CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9314	3	71-9314	USA/9314/B(U)-96	1	OF	6

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. ISSUED TO *(Name and Address)*

QSA Global, Inc.
40 North Avenue
Burlington, MA 01803

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

QSA Global, Inc., consolidated application dated December 6, 2005, as supplemented.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

(1) Model No.: 976 Series

(2) Description

The Model No. 976 Series packages are designed for use as transport packages for Type B quantities of radioactive material in special form. The Model No. 976 has six versions called the 976A, 976B, 976C, 976D, 976E and 976F. The Model 976A package contains a 855 shield container. The Model 976B package contains a 3015 shield container. The Model 976C package contains a 3056 shield container. The Model 976D package contains a 3018 shield container. The Model 976E package contains a 3078 shield container. The Model 976F package contains a 1911 shield container. All versions of the package include a 16 gauge stainless steel 20 gallon drum, four 3/8" - 16 UNC x ¾" long stainless steel lid closure bolts, a clamp band with M8 stainless steel bolt, and cork inserts to position and support the individual shield containers within the package. All Model No. 976 Series packages measure 19 ¾" in diameter by 21 ¼" tall.

The shield containers are described as follows:

855 - An outer carbon steel shell, rigid polyurethane potting material, uranium shield, eight titanium "J" tubes, source stop, top and bottom support plates, and a gasketed lid which is secured with eight 3/8" - 16 UNC x 5/8" long stainless steel hex head bolts. Approximately 11 ¼" in diameter at the base by 11 ¾" tall (without the eyebolt).

5(a) (2) (Description continued)

3015 - A lead shield container surrounded on the sides and partially on the top by an outer stainless steel jacket. The steel jacket incorporates two stainless steel lifting handles. The container includes a lower depleted uranium shielding insert encased in stainless steel, a tungsten capsule holder, an upper lead insert, a lead top shield plug with a stainless steel extension, and a gasketed shield lid which secures to the shield container body by two M10 stainless steel screws and washers. Measures approximately 7 ½" in diameter (including the handle bosses) by 10.1" tall.

3056 - A lead shield container which incorporates stainless steel strapping, handle bosses and lifting handles along with a combination lower depleted uranium insert and upper lead insert with ten stainless steel "J" tubes. The lead insert is partially enclosed by stainless steel. The "J" tubes are covered with tube caps and the tube caps are further covered by a stainless steel "top hat" or lid secured to the container by an M12 steel rod and retaining nut. Measures approximately 7.7" in diameter (including the handle bosses) by 10.4" tall.

3018 - A lead shield container surrounded on the sides and partially on the top by an outer stainless steel jacket. The steel jacket incorporates two stainless steel lifting handles. The container includes a lower depleted uranium shielding insert encased in stainless steel and upper lead insert with four stainless steel "J" tubes. The "J" tubes are covered with tube caps. The shield inserts are secured to the shield body by means of a stainless steel bracket and two M10 stainless steel bolts and washers. The metal bracket also incorporates a stainless steel disk above the "J" tubes which further protects the tube caps during shipment. Measures approximately 7 ½" in diameter (including the handle bosses) by 11" tall.

3078 - A stainless steel encased, depleted uranium shield container which includes two stainless steel lifting handles. The shield container incorporates a stainless steel encased depleted uranium upper shield plug that is inserted into the shield body over an optional stainless steel or aluminum source holder can. The upper shield insert is secured to the shield body by a stainless steel cover bolted above the shield insert by four M8 stainless steel screws. Measures approximately 6.1" in diameter by 8.4" tall.

1911 - A stainless steel encased, lead shield container which includes a bolted shield lid and an M10 stainless steel lifting eyebolt. The shield lid is secured to the shield container body by four stainless steel M8 bolts and washers. The inner shield cavity incorporates either a depleted uranium upper and lower shield insert, a tungsten upper and lower shield insert or a lead upper and lower shield insert. Additional handling source stainless steel, aluminum or tungsten capsule holders or cans may be used in the shield insert cavities. Measures approximately 8" in diameter by 8 ¾" tall (without the eyebolt).

5(a) (2) (Description continued)

The following table gives the maximum package weight.

