March 7, 2011

Ms. Lori Podolak
Senior Regulatory Affairs Specialist
Regulatory Affairs Department
QSA Global, Inc.
40 North Avenue
Burlington, MA 01803

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE MODEL NOS. SENTRY 110, SENTRY 330, AND SENTRY 867 PACKAGES

Dear Ms. Podolak:

On November 5, 2010, QSA Global, Inc., (QSA) submitted an application for a Certificate of Compliance (CoC) for the Model Nos. SENTRY 110, SENTRY 330, and SENTRY 867 Transport Packaging Systems. QSA also requested that the package review include consideration of NUREG-1886, "Joint Canada – United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages."

In connection with the staff's review, we need the information identified in the enclosure to this letter. We request that you provide this information by April 15, 2011. Please inform us at your earliest convenience, but no later than April 2, 2011, if you are not able to provide the information by that date. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

Please reference Docket No. 71-9357 and TAC No. L24487 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3408.

Sincerely,

/RA/

Pierre Saverot, Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9357
TAC No. L24487

Enclosure: Request for Additional Information

Ms. Lori Podolak
Senior Regulatory Affairs Specialist
Regulatory Affairs Department
QSA Global, Inc.
40 North Avenue
Burlington, MA 01803

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Request for Additional Information
QSA Global, Inc.
Docket No. 71-9357
Certificate of Compliance No. 9357
Model No. Sentry

By letter dated November 5, 2010, QSA Global, Inc., (QSA) submitted an application for a Certificate of Compliance (CoC) for the Model Nos. SENTRY 110, SENTRY 330, and SENTRY 867 Transport Packaging Systems. QSA also requested that the package review include consideration of NUREG-1886, "Joint Canada – United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages."

This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff to complete its review of the Model No. Sentry package, and to determine whether the applicant has demonstrated compliance with the regulatory requirements of 10 CFR Part 71 and TS-R-1, 1996 Edition (as amended 2003). NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," and NUREG-1886 were used by the staff in its review of the application.

1. Make the following corrections and changes to the drawings R86000 Rev. B (see tables below). Ensure that the materials listed in Table Nos. 2.2a, 3.2a, and 3.2b cover all the materials listed in the drawings, and no more.

   Whenever possible, all components that are important to safety must have materials specified by a national consensus standard, corresponding material grade or type, and condition. For example, "Type 17-4 PH stainless steel" is not an acceptable material designation, but "Type 630 per ASTM A564 condition H925" is acceptable.

   This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

Item	**Issue/Question**	**Note(s)**
Sheet 2		
Note 1	Replace 'OR' by 'AND' Replace 'V111' by 'VIII'	Weld qualification per a national consensus standard is required for safety related components
Shield Disk	Specify national consensus material standard(s) and grade(s)/type(s)	Specific copper alloy must be specified

Bottom Plate Top Endplate Shell	(1) Remove A480 from list of standards (2) Resolve discrepancy between A276 Type 304/304L and A276 Type 316/316L	(1) A480 is not a materials specification, but a general requirements standard (2) A276 Type 304/304L is not listed in Table 2.2a, instead, A276 Type 316/316L is listed
Sheet 3		
Note 1	Add same statement as in sheet 2: "AND certified to ASME boiler and pressure vessel code Section VIII Div 1"	Weld qualification per a national consensus standard is required for safety related components
Cotter Pin	Specify national consensus material standard(s)	
Shield Bracket Shield Cup	Specify national consensus material standard(s) and grade(s)/type(s)	Specific copper alloy must be specified
Shield Mount Back Plate Mounting Plate Port Tube	(1) Remove A480 from list of standards (2) Resolve discrepancy between A276 Type 304/304L and A276 Type 316/316L	(1) A480 is not a materials specification, but a general requirements standard (2) A276 Type 304/304L is not listed in Table 2.2a, instead, A276 Type 316/316L is listed
Sheet 4		
Rib Insert	Indicate component on drawing	
Sheet 5		
Source Wire Assembly	Remove 'or equivalent'	
Cover Screw	Specify national consensus material standard(s)	
Lock Cover Assembly	(1) Specify components and materials constituting the assembly (2) Separate drawing may be needed in certificate drawing	(1) Components must be separated and indicated on the drawings (2) All materials should be specified using national consensus standards
Dust Cover Assembly	(1) Specify components and materials constituting the assembly (2) Separate drawing may be needed in certificate drawing	(1) Components must be separated and indicated on the drawings (2) All materials should be specified using national consensus standards
Collar Screw	Specify an alloy	ASTM F837 Group 1 contains several stainless steels. One must be specified

