NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9314	10	71-9314	USA/9314/B(U)-96	1 OF	4

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 0077hich 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., application dated March 26, 2018, 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 transport packages include three versions called the 976A, 976C, and 976F, all designed for Type B quantities of radioactive material in special form. All versions of the Model No. 976 package include an inner shield container and a stainless steel drum with cork liner inserts to position and support the individual shield containers within the package. The drum is a 20 gallon capacity drum, with a 19 3/4" (502 mm) diameter and a height of 21 1/4" (540 mm), with 16 gauge, 0.06" (1.5 mm) thick 304 series stainless steel walls. The drum lid is secured in place with a lid closure band, and four 3/8" - 16 x 3/4" (19 mm) long 304 series stainless steel lid closure bolts. The lid bolts are inserted through four 3/8" (9.5 mm) diameter holes spaced equidistantly around the drum diameter. The drum lid has four 304 series stainless steel blocks measuring 1" (25.4 mm) by 1" (25.4 mm) by 3/4" (19 mm) tall; the steel blocks are welded on all four sides to the underside of the drum lid and the block welds are on the full length of the block on each side. Alternatively, the drum lid can be constructed to replace the welded, threaded blocks with floating nuts retained in square tubes that are welded to the lid. The cork liner inserts provide shield stability during transport and act as a thermal insulator in case of fire.

The Model 855 inner shield container for the Model No. 976A package is comprised of a depleted uranium shield, secured within a steel welded housing, capable of loading up to eight individual sources with titanium "J" tubes. Locking assemblies secure the sources at the bottom of the "J" tubes.

The Model 855 is approximately 11 1/4" (286 mm) in diameter at the base by 11 3/4" (298 mm) tall, without the eyebolt height. Copper separators are installed around all exposed surfaces of

5.(a)(2) Description (Continued)

the depleted uranium to prevent any steel-uranium interactions inside the shield container. The shield is further retained in place by polyurethane foam to fill the voids between the shield and the inner surfaces of the Model 855 housing. The cover is bolted to the top of the shield container during shipment. The Model 855 shield weighs a maximum of 225 lbs (102 kg) and contains a maximum of 135 lbs (61 kg) of depleted uranium.

The Model 3056 inner shield container for the Model No. 976C package is a lead shield pot measuring approximately 7.7" (196 mm) in diameter (including the handle bosses) with a height of 10.4" (264 mm). The Model 3056 inner shield container includes a depleted uranium inner core shield to provide additional shielding in close proximity to the source positions during transport. An insert contains the "J" tubes which are closed by tube caps. The Model 3056 container includes a cover to protect the source tubes and caps during shipment, stainless steel strapping, handle bosses, lifting handles and weighs a maximum of 114 lbs (52kg).

The Model 1911 inner shield container for the Model No. 976F package is a lead shield pot with a maximum thickness of 2 1/4" (57 mm), encased by a welded steel cylinder, 8" (203 mm) in diameter, 8 3/4" (222 mm) high and a maximum weight of 184 lbs (84 kg). The shield lid is secured to the shield container body by four stainless steel bolts and washers. The Model 1911 container is designed to be lifted by a steel eyebolt which is threaded onto a recess in the shield lid. The eyebolt is removed after loading the Model 1911 into the Model No. 976 F package cork lined drum and during transportation. There are three inner shield insert configurations to allow for different source loading applications within the Model 1911 shield container: 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.

The maximum package weights of the Model No. 976 Series Transport Packages are indicated below:

Model No.	Maximum Package Weight
976A	300 lbs (136 kg)
976C	190 lbs (86 kg)
976F	263 lbs (119 kg)

(3) Drawings

The Model No. 976 Series transport package is constructed in accordance with the following AEA Technology or QSA Global, Inc. drawings:

R97600, Rev. E, sheets 1–4	Model No. 976 Transport Package
R97608, Rev. K, sheet 1	20 Gallon Drum Model 976

(3) Drawings (Continued)

RCLM009, Rev. C, sheet 1	Clamp Band
R85590, Rev. K, sheets 1-6	Model 855 Source Changer
R3056, Rev. H, sheets 1-4	Model 3056 Shield Container Top Level Assy
RCLM011, Rev B	Clamp Band
R1911, Rev. H, sheets 1-6	Model 1911 Shield

The Model Nos. 976A, 976C and 976F drum and cork inserts, and the Model 1911 inner shield container, are authorized for fabrication.

