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
9296	11	71-9296	USA/9296/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 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

Safety Analysis Report for the Model No. 880 Series Transport Packages, Revision No. 12, dated June 2017.

4. CONDITIONS

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

5.

Packaging

(1) Model No. 880 Series Packages

(2) Description

The Model No. 880 series packages are designed for use as radiography exposure devices (or source changers) and as transport packages for Type B quantities of radioactive material in special form. The Model No. 880 series packages have four versions called the 880SC, 880 Delta, 880 Sigma, and the 880 Elite. The 880 Delta and the 880SC have a maximum capacity of 150 Curies of Iridium-192 or 150 Curies of Selenium-75, the 880 Sigma has a maximum capacity of 130 Curies of Iridium-192 or 150 Curies of Selenium-75, and the 880 Elite has a maximum capacity of 50 Curies of Iridium-192 or 150 Curies of Selenium-75. The Delta and Sigma versions are identical and the Elite has a lighter weight depleted uranium shield. The 880SC version is identical to the Delta version except for a different lock plate assembly for the front and rear plates. There are three versions of an optional jacket to facilitate the use of the 880 Delta, Sigma and Elite packages as a radiography device/source changer and transport package. The 880SC can only use the Version 1 jacket.

The 880 Delta, 880 Sigma, and 880 Elite versions of the package, without the jacket, are cylindrical in shape with a diameter of 5 inches (127 mm) and a length of 13 5/16 inches (338 mm). With the Version 1 of the jacket, the shape of the package is an extruded triangle 9 inches (229 mm) high, 7 ½ inches (191 mm) wide, and 13 5/16 (343 mm) inches long. With the Version 2 of the jacket, the package measures 13 ½ inches (343 mm) long by 6 inches (152 mm) wide by 11.33 inches (288 mm) tall. With the Version 3 of the jacket, the package measures approximately 13 ½ inches (343 mm) long by 6 inches (152 mm) wide by 9.7 inches (246 mm) tall.

5.(a) (2) Description (continued)

The 880SC version of the package, without the jacket, is cylindrical in shape with a diameter of 5 inches (127 mm) and a length of 15 ¼ inches (387 mm). With Version 1 of the jacket, the only one that can be used, the shape of the package is an extruded triangle 9 inches (229 mm) high, 7 ½ inches (191 mm) wide, and 15 ¼ inches (387 mm) long.

The weight of the Delta and Sigma versions is 46 pounds (21 kg) without the jacket, 52 pounds (24 kg) with Version 1 of the jacket and 55 pounds (25 kg) with Version 2 or 3 of the jacket. The weight of the Elite version is 37 pounds (17 kg) without the jacket, 42 pounds (19 kg) with Version 1 of the jacket, and 45 pounds (20 kg) with Versions 2 or 3 of the jacket. The weight of the 880SC is 46 lbs (21 kg) without the jacket, and 52 pounds (24 kg) with Version 1 of the jacket.

The major components of the packages consist of a welded stainless steel cylindrical body, a depleted uranium shield, a containment system, and optional jackets. The Delta, Elite, and Sigma versions have a stainless steel rear plate with a locking assembly and a stainless steel front plate with a shielded port. The 880SC version has lock assembly plates and a shipping plug assembly.

The welded cylindrical body consists of a 5 inch (127 mm) diameter, 0.06 inch (1.5 mm) wall tube shell with 0.12 inch (3 mm) end-plates. A U-bracket is welded to each end-plate and is located on the inside cavity of the shell tube. The depleted uranium shield is centrally located within the welded body between the end-plate and is fastened to each U-bracket by a 0.37 inch (9.5 mm) diameter titanium shield pin. A U-shaped copper spacer fills the gap between the shield and the U-bracket. An S-shaped titanium source tube is cast into the center of the shield to provide a cavity for the source wire assembly and shipping plug assembly to travel through during use.

For the Delta, Sigma, and Elite versions, the front and rear plates are attached to the welded body with four tamperproof screws through rivnuts assembled into end-plates. The rear plate assembly consists of a source locking mechanism fastened to the rear plate. The front plate assembly consists of a shielded port mechanism contained within the front plate.

For the 880SC, front and rear locking plate assemblies are attached to the welded body with four tamperproof screws through rivnuts assembled into end-plates.

These locking assemblies, which are interchangeable, are used to secure a source wire assembly on one end of the package and a shipping plug assembly on the opposite end of the package. The locking plate assembly consists of a locking mechanism, consisting of a keyed plunger lock, fastened to the plate. The keyed plunger lock can only be engaged when the source wire and shipping plug assemblies are located in the fully shielded position.