Selector Ring	Specify national consensus material standard(s)	
Lock Slide	Specify a condition for ASTM A564 Type 630	Type 630 is 17-4 PH
Anti-Rotate Lug	List component in bill of materials	
Sheet 6		
Cover Screw	Specify national consensus material standard(s)	
Collar Screw	Specify alloy(s)	ASTM F837 Group 1 contains several stainless steels. Specific alloy(s) must be provided
Lock Cover Assembly	(1) Specify components and materials constituting the assembly (2) Separate drawing may be needed in certificate drawing	(1) Components must be separated and indicated on the drawings (2) All materials should be specified using national consensus standards
Fitting	Specify national consensus material standard(s) and grade(s)/type(s)	(1) Brass is an alloy family covering a wide variety of compositions (2) Specific alloy(s) must be provided, as well as condition(s) (if applicable)
Lock Pin	Specify correct level of hardening	50-55 Rc is below the minima specified in ASTM A681 (60 and 59 for O-1 and A-2 respectively)
Sheet 7		
Rotor Shield	Specify national consensus material standard(s) and grade(s)/type(s)	Table 2.2a specifies ASTM B777 Class 1
Slider Spring	Specify national consensus material standard(s)	
Flat Washer Slider	Specify national consensus material standard(s) and grade(s)/type(s)	(1) Brass is an alloy family covering a wide variety of compositions (2) Specific alloy(s) must be provided, as well as condition(s) (if applicable)
Shaft	Specify national consensus material standard(s) and grade(s)/type(s)	Specific alloy(s) must be provided, as well as condition(s) (if applicable)
Retainer Screw […] Front Plate	Specify national consensus material standard(s)	
Rotor	Indicate component on drawing	
Sheet 8		

Small Rivnut Security Screw	Specify national consensus material standard(s)	
Nut Ring	(1) Remove A480 from list of standards (2) Resolve discrepancy between A276 Type 304/304L and A276 Type 316/316L	(1) A480 is not a materials specification, but a general requirements standard (2) A276 Type 304/304L is not listed in Table 2.2a, instead, A276 Type 316/316L is listed
Hex Bolt	(1) Specify condition for ASTM A593 Type 630 (2) Add ASTM A453 Grade 660 Class D to Table 2.2a and to sections of the SAR referencing the Hex Bolts or remove from list of materials	(1) Condition AH listed in Table 2.2a (2) ASTM A453 Grade 660 Class D has slightly lower mechanical properties than ASTM A593 Type 630 Condition AH
Sheet 9		
Note 1	Specify national consensus material standard(s) and grade(s)/type(s)	Table 2.2a lists U-0.75%Ti, which corresponds to SAE AMS 7730

2. Make the following corrections and edits to Table No. 2.2a:

Correct the form of stainless steel 17-4 PH (Type 630) per ASTM A564 from ‘Plate’ to ‘Bar’.

Correct the minimum tensile strength, yield strength, and elongation of stainless steel 316/316L per ASTM F879 in the CW condition to agree with the minimum values specified in ASTM F879.

Correct the minimum tensile strength, and yield strength of stainless steel 316/316L per ASTM A276 in the annealed condition to reflect the minimum values specified in ASTM A276 for Type 316L.

Correct the minimum tensile strength, yield strength and elongation of stainless steel 304/304L per ASTM A511 to agree with the tensile requirements specified for all austenitic steels in ASTM A511.

Justify the values provided for minimum tensile strength, yield strength, and elongation of stainless steel 303 per ASTM A582. ASTM A582 does not provide minimum tensile properties, thus an alternate standard must be referenced for the minimal tensile properties.

Provide a standard specification and condition for the U-0.75%Ti depleted uranium casting, and justify or correct the minimum tensile properties provided. If a standard is

not available, provide the reference for the material properties provided in Table 2.2a and specify the nominal density of the uranium alloy.

Provide a standard specification, condition, and elongation for the brass alloy 485 bar, and justify or correct the minimum tensile properties provided.