5.(b) Contents

(1) Type and form of material

Iridium-192, Selenium-75, and Ytterbium-169 as special form sealed sources.

(2) Maximum quantity of material per package

Model No.	Inner Shield	Nuclide	Maximum Capacity[1] Ci	Maximum content weight (grams)
976A	855	Ir-192	1,000 (37 TBq)	176
		Se-75	1,000 (37 TBq)	
		Yb-169	865 (32 TBq)	
976C	3056	Ir-192	1,250 (46.25 TBq)	220
		Se-75	1,250 (46.25 TBq)	
		Yb-169	1,000 (37 TBq)	
976F	1911	Ir-192	1,000 (37 TBq)	220
		Se-75	1,000 (37 TBq)	
		Yb-169	1,000 (37 TBq)	

[1] For Ir-192, the maximum capacity is based on output curies which 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.
For Se-75 and Yb-169, the maximum capacity is based on the content curies contained in the radioactive source(s).

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

   (a) The package shall be prepared for shipment and operated with the sources secured in the shielded positions of the package, in accordance with Chapter 7 of the application, as supplemented.

   (b) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8 of the application, as supplemented.

   (c) No new fabrication of the Model Nos. 855 and 3056 inner shield containers is authorized. Replacement components are provided as part of service and maintenance for existing units. Service operations for the Model No. 3056 shield container are limited to non-welded components.

   (d) Minimum values for the tensile and yield strengths of construction materials are indicated in Table 2.2.a of the application.

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

8. Revision No. 9 of this certificate may be used until July 31, 2019.

9. Expiration date: July 31, 2024.

REFERENCES

QSA Global, Inc., applications dated: March 26, 2018 and August 8, 2018.

Supplements dated: September 24, 2018, September 25, 2018, and November 7, 2018.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Ilka Berrios, Chief (Acting)
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: 3/14/19

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

SAFETY EVALUATION REPORT
Docket No. 71-9314
QSA Global, Inc.
Model No. 976-Series
Certificate of Compliance No. 71-9314
Revision 10

Summary

By applications dated March 26, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18089A096) and August 8, 2018 (ADAMS Accession No. ML18226A090), as supplemented on September 24, 2018 (ADAMS Accession No. ML18277A155), September 25, 2018 (ADAMS Accession No. ML18275A118), and November 7, 2018 (ADAMS Accession No. ML18318A323), QSA Global Inc., (QSA or the applicant) requested that the U.S. Nuclear Regulatory Commission (NRC) approve a revision and five-year renewal to the Certificate of Compliance (CoC) No. 9314 for the Model No. 976 Series package.

In addition to editorial changes to ensure consistency with the new information, QSA revised five drawings, added one new drawing, and requested changes to the safety analysis report (SAR) referenced in the certificate of compliance as described in sections throughout this safety evaluation report (SER).

The staff used the guidance in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," as well as associated ISG documents to perform the review of the proposed packaging changes. Based on the statements and representations in the application, as supplemented, and the conditions listed in the following chapters, the staff concludes that the package meets the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

1.0 GENERAL INFORMATION

1.1 Packaging Description

The Model No. 976 Series packages are designed for use as transport packages for Type B quantities of special form radioactive material. The general design of the packages consist of a steel jacketed lead and/or depleted uranium shield container housed within a cork lined, stainless steel drum.

The Model No. 976 Series packages house three different inner shield containers. The shield containers are comprised of lead, tungsten, depleted uranium or a combination of these materials.

