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26 March 2010

Pierre Saverot, Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
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Rockville, MD 20852

Docket No. 71-9035 (Model 680-OP Type B Package)

Dear Mr. Saverot:

The following is submitted in response to your 23 March 2010 email request for additional detail on how the latest SAR for this package complies with the shaded box recommendations in NUREG-1886. Please see the attached document that identifies each item and addresses how and where the issue is addressed in the latest SAR submission. (Note that in one case, the SAR will be revised and submitted at a later date to include an additional sketch of the package as prepared for transport.)

Response to the issues raised in your letter dated 17 March 2010 will be addressed and submitted under separate cover. Should you have any questions on this letter or its enclosure, please feel free to contact me to discuss.

Sincerely,

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RA/QA Approval — Date: 26 Mar 10

Engineering Approval — Date: 26 Mar 10

Enclosure:

- Description for the Model 680-OP SAR Revision 12 Changes to Address Shaded Box Issues from NUREG-1886 (Final Report – March 2009)

NMSS24

Description for the Model 680-OP SAR Revision 12 Changes to Address Shaded Box Issues from NUREG-1886 (Final Report – March 2009)

The following table summarizes how Revision 12 to the 680-OP SAR addresses the shaded box issues in NUREG 1886, *"Joint Canada – United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages"* (Final Report – March 2009) .

Section Reference	Shaded Box Recommendation	Details
1.2.3 (Page 1-6)	The application should include only contents in solid form for plutonium in excess of 0.74 TBq (20 Ci).	Not applicable. This package is not used for the transportation of plutonium.
1.3 (Addl Sketch To Be Added)	A generic sketch representing the package as prepared for transport is required in order to comply with Paragraph 807(h) of TS-R-1 as referenced in Paragraph 7(1)(a) of the PTNS Regulations. This sketch is required under the Canadian regulations. The appendix should include a generic sketch which represents the package as prepared for transport. The 1996 edition of IAEA TS-R-1 referenced in NUREG 1886 states the requirement for Paragraph 807(h) as follows: "An application for approval shall include: ... a reproducible illustration, not larger than 21 cm by 30 cm, showing the make-up of the package;..."	Though we believe the descriptive assembly drawing currently provided meets the intent of the original IAEA recommendation, we will revise Section 1.3 of the SAR to include an additional generic sketch of the package as prepared for transport as recommended in NUREG 1886. This will be included with Revision 13 of the 680-OP SAR.
2.5.1 (Page 2-4)	Canadian regulations do not specify a numerical criterion for acceleration load factors or snatch factors for lifting fixtures that are a structural part of the package as per Paragraphs 607 and 608 of TS-R-1. The criterion specified in 10 CFR 71.45(a) is a minimum safety factor of 3 against yielding. This section should show that the lifting devices meet the criterion in 10 CFR 71.45(a).	Section 2.5.1 of the SAR includes an assessment to demonstrate package compliance with a minimum safety factor of 3.
2.5.2 (Page 2-5)	Canadian regulations do not specify numerical design criteria for tie-down devices as per Paragraph 636 TS-R-1. The design criteria for tie-down devices that are a structural part of the package are defined in 10 CFR 71.45(b) as follows: > The system must be capable of withstanding, without generating stress in any material of the package in excess of its yield strength, a static force applied to the center of gravity of the package having a vertical component along the direction in which the vehicle travels of 10 times the weight of the package with its contents, and a horizontal component in the transverse direction of 5 times the weight of the package with its contents. This section should show that the tie-down devices meet the criteria of 10 CFR 71.45(b). For attachments or other features that are a structural part of the package, that could be used for tie-down and that do not meet the tie-down criteria, this section should show how they are rendered inoperable for tie-down.	The Model 680-OP packages have no tie down attachments. The package can be blocked and braced according to standard transportation practices.