Provide a standard specification, condition, and elongation for the copper alloy 100 sheet/bar, and justify or correct the minimum tensile properties provided.
Provide a condition and the corresponding minimum tensile properties (tensile strength, yield strength, and elongation) for the silicon bronze alloy 655 per ASTM B98.

This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

3. Clearly indicate the Lock Plate and Lock Plate Bolts referenced in Table No. 3.2a on the certificate drawings, and specify the condition of the 17-4 PH stainless steel per ASTM F593 Group 7 in Table No. 3.2a.

   The Lock Plate and Lock Plate Bolts are not referenced on the drawings. The components are classified as important to safety, and as such, should be clearly shown on the certificate drawings. The minimum properties of 17-4 PH stainless steel are dependent on the condition of the material; thus, the condition of the material should be specified in the comments.

   This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

4. Confirm which Source Wire Assembly will be used in the Model No. Sentry 110, Sentry 330, and 867 packages and correct the application accordingly. Provide drawings and materials for the Source Wire Assembly that will be used.

   Section No. 2-10 of the application only specifies the source wire assembly Model 424-14, while drawing R86000 sheets 5 and 6 specify “Model 424-13, -14 or equivalent.” The source wire assembly must be specified. No equivalent is acceptable for this component because it is important to safety.

   In addition, the staff could not obtain SS&D registration MA-1059-S-105-S and CNSC device registrations R-061-1996-'3-2016 or R-061-2032-3-2016 (containing details for the 424-24 source wire assembly). Please provide relevant sections from these documents.

   This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

5. Provide drawings and materials for the source wire assemblies Model 42465-8, 42465-9, and 42465-10.

   Test Plan 180 and Test Plan 195 used source wire assemblies Model 42465-8, 42465-9, and 42465-10, but the Model No. Sentry package is to use Model 424-14. Staff must be

able to compare these different source wire assemblies in order to assess the relevancy of the tests performed in Test Plan 180 and 195 with regards to the Model No. Sentry package.

This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

6. Confirm the choice of materials to be used to fabricate the Source Capsule, and correct Table No. 3.2a accordingly.

   Table No. 3.2a lists Type 304L or 316L stainless steel as the materials for the source capsule, but the IAEA certificate USA/0377/S-96 specifies Type 304 or 304L stainless steel as the source capsule materials. The materials for the Model 60011 and 60012 source capsules to be used in the Model No. Sentry package must conform to IAEA certificate USA/0377/S-96.

   This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

7. Specify whether the polyurethane foam is open cell foam or closed cell foam, and specify tolerances on the density of the 20 pound per cubic foot polyurethane foam in the certificate drawings.

   The properties of the polyurethane foam will have a direct impact on the thermal and mechanical performance of the Model No. Sentry package. The open or closed cell structure of the foam will have an impact on whether oxygen can reach the depleted uranium (DU) shield and cause undesired oxidation. Possible changes in foam density will have an impact on the crush strength of the foam, its ability to absorb energy during a drop, and the properties of the char resulting from the hypothetical fire accident. As a result, the properties of the foam must be better described in the application, and tolerances must be included in the drawings and acceptance criteria for the package.

   This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1) and 10 CFR 71.51(a)(2).

8. Explain the discrepancy between the thermal expansion coefficient provided for the depleted uranium in Table No. 3.2b and that provided in Section No. 2.7.4.5(b)(2) of the application.

   The thermal expansion coefficient used for the depleted uranium in Section No. 2.7.4.5(b)(2) is 14 µin/in °C, but the one provided in Table No. 3.2a for the same material is 20 µin/in °C. Provide the correct thermal expansion coefficient or justify the use of two different values for the same material.

   This information is required by the staff to determine compliance with 10 CFR Part 71.73(c)(4).

9. Provide additional proof that the DU shield does not oxidize during the hypothetical accident condition thermal test (fire).

Oxidation of the DU shield during the hypothetical fire accident may result in the loss of integrity of the shield, and associated loss of shielding ability. Neither thermal testing nor thermal analyses were performed for this package for the following reasons stated in the application:

(a) There are "no openings in the transport package welded body that could result in oxidation of the depleted uranium shield" (Section No. 2.7.4).
(b) Two major factors to limiting this oxidation are the oxygen inhibitive nature of charred polyurethane foam and the packages' "ability to contain the foam once charred" per Section No. 2.7.4.5(a).
(c) "Based on previous empirical data and analyses, […] oxidation of the shield will not occur" per Section 2.7.4.5(c).

