

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 tests 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.

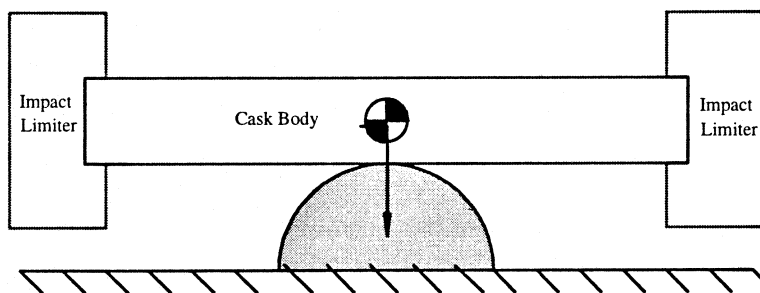
Collision Test Protocol

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 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

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.