, "Monthly Letter Status Report Requirements."

11.0 Distribution of Deliverables

The following summarizes the required report distribution under this SOW. The NMSS TPM shall provide the performing organization with current NRC mailing addresses for this distribution.

Tasks 1and 2

Distribution	Monthly Letter Status Reports	Meetings Workshops & Trip Reports	Draft Formal Tech. Reports	Final Formal Tech. Reports
NMSS TPM	1	1	1	1
NMSS TAPM	1	1	5	1*
SFPO Pgm Coordinator	1			
Div. of Freedom of				

Info. and Pub. Services (FIPS)	0	0	0	1

* Camera-ready and electronic media

12.0 Technical/Project Direction

Technical Assistance Project Manager: Penny Kinney
Technical Project Manager: John Cook

The NMSS TAPM is the focal point for all contract-related activities. All work assignments and program funding actions are initiated by the NMSS TAPM. All proposed work scope or schedule changes must be processed through the NMSS TAPM.

The NMSS TPM is responsible for providing technical guidance to the performing organization regarding staff interpretations of the technical aspects of regulatory requirements along with copies of relevant documents (e.g. Regulatory Guides) when requested by the performing organization. All work products must be reviewed and approved by the NMSS TPM before they are submitted as final documents. All technical direction given to the performing organization must be consistent with the work scope and schedule. The NMSS TPM is not authorized to unilaterally make changes to the approved work scope or schedule or give the performing organization any direction that would increase costs over approved levels.

Directions for changes in cost or period of performance will be provided by the DOE Operations Office after receipt of an approved Standard Order for DOE Work (SOEW) (NRC Form 173) from the Office of Nuclear Material Safety and Safeguards. If the performing organization receives guidance which is believed to be invalid under the criteria cited above, the performing organization shall immediately notify the NMSS TAPM. If the NMSS TAPM and the performing organization are unable to resolve the question within five days, the performing organization shall notify the DOE Operations Office.

13.0 Quality Assurance

13.1 - For all draft and final reports delivered under this agreement, the performing organization shall assure that an independent review and verification of all numerical computations and mathematical equations and derivations are verified by qualified personnel other than the original author(s) of the reports. If the performing organization proposes to verify/check less than 100 percent of all computations and mathematical equations and derivations in the report(s) (such as might be the case when there are a large number of routine, repetitive calculations), the performing organization must first obtain written approval from the NMSS TPM. Computer generated calculations will not require verification where the computer program has already been verified. The NMSS TPM has the option of auditing all documentation including project correspondence, drafts, calculations and unrefined data.

13.2 - In addition, all reports, including those which do not contain numerical analyses, must be reviewed by the performing organization's management and approved with two signatures, one of which is for the performing organization's management at a level above the program manager.

13.3 - When revisions for the reports are issued, a section must be included in the revised

report to document dates of, reasons for, and the scope of all changes made since the issuance of the first performing organization's approved report.

13.4 - NRC has the option of appointing a Peer Group to review the draft report and make changes to the final report. The performing organization may recommend candidates for the Peer Group for approval by the NMSS TPM. On the occasion of dissent in the content of the final report, the dissenting party will have the option of stating its viewpoints and findings in a section of the report. Alternative QA plans should be submitted for NRC review and approval.

14.0 Disposal of Property

Management of property purchased under this Interagency Agreement will follow the procedures as stated in Part VIII of MD 11.7.

15.0 DOE-Acquired Material

The performing organization must notify the Office of Nuclear Material Safety and Safeguards (Attn: Director, PMDA) and the NMSS TPM prior to acquisition of any capital Federal Information Processing (FIP), or word processing equipment.

16.0 NRC-Furnished Material

None