Section Reference	Shaded Box Recommendation	Details
2.6.3 (Page 2-7)	There are some differences in the provisions of 10 CFR 71.71(c) and Paragraphs 643 and 619 of TS-R-1. Paragraph 643 of TS-R-1 specifies a reduced ambient pressure of 60 kilopascals (kPa) (8.7 pound-force per square ince (lbf/in^2)), and 10 CFR 71.71(c) specifies a reduced ambient pressure of 25 kPa (3.5 lbf/in^2) absolute. Paragraph 619 of TS-R-1 specifies the reduced ambient pressure for air transport. This section should show that the package meets all three requirements, unless the package will not be transported by air, in which case Paragraph 619 does not apply.	The transport package is open to the atmosphere and contains no components which could create a differential pressure relative to atmospheric conditions or components within the package. Therefore, the reduced external pressure requirements of 3.5 psi in 10 CFR, 3.6 psi in 49 CFR and 8.7 psi (60 kPa) and 0.7 psi (5 kPa) in IAEA are met. The authorized contents are special form source capsules that meet a minimum ISO 2919-1999 classification of Class 3 for pressure. This classification is more limiting than the reduced external pressure requirement as it covers 25 kN/m^2 to 2 MN/m^2. Therefore, the reduced external pressure requirements of 3.5 psi in 10 CFR and 8.7 psi (60 kPa) in 49 CFR and IAEA will not adversely affect the package containment
2.6.4 (Page 2-7)	Since 10 CFR 71.71(c)(4) includes a specific value for the increased external pressure and there is no analogous value in TS-R-1, this section should show that the package can withstand the increased external pressure defined in 10 CFR 71.71(c)(4) (i.e., 140 kPa (20 lbf/in^2) absolute).	The transport package is open to the atmosphere and contain no components which could create a differential pressure relative to atmospheric conditions. Therefore, the increased external pressure requirements of 20 psi in 10 CFR 71 will not adversely affect the package containment. The authorized contents are special form source capsules that meet a minimum ISO 2919-1999 classification of Class 3 for pressure. This classification is more limiting than the increased external pressure requirement as it covers 25 kN/m^2 to 2 MN/m^2. Therefore, the increased external pressure requirements of 20 psi in 10 CFR 71 will not adversely affect the package containment
2.6.9 (Page 2-10)	Canadian regulations specify that the compression (or stacking) test does not need to be considered if the shape of the packaging effectively prevents stacking, as stated in Paragraph 723 of TS-R-1 which is incorporated in Subsection 1(4) of the PTNS Regulations by reference to Paragraph 716 of TS-R-1. U.S. regulations in 10 CFR 71/71(c)(9) do not include the exception; however, the compression test is only required for small, light packages with a mass less than 500 kilograms (kg) (1,100 pounds (lb)). For this section, the evaluation should consider the effects of the compression test for the following: 1. All packages with mass less than 500 kg (1,100 lb); and 2. Packages with mass greater than 500 kg (1,100 lb) if the shape of the packaging does not prevent stacking.	Test Plan Report 72 demonstrated that the Model 680-OP transport package maintained its structural integrity and shielding effectiveness under the Normal Conditions of Transport compression test. The actual test specimen for the compression test weighed 598 lbs. The test specimen was subjected to a compressive load of 3,149 lbs (1,431 kg) for a period of 24 hours, which exceeds five times the package weight of 615 lb. This is greater than 2 lb/in^2 (13 kPa) multiplied by the vertically projected surface area of the package. Following the test, no damage to the unit was observed. There was a 5/16" reduction in overall height but this was due to settling of the lid and occurred immediately after the load was applied