1.1.1 Model 855 Shield

The Model 855 shield container (Model 855) is comprised of a depleted uranium shield secured within a steel welded housing. The shield allows for the loading of up to eight individual sources within titanium J-tubes in the shield. The sources are attached to the end of a source wire assembly and prevented from movement during transport by means of lock assemblies which secure the radioactive sources at the bottom of the eight J-tubes. A polyurethane foam is also used to fill the voids between the shield and the inner surfaces of the Model 855 steel housing. The Model 855 shield weighs a maximum of 225 lbs (102 kgs) and contains a maximum of 135 lbs (61 kgs) of depleted uranium.

1.1.2 Model 3056 Shield

The Model 3056 is 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 lid secured to the container by a steel rod and retaining nut. The shield incorporates two lifting handles 180 degrees apart on the sides. The Model 3056 includes a cover which protects the source tubes and caps during shipment. The shielding components are clamped together by means of a steel cradle or sheath and a flange on the upper insert. The Model 3056 shield weighs a maximum of 114 lbs (52 kgs).

1.1.3 Model 1911 Shield

The Model 1911 is a stainless steel encased, lead shield container which includes a bolted shield lid and a stainless steel lifting eyebolt. The shield lid is secured to the shield container body by four stainless steel 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. The maximum weight of the Model 1911 shield is 184 lbs (84 kgs).

The main shielding for the Model 1911 is provided by a lead shield body encased by a welded steel cylinder. The design incorporates one of three insert configurations within the source cavity to allow for different source loading applications within the Model 1911 shield. Approval of all three shield insert configurations is for the same Ir-192 radioactive capacity of 1,000 Ci. The inner shield insert combinations are as follows:

i. Option 1: DU Plug/Insert Configuration (P1992 and P1991)
ii. Option 2: Lead Plug/Insert Configuration (L1992 and L1991)
iii. Option 3: Tungsten Plug/Insert Configuration (T1992 and T1991)

1.1.4 Package Assembly

The stainless steel drum with cork liner inserts to provide shield stability during transport. The drum provides structural strength to the overall package while the cork serves to limit inner shield movement during transport as well as act as a thermal insulator in case of fire.

The drum includes a removable lid which is secured in place using a lid closure band and four stainless steel lid bolts. The lid bolts are inserted through four holes spaced equidistantly around the diameter of the drum. The drum lid has four stainless steel blocks welded on all four

sides to the underside of the lid. The block welds are on the full length of the block on each side. This application proposes an additional construction for the drum lid. The drum lid can alternatively be constructed to replace the welded, threaded blocks with floating nuts retained in square tubes that are welded to the lid. Both constructions (blocks/floating nuts) are drilled and tapped to accept the same sized bolt.

The drum uses a closure band that can be carbon steel or stainless steel and associated hardware. There are two versions of the closure band described in SAR Drawing Nos. RCLM009, Revision C and RCLM011, Revision B.

1.2 Contents

The applicant requested an increase in the maximum content weight for the 976F model from 3.3 grams to 220 grams. The overall package weight for the 976F remains essentially unchanged (change represents 0.18% of overall package weight). This change is made for consistency with the other package models (976A and 976C) and has no adverse impact on the package integrity.

1.3 Drawings

QSA revised five drawings and added one new drawing showing the proposed changes. The revised drawings showing the transport packaging include:

R97600, Rev E, Sheets 1-4	Model 976 Transport Package
R97608, Rev K, Sheet 1	20 Gallon Drum, Model 976
R1911, Rev H, Sheets 1-6	Model 1911 Shield
R3056, Rev H, Sheets 1-4	Model 3056 Shield Container Top Level Assy
R85590, Rev K, Sheets 1-6	Model 855 Source Changer

New drawing:

RCLM011, Rev B	Clamp Band

Revisions to R97600, R1911, R3056 and R85590, which stem from the August 8, 2018 application, remove the ASME B18 hardware requirement from the drawings, however, material specification requirements for the lid screw hardware which are important to safety remain on SAR Drawing No. R97600, Revision E.

