

February 13, 2003

MEMORANDUM TO: Michael Lesar, Chief
Rules and Directives Branch
Division of Administrative Services, ADM

FROM: Amy M. Snyder, Project Manager /RA/
Spent Fuel Project Office

SUBJECT: PUBLICATION IN FEDERAL REGISTER, SOLICITATION OF PUBLIC
COMMENTS ON SPENT FUEL TRANSPORTATION PACKAGE
PERFORMANCE STUDY TEST PROTOCOLS

Attached is an original signed copy of a Federal Register (FR) notice announcing the U.S. Nuclear Regulatory Commission's issuance for solicitation of public comments on the Spent Fuel Transportation Package Performance Study Test Protocols. Four copies of the notice and a diskette containing an electronic version of the notice are also attached. Please transmit the FR notice to the Office of the Federal Register for publication.

Attachments:

1. Signed original FR notice
2. 4 copies of FR notice
3. Diskette

CONTACT: Amy Snyder, NMSS/SFPO
(301) 415-8580

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U.S. NUCLEAR REGULATORY COMMISSION

SOLICITATION OF PUBLIC COMMENTS ON SPENT FUEL TRANSPORTATION PACKAGE
PERFORMANCE STUDY TEST PROTOCOLS

AGENCY: U.S. Nuclear Regulatory Commission (NRC).

ACTION: Opening of comment period and public meeting announcement.

SUMMARY: This Federal Register notice announces the availability, for public comment, of the Test Protocols Report (draft NUREG-1768) for the NRC's spent nuclear fuel transportation Package Performance Study (PPS). The PPS is a confirmatory research program focused on the probabilities and consequences of severe transportation accidents - the very small fraction of accidents that could result in impact or thermal forces, on casks, that exceed NRC's standards for cask design. The PPS will use a combination of testing and analyses to develop data and validate methods of analysis for use in transportation risk assessments. A public participation process will continue as PPS proceeds, to ensure that stakeholder concerns are considered by the PPS and to support increased public confidence in NRC's regulatory activities, considering potential future increases in the number of spent fuel transports.

The test protocols report describes, at a conceptual level, full-scale spent fuel cask impact and fire physical testing that NRC may sponsor over the next couple of years. The "Executive Summary" of the test protocols report is included in this notice, and full copies of the report are available for comment at NRC's Web site at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff> or may be obtained from the contact. Additional copies of the report

and other PPS related documents can also be found at the Sandia Web site:

<http://ttd.sandia.gov/nrc/modal.htm>.

DATES: Written comments will be accepted until May 30, 2003. Comments received after this date and time will be considered if it is practical to do so, but the Commission is able to ensure consideration only for comments received before this date and time. As part of the public comments period, NRC will hold four (4) facilitated meetings: in Bethesda, Maryland, on March 6, 2003; in Las Vegas, Nevada, on March 12, 2003; in Pahrump, Nevada, on March 13, 2003; and in Rosemont, Illinois, on March 19, 2003. The meetings will be transcribed and transcripts will be made available from the Sandia Web site.

ADDRESSES: NRC recommends that comments be submitted by e-mail, but mail delivery is acceptable. Submit comments to Michael Lesar, Chief Rules and Directives Branch, Office of Administration, Mail Stop: T6-D-59, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555-0001; or by internet electronic mail to nrcprep@nrc.gov. Comments may also be provided at the NRC Web site: <http://www.nrc.gov/public-involve/doc-comment/form.html>.

FOR FURTHER INFORMATION: Contact Dr. Andrew J. Murphy about any questions on the material in the Test Protocols Report. He can be reached at the Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Mail Stop: T-10-D-20, Washington, D.C., 20555-0001; telephone 301-415-6011 or by internet electronic mail at ajm1@nrc.gov.

Any questions on participation in the public meetings should be directed to Mr. Francis X. Cameron; telephone 301-415-1642 or by internet electronic mail at fxc@nrc.gov.

