

June 21, 2007

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

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9314 FOR THE MODEL NO. 976  
SERIES PACKAGES

Dear Ms. Podolak:

As requested by your application dated October 31, 2006, as supplemented February 27 and May 31, 2007, enclosed is Certificate of Compliance No. 9314, Revision No. 3, for the Model No. 976 Series packages. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

QSA Global, Inc., is registered as the certificate holder for these packages. The approval constitutes authority to use the package for shipment of radioactive material and for the packages to be shipped in accordance with the provisions of 49 CFR 173.471.

If you have any questions regarding this certificate, please contact me or Jessica Glenny of my staff at (301) 492-3285.

Sincerely,

**/RA/**

Robert A. Nelson, Chief  
Licensing Branch  
Division of Spent Fuel Storage and Transportation  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 71-9314  
TAC No. L24038

Enclosures: 1. Certificate of Compliance  
No. 9314, Rev. No. 3  
2. Safety Evaluation Report

cc w/encl: R. Boyle, Department of Transportation  
J. Shuler, Department of Energy

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SAFETY EVALUATION REPORT  
Docket No. 71-9314  
Model No. 976 Series Packages  
Certificate of Compliance No. 9314  
Revision No. 3

## SUMMARY

By application dated October 31, 2006, as supplemented February 27 and May 31, 2007, QSA Global, Inc. (QSA), requested an amendment to Certificate of Compliance No. 9314, for the Model No. 976 Series packages. Based on the statements and representations in the application, as supplemented, the staff agrees that these changes do not affect the ability of the packages to meet the requirements of 10 CFR Part 71.

## GENERAL INFORMATION

By application dated October 31, 2006, supplemented on February 27 and May 31, 2007, QSA submitted an amendment request for the Model No. 976 Series packages to modify the Model No. 976C package configuration to evenly center the inner shield container within the drum overpack. As a result of the re-centering of the inner shield, the Model No. 976C maximum Iridium-192 (Ir-192) capacity will increase from 800 curies (Ci) to 1,250 Ci. Additionally, QSA is requesting the addition of Selenium-75 (Se-75) and Ytterbium-169 (Yb-169) as authorized contents for the Model No. 976 Series packages, as well as minor modifications to the cork and shield assemblies for some of the other package designations.

The Model No. 976 Series packages have six configurations authorized for the transportation of Type B quantities of special form sources. The Model No. 976 Series package configurations are called the 976A, 976B, 976C, 976D, 976E, and 976F.

As a result of the amendments requested, QSA either added new drawings or updated revisions of older drawings. Drawing Nos. R97615-1 and R97615-2 are new additions to the drawings identified in the certificate of compliance. The drawings revised by the amendment request are Drawing Nos. R976C, 97615, R1911, R3018, R97623, and R97623A. Details of the specific changes included in the drawings are provided in the structural evaluation of this safety evaluation report.

## STRUCTURAL

The objective of the structural evaluation and review of the requested amendment is to verify that the Model No. 976 Series packages have adequate structural integrity to meet the requirements of 10 CFR Part 71. The requested package design modifications have been reviewed and evaluated to ensure that the packages will perform adequately under the specified tests for normal conditions of transport (NCT) and the hypothetical accident conditions (HAC).

Drawing No. R976C, Revision F, revises the thickness of the impact absorbing cork above the inside of the inner shield container while re-centering the shield container within the drum overpack. This change resulted in a shift of the center of gravity of the package by 2", which reflects a decrease at the top and an increase at the bottom of the package of cork thickness. As a result of this change, two new drawings, Drawing Nos. R97615-1, Revision B, and R97615-2, Revision A, were added to show the new top outer and bottom cork inserts. Drawing No. R97615, Revision C, of the top outer cork insert, was revised to allow space for the mating of the lid weld blocks spaced around the perimeter of the outer cork. Drawing No. R3018, Revision D, of the Model No. 3018 shield container revises the overall package height by 0.2" as a result of the addition of lead spacers used between the inner shield body and the inner container shield insert and steel spacers/shims that are used under the lid attachment brace of the package. Drawing Nos. R97623 and R97623A were revised to increase the tolerances on the dimensions of the inner cavities from  $\pm 1/8"$  to  $\pm 1/4"$  to allow for the ease of insertion of components. Drawing No. 1911, Revision D, of the Model No. 1911 shield container, was revised to increase the maximum weight of the tungsten insert from 12 to 13 lbs; however the maximum weight of the entire package when used with this insert still remains the same.

The amendment request did not change the maximum package weights for the Model No. 976 Series packages. The center of gravity for the Model No. 976C shifted 2" as a result of re-centering its inner shield container within the drum overpack. There have been no changes in the structural materials of the packages. Minor modifications have been made to some of the dimensions and material tolerances. There have been no changes in the maximum normal operating pressure, fabrication methods, closure system for the package, or the handling requirements for the Model No. 976 Series packages.