Section Reference	Shaded Box Recommendation	Details
2.7 (Section 2.12 Appendices)	The cold temperature condition that is to be considered as the initial condition for the accident tests is different for U.S. and Canadian regulations. Paragraph 664 of TS-R-1 specifies -40°C (-40°F) and 10 CFR 71.73(b) specifies -29°C (-20°F). Therefore, the cold temperature considered as the initial condition for the hypothetical accident conditions drop test must be -40°C (-40°F).	Justification for the drop test unit temperatures prior to Hypothetical accident condition testing is contained in the Test Plan Reports in Section 2.12. Since these units contain carbon steel components that are prone to brittle fracture at cold temperatures, test units were taken to -40°C prior to the 30 ft drop and 1 m puncture tests.
2.7 (Page 2-11)	Paragraph 727 of TS-R-1 which is incorporated in Subsection 1(4) of the PTNS Regulations by reference to Paragraph 716 of TS-R-1 specifies that the accident condition drops (drop I, the 9 meter (m) (30 ft) free drop; drop II, the puncture test; and drop III, the crush test) be performed, as applicable, in whichever order results in the maximum damage, considering the subsequent application of the fire test. On the other hand, 10 CFR 71.73 specifies that the sequence of the test must first be the 9 m (30 ft) free drop, followed by the crush test for certain packages, and then followed by the puncture test. In this section, the application should specifically address the most restrictive conditions. If the 9 m (30 ft) drop is performed first, the application must include a justification that this sequence results in maximum damage, also considering the subsequent fire test. If there is evidence that performing the puncture test before the 9 m (30 ft) drop will result in maximum damage, then two puncture tests should be performed, one prior to the 9 m drop (30 ft) and one following the 9 m (30 ft) drop. For packages requiring the crush test, the accident sequence must include a 9 m (30 ft) drop, followed by the crush test.	The test sequence as specified in 10 CFR 71.73 was determined to be the order which would result in the maximum damage to the package, considering the subsequent application of the fire test, because the inner device is more vulnerable to containment related damage during the puncture test than the device inside the overpack assembly. The intention of the 30 ft drop was to release the inner device and test the device without the overpack for both the puncture and thermal tests which would produce the worst case potential damage to the containment system.
2.7.2 (Page 2-15)	Canadian regulations require that the crush test (drop III) be substituted for the 9 m (30 ft) drop (drop I) for certain packages. U.S. regulations require that both tests be performed (the 9 m (30 ft) drop followed by the crush test) for these packages. The package type that is subjected to the crush test is the same in both regulations and is based on the weight, density, and authorized contents of the package. For packages requiring the crush test, the accident sequence must include a 9 m (30 ft) drop, followed by the crush test.	Not applicable. This package is not used for the Type B transport of normal form radioactive material.

Section Reference	Shaded Box Recommendation	Details
2.7.6 (Page 2-17)	The immersion test should be evaluated for a period of not less than 8 hours, as specified in Paragraph 729 of TS-R-1.	The Model 680-OP transport packages are open to the atmosphere and contain no other components that would create a differential pressure under immersion. All materials are impervious to water and would not be affected. The primary containment system in these packages is a special form source, which minimally meets the ANSI N43.6 and ISO 2919 requirements for Class 3 pressure testing. Therefore the Model 680-OP could withstand the immersion test criteria since the Class 3 pressure test requirements are in excess of the required 150 kPa (21.7 lb ft/in^2).
2.7.7 (Page 2-17)	These regulations differ primarily in the application of the external pressure (TS-R-1 states "immersion of the specimen," and 10 CFR 71.61 states "undamaged containment system") and in the acceptance standard (TS-R-1 states "no rupture" and 10 CFR 71.61 states "without collapse, buckling, or in-leakage of water"). The NRC requirements are more restrictive since application of the pressure is on the containment system and the acceptance standards are more restrictive (i.e., in-leakage of water is acceptable under TS-R-1 standard but not under the 10 CFR 71.61 standard). Therefore, this section should show that the package meets the most restrictive standard defined in 10 CFR 71.61.	Not applicable. This packaged does not transport normal form radioactive material in quantities exceeding 10^5A_2.
2.10 (Page 2-22)	For approval in Canada, the application should also include a copy of the special form certificate and drawings for each capsule authorized in the package. Providion for allowance of similar capsules meeting the requirements for special form radioactive material may be granted, provided that the application includes proper demonstration that these would be bounded by the analysis provided.	The Model 680-OP transport packages are designed for use with a special form source capsule Models 60011 or 60012 attached to a flexible source wire assembly (Model A424-14). The source capsules are approved under a U.S. Department of Transportation special form certification USA/0377/S-96. A copy of the current USDOT certificate, including the current approved capsule drawing, is included in Section 2.12.7. Details of encapsulation as well as chemical and physical form of the radioactive material will comply with specifications approved under U.S. Department of Transportation special form certifications. Details of the Model A424-14 source wire assembly can be found under USA SS&D registration MA-1059-S-105-S and CNSC device registrations R-061-1996-3-2016 or R-061-2032-3-2016.