SUPPLEMENTAL INFORMATION: The PPS began in 1999 with a scoping phase, consisting of a series of public meetings to identify stakeholder issues with transportation risk studies and identify potential areas of further research. The scoping phase of PPS culminated in 2000 with issuance of the PPS issues and resolution options report (hereafter Issues Report) for comment, and an associated series of public meetings. NRC has since reissued the Issues Report, together with summaries of the public meetings and written comments received, as NUREG/CR-6768. The Issues Report identified the lines of investigation for PPS: (1) use recent accident statistics/data to reconstruct train and train accident event trees; (2) perform a high-speed impact test on a full-scale rail cask, to compare pre-test analyses with test results; (3) perform a long-duration fire test to compare pre-test analyses with test results; and (4) perform experiments on fuel pellets, rods, and assemblies, to examine failure modes and fracturing properties, to support radioactive material release analyses.

The PPS Test Protocols Report is the first major PPS document since the Issues Report. The Test Protocols Report describes, at a conceptual level, the impact and fire tests that are currently planned for PPS, along with the goals for these tests. Several other PPS tasks, including the accident statistics/data work, historical accidents investigation, and uncertainty/sensitivity analyses for risk assessments, are planned as part of PPS, but they are not part of the Test Protocol, as it focuses on testing. Fuel tests are not discussed in the Test Protocols Report, because those tests are proceeding on a different schedule from the impact and fire tests being conducted under the PPS.

As mentioned, the Test Protocols describe PPS tests at a conceptual level. NRC believes it is prudent to obtain comments on the tests while at a conceptual level, because detailed planning and procurement for a specific series of tests will be a resource-intensive effort, and NRC recognizes that comments could change test approaches and plans. After comments on the

Test Protocols have been collected and considered, NRC will modify PPS plans as necessary and direct development of detailed test plans and procedures for each of the PPS testing programs. The detailed plans, procedures, and tests will be made available.

PUBLIC MEETINGS

In addition to soliciting written public comment on the protocols, NRC will conduct public meetings to facilitate discussion and comment on the PPS Test Protocols. The meetings are planned as follows:

- *Workshop*: March 6, 2003, 8:00 a.m. - 5:30 p.m., in the Auditorium at the U.S. Nuclear Regulatory Commission Headquarters, Washington, D.C. 20555-0001;
- *Workshop*: March 12, 2003, 10:00 a.m. - 7:00 p.m., at the Clark County Building Department, Russell/Cameron Office, 4701 West Russell Road, Las Vegas, Nevada 89118;
- *Public Meeting/Seminar*: March 13, 2003, 6:00 p.m. - 9:00 p.m., at the Mountain View Casino and Bowl, 1750 South Pahrump Valley Boulevard, Pahrump, Nevada 89048; and
- *Workshop*: March 19, 2003, 8:00 a.m. - 5:30 p.m., at the Embassy Suites Hotel O'Hare, 5500 N. River Road, Rosemont, IL 60018.

The workshops will be convened in a "roundtable format." To have manageable discussions, the number of participants at the table will be limited. NRC, through the meeting facilitator, will ensure that by a broad spectrum of interests participates at the meetings, including citizen and environmental groups, nuclear and transportation, industry, academia, and governmental representatives at the Federal, State, and local level. Other members of the public are welcome to attend, and there will be opportunities to comment on each agenda item to be discussed by roundtable participants. Written comments will also be accepted at all meetings.

Workshop Provisional Agenda [March 6, Washington, D.C. (8:00 a.m. -5:30 p.m.);
March 12, Las Vegas, NV (10:00 a.m. - 7 p.m.); March 19, Rosemont, IL
(8:00 a.m. - 5:30 p.m)]

Meet and Greet

Work shop objectives, ground rules, agenda overview

Participant Introductions and Concerns

Regulatory and research framework for cask testing/Questions

Overarching Issues: participant participation

Break

Discussion on General Testing Issues

Lunch on your own

Impact Test Issues

Break

Baltimore Tunnel Fire Presentation

Fire Test Issues: participant discussion

Other Issues

Adjourn

Seminar Provisional Agenda (March 13, Pahrump, NV)

NRC Opening remarks and welcome

NRC Activities and Roles for Spent Fuel Transportation

Introduction of Package Performance Study

Break

Test Protocols Report: impact and fire tests

Wrap up

Adjourn

A World-Wide Web site has been established for dissemination of PPS information and documents to interested members of the public. Electronic copies of the Test Protocols Report and additional information on the public meetings can be obtained at <http://ttd.sandia.gov/nrc/modal.htm> .