While there are increased temperatures shown in Table 2.6.1.a, under NCT, as a result of the changes in the material content in the Model No. 976 Series packages, there has been no impact on the structural aspects of the current system as designed with regard to heat. None of the modifications in the amendment have a structural impact on the considerations originally made and currently reflected in the package design. The effects of cold, reduced external pressure, increased internal pressure, vibration, water spray, free drop, corner drop, compression or penetration under normal conditions of transport have no measurable impact on the modified Model No. 976 Series packages.

The increased temperatures of the materials at the initiation of the fire test, as shown in the revised Table 2.7.4.1.a, had no impact on the structural integrity of the package for either temperature or pressure. The evaluation identified the free drop test as having the most potential to be impacted by the requested changes to the packages. Specifically, a decrease of cork thickness in one area could have an impact on the response of the package to that test. QSA indicated that the previous free drop test results could be used to evaluate the modifications in the cork thickness to a lesser amount. Previous testing performed on the Model No. 976A package configuration, with the Model No. 855 shield, which is nearly twice the mass of the Model No. 3056 shield used with the Model No. 976C package configuration, showed that 2" of cork material was adequate to protect the contained radioactive materials. Therefore, this aspect of the requested amendment has been found to be acceptable under HAC.

Based on the review of the statements and representations in the amendment application, the staff concludes that the structural design has been adequately described to reflect the modifications. The staff has evaluated the information contained in the amendment and concludes that the Model No. 976 Series packages have adequate structural integrity to meet the requirements of 10 CFR Part 71.

## THERMAL

The objective of the thermal review is to determine whether the performance of the Model No. 976 Series packages have been demonstrated to meet the requirements of 10 CFR Part 71 under NCT and HAC.

The maximum content activity for the Model No. 976 Series packages is 2875 Ci of Ir-192. The corresponding decay heat generation rate for the content activity is approximately 25 W. Cooling of the package is through free convection and radiation.

A summary of the various configurations for the Model No. 976 Series packages is provided in the table below.

Table 3.1 Model No. 976 Series Package Information

<u>Model No. Configuration</u>	<u>Shield Design</u>	<u>Weight (lbs)</u>	<u>Maximum Decay Heat (W)</u>
976A	855	300	20
976B	3015	190	7
976C	3056	190	25
976D	3018	190	10
976E	3078	226	20
976F	1911	263	20

The applicant calculated the maximum surface temperature of the Model No. 976 Series packages in the shade, for an ambient temperature of 100°F (38°C) and a decay heat input of 25 watts using textbook equations which were evaluated and accepted by the staff in the initial application and in this amendment. The steady-state temperature of the package surface was determined to be 109°F (42.7°C). This temperature is below the allowable temperature limit specified in 10 CFR 71.43(g) (122°F or 50°C) and will not adversely affect the package or contents during normal conditions of transport. Temperatures calculated for the package are well below the melting temperatures of all safety critical components. The applicant also calculated the maximum surface temperature for the conditions stated in 10 CFR 71.71(c)(1) for an ambient temperature of 100°F (38°C) and solar insolation. The steady-state temperature of the package surface was determined to be 195°F (90.3°C). The applicant determined that the safety related components of the Model No. 976 Series packages are not affected by the cold conditions tests (-40°F or -40°C) in 10 CFR 71.71(c)(2).

The maximum normal operating pressure was calculated by the applicant to be 22.8 psi, which is within the performance envelope of the package.

The applicant assessed HAC thermal performance of the Model No. 976 Series packages by comparing the condition of the packages with other packages that were previously tested or evaluated. The estimated surface temperatures during the fire ranged from 195°F (90.3°C) to 1472°F (800°C), while the estimated shield container temperatures during the fire ranged from 229°F (109.4°C) to 318°F (159°C).

Based on the thermal tests performed on other similar packages (including Model Nos. 650L and 3605B) the applicant concluded that the performance of the Model No. 976 Series packages would be within acceptable limits.

The outer drum components are vented to the atmosphere. However, some shields do have small cavities with gasket seals. The applicant evaluated the maximum pressures for these designs and determined that these pressures would not affect the packages' performance.

The staff performed a confirmatory analysis in a previous approval of an earlier design configuration. The applicant used the same thermal methodology and assumptions, which was previously confirmed by the staff in a prior approval. The staff has found reasonable assurance that the methodology is still applicable to this new proposed design configuration.

Based on the review of the statements and representations in the application, the staff finds that the thermal design has been adequately described and evaluated and has a reasonable assurance that the package meets the thermal requirements of 10 CFR Part 71.