5.(a) (2) Description (continued)

For the 880SC version, a shipping plug assembly is loaded into the other locking plate assembly on the opposite side of the package. During transport and storage, this shipping plug assembly provides additional shielding to the package and it is only removed during radiography operations.

An optional polyurethane jacket covers the package cylinder, provides a handle and a stable base, and is attached to the shell cylinder either by rivets or screws located outside the shield cavity area. Version 1 of the jacket has a handle section that contains a wire molded in for additional reinforcement. Version 2 of the jacket incorporates wheels on the base to facilitate movement during use as a radiography exposure device. Version 3 of the jacket incorporates a PM-Tag assembly used for unit tracking purposes.

(3) Drawings

The packaging is constructed in accordance with the QSA Global, Inc., drawings R88000, Rev. W, sheets 1-6, and R88095, Rev. A, sheets 1-2, R880SC, Rev. E, sheets 1-6.

(b) Contents

(1) Type and form of material

Iridium-192 as a sealed source which meets the requirements of special form radioactive material.

Selenium-75 as a sealed source which meets the requirements of special form radioactive material.

(2) Maximum quantity of material per package

150 Curies (5.55 TBq) (output) Ir-192 for the Model No. 880 Delta and 880SC.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Delta and 880SC.

130 Curies (4.81 TBq) (output) Ir-192 for the Model No. 880 Sigma.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Sigma.

50 Curies (1.85 TBq) (output) Ir-192 for the Model No. 880 Elite.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Elite.

Output curies for Ir-192 are determined by measuring the source output at 1 meter and expressing its activity in curies derived from the following: 0.48 R/(hr-Ci) (Ref: American National Standards Institute N432-1980, “Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography”).

(3) Maximum weight: 18 grams.

(4) Maximum decay heat: 3 Watts.

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

(a) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8.0 of the application; and,

(b) The package shall be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7.0 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. 10 of this certificate may be used until September 30, 2018.

9. Expiration date: June 30, 2021.

REFERENCES

QSA Global, Inc., application "Model 880 Series Type B(U)-96 Transport Package", Revision No. 12, dated June 2017.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: September 12, 2017.

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

SAFETY EVALUATION REPORT
Docket No. 71-9296
Model No. 880 Series Packages
Certificate of Compliance No. 9296
Revision No. 11

SUMMARY

By application dated January 13, 2017, as supplemented June 29, 2017, QSA Global, Inc. (QSA or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9296, for the Model No. 880 Series Packages. QSA requested adding a new optional "Version 3" jacket design to the packaging. QSA also requested a clarification to Condition No. 5(a)(2) of the certificate to reflect that the jacket can be attached with either rivets or screws.

Staff reviewed these changes and concludes that they do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

EVALUATION

QSA requested to use a third optional jacket (Version 3) to facilitate operator handling and source tracking of three of the four Model 880 transportation package. The Version 3 jacket incorporates a PM-Tag assembly unit used for tracking. This assembly, including antennas in the handle support, lithium-ion batteries and other electronics, is sealed in a watertight plastic box located in the base of the jacket. Details associated with the batteries and electronics are not included on the drawings as they have no impact on the package integrity and are not expected to be installed or replaced by the users of the package.

Drawing No. R88000 has been updated to Revision W to list the jackets, jacket rivets, and sealant as Not Important to Safety (NITS). The maximum package weights, with the heaviest jacket attached, are specified also on sheet 1 of drawing R88000, Revision W. QSA rescinded its request to add Version 3 of the optional jacket to the Model 880SC package design. As such, Drawing R880SC drawings remain at Revision E and have not changed. Whereas there are three versions of the jacket for use on the Model Nos. 880 Delta, 880 Sigma and 880 Elite packages, the Model 880 SC can use only the version 1 jacket design.

The applicant describes jacket Version 3 as being interchangeable with other jackets already approved for use with the Model 880 transportation package. All jackets are NITS, optional, made of a polyurethane material and to some degree protect the transportation package with respect to the free drop requirements. The applicant stated that Version 3 weighs 3 lbs more than Version 1 and weighs as much as jacket Version 2. This new jacket does not exceed the weight at which any of the packages were previously drop tested. However, staff noted that, in Table 1.2A of the application, jacket weights were not fully consistent due to rounding.

The jacket Version 3 was drop tested (Test Plan 216) with the Model 880. This portion of the application was not reviewed as the jacket is optional, NITS, and the total package weight does not exceed the overall weight of the package at which it was tested.