EXECUTIVE SUMMARY OF TEST PROTOCOLS REPORT

The U.S. Nuclear Regulatory Commission (NRC) believes that current regulations and programs for transporting spent nuclear fuel (SNF) result in a high degree of safety. The Agency bases this belief largely on the staff's confidence in the shipping casks NRC certifies. Ongoing confirmatory research regarding transportation safety further supports the Agency's belief.

Under the current regulations, NRC requires that SNF casks must be designed and constructed to survive a sequence of tests designed to simulate postulated accidents. These tests include a 30-foot drop onto an unyielding surface and a 30-minute fully engulfing fire. NRC regulations

permit certification through testing, analysis, comparison with similar certified designs, or various combinations of these methods. Typically, the Agency has certified SNF casks using a combination of analyses and testing of scale models or cask components. Previous NRC risk studies have estimated that the Agency's certification standards encompass well over 99 percent of possible transportation accidents.

NRC certification of SNF casks has contributed to an excellent safety record for transporting spent fuel. Further, the characteristics of both fuel and cask systems continue to evolve, and the testing and analytical techniques used in certification applications continue to improve. However, the near-term possibility of a significant increase in the number of spent fuel shipments has focused public attention on the safety of SNF transportation. Despite the excellent record achieved to date and general improvements in cask design and analysis, some stakeholders have voiced concerns regarding transportation safety and the lack of full-scale testing of SNF casks.

NRC believes the safety protection the current transportation regulatory system provides is well-established. NRC's primary role in transportation of spent fuel is certification of the casks used for transport. NRC ensures that shipping casks are robust by regulating their design and construction, by independently confirming the ability of designs to meet the regulations and accident conditions through modeling and analyses, and by overseeing that licensees properly build, use, and maintain the casks. NRC's confidence in casks that it certifies is also supported by ongoing transportation safety research and by the outstanding safety record compiled using NRC-certified casks. Currently, NRC has certified several transportation cask designs that could be used to transport spent fuel, and additional designs are under review.

Package Performance Study

Because of stakeholder concerns and a desire to further validate the computer models used to evaluate the safety of cask transportation, NRC initiated, in 1999, a program known as the Package Performance Study (PPS). Under this ongoing program, the NRC staff is examining the adequacy of the analytical methods and data that are used to estimate the response of transportation casks to those improbable, extreme accidents that might cause radioactive materials to be released to the environment. However, the PPS is not intended to involve the development of new standards for transportation casks.

The NRC staff identified the tasks that are described in this report through two series of public meetings and associated comment periods, during which the staff solicited and discussed the various concerns of citizens, members of the nuclear industry, and governmental organizations. The staff, with contractor support, subsequently rated and summarized those concerns in the “Spent Nuclear Fuel Transportation Package Performance Study Issues Report,” NUREG/CR-6768, June 2002, which Sandia National Laboratories (SNL) prepared for NRC. Specifically, on the basis of its review of the public record from both the public meetings and written comments, the NRC staff concluded that the following four tasks would address the primary concerns stakeholders raised:

- (1) Use recent accident data to re-analyze the truck and rail accident-speed and fire-duration statistics developed by the Modal Study (Fischer, et al., 1987).

- (2) Perform high-speed collision tests on full-scale rail and truck casks¹ and compare the test results with pretest damage predictions developed by computer models.
- (3) Expose full-scale rail and truck casks to fully engulfing, long-duration fires and compare the measured cask temperatures with pretest temperature predictions developed by computer models.
- (4) Conduct laboratory tests to examine rod failure, pellet fracturing, and the release of particles from the failed rods, and use the test results to determine the response to extreme impacts of fuel pellets, fuel rods, and fuel rods containing fuel pellets.

