January 22, 2007

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE MODEL NO. 770 PACKAGE

Dear Ms. Podolak:

By letter dated August 30, 2006, as supplemented on September 20, and October 31, 2006, QSA Global, Inc., submitted an amendment request to the U.S. Nuclear Regulatory Commission for Certificate of Compliance No. 9148.

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 March 16, 2007. Inform us at your earliest convenience, but no later than March 2, 2007, 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. 71-9148 and TAC No. L24020 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) 415-8500.

Sincerely,

/RA/

Jessica M. Glenny, Project Engineer
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9148
TAC No. L24020

Enclosure: Request for Additional Information

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Request for Additional Information
QSA Global, Inc.
Docket No. 71-9148
Certificate of Compliance No. 9148
Model No. 770 Package

By application dated August 30, 2006, as supplemented on September 20, and October 31, 2006, QSA Global, Inc. (QSA) requested approval of the Model No. 770 package. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the amendment. The requested information is listed by chapter number and title in the applicant's safety analysis report (SAR). NUREG-1609, "Standard Review Plan for Transportation Package for Radioactive Material," and Regulatory Guide 7.9, "Standard Format and Content of Part 71 Applications for Approval of Packages for Radioactive Material," were used by the staff in its review of the application.

Each individual RAI describes information needed by the staff for it to complete its review of the application and/or the Safety Analysis Report (SAR) and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

Section 1 General Information

1-1 Explain the method for attaching the supplemental lead shielding.

It is not clear from the descriptions and the drawings provided in the application how the supplemental lead shielding is to be placed in the unit, whether or not it is attached to the depleted uranium (DU) shield, and how it is held in place for the normal and hypothetical accident conditions of transport.

This information is needed to determine compliance with 10 CFR 71.33, 71.47, and 71.51.

1-2 Revise Drawing No. R77090 to show the method and location(s) of attachment of the supplemental lead shield to the DU shielding assembly.

Drawing No. R77090 and the text indicate that supplemental lead shielding may be added as needed to the Model No. 770 (and 770B). However, it is not clear what the distribution of the lead shielding may be within the unit. Additionally, it is difficult to establish the validity of Technical Report 92 in Section 2.12.5 without a detailed sketch illustrating final geometric configuration of the overall source changer assembly. This is because the structural performance and the shielding function of the package are strongly dependent on the total mass of the added lead and its distribution, and the method of attachment.

This information is needed to determine compliance with 10 CFR 71.31(a)(1), 71.33(a)(5), and 71.47.

Section 2 Structural Evaluation

2-1 Revise Section 2 of the application to clearly explain how the porosity in the DU shield is controlled. Identify and justify the criteria used to determine acceptance or rejection of a DU shield and the tests associated with each criterion.

From the proposed addition of 2 inch thick lead supplemental shielding, and from the proposed addition of the Model No. 770B with a reduction in source capacity from that of the Model No. 770, the control of porosity is a significant problem. While dose measurements are made for each packaging as part of the acceptance tests and actual measurements were used in the shielding analysis, the shielding analysis still relies on the assumption that the DU shield will be fabricated so that it will perform its function effectively for the proposed contents of the package (e.g., the transmission ratios). Thus, it is important to understand how porosity is controlled in fabricating the DU shield, including the source(s) of porosity, the range of porosity (pore sizes and pore distribution through the DU) possible, techniques employed to minimize porosity, and so forth (see RAI 8-1).

This information is needed to determine compliance with 10 CFR 71.47.

2-2 Provide physical and mechanical properties data and their variability in the poured DU shielding assembly.

Under the drop test conditions, structural performance and integrity are strongly dependent on the density, porosity and flaw/void distributions within the assembly which, in turn, will affect the center of gravity and mechanical strength of the DU material. These data are required to show that the DU shielding assembly will maintain its structural integrity during drop test conditions.

This information is needed to determine compliance with 10 CFR 71.31, 71.33, 71.35, 71.47, and 71.51.

2-3 Revise Sections 2.6.3 and 2.6.4 to adequately address the affects of reduced and increased external pressure.

It is not clear that the pressure ranges specified in Sections 2.6.3 and 2.6.4 are consistent with the ISO 2999-1999 standard, and necessarily bound the regulatory requirements. For example, Section 2.6.4 of the application states that the sources meet a minimum ISO 2919-1999 classification of Class 3 for pressure, and that “This classification is more limiting than the increased external pressure requirement as it covers 25 kN/m^2 to 2 MN kN/m^2. Therefore the increased external pressure requirements of 20 psi in 10 CFR 71 will not adversely affect the package containment.” Since 10 CFR 71.71(c)(4) specifies an increased absolute external pressure of 140 kPa (approximately 20 psi), it is not clear how the ISO standard requirements necessarily bound the regulatory requirement. Additionally, in the attachment “Revision Description for the Model 770 SAR from Revision 4 to Revision 5,” page 1 of 2, of QSA’s letter dated August 30, 2006, a pressure range of 7 MN kN/m^2 to 2 MN kN/m^2 is indicated. This also should be clarified.