Section Reference	Shaded Box Recommendation	Details
3.5.1 (Page 3-9)	*{With Respect to the initial conditions for the hypothetical accident testing...}* An ambient temperature between -40°C (-40°F) and +38°C (+100°F) with no insolation. This range is specified in the Canadian and IAEA regulations. The U.S. regulations specify a minimum ambient temperature of -29°C (-20°F) for the initial condition. Therefore, an ambient temperature range between -40°C (-40°F) and +38°C (+100°F) should be considered.	The ambient temperature recorded prior to testing under Test Plan 72-S2 was 20-22°C. This testing was performed in 1999 and the ambient temperature after the test was not recorded at that time. It is reasonable to assume that the ambient temperature outside the oven was approximately the same as before the test because the oven was located inside a building that was temperature controlled for normal occupancy. The carbon steel on the package could be affected by thermal shock related to a temperature change from 800°C to -40°C. Most thermal shock based damage is related to the creation of cracks in the steel and usually require application of the thermal gradient shock over a large number of cycles to produce cracking of note. Based on the thickness of the carbon steel components of the inner container, any cracks created in the steel material would be less significant than the damage created to the inner device during the drop testing. Had the test specimen been subjected to a thermal shock before and after the oven testing, the temperature reduction to -40°C after removal from the oven could have been viewed as the application of artificial cooling of the package which is specifically prohibited in the NUREG-1886 document. Testing at +38°C is not expected to have any significant detrimental impact on the containers that were exposed to the ~20°C ambient temperature before/after the oven test as the difference in these temperatures will not adversely impact the package materials performance. QSA Global believes the testing performed to date, under the conditions accepted at the time of application for Type B(U) approval, sufficiently bounds the package design for continued Type B(U) transport.
6.0 (Page 6-1)	The following are exceptions from the requirements for fissile material packages.....	All parts of this section are not applicable. The Model 680-OP transport packages are not used for shipment of fissile material.

Description for the Model 680-OP SAR Revision 12 Changes to Address Shaded Box Issues from NUREG-1886 (Final Report – March 2009)

Section Reference	Shaded Box Recommendation	Details
6.4.1 (Page 6-1)	10 CFR 71.55(c) provides....	All parts of this section are not applicable. The Model 680-OP transport packages are not used for shipment of fissile material.
7.2.1 (Page 7-4)	The U.S. regulations require the receiver to conduct a radiation and contamination survey of packages in accordance with 10 CFR 10.1906, "Procedures for Receiving and Opening Packages." Subsection 21(3) of the Canadian PTNS regulations requires that the consignee verify whether the package is damaged, shows evidence of having been tampered with, has any portion of the fissile material outside the confinement system, and has any portion of the contents outside the containment system.	Applicable criteria addressed in SAR section 7.2.1 titled "Receipt of Package from Carrier".
8.1 (Page 8-1)	Paragraph 501 of TS-R-1 and 10 CFR 71.85 contain slightly different requirements for acceptance testing. 10 CFR 71.85 requires that it be determined that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce the effectiveness of the packaging. Paragraph 501 of TS-R-1 requires that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits for the approved design. If the design pressure of the containment system exceeds 35 kPa (5 lbf/in^2) gauge, Paragraph 501 requires it be ensured that the containment system of each package conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure. 10 CFR 71.85 more specifically requires a test of the containment system at an internal pressure at least 50 percent higher than the maximum normal operating pressure.	Per Section 8.1.3 & 8.1.4 of the SAR, prior to first use as part of a 680-OP transport package, container structural conformance will be evaluated in accordance with the applicable drawings requirements and in accordance with QSA Global Inc.'s USNRC approved Quality Assurance Program No. 0040. The containment system is not designed to require increased or decreased operating pressures to maintain containment during transport, therefore pressure tests of package components prior to first use is not required. The source capsules (primary containment) are wipe tested for leakage of radioactive contamination upon initial manufacture. The removable contamination must be less than 185 Bq (0.005 μCi). The source capsules will also be subjected to leak tests under ISO9978:1992(E) (or more recent editions). The source capsules are not used if they fail any of these tests.
9.0 (Page 9-1)	Packages originally certified in Canada must meet the CNSC QA requirements described in Section 9.2 of this document {NUREG-1886}, while packages originally certified in the United States must meet the NRC QA requirements outlined in Section 9.1. Validation requests should reference the applicable QA program approved with the original certification. Additional information may be requested to determine whether the referenced QA program is sufficient for package validation purpose.	This package is originally submitted for certification in the United States. All component fabrication (including assembly) is controlled under the QSA Global, Inc. Quality Assurance program approved by the USNRC (approval number 0040) and ISO 9001.