Further, revised SAR Drawing No. RCLM011, Revision B to address concerns regarding the lug welding specified on the drawing, which stem from the September 25, 2018 submittal. This updates the drawing to add weld specifications to the drawing to reflect the construction of the clamp bands used in the testing under Test Plan 214 (TP-214) report. Note 5 is also added to the drawing to state that weld sizes shown are minimum and can be larger. This was added to reduce unnecessary component rejection for production clamp bands that may be received with oversized welding, while ensuring the same or better performance when used on the 976 Series packages.

2.0 STRUCTURAL AND MATERIALS EVALUATION

The objective of the structural evaluation is to verify that the structural performance of the package is adequately demonstrated to meet the requirements of 10 CFR Part 71. The NRC staff limits the scope of the structural review to the areas of the SAR that are affected by the new contents.

In revision 9, the applicant proposed to use an alternative drum lid closure band for the Model No. 976 Series Type B(U) containers, in addition to the band currently approved under the Drawing No. RCLM009, Revision C in SAR revision 8. The applicant stated that an alternative is needed because the currently approved closure band is no longer available from its supplier, and the alternative is required to support continued shipments of this package.

In order to justify the use of the alternative drum lid closure band described in the SAR Drawing No. RCLM011 Revision B, the applicant performed a series of structural drop tests under the TP-214 program. The applicant submitted the results of the TP-214 program with conclusions that the use of the alternative drum lid closure band has no significant impact on the package performance, and that the package continues to be in compliance with Type B package standards, found in 10 CFR Part 71, for transport.

2.1 Normal Conditions of Transport

The applicant performed six drop tests under normal conditions of transport in the TP-214 program to assess an alternate clamp band construction for the transport package designs. The applicant stated that the test package performance was under the following configurations: (i) the same configuration as previously reviewed and accepted by the NRC, but without use of a clamp band on the drum, (ii) the same configuration as previously reviewed and accepted, but without use of a clamp band on the drum with floating nuts replacing the fixed nuts which were welded to the cover, and (iii) the same configuration as previously reviewed and accepted, but with the approved clamp band replaced by a commercially available clamp band. More detailed information regarding the test configuration, orientation, results and evaluation criteria for the TP-214 program, as well as the previously accepted TP-90 and TP-163 programs, were provided in SAR Section 2.12.

Those six drop tests with the package configuration and test results are provided in Table 1 of this SER.

Based on the drop test results from the TP-214 program, as well as the previously accepted test results from the TP-90 and TP-163 programs, the applicant made an assessment that the use of the alternative drum lid closure band will not adversely impact the structural performance of the Model 976 packages. The NRC staff reviewed the applicant's test plan, test results, evaluation criteria and the assessment. Based on the review, the NRC staff determines that the use of the alternative drum lid closure band described in the SAR Drawing No. RCLM011 Revision B is acceptable, and it complies with the requirements of 10 CFR 71.71(c)(7).

Table 1: Summary of the Test Results under Normal Conditions from the TP-214 Program

Specimen	Test Performed	Test Results
Test No. 1	Without clamp band	No damage identified. Cover remained secured, bolts intact, no lid/base gaps.
Test No. 2	Without clamp band	Slightly crushed cover and drum edge, about 0.5-inch. Cover remained secured, bolts intact, no lid/base gaps.
Test No. 3	Without clamp band	No damage identified. Cover remained secured, bolts intact, no lid/base gaps.
Test No. 4	Without clamp band	Slight flattening of drum outer wall. Cover remained secured, bolts intact, no lid/base gaps.
Test No. 5	Without clamp band fixed lid nuts replaced with floating lid nuts	Minor crushed cover and drum edge. Cover remained secured, bolts intact, no lid/base gaps.
Test No. 6	Approved clamp band replaced with commercially available clamp band	Minor crushed cover and drum edge. Cover remained secured, bolts intact and no lid/base gaps.