This information is needed to determine compliance with 10 CFR 71.71(c)(3) and (4).

2-4 Justify the linear assumption in the structural response upon impact so that extrapolation of added weight can be made to predict the deformation behavior of the DU due to the extra lead shield attached to the DU in Section 2.12.5, “Normal Conditions of Transport, 1.2m (4-ft) Free Drop Test.”

The structural response of a transportation package is, in general, nonlinear as the structure consists of many components with nonlinear material properties and gaps. Upon impact the interaction between contacting parts is highly nonlinear. It is not clear that extrapolation can be used to predict the structural responses unless the response is completely linear.

This information is needed to determine compliance with 10 CFR 71.31(a) (1) and (2), 71.33, and 71.35(a).

2-5 Justify the scaling factors of 6 - 7% based on the ratio of a maximum lead weight of 55 lbs to the gross package weight of 958 - 968 lbs in Section 2.12.5.

It is not clear that the use of the scaling factors is a valid approach to predict structural performance since the distribution of the 55 lbs lead shielding is unknown (see RAI No. 1-2). The scaling should be used only if the supplemental lead is added uniformly around the DU shield assembly such that the center of gravity of the entire source changer assembly is not altered. In this case, the scaling factor is the ratio of the added lead mass of 55 lbs to the mass of the DU (425 lbs), not the package weight (968 lbs), which turns out to be 13%, not 6 - 7%. This ratio of 13% appears to be too high to justify without additional testing.

This information is needed to determine compliance with 10 CFR 71.31(a) (1) and (2), 71.33, and 71.35(a).

2-6 (a) Describe the type of void or porosity structure that could reasonably be expected in the DU shield that would justify a 2 inch thick supplemental lead shield, and provide justification for the void porosity structure described.

(b) For the void/porosity structure described in (a), provide an evaluation demonstrating that the structural integrity of the DU shield is maintained for the worst drop orientation given the presence of the voids/porosity and 55 lbs lead shield. Justify the selection for the worst drop orientation.

The structural integrity of the DU shield must be maintained during the hypothetical accident drop impact event. Porosity and other material voids within the DU shield will increase the stresses in the DU shield in the vicinity of these voids due to the drop impact forces. The applicant has not evaluated the effect of these increased stresses on the structural integrity of the DU shield.

This information is needed to determine compliance with 10 CFR 71.31(a)(1) and (2), 71.33, 71.35(a), and 71.47.

Section 5 Shielding Evaluation

5-1 Clarify the package conditions for the dose rates reported in Tables 5.1a, d, e, and f.

The second paragraph of Section 5.1.2 of the application states that the values shown in Table 5.1a also demonstrate the dose rates for a package under normal conditions of transport. The regulatory dose rate limits cited in Table 5.1a (and in the other tables listed above) are for the normal conditions of transport. However, the title of Table 5.1a indicates the reported dose rates are for a package under hypothetical accident conditions. The remaining tables have titles that indicate the dose rates are for both normal and accident conditions of transport. Thus, it is not clear what package conditions are represented by the dose rates provided in the tables. Dose rates for normal conditions and accident conditions need to be presented in separate tables and compared to the respective regulatory limits. Section 5.5.1.2 of NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," and Section 5.1.2 of Regulatory Guide (RG) 7.9, "Standard Format and Content of Part 71 Applications for Approval of Packages for Radioactive Material," provide examples of how to present the dose rates for normal and accident conditions. In any case, the table title should match the contents of the table, including the regulatory limits cited in the table.

This information is needed to determine compliance with 10 CFR 71.33, 71.47 and 71.51.

5-2 Confirm that the maximum Transport Index (TI) measured for the package was 0.8.

At the bottom of page 5-1, the application states the maximum TI based on measurements at one meter from the package was 0.8. However, the dose rates provided in Table 5.1a indicate the maximum TI was 5.2. Clarify this discrepancy.

This information is needed to determine compliance with 10 CFR 71.47(a).

5-3 Revise Section 5 of the application to include a complete shielding evaluation of the Model Nos. 770 and 770B. The evaluation should include dose rates under normal and accident conditions for both models and should address DU porosity and supplemental lead shielding.