This report addresses Tasks 2 and 3, listed above. It does not address the reanalysis of rail and truck accident statistics published in the Modal Study because that reanalysis does not involve conducting any tests or experiments. Similarly this report does not discuss NRC's plans regarding laboratory tests to determine the response of spent fuel pellets and rods to extreme accident conditions, because those test are proceeding on a different schedule than the impact and thermal tests being conducted under the PPS.

Test Protocols

This report summarizes the field tests that NRC proposes to perform under the PPS, as well as the analyses performed to develop the test summaries. Throughout this report, these summaries are called "test protocols." Publication of these test protocols does not imply any NRC commitment to conduct any of these tests, or to conduct any test exactly as described in this report.

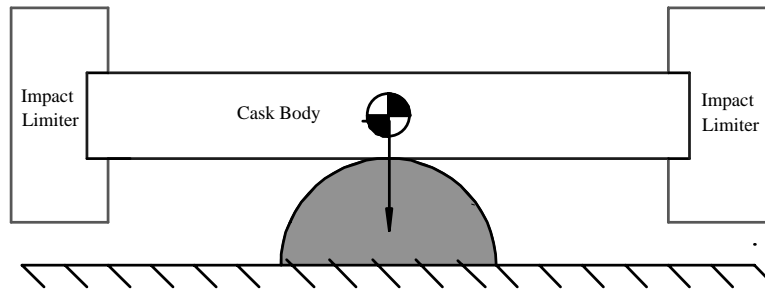
¹ The "Spent Nuclear Fuel Transportation Package Performance Study Issues Report," NUREG/CR-6768, did not specify the type of transportation cask to be tested; subsequently, NRC has proposed that the PPS test program should involve one rail cask design and one truck cask design.

Collision Test Protocol

Within the context of the PPS, NRC plans to conduct separate high-speed impact tests of a full-scale rail spent fuel cask and full-scale truck spent fuel cask, using a drop impact as opposed to a horizontal impact test. The drop impact test was proposed after weighing such factors as test objectives, costs, local environmental and logistical concerns, and modeling issues. The staff will then compare the results of these tests to detailed pre-test damage predictions developed by computer models. (The computer model analyses conducted in the process of developing the preliminary design of the impact test are described in this report.) The staff proposes the following tasks for the collision test protocol:

- Subject a full-scale rail cask to an extreme impact onto a flat, unyielding surface. (The staff proposes an unyielding surface because: (1) the proposed impact test is intended to evaluate cask performance, and an unyielding surface causes all the cask kinetic energy to be spent deforming the cask; and (2) an unyielding surface simplifies the analysis by deforming only the cask and not the target.)
- Equip the lid end of the test cask with an impact limiter; ensure the cask contains a fuel canister, if the test cask design uses canisters, with one real fuel assembly containing surrogate fuel, and sufficient dummy assemblies to fill the canister or cask.
- Structure the test to deliver the impact onto the lid end of the cask that is equipped with the impact limiter.
- Orient the cask so the impact is on the corner or edge of the lid.
- Test cask performance on impact with an unyielding surface at an impact speed of 26.8 to 40.2 meters per second (m/s) (60 to 90 miles per hour (mph)) (based on preliminary analysis of the computer model).

- Subject a full-scale truck cask to an extreme “back-breaker” impact² onto one of the internal flat sides of the cask, midway between the impact limiters onto a rigid semi-cylinder, as shown in the following illustration.



- Ensure that the cask contains one real fuel assembly and sufficient dummy assemblies to fill the cask.
- Test cask performance on impact with an unyielding surface at an impact speed of 26.8 to 40.2 m/s (60 to 90 mph) (based on preliminary analysis of the computer model).