Upon review, the staff finds that:

(a) There are a number of holes in the outer shell of the Sentry packages, particularly if the basic configuration is used. The holes are relied upon to allow for out-gassing of the burning polyurethane foam during the hypothetical fire accident, as well as prevent over or under pressurization of the package at all times. As a result, the staff requires additional proof that no oxygen can enter the outer shell and result in oxidation of the DU shield. In particular, once the foam is charred and out-gassing has ceased, oxygen could enter the outer shell and interact with the DU shield that will remain hot for some time after the hypothetical fire accident.

(b) There is no data in the application that clearly shows the oxygen inhibitive nature of the charred foam, and thus staff requires that such data be provided.

(c) Test Plan 80 Report shows that where a crack was present in the shell (analog to a hole), the polyurethane foam burned off and the shield was exposed, which resulted in significant oxidation of the DU shield. Since holes do exist in the shell of the Sentry packages, provide additional explanation as to why such a scenario could not occur.

This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1), 10 CFR 71.51(a)(2), and the requirements of paras. 530, 531 and 656(b)(ii)(I) of TS-R-1.

10. Provide information on the essentially unyielding, horizontal surface.

The Normal Conditions of Transport Free Drop (10 CFR 71.71(c)(7)), Hypothetical Accident Condition Free Drop (10 CFR 71.73(c)(1)), and Hypothetical Accident Condition Puncture (10 CFR 71.73(c)(3)) tests require an essentially unyielding surface.

Supplement the application to provide evidence that the tests were performed on a target that represents an essentially unyielding target.

This information is required by the staff to determine compliance with 10 CFR 71.71 and 10 CFR 71.73.

11. Make the following corrections and changes to the application (see tables below).

Item	Issue/Question	Correction(s)
Test Plan 180 February 2009 Page 21 of 41	4. **2m** (Four-foot) free drop test (10 CFR 71.71(c) (7))	4. **<u>1.2m</u>** (Four-foot) free drop test (10 CFR 71.71(c) (7))
October 2010 - Revision 0 Page 3-6	$\mathbf{Q_{TS}}$ **+** Q_D **=** 39W **+** <u>6W</u> **=** 44.5W	$\mathbf{Q_{TS}}$ **+** Q_D **=** 39W **+** **<u>5.5W</u>** **=** 44.5W
Test Plan 180 March 2009 Page 16	Appendix	Add No.1 to 3 to SAR or delete this Appendix, since reader <u>does not</u> access to your internal network location K:

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

12. Clarify why the radiation level at surface after post test is lower than initial build.

Table No. 4.5.1 from Section No. 4.5 of "Test Specimen TP180E Test Results" indicates a dose rate reading of 39 mrem/hr for post test compared to 51 mrem/hr for the initial build.

Staff also notes that, in Appendix A "Radiation Profile Results," the post test dose rate measurements are below those for initial build dose rate measurements. Explain why the readings decrease after the test, and how the shield was shifted relative to the exterior of the package and not to the source.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51, and the requirements of paras. 530, 531 and 656(b)(ii)(I) of TS-R-1.

13. Verify the inconsistency in the radiation dose rates at the surface for Test Plan 72-S2 and 80 (October 2010 Revision 0 Page 2-35, Section: *(a) Oxidation of Depleted Uranium (DU) Shielding)* and demonstrate that the DU shield oxidization does not progress after the end of the hypothetical accident condition thermal test (fire).

It appears from the test results that, after a slight oxidation of shield (*Test Plan 80 Report, Section 2.12)*, the radiation dose rate is smaller by factor of ten compared to the measurements of *Test Plan Report 72-S2 (Section 2.12)* when no oxidation takes place.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51, and the requirements of paras. 530, 531 and 656(b)(ii)(I) of TS-R-1.

14. Correct the numbering on page 7-6 from Section Nos. 7.3.1.1 to 7.4.1.1.

Staff noticed a numbering discrepancy in Section No. 7.4.1, “Package Transportation by Consignor.”

This information is required by the staff to determine compliance with 10 CFR 71.7.