

September 8, 2006

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

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9035 FOR MODEL NUMBER 680-OP  
TRANSPORT PACKAGE (TAC NOS. L23897 AND L23921)

Dear Ms. Podolak:

As requested by your application dated August 29, 2005, as supplemented October 25, 2005, February 20, August 1, August 11, and August 15, 2006, enclosed is Certificate of Compliance (CoC) No. 9035, Revision No. 20, for the Model No. 680-OP. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR §71.17 or 49 CFR §173.471. The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR §173.471. Registered users may request by letter to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me at (301) 415-1179 or Stewart W. Brown of my staff at (301) 415-8531.

Sincerely,

**/RA/**

Christopher M. Regan, Acting Chief  
Licensing Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 71-9035

Enclosures: 1. CoC No. 9035, Rev. No. 20  
2. Safety Evaluation Report  
3. Registered Users List

cc w/encls 1 & 2: R. Boyle, Department of Transportation  
J. Schuler, Department of Energy  
Registered Users  
RAMCERTS

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## SAFETY EVALUATION REPORT

Docket No. 71-9035  
Model No. 680-OP Transport Package  
Certificate of Compliance No. 9035  
Revision No. 20

### SUMMARY

By application dated August 29, 2005, as supplemented by letters dated October 25, 2005, February 20, August 1, August 11, and August 15, 2006, AEA Technology QSA Inc./QSA Global Inc., (QSA Global or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9035, for the Model No. 680-OP transport package. The applicant requested CoC No. 9035 be amended to: (1) reflect new ownership by QSA Global, and (2) include revised design drawings. The applicant, to support its request, submitted a consolidated safety analysis report (SAR) by application dated August 29, 2005.

Based on the statements and representations in the application, the staff finds that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

### EVALUATION

#### 1.0 GENERAL INFORMATION

By application dated August 29, 2005, as supplemented by letters dated October 25, 2005, February 20, August 1, August 11, and August 15, 2006, QSA Global requested an amendment to CoC No. 9035, for the Model No. 680-OP transport package. The applicant requested CoC No. 9035 be amended to: (1) reflect new ownership by QSA Global, and (2) include revised design drawings.

The applicant, in support of its request, provided a consolidated application dated August 29, 2005. The staff reviewed the consolidated application and concluded that the application incorporated the changes to the SAR that were previously referenced in CoC No. 9035.

The applicant submitted the following drawings in support of this amendment request:

<u>Drawing Title</u>	<u>Drawing Number</u>
Model 680-Projector	R68090, Rev. H (Sheets 1-7)
Model 680-OP	R680-OP, Rev. G (Sheets 1-7)

The staff has concluded that these drawings will not affect the ability of the Model No. 680-OP transport package to meet the requirements of 10 CFR Part 71.

## 2.0 STRUCTURAL

A potential fabrication deficiency was identified for approximately 300 previously manufactured source packages. The potential deficiency was related to the certification of the welders who made all the welds on the packages, and particularly the welds attaching the source shield to braces which position the source shield inside the housing. The original fabrication drawings specified that all welds be inspected to the acceptance criteria of the American Welding Society (AWS) Code D 1.1-"Structural Welding." This requirement implied, through invoking the use of AWS D1.1 as the governing welding code, that the welders themselves would also be AWS Code certified per the provisions of the D 1.1 Code. However, this provision was not specifically indicated on the fabrication drawings. Consequently, approximately 300 source packages manufactured prior to 2006 and all the transportation overpacks manufactured from 1998 to 2006 were manufactured by welders who may not have been certified per the provisions of the governing AWS welding code.

The question of the suitability of the affected welds for continued service was examined. The applicant provided the detailed results of the tests (to support NRC certification) which had previously been performed on one source package itself and seven other source packages with overpacks, all of which had been constructed using welders who may not have been certified. Additionally, the applicant provided a synopsis of the operating experiences with the welds that had been in service in these packages.

During manufacture, the source package welds were visually inspected on a sampling basis up until 1995. From 1995 onward, the welds received 100 percent inspection due to small lot sizes. The overpack welds have been inspected on a lot sample basis. Approximately 15 to 20 percent of the overpack welds were thus examined to the Code criteria. The inspection criteria were based on the provisions of AWS D1.1, Sections 5.24, 6.9, and others.

Out of the population of welds examined from the approximately 300 packages manufactured, only seven source packages had welds that failed to meet the Code acceptance criteria. Most of these were repaired/reworked for acceptance. Rejections on overpack welds since 1999 included six non-conformance reports. In three cases they were non-conforming due to too many welds and dispositioned use-as-is. The others were repaired/reworked. This rejection rate is low, which demonstrates that the overall quality of the welding was adequate, even though the welders may not have been properly certified.

NRC regulation 10 CFR 71.73 requires that a transportation package be evaluated for impact resistance by means of a drop test onto an unyielding surface, from a height of 9 meters (m) (30 feet), while the package is at a temperature of minus 28.9 degrees Celsius (EC) (minus 20 degrees Fahrenheit (EF)) or lower. Additionally, other drop tests are conducted from lesser heights. The licensee conducted 9 m (30-foot) drop tests on one source package without an overpack and seven others with the overpack installed. These packages were from regular production units.

During these tests, the licensee cooled each package by placing it into "dry ice" (frozen carbon dioxide) for sufficient time to ensure that the packages were colder than a desired maximum (high) temperature of minus 40 EC (minus 40 EF). Note that this desired test temperature is 11.1 EC (20 EF) colder than the regulatory requirement. The actual temperature of most of the source packages at the time they were drop tested ranged well below the desired maximum (high) temperature of minus 40 EC (minus 40 EF), with some packages being between minus 56.7 EC (minus 70 EF) and minus 80 EC (minus 112 EF) when dropped from 9 m (30 feet). These test temperatures were verified by before-and-after-drop temperature measurements of the individual packages. This range of achieved test temperatures makes the drop tests a very severe test of the weld quality. This is due to the fact that the package welds, in all likelihood, were well below the ductile-to-brittle transformation temperature for the carbon steel used to manufacture the source package housing, braces, and attaching welds. At such low temperatures, any linear (crack-like) type weld flaw would be expected to propagate under the impact load imposed by the drop test.