Proposed Speed for Rail Impact Test

The NRC staff, with contractor support, obtained preliminary impact analyses to support the development of the test protocols. These analyses spanned the range of impact speeds from 26.8 to 40.2 m/s (60 to 90 mph); this report presents the results of these analyses for impact speeds of 26.8 and 33.5 m/s (60 and 75 mph). The NRC staff reviewed these SNL analyses

² A back-breaker impact is one in which the cask strikes the target between the impact limiters in a sideways orientation. The impact target is similar to a bridge column or abutment.

and developed three criteria for proposing test parameters for the PPS impact and thermal tests. The NRC staff conducted a trial application of these criteria to determine the speed for the rail cask impact. (Appendix A to this report fully describes the three criteria and the trial application.) The NRC staff optimized the benefits of the three criteria [i.e., (1) enhancing public confidence; (2) validating the computer models; and (3) ensuring realism in the probability of the occurrence of the test parameters]. On the basis of that optimization, the NRC staff proposes the impact speed of 33.5 m/s (75 mph).

Fire Test Protocol

Within the context of the PPS, NRC plans to conduct separate fire tests of a full-scale rail cask and a full-scale truck cask. For these thermal tests, PPS will use a fully engulfing, optically dense fire, which completely surrounds the test specimen and obscures visibility of the test specimen through the flames. In each test, the fire will burn for more than the half-hour duration of the thermal certification test. The NRC staff will compare the measured temperature history of the cask at various points with the detailed pretest predictions developed by computer models. (Again, the computer model analyses conducted in the process of developing the preliminary design of the thermal test are described in this report.) The staff proposes the following tasks for the fire test protocol:

- Subject a full-scale rail cask to a fully engulfing, optically dense fire for a duration of more than one-half hour.
- Subject a full-scale truck cask to a fully engulfing, optically dense fire for a duration of more than one-half hour.

Public Comments

NRC is publishing and distributing this report to solicit public comments regarding the proposed SNF cask performance test protocols, while they are still at a conceptual level as reflected in this report. In addition to continuing the interactions in developing the scope of the PPS, this review at the conceptual level is being conducted because detailed planning and procurement for a specific series of tests will be resource-intensive. NRC anticipates that the public comments could result in worthwhile changes to the underlying test approaches and plans. The Agency is particularly interested in stakeholders' views on the following eleven issues:

- How many casks and what types of cask designs should be used in the tests?
- At what scale should the cask impact tests be conducted (e.g., full-scale or partial-scale)?
- Should the impact tests be conducted as drops from a tower, as proposed in this report, or along a horizontal track, using a rocket sled?
- What should the impact speed and orientation be for the rail cask impact test?
- Are 26.8 to 40.2 m/s (60 to 90 mph) a reasonable speed range for the rail cask impact test, given that the frequency for a rail cask impacting a hard rock surface within this speed range is 10^{-6} to 10^{-8} per year?
- Is the 33.5-m/s (75-mph) rail cask impact speed proposed by the NRC staff appropriate?
- What should the impact speed be for the back breaker truck cask impact test?
- What should be the duration and size of the cask fire tests?
- What should be the cask position relative to the fire?

- How many and what types [real or surrogate, pressurized-water reactor or boiling-water reactor] of fuel assemblies should be in the casks during the tests?
- Will the proposed tests be able to yield risk insights consistent with NRC's risk-informed regulatory initiatives?

After receiving and considering all stakeholder comments on the test protocols, the NRC staff will direct the development of detailed test plans and procedures for each of the PPS testing programs. NRC will make these detailed plans, procedures, and tests available to the public before finalizing and conducting the planned tests. Thus, the finalized detailed plans will reflect public comments on these test protocols, constraints imposed by NRC's programmatic priorities, and the available funding to support these tests.

Conclusion

PPS development of this new cask impact, cask fire, and spent fuel response data will substantially improve the technical basis that underlies the estimation of the risks posed by extra-regulatory accidents that might occur during the shipment of spent fuel in Type B packages.

Dated at Rockville, Maryland, this 13th day of February, 2003.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION
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Charles L. Miller, Deputy Director
Spent Fuel Project Office
Office of Nuclear Material Safety
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