2.2 Hypothetical Accident Conditions of Transport

Six drop tests were performed under the hypothetical accident conditions for the TP-214 program to assess an alternate clamp band construction for the transport package designs. The test specimens consisting of separate drum/cork inserts with a shield container were tested to the free drop and puncture tests. The applicant indicated that the Model 855 shield containers were used in two previous separate free drop and puncture tests under Test Plan 90 (TP-90) program, which was previously reviewed and accepted by the NRC staff.

Those six drop tests with the drop orientations and test results are provided in Table 2 of this SER.

The applicant observed that the three test specimens (Test No. 2, Test No. 5 and Test No. 6) showed sustained pronounced deformation at the cover edge; however, the applicant also observed that: (i) the covers for all test specimen remained attached to their drums, and (ii) the source assemblies contained within the Model 855 shielded container were unaffected and fully secured.

Based on the drop test results from the TP-214 program, as well as the previous test results from the TP-90 and TP-163 programs, the applicant made an assessment that the use of the alternative drum lid closure band would not adversely impact the structural performance of the Model 976 packages under the hypothetical accident conditions.

Table 2 - Summary of Test Results under Hypothetical Accident Conditions from the TP-214 Program

Specimen	Test Performed	Test Results
Test No. 1	9 meter (30 foot) drop with bottom surface orientation	(1) Slight compression dent on outer side wall and drum base. (2) Cover remained secured and bolts intact.
	1 meter (40 inch) puncture with bottom surface orientation	(1) No additional damage. (2) Model 855 shield container undamaged from post-drop inspection.
Test No. 2	9 meter (30 foot) drop with bottom surface orientation	(1) Significantly crushed cover and drum edge. (2) Cover remained secured, bolts intact. (3) No lid/base gaps.
	1 meter (40 inch) puncture with bottom surface orientation	(1) No additional damage. (2) Model 855 shield container undamaged from post-drop inspection.
Test No. 3	9 meter (30 foot) drop with bottom surface orientation	(1) Slight outer drum wall compression. (2) Cover remained secured, bolts intact. (3) No lid/base gaps.
	1 meter (40 inch) puncture with bottom surface orientation	(1) No additional damage. (2) Model 855 shield container undamaged from post-drop inspection.
Test No. 4	9 meter (30 foot) drop with bottom surface orientation	(1) Significant flattening of drum outer side wall. (2) Cover remained secured and bolts intact. (3) No lid/base gaps.
	1 meter (40 inch) puncture with bottom surface orientation	(1) Imprint of puncture billet on drum. (2) No additional damage. (3) Model 855 shield container undamaged from post-drop inspection.
Test No. 5	9 meter (30 foot) drop with bottom surface orientation	(1) Two gaps between cover and drum created approximately 180 degrees apart. Each gap is about 0.3 inch wide at maximum, about 6 inches long tapering down to no gap. (2) Cover remained secured and bolts intact.
	1 meter (40 inch) puncture with bottom surface orientation	(1) No additional damage. (2) Model 855 shield container undamaged from post-drop inspection.
Test No. 6	9 meter (30 foot) drop with bottom surface orientation	(1) Significant cover & drum edge crushed. (2) Cover remained secured and bolts intact. (3) No lid/base gaps. - Cover remained secured, bolts intact. - No lid/base gaps.
	1 meter (40 inch) puncture with bottom surface orientation	(1) No additional damage. (2) Model 855 shield container undamaged from post-drop inspection.

The NRC staff reviewed the applicant's test plan, test results, evaluation criteria, and observations provided in the SAR Section 2.12 Appendix. Based on the review, the NRC staff determines that the use of the alternative drum lid closure band described in the SAR Drawing No. RCLM011, Revision B is acceptable under hypothetical accident conditions, and complies with the requirements of 10 CFR 71.73(c)(1) and (3).