Thermal Evaluation under Normal Conditions of Transport (NCT):

The Version 3 jacket with a PM-tag is NITS, as said above, and its use does not change the previously approved decay heat of the contents which remains approximately 3 Watts as described in Table 1.2.B of the application. However, the Version 3 jacket introduces another heat source, produced when the tag electronics are turned on and when the batteries are being charged, in addition to the decay heat from the radioactive source. Section 2.6.1 of the application describes that the Model 880 with the Version 3 jacket can be transported in two configurations that can affect the package compliance with the heat conditions under NCT. The first configuration is the Model 880 Series using the Version 3 jacket transported outside of the charging box. The applicant submitted Technical Report 318 as Appendix 3.6.1 to the application which demonstrates, through temperature tests, that the maximum temperature of the Model 880 using the Version 3 jacket in configuration 1 is 48°C. The second transportation configuration places the Model 880 with the Version 3 jacket inside a charging box where the lithium-ion batteries are charging during transport. In this configuration, Section 3.4.1.2 of the application and Technical Report 318 state that, in still air and shade, the maximum surface temperature of the Model 880 is 50°C. The staff concludes that, with the use of the Version 3 jacket with lithium-ion batteries which add an additional heat source to the package, the Model 880 Series will meet the requirements of 71.43(g).

The applicant demonstrated in Section 2.6.2 that, under NCT cold conditions, an ambient air temperature of -40°C in still air and shade will have no adverse effect on the lithium-ion batteries in the Version 3 jacket, and therefore no adverse impact on the previously approved safety of the Model 880 Series package. Section 2.6.2 states that the batteries comply with 49 CFR 173.185 and retain integrity after repeated exposure to -40°C.

The staff concludes that, because the Version 3 jacket is optional and NITS, and the lithium-ion batteries do not adversely impact the results of the NCT hot and cold tests, the Model 880 with the Version 3 jacket meets 10 CFR Part 71 NCT conditions.

Thermal Evaluation under Hypothetical Accident Conditions (HAC):

The applicant did not perform an updated thermal test of the package since the new Version 3 jacket is optional and NITS. However, the applicant did perform an analysis of the new Version 3 jacket itself under HAC to determine the effect the lithium-ion batteries may have on the package. In Section 3.5 of the application, as supported by Section 2.7.4, the applicant states that, under the HAC thermal test, the individual cells contained within the battery pack would be expected to exceed the threshold temperature needed to exhibit a thermal runaway.

The applicant notes that, based on DOT/FAA/TC-TN 15/17 report referenced in Section 2.1.4, the severity of a cell thermal runaway event will depend upon a number of factors, but it is assumed for the analysis that all four batteries are fully charged which would conservatively cause the most severe thermal runaway reaction.

In Section 2.7.4, the applicant describes what may occur during a thermal runaway reaction for a fully charged cell, including:

- Cell internal temperature increases can reach temperatures in excess of 600°C (1,110°F).
- Cell vent gases may ignite.

- The expected package temperature exterior to the shell could be expected to increase to ~ 1,000°C.

The staff finds that, although a thermal runaway could lead to these high temperatures, temperatures do not reach the 1,400°C melting temperature of the shell of the Model 880 package. Additionally, this temperature increase in the package shell will be in localized to a small area surrounding and in contact with the individual battery pack cells that come into direct contact with the base of the package shell. Again, this value is below the melting point of 304L stainless steel of 1,400°C. The staff also understands that the cell vent gases are not self-igniting and there must be sufficient oxygen in the surrounding environment to sustain combustion as well as an ignition source. During the thermal test, the battery pack is protected by the jacket and the 880 body weldment. Access to oxygen would therefore require combustion of the jacket material and breach of the battery pack case prior to accessing the individual lithium-ions cells contained within the watertight case.

The staff has reviewed the applicant's analysis and agrees with the applicant's conclusion that, based on the information related to lithium-ion cells under thermal runaway conditions, no failure or breach of the Model 880 package shell weldment will occur even if all cells in the battery pack undergo thermal runaway during the HAC thermal test.

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

CONDITIONS

Condition No. 3.(b) has been updated to reflect Revision No. 12 of the application, dated June 2017.

Condition No. 5.(a)(2) has been modified to include Version 3 of the jacket, reflect the use of either rivets or screws to attach the jackets, and specify that the Model 880SC can use only the Version 1 of the jacket design.

Condition No. 5.(a)(3) has been updated to include the latest revisions of the drawings.

Condition No. 8 has been updated to allow continued use of the previous revision of the certificate for approximately one year.

The expiration date of the certificate has not been changed. The references section of the certificate has been updated to include the June 2017 application.

CONCLUSION

Based on the statements contained in the application, and the conditions listed above, the staff concludes that the changes indicated do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9296, Revision No. 11,
On September 12, 2017.