RAI Volume 2, Chapter 2.1.1.5, Set 2, Number 2:

Provide the technical basis for selecting TS125 as a representative rail cask for the shielding calculations in the staging area and for the transient operations (BSC 2007a, sections 6.1.1 and 6.1.2.1). Also, clarify whether or not DOE has used the TS125 dose rates in any dose calculations in the SAR to demonstrate compliance with dose limits.

1. RESPONSE

1.1 TECHNICAL BASIS FOR SELECTING FUELSOLUTIONS TS125 CASK

The FuelSolutions TS125 cask was selected as the representative rail transportation cask to be used for shielding calculations for the railcar buffer (staging) area and cask transfer operations and in development of dose rate distributions for worker dose estimates of cask processing activities. The selection of the FuelSolutions TS125 cask was based on evaluating transportation cask dose rates in the axial and radial directions from information in safety analysis reports for the following NRC certified rail casks: NAC-UMS, NAC-STC, TN-68, HI-STAR, FuelSolutions TS125, NUHOMS-MP-187, and NUHOMS-MP-197. Table 1 shows the dose rates in the radial, top axial, and bottom axial directions at the rail cask surface and at 2 m from a rail car as taken from the safety analysis reports and used in the evaluation.

The radial dose rates at 2 m away from the rail car are all close to the 10 CFR 71.47(b)(3) regulatory limit of 10 mrem/hr at 2 m. The rail cask dose rates vary, however, in the axial top and axial bottom directions. The FuelSolutions TS125 transportation cask has the highest dose rate in the top axial direction while the HI-STAR transportation cask has the highest bottom axial dose rate. Relative to shielding in the buffer area and during cask processing operations, the radial direction is the most important dose contributor. For use in worker dose estimates, time and motion studies showed that worker operations during cask processing are typically in the radial or top axial directions. These factors led to the FuelSolutions TS125 cask being selected as the representative transportation cask model both for rail and truck casks.

1.2 USE OF FUELSOLUTIONS TS125 IN COMPLIANCE WITH DOSE LIMITS

Dose rates determined from computer models based on the FuelSolutions TS125 representative transportation cask were used in several analyses to demonstrate compliance with regulatory dose limits. These analyses included attenuation distances for access control restrictions, shield barrier thicknesses, and worker dose estimates.

The distances for access control restrictions from the railcar and truck buffer areas as well as from transportation cask sources during geologic repository operation area movements were determined from computer models based on the FuelSolutions TS125 representative transportation cask. The distance calculations were used to locate the perimeter intrusion detection and assessment system fencing and posting in these areas to limit public doses to less than 100 mrem/yr. If necessary, additional postings or fencing will be provided as determined by radiation surveys.

Computer models based on the FuelSolutions TS125 representative transportation cask are used to determine preliminary concrete wall thicknesses for shielding to reduce dose rates to below 0.05 mrem/hr: (1) on the inside of the exterior walls of nonnuclear buildings adjacent to the railcar and truck buffer areas, and (2) from transportation casks during surface transfer to the handling facilities (SAR Table 1.10-35). This is to allow the dose to individuals working in the nonnuclear buildings to be controlled to the on-site public dose limit of 100 mrem/yr. Because transient sources will not be present for the entire 2000 hours/yr needed to exceed 100 mrem/yr at a dose rate of 0.05 mrem/hr, this design parameter is conservative.

Computer models based on the FuelSolutions TS125 representative transportation cask are also used for nuclear facility shielding analysis and worker dose estimates in the waste handling facilities to demonstrate meeting as low as reasonably achievable exposure goals as well as radiation worker regulatory dose limits. SAR Tables 1.10-35 through 1.10-40 show where the FuelSolutions TS125 representative transportation cask was used as a source for shielding or dose analysis.

The computer model of the FuelSolutions TS125 representative transportation cask also provides a two-dimensional dose rate distribution around a transportation cask for use in worker dose estimates. The dose rate distribution is used along with time and motion results of generic operational steps for receiving and processing a transportation cask in order to estimate worker doses and demonstrate compliance with 10 CFR Part 20 worker dose limits. The bounding normal operations worker dose estimate is for the Receipt Facility and is used in SAR Section 1.8 (See SAR Section 1.8.4.2.1.2 and SAR Tables 1.8-25, 1.8-36).

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

Table 1. Rail Transportation Cask Dose Rates

Rail Cask	Total Dose Rate (mrem/hr)					
	Radial		Top Axial		Bottom Axial	
	Surface	2 meter[a]	Surface	2 meter	Surface	2 meter
NAC-UMS[b]	167.2	9.6	0.5	<0.1	6.0	1.3
NAC-STC	366.4	9.5	6.2	1.4	14.4	2.7
TN-68	122	10	12	—	9.2	—
HI-STAR[b]	138.47	9.57	4.33[c]	0.1[c]	89.54[c]	8.11[c,d]
FuelSolutions TS125	122.55	9.28	17.27	4.90	3.91	1.75
NUHOMS-MP-187	237	9.94	0.847	0.337	1.62	0.672
NUHOMS-MP-197	137	10	2.0	—	3.7	—

NOTE: [a]From the railcar. Equal to outer edge of impact limiters for HI-STAR and FuelSolutions TS125.
[b]For bounding pressurized water reactor fuel.
[c]Does not take credit for the impact limiters.
[d]Actual distance is 2 m + 9 ft from bottom impact limiter.