Model No.	Maximum Package Weight (lbs)
976A	300
976B	190
976C	190
976D	190
976E	226
976F	263

(3) Drawings

This packaging is constructed in accordance with the following AEA Technology or QSA Global Drawings.:

R97608, Rev. E, Sheet 1	20 Gallon Drum Model 976
RCLM009, Rev. B, Sheets 1-2	Clamp, Band
R97637, Rev. A, Sheet 1	Cork Spacer Top Inner
R97623, Rev. B, Sheet 1	Bottom Inner Cork Insert
R97623A, Rev. B, Sheet 1	Bottom Inner Cork Insert
R97615, Rev. C, Sheet 1	Top Outer Cork Insert
R97615-1, Rev. B, Sheet 1	Top Outer Cork Insert
R97615-2, Rev. A, Sheet 1	Bottom Cork Insert
R97616, Rev. B, Sheet 1	Bottom Outer Cork Insert
R976A, Rev. D, Sheet 1	976A Type B Package with 855 Shield Container
R85590, Rev. E, Sheets 1-6	Model 855 Source Changer
R976B, Rev. E, Sheet 1	976B Type B Package with 3015 Shield Container
R3015, Rev. C, Sheets 1-3	3015 Shield Container
R976C, Rev. F, Sheet 1	976C Type B Package with 3056 Shield Container
R3056, Rev. D, Sheets 1-4	Model 3056 Shield Container Top Level Assy
R976D, Rev. E, Sheet 1	976D Type B Package with 3018 Shield Container
R3018, Rev. D, Sheets 1-4	3018 Shield Container
R976E, Rev. E, Sheet 1	976E Type B Package with 3078 Shield Container
R3078, Rev. D, Sheets 1-4	Model 3078 Shield Container Top Level Assembly
R976F, Rev. C, Sheet 1	976F Type B Package with 1911 Shield Container
R1911, Rev. D, Sheets 1-8	Model 1911 Shield

(b) Contents

(1) Type and form of material

Iridium-192, Selenium-75, and Ytterbium-169 as sealed sources that meet the requirements of special form radioactive material.

(2) Maximum quantity of material per package

Model No.	Inner Shield	Nuclide	Maximum Capacity[1] (Ci)	Maximum Capacity (TBq)
976A	855	Ir-192	1,000	37
		Se-75	1,000	37
		Yb-169	865	32
976B	3015	Ir-192	350	12.95
		Se-75	350	12.95
		Yb-169	350	12.95
976C	3056	Ir-192	1,250	46.25
		Se-75	1,250	46.25
		Yb-169	1,000	37
976D	3018	Ir-192	500	18.5
		Se-75	500	18.5
		Yb-169	500	18.5
976E	3078	Ir-192	1,000	37
		Se-75	1,000	37
		Yb-169	1,000	37
976F	1911	Ir-192	1,000	37
		Se-75	1,000	37
		Yb-169	1,000	37

[1] Output curies are determined by measuring the source output at 1 meter and expressing its activity in curies derived from the following: 0.48 R/h-Ci Iridium-192 at 1 meter. (Ref: American National Standard N432-1980, "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography.")

6. Tensile and yield strength for the materials of construction must comply with the following values:

Material	Tensile Strength	Yield Strength
Depleted Uranium	65 ksi	30 ksi
Copper	25 ksi	9 ksi
Steel (nominal)	53 ksi	36 ksi
Stainless Steel	75 ksi	30 ksi
Tungsten	142 ksi	109 ksi
Cork (minimum)	80 psi	NA
Lead (^{96}Pb/^{4}Sb)	3,990 psi	NA

7. The sources shall be secured in the shielded positions of the packaging in accordance with the Package Loading requirements contained in Section 7 of the application, as supplemented. For "J" tube style shield containers, the flexible cable of the source assembly and source cap must be of sufficient length and diameter to provide positive positioning of the source in the shielded position.

8. The name plate must be fabricated of materials capable of resisting the fire test of 10 CFR Part 71 and maintaining its legibility.

9. In addition to the requirements of Subpart G of 10 CFR Part 71:

   (a) The package shall be prepared for shipment in accordance with the Package Operations in Section 7 of the application, as supplemented, and,

   (b) Each packaging must be acceptance tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Section 8 of the application, as supplemented.

10. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

11. Revision No. 2 of this certificate may be used until June 30, 2008.

12. Expiration date: June 30, 2010.

REFERENCES

QSA Global, Inc., consolidated application dated December 6, 2005.

Supplements dated December 13 and December 15, 2005; October 31, 2006; February 27, and May 31, 2007.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

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

Date: June 21, 2007

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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 ±1/8" to ±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

Model No. Configuration	Shield Design	Weight (lbs)	Maximum Decay Heat (W)
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 noted 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.