The dose rates presented in the current shielding section of the application have not changed from those dose rates reported in previous amendments for the Model No. 770 that did not need the additional lead shielding. For a package that experiences transport conditions, particularly the hypothetical accident conditions of transport, the additional shielding may shift position and/or its ability to provide adequate shielding may be adversely affected (by fire, for example). Provide dose rates that consider damage or other adverse affects of the normal conditions and hypothetical accident conditions of transport on packages that use additional lead shielding to meet the dose rate limits in 10 CFR Part 71. The

dose rates should be given for the bounding package conditions. The applicant should also justify the selection of package (shielding) conditions as the bounding package conditions. The remaining shielding analysis should be updated to account for these effects as well. Dose rates should be provided for both the Model No. 770 and Model No. 770B containing a DU shield with the worst possible porosity, since it is not apparent that the dose rates from the Model No. 770 represent or bound the dose rates from the Model No. 770B.

This information is needed to determine compliance with 10 CFR 71.35(a), 71.47 and 71.51.

5-4 Provide Section 5.5.1, referenced on page 5-2 of the application.

The last paragraph on page 5-2 refers to Section 5.5.1 for further information on the Microshield calculations for transmission exposure rates. However, this section is not included with the current application.

This information is needed to determine compliance with 10 CFR 71.47.

5-5 Verify the table references in the paragraph on page 5-3.

The discussion in the paragraph at the bottom of page 5-3 of the application refers to a few tables. However, the table references do not match the discussion in the paragraph. For example, Table 5.1c is referenced for the transmission ratios when those ratios are contained in Table 5.1b. Also, the estimated dose rates for the non-Co-60 sources are stated to be in Tables 5.1d through 5.1g; however, there is no Table 5.1g. Table 5.1f appears to be the table indicated.

This information is needed to determine compliance with 10 CFR 71.47.

5-6 Verify the units of the dose rates in Tables 5.1d through 5.1f.

There is an inconsistency in the units of the dose rates provided for the sources listed in each table and the units of the regulatory limits also shown in the tables. As currently written, the surface dose rates appear to exceed the regulatory limit in one form and not in another form (comparing the value reported in the parentheses and outside the parentheses with the respective regulatory limit value cited in the tables).

This information is needed to determine compliance with 10 CFR 71.47.

5-7 Verify that the dose rates for the Scandium-46 (Sc-46) source listed in Table 5.1f are for the appropriate Sc-46 source strength capacity.

Section 1 of the application specifies the package's source capacity for Sc-46 as 800 Ci. The dose rates appear to have been determined by multiplying the Cobalt-60 (Co-60) dose rates by the ratio of the transmission rates for 800 Ci of Sc-46 versus the rates for the 800 Ci of the Co-60 source. Table 5.1f indicates, however, that the doses are for a capacity of 1000 Ci of Sc-46.

This information is needed to determine compliance with 10 CFR 71.47.

5-8 Confirm that only one method, or relationship, was used to determine surface correction factors (SCF).

Page 5-7 of the application describes the use and determination of SCF. The text indicates that multiple methods were used; however, only one is presented. Further, the method makes reference to a Figure 5.a, but it appears that the reference should be to Figure 5.4a. If multiple methods were used, the application should explain when each method is used and why a particular method is used for certain situations and the others are not used.

This information is needed to determine compliance with 10 CFR 71.47.

Section 7 Package Operations

7-1 Confirm the appropriate order of the sequence of package operations described in Section 7.1.1.2, “Packaging Maintenance and Inspection Prior to Loading,” and Section 7.1.2, “Loading of Contents.”

Some of the operations listed in Section 7.1.1.2, “Packaging Maintenance and Inspection Prior to Loading,” appear to be operations that would, if done before loading the contents, also need to be done after the contents are loaded and should thus also be described in Section 7.1.2, “Loading of Contents,” after the contents have been loaded into the package. An example is the description of operations in paragraph 7.1.1.2.c.

This information is needed to determine compliance with 10 CFR 71.87.

7-2 Confirm the cover plates are secured in place after the source(s) are loaded into the package.

Item No. 3 in paragraph 7.1.2.1.c of the current application, describes the procedures for securing the source(s) into their storage positions and takes the place of Item No. 2 of Section 7.1 in the approved SAR. However, 7.1, Item No. 2 in the approved SAR described installation of the cover plates after shipping caps were installed over the ends of the locked source assemblies. This step is missing in the current application and should be included in the operations description for securing the loaded source(s).

This information is needed to determine compliance with 10 CFR 71.87.

7-3 Clarify the limits referred to in paragraph 7.2.1.2.c on page 7-4 of the application.

Paragraph 7.2.1.2 describes operations in the event radiation levels exceed certain levels; however, the limits the paragraph refers to are not stated in that paragraph nor are they in the preceding paragraphs.

This information is needed to determine compliance with 10 CFR 20.1906 and 71.47.

