SHIELDED CONTAINER COMPLETENESS COMMENTS
July 13, 2010

EPA Comment 1

DOE described studies conducted to demonstrate that shielded containers comply with Class A requirements in the June 2008 Type A Evaluation Report (TAER) (WTS 2008). The TAER identifies the analyses, tests, and evaluations performed on the shielded container to demonstrate compliance of the packaging design with the applicable requirements of 49 CFR 178.350.

According to Section 3.1 of the TAER:

> *Determination of the response of a point radiation source subject to movement within the package and any associated effects on radiation levels are not provided in this document. Drop test damage information is provided in Section 4.2.2 for use by the shipper in determining whether a significant change in radiation level would result for a specific payload.*

This raises the question as to how the shipper would determine whether a significant change in radiation could result for a specific payload. We presume that, if no significant damage occurs during drop testing and no tracers or other materials are released, significant changes in radiation levels would not result. If this is the intent, why is it not so stated? What is the burden imposed on the shipper? The TAER would benefit if this ambiguous statement were clarified.

This excerpt also raises the question as to where movement of point sources of radiation is addressed and what actions must be taken to prevent such movement.

Similarly in Section 3.2, the authors note that:

> *Damage information is provided to assist the shipper in evaluating the possible dose rate changes at the surface of the package for the intended payloads to be shipped.*

The same concerns as outlined above apply here.

Reference

WTS 2008. *Shielded Container Type A Evaluation Report*, ECO No.: 11834, Rev. 0, Washington TRU Solutions LLC, Carlsbad, New Mexico, June 2008.

DOE Response

Changes in radiation levels at the surface of the container are dependent on two factors during transportation. One is damage to the packaging, which is addressed in the SCA (Shielded Container Assembly) TAER with testing performed before and after the 4 foot drop tests, and discussed in Section 4.2.2.4, Shielding. There was no significant reduction of shielding effectiveness as a result of the drop tests. The other factor is the location of a point gamma radiation source within the SCA. It is the responsibility of the shipper to ensure that there is adequate bracing within the 30-gallon internal payload container such that the point radiation source doesn't move during transportation to cause a significant increase (20%) in the external radiation levels. This is addressed in Sections 2.4, 5.1 and Appendix A, Section 4.6.3. Specific loading instructions are not addressed in the SCA TAER, as that is not the intent of the document. The SCA TAER references the SCA Handling and Operation Manual, WP 08-PT.16 which does provide specific loading instructions, in Sections 2.4, on page 4-11 and on section 5.1. WP 08-PT.16 is also referenced on WTS drawing, 165-F-026. These references are provided to inform the shipper that the SCA must be loaded and closed in accordance with those specific instructions in order for a loaded SCA to be certified as a Type A Packaging. While changes to the SCA TAER are not deemed necessary, the Handling and Operation Manual will be revised to further instruct the shipper to securely fasten and position contents within the 30-gallon internal payload container in a manner to prevent a significant increase in the level of radiation at the external surface of the SCA as a result of movement during transport.

References

SCA Handling and Operation Manual, WP 08-PT.16

WTS drawing, 165-F-026

EPA Comment 2

With regard to vibration testing, DOE asserts that because of the robust nature of the shielded container, it would meet the vibration testing requirement of 49 CFR 178.608. This requirement specifies that the waste package be tested on a vibrating table for one hour at a frequency that causes the shielded container to be raised above the table by about 0.063 in. DOE did not subject a shielded container to vibration testing and, instead, based its compliance opinion on the following reasoning (WTS 2008, Section 4.2.5):

> *The stiffness of the 3 in. thick lid and base, and the greater than 1 in. thick steel/lead/steel body sidewall is such that resonant frequencies would not be encountered during normal condition transport. The 15 closure bolts, when preloaded to the torque requirements referenced herein, would not loosen or otherwise be significantly affected by vibration conditions. Other miscellaneous components are either welded, press-fit, or otherwise secured in place and not significantly affected by vibration conditions and/or not critical components serving a containment or shielding function in the package.*

This quotation contains several unsupported statements including:

- resonant frequencies would not be generated
- properly torqued bolts would not be loosened by vibration
- press fit items would not be significantly affected by vibration

DOE needs to provide the technical basis for these suppositions.

DOE Response

1) Generally a resonant frequency of 500Hz or more is considered inconsequential to normal transport conditions. A simplified calculation as well as a finite element analysis (FEA) model both show that the lid has a resonant frequency of approximately 1300Hz which is therefore out of this range.
2) A calculation of the worst case clamping load of the 15 closure bolts shows a force of 88,000 lbs. This corresponds to 262 Gs of acceleration required to lift the lid.
3) The only two press fit items are protective plugs used to keep water from collecting in two areas, the filter port and the threaded lift interface holes. During transport the SCA is required to have a DOT Type A compliant filter vent installed, therefore the filter port plug is not used and is of no concern. The threaded lift interface holes are still plugged during transport, but only to prevent the collection of water or debris since they are not part of the containment boundary (reference WTS drawing, 165-F-026-W1, see section C-C). It should also be noted that for our intended use of the SCA, inside of a Type B package during transport, the container will not be exposed to the elements either.

Reference

WTS drawing, 165-F-026

EPA Comment 3

In lieu of the physical stacking test required under § 173.465(d), DOE performed an analytical calculation assuming that six containers were stacked on top of the target container, thereby increasing the axial load by 20% above that specified in § 173.465(d). This axial load of 13,560 lbs was assumed to be borne solely by the inner cylindrical shell of the shielded container. Using procedures documented in ASME Boiler and Pressure Vessel Code Case N-284-1, DOE calculated that the axial load would not cause buckling of the inner shell. However, NRC’s current position on Code Case N-284-1 (NRC 2007) is that use of this case by licensees to evaluate canisters and transportation casks is permissible only if it has been reviewed and approved by NRC. Given NRC’s concerns about the Case, DOE should demonstrate that the errata, misprints, recommendations, and errors identified in NRC 2007 do not unfavorably affect the TAER calculations.

Reference

NRC (U.S. Nuclear Regulatory Commission) 2007. *ASME Code Cases Not Approved for Use*. Regulatory Guide 1.193, Rev. 2. October 2007.

DOE Response

When analyzed by calculating the slenderness ratio (L_e/r) of the geometry, the SCA has a ratio of 9.36, which is well below the limit for a geometry to be considered short and wide ($L_e/r<30$). Therefore this geometry would be bounded by a normal axial stress calculation, which shows a safety factory to yield when loaded to 13,560lbs of 19:1 against the outer shell, which has the smaller cross sectional area of the two shells. Therefore it is more than reasonable to assume that the design of the SCA is not affected by the regulatory stacking test by a large margin.

It should also be noted that NRC Regulatory Guide 1.193 is specific to 10CFR50, which governs NRC licensed "Nuclear Power Plants". Also, in the HalfPACT SAR, section 2.6.7, ASME Code Case N-284 is specifically used and cited for the buckling calculations of the containment boundary of the HalfPACT, which is a NRC approved and licensed Type B package.