71-9027

QSA Global, Inc.
40 North Avenue
Burlington, MA 01803
Telephone: (781) 272