7-4 Verify that the text of Section 7, “Package Operations,” clearly and consistently indicates that the operations are applicable to the Model No. 770B.

Part of the current amendment request was to include the proposed Model No. 770B as part of the Certificate of Compliance. The SAR text was to be modified to include this proposed model. However, there are places where only the Model No. 770 is mentioned in Section 7 of the application. These places include paragraph 7.2.1.2.e and the first paragraph in Section 7.3. The text in this section (and the application in its entirety) should be modified to include the Model No. 770B where reference to the Model No. 770 is made, or some statement should be provided to indicate that, unless specifically identified otherwise, references to the Model No. 770 include both the Model No. 770 and the Model No. 770B.

This information is needed to determine compliance with 10 CFR 71.87.

7-5 Clarify operations described in paragraph 7.3.1.5 on page 7-5 of the application.

Paragraph 7.3.1.5 describes an operation to check for unauthorized sources in a package to be shipped as empty and appears to be a continuation of the preceding paragraph. The paragraph is not clear as to what the operation will accomplish (i.e., what the outcome will be). If the tube has an obstruction but the radiation levels remain normal, explain the next step in the operation, whether that will be to attempt removal of the obstruction, contacting QSA for further instructions, and/or some other action. Further, it is not clear that the action currently described in the paragraph is sufficient to determine the nature of the obstruction and thus whether or not the package contains any unauthorized sources. As stated in Appendix A1, Section A1.2.4 of NUREG-1609, “Standard Review Plan for Transportation Packages for Radioactive Material,” because of the shielding effectiveness of and the radiation from the DU shield itself, verification by radiation measurements alone may not be sufficient to determine the obstruction is not an unauthorized source.

This information is needed to determine compliance with 10 CFR 71.5 (i.e., 49 CFR 173.428) and 71.87.

7-6 Justify the removal of operations described in paragraph 7.1.d of the approved SAR.

In the current application, operations for transport/loading of multiple source nuclides in the same package has been removed. These operations are currently described in paragraph 7.1.d of the approved SAR. Removal of this operation should be adequately justified, or the description should be included in the appropriate portion of the package operations in Section 7 of the current application.

This information is needed to determine compliance with 10 CFR 71.87.

Section 8 Acceptance Tests and Maintenance Program

8-1 Describe the tests and the acceptance criteria for the quality of the DU shielding assembly in terms of the DU's material properties (e.g., density, porosity distribution, etc.).

The quality of the poured DU shields is apparently highly variable due to porosity or other defects (see RAI 2-1).

This information is needed to determine compliance with 10 CFR 71.31(b) and (c), 71.37(b), 71.85(a) and (c), and 71.93(b).

8-2 Explain the need for paragraph 8.1.1.1.a in the visual inspection part of the acceptance tests.

Paragraph 8.1.1.1.a is a step to remove source assemblies from the package, similar to a step describe in the operations for preparing an empty package for shipment. The current application adds this step to the visual inspection test description given in the approved SAR. However, the need to add this statement is not clear since the visual inspections are done as part of the acceptance tests performed before first use of each packaging.

This information is needed to determine compliance with 10 CFR 71.85.

8-3 Revise paragraphs 8.1.1.1.b and 8.1.1.1.c to specify the applicable drawing for these visual inspections.

The current application proposes to replace Section 8.1.1 of the approved SAR with the proposed paragraphs 8.1.1.1.b and 8.1.1.1.c, which modify the language used to reference the drawing used in these visual inspections. The proposed language is vague and implies that drawings other than those required to be used in the Certificate of Compliance (CoC) may be used for the purpose of these inspections. The proposed paragraphs should reference the necessary drawings explicitly. This can be done by referencing the drawings by their drawing numbers or by using the words "the applicable drawings referenced in the CoC," since the CoC requires the packaging to be constructed in accordance with the drawings it references by drawing numbers.

This information is needed to determine compliance with 10 CFR 71.85.

8-4 Justify removal of the swage coupling test from the structural acceptance tests.

In the current application, the swage coupling test has been removed from the structural tests described in Section 8.1.2 of the approved SAR, now Section 8.1.3 in the application. This test is necessary to verify the performance of an important package component. Removal of this test should be adequately justified, or the SAR should explicitly indicate that this test will continue to be a part of the structural acceptance testing program.

This information is needed to determine compliance with 10 CFR 71.85.

8-5 Justify removal of the lock assembly test from the component acceptance tests.

In the current application, the lock assembly test has been removed from the component tests described in Section 8.1.4 of the approved SAR, now Section 8.1.5 in the application. This test is necessary to verify the performance of an important package component. Removal of this test should be adequately justified, or the SAR should explicitly indicate that this test will continue to be a part of the component acceptance testing program.

This information is needed to determine compliance with 10 CFR 71.85.