2.3 Materials Evaluation

The staff reviewed the amendment of the Model 976 Series package to understand any changes to the materials used in important-to-safety components. All changes impacting materials pertained to the revised certification drawings.

The various Model 976 Series package designs are differentiated based on inner shield design, spacer configurations and activity capacities. The general design of the package is a steel jacketed lead and/or depleted uranium shield container housed within a cork lined, stainless steel drum and associated lid. The drum lid and body are clamped to each other using a closure band (clamp) fabricated of either carbon steel or stainless steel and associated hardware.

In this amendment, the applicant requested approval of SAR Drawing No. RCLM011, Revision B, which details an alternative construction for the closure band used for the drum body and lid. The new closure band consists of a ring with welded lugs, which are bolted together at a pre-specified torque. The staff confirmed that the new drawing specifies minimum mechanical properties for the closure band ring and lugs. Further, the staff confirmed that the weld specification and bolt torque requirements are also properly identified in SAR Drawing No. R97600, Revision C, which in turn references SAR Drawing No. RCLM011, Revision B. The applicant provided TP-214 to demonstrate the structural performance of the package with the alternate drum lid closure band - see Section 2 of this SER. The test specimens used in TP-214 were constructed in accordance with the application's drawings and certificate holder's approved quality assurance program. Therefore, the materials used for testing reflect those that would be used for transport and considered acceptable for accurately demonstrating package performance.

As part of the addition of SAR Drawing No. RCLM011, Revision B, the applicant also had to revise SAR Drawing No. R97600 (to Revision E) for the Model 976 transport package in order to reference the alternative drum lid closure band. The staff confirmed that the revised drawing is clear and no other revisions were made.

The applicant also submitted a revision to the stainless steel drum design (SAR Drawing No. R97608, Revision K), which allows for an alternate construction of the drum lid to replace the current welded, threaded blocks with a welded stainless steel tube housing threaded floating nuts. The staff verified that the revised drawing includes weld specification and inspection, as well as material requirements for the square tube and floating nut components of the drum lid. The applicant provided TP-214 to demonstrate the structural performance of the alternate construction of the revised drum lid - see Structural Evaluation of this SER. The test specimens used in TP-214 were constructed in accordance with the application's drawings and certificate holder's approved quality assurance program. Therefore, the materials used for testing reflect those that would be used for transport and considered acceptable for accurately demonstrating package performance.

The staff notes that TP-214 also included testing of a package configured without a closure band, i.e., with just the bolt down cover. The intent of the testing was to determine if the closure band is necessary to ensure compliance with the requirements of 10 CFR Part 71. After evaluating the results of the testing, the applicant concluded this configuration may not meet all requirements of 10 CFR Part 71. Additional thermal testing would be required to make a full assessment. Therefore, the staff notes that the clamp continues to be important to safety, other than the specific clamp subcomponents identified in the SAR Drawing No. RCLM011,

Revision B. The staff confirmed that SAR Drawing No. RCLM011, Revision B is consistent with this conclusion.

2.4 Evaluation Findings

Based on review of the statements and presentations in the application, the NRC staff determined that the applicant adequately described and evaluated the use of the alternative drum lid closure band and demonstrated that it has no significant impact on the package performance. The NRC staff concludes that the package maintains adequate structural integrity to meet the structural requirements in 10 CFR Part 71.

Based on a review of the statements and representations in the application, the NRC staff concludes that the structural design has been adequately described and evaluated, and that the package has adequate structural integrity to meet the requirements of 10 CFR Part 71.

3.0 THERMAL EVALUATION

There were no changes that affected the package's thermal evaluation.

4.0 CONTAINMENT

There were no changes that affected the package's containment evaluation.

5.0 SHIELDING EVALUATION

The objective of this review is to verify that the 976 series package provides adequate protection against direct radiation from its contents and that the package design meets the external radiation requirements of 10 CFR Part 71 under normal conditions of transport and hypothetical accident conditions.