However, in every case, the package welds survived the drop tests without failure. This result provide evidence that the package welds are of sufficient quality to withstand the required design accident conditions. It is especially notable that the one source projector that was dropped 9 m (30 feet) without the protective overpack installed survived without damage to any welds.

The applicant also reported that, over a 20 year period, no package or overpack welds have failed or otherwise been discovered to be damaged or defective as a result of normal service.

The staff finds that the licensee-conducted cold drop tests of the packages were beyond the severity of the regulatory required tests. The fact that no welds failed as a result of these severe tests and that a significant percentage of all welds have been inspected per the Code requirements provides reasonable assurance that the existing package welds are capable of continued service without danger of failure. The staff further notes that all future welds will be produced by welders certified in accordance with the provisions of the AWS D 1.1 Code. Thus, no further remedial action is warranted.

In addition, the staff evaluated the lifting devices. The transportation package is designed to be lifted by the base of the overpack using a forklift or by slinging. The applicant evaluated the maximum stress on the base of the overpack through analysis. For this lifting analysis, the applicant modeled the base as a box section between the two overpack feet which is 0.81 m (32 inches (in.)) long, 0.48 m (19 in.) wide, and 0.38 m (15 in.) deep with a steel thickness of 0.15 cm (0.06 in.). The moment of inertia calculated for the cross-section is  $10,406 \text{ cm}^4$  ( $250 \text{ in}^4$ ). Using the total weight of the Model No. 680-OP,  $P = 2,780 \text{ Newtons (N)}$  (625 lbs), the length of the base between the two forks,  $L = 0.23 \text{ m}$  (9 in.), and half the height of the box section,  $c = 0.19 \text{ m}$  (7.5 in.), the maximum elastic stress that occurred at the loading point of the fork is calculated as 0.29 mega-Pascal(MPa) (42 lbs/in<sup>2</sup> (psi)). However, the staff performed confirmatory evaluations on the local stress, using a local thin plate model which resulted in substantially higher stress. In the staff's model, the bending moment of inertia of the wood base is  $1.66 \text{ cm}^4$  ( $0.04 \text{ in}^4$ ) (rather than  $10,406 \text{ cm}^4$  ( $250 \text{ in}^4$ )), conservatively

discounting the thin steel sheet. The maximum bending moment at the liftfork when subjected to a uniformly distributed load of 0.011 MPa (1.57 psi) is 3.2 m-N (28.2 in.-lbs) which is higher than 1.4 m-N (12.5 in.-lbs) at the center of the base. The maximum stress that occurred at the liftfork is therefore 2.07 MPa (300 psi), which is much higher than the 0.29 MPa (42 psi) calculated by the applicant. With a safety factor of 3 applied, the maximum stress in the base is 6.2 MPa (900 psi), which is less than 25 percent of the allowable stress of the wood material, 25.4 MPa (3680 psi). Moreover, measurements of deformation were made at the center of the base to show that no plastic or buckling phenomena occurred during a 24 hr duration. Accordingly, the staff determined that the lifting device and its effect on the transportation package are adequate and thus in compliance with the requirements of 10 CFR 71.45(a).

Based on its review of the statements and representations in the application, the staff concludes that the structural design has been adequately described and evaluated to demonstrate its structural capabilities to meet the requirements of 10 CFR Part 71.

## 7.0 PACKAGE OPERATIONS

As part of the amendment application, the licensee made changes to the package operations described in Section 7 of the SAR. The changes were made to modify and/or clarify the procedures, where needed. The staff reviewed the proposed changes and finds that the package operations, as modified by the amendment, continue to meet the requirements of 10 CFR Part 71 and are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

## 8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

As part of the amendment application, the licensee made changes to the acceptance tests and maintenance program described in Section 8 of the SAR. The changes were made to modify and/or clarify the test descriptions, where needed. The staff reviewed the proposed changes and finds that the acceptance tests and maintenance program, as modified by the amendment, continue to meet the requirements of 10 CFR Part 71 and that the maintenance program remains adequate to assure packaging performance during its service life.

## 9.0 CONDITION

The staff has determined that it is appropriate to allow applicants to use the previous revision of a CoC for a period of approximately one year. During this period applicants can continue shipments while implementing the approved CoC revision. In addition, the staff noted that the terms of Condition No. 9 of CoC No. 9035, which allowed time to mark Model No. 680-OP packagings with the "-96" designation, expired on June 30, 2006. Therefore, the staff has revised Condition No. 9 of CoC No. 9035 as follows:

Condition 9, page 2 of 3 - Revised wording from:

"Packages may be marked with Package Identification Number USA/9035/B(U)-85 until June 30, 2006, and must be marked with

Package Identification Number USA/9035/B(U)-96 after June 30, 2006.”

to:

“Revision No. 19 of this certificate may be used until August 31, 2007.”

## **CONCLUSION**

In response to the applicant's request, CoC No. 9035 has been revised as follows: (1) to reflect new ownership by QSA Global and (2) to include revised design drawings. The applicant, to support its request, submitted a consolidated application for the package. Also, staff made an additional change to CoC No. 9035. This change provides the applicant sufficient time to use the previous revision of the CoC to continue shipments while implementing the approved CoC revision.

Based on the statements and representations in the application, the staff finds that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9035,  
Revision No. 20, on September 8, 2006.