## SHIELDING EVALUATION

The staff reviewed the proposed amendment to ensure that the Model No. 976 Series packages' design will continue to meet the radiation requirements of 10 CFR Part 71 under NCT as well as HAC.

As part of the amendment, the applicant proposed changes that affect the package shielding design. These changes include: 1) shifting the position of the Model No. 3056 shield container 2" closer to the top of the Model No. 976C package configuration, 2) increasing the allowed contents limit for Ir-192 from 800 Ci to 1250 Ci in the Model No. 3056 shield container, 3) adding Se-75 and Yb-169 to the list of allowed contents for each of the shield containers loaded in the Model No. 976 Series packages, and 4) allowing multiple isotope contents to be loaded in the same package. The proposed limits for the additional contents are given in Table 1.2a of the amendment. Other changes were also proposed but do not affect the package shielding design.

For the analysis, the applicant relies upon the results from previous NCT and HAC tests to demonstrate package performance. Testing was performed on packages containing the Model Nos. 855 and 1911 shield containers, which are heavier shield containers than the Model No. 3056 shield container. Therefore, the results of the NCT and HAC tests for the Model Nos. 855 and 1911 shield containers are bounding. Staff reviewed the change to the Model No. 976C package configuration and finds that the previous NCT and HAC tests are still bounding for the proposed change to this package configuration. The results of those tests indicate that there is no significant change in dose rates for a package experiencing HAC conditions versus an as-fabricated package. Therefore, the applicant provides dose rates for the Model No. 976C package configuration in the as-fabricated condition.

The staff reviewed the dose rates measured for the Model No. 976C package configuration as modified in the amendment. The dose rates include the affect of increasing the quantity limit of the allowable contents. The staff noticed that, overall, the dose rates for the modified package configuration and greater source quantity increased as would be expected. The staff also noticed, however, what appears to be an anomalous result in the dose rates. The surface dose rate at the package bottom is less than for the currently approved configuration and contents while the 1-meter dose rate for the package bottom is greater than for the currently approved package configuration. The staff notes, though, that the dose rates for the Model No. 976C package configuration, as modified, demonstrate significant margin in meeting the 10 CFR Part 71 dose rate limits. Furthermore, dose rate measurements are performed prior to every shipment of the package and only packages that meet the regulatory dose rate limits will be transported. Therefore, based upon these considerations, the staff has a reasonable assurance that the Model No. 976C package configuration, as modified, meets the radiation requirements of 10 CFR Part 71.

The applicant does not provide additional dose rate measurements or analyses for the proposed new contents (the Se-75 and Yb-169). The applicant states that the photon energies of the Se-75 and Yb-169 are less than the Ir-192 photon energies. The applicant further limits the curie amount of these radioisotopes to quantities that are less than or equal to the Ir-192 quantity proposed for each shield container. Therefore, the dose rates from the proposed Se-75 and Yb-169 contents will be bounded by the dose rates from the Ir-192 contents. The staff reviewed the proposed contents and quantities and finds that, due to the quantity limits proposed by the applicant and the differences in photon energies for the radioisotope contents, use of the Ir-192 dose rate measurements is sufficient to demonstrate compliance with the radiation requirements of 10 CFR Part 71. The staff finds the addition of Se-75 and Yb-169 as allowable contents in the proposed quantities to be acceptable. Regarding the proposal to allow multiple isotope contents to be loaded in the same package, the applicant limits the total contents by taking the ratio of the quantity of each isotope to be loaded in the package versus the total package capacity for that isotope and restricting the summation of the ratios of the loaded contents to less than or equal to unity. Based upon this restriction and the previously justification for the addition of the Se-75 and Yb-169 to the allowable contents, the staff finds the loading of multiple isotope contents in the same package to be acceptable.

Based upon its review of the statements and representations in the application, the staff finds that the shielding design has been adequately described and evaluated and has a reasonable assurance that the package meets the radiation requirements of 10 CFR Part 71.

## PACKAGE OPERATIONS

As part of the amendment application, the applicant proposed changes to Section 7 of the SAR. These changes include the addition of the proposed new contents, allowance for and quantity limits for multiple isotope contents loaded in the same package, modifications to operations resulting from proposed package design modifications, and other minor changes determined by the applicant to be necessary for clarity and consistency. The staff reviewed the proposed changes and finds that the package operations, as modified in the amendment, continue to meet the requirements of 10 CFR Part 71 and remain adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

## CONCLUSION

Based on the statements and representation contained in the application, as supplemented, and the conditions listed above, the staff concludes that the Model No. 976 Series packages meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9314, Revision No. 3,  
on June 21,, 2007.