As part of the amendment, the applicant proposed the following change:

> *"Revised Maximum content weight (grams) for 976F from 3.3 to 220. Content weight for the 976F can be similar to the 976C based on sources transported. The overall package weight for the 976F remains unchanged. This change is made for consistency and has no adverse impact on the package integrity"*

The applicant didn't provide any shielding calculation for increasing content from 3 grams to 220 grams. The staff reviewed the Model No. 976F package configuration as modified in the amendment and previous amendments. The package weights and isotope maximum capacities for the 976F is shown in SAR Table 1. The isotope maximum capacity remain the same as previous approved amendments. The weight of the package is 119 kg and adding 220 grams content, does not change overall weight. The structure of the content of the Model No. 976 series was not credited in the previous amendments in shielding analyses. Therefore the shielding analyses for increase in weight of content is the same as previous amendments. Therefore, based upon these considerations, the staff has a reasonable assurance that the Model No. 976F package configuration, as modified, meets the radiation requirements of 10 CFR Part 71.

6.0 CRITICALITY EVALUATION

There were no changes that affected the package's criticality evaluation.

7.0 PACKAGE OPERATIONS

The applicant made changes in Chapter 7 of the application related to the lid closure band alternatives to ensure that the package will be prepared for shipment and operated in a manner consistent with the package design.

The primary changes to SAR Chapter 7 include ensuring proper verification of the address lid closure band alternatives (lid closure blocks or floating nuts). The procedure involves very similar steps to that of the lid closure blocks which were already accounted for with the package. Additional details can be found in the revised drawings themselves, SAR Drawing Nos. RCLM009, Revision C and RCLM011, Revision B.

7.1 Findings

The staff confirmed that the operating procedures include appropriate language to verify that proper verification has taken place.

The staff reviewed and evaluated the revised procedures for the lid closure band alternatives. Based on the statements and representations in the application, the staff concluded that the package operations meet the requirements of 10 CFR Part 71, and that they are adequate to assure the package will be operated in a manner consistent with its evaluation for approval. Further, the certificate is conditioned to specify that the package must be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7 of the SAR, as supplemented.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM REVIEW

Chapter 8 of the application identifies the acceptance tests and maintenance programs to be conducted on the Model No. 976 series package and verifies their compliance with the requirements of 10 CFR Part 71.

9.0 CONDITIONS

The staff made editorial changes to improve the readability of the CoC. The CoC includes the following condition(s) of approval:

The following new and revised drawings were incorporated into the certificate of compliance:

The revised drawings showing the transport packaging include:

R97600, Sheets 1-4, Rev E	Model 976 Transport Package
R97608, Sheet 1, Rev K	20 Gallon Drum, Model 976
R1911, Sheets 1-6, Rev H	Model 1911 Shield
R3056, Sheets 1-4, Rev H	Model 3056 Shield Container Top Level Assy
R85590, Sheets 1-6, Rev K	Model 855 Source Changer

New drawing:

RCLM011, Rev B	Clamp Band

Date of application in 3.(b) was revised to reflect the renewal application date.

The description in 5.(a)(2) was updated to reflect the addition of an alternative lid closure band and to remove specific reference to ASTM 240.

The maximum content weight for the Model 976F in 5.(b)(2) was changed to 220 grams.

Content 8 was revised to list the correct date of expiration of the previous certificate.

Content 9 was revised to reflect the new expiration date of the certificate as a result of this renewal.

The references section was updated to include the applications for the two amendments dated March 26, 2018 and August 8, 2018, as supplemented on September 24, 2018, September 25, 2018, and November 7, 2018.

10.0 CONCLUSIONS

Based on the statements and representations contained in the application, as supplemented, and the conditions listed above, the staff concludes that the design has been adequately described and evaluated, and the Model No.976 Series package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 976 Series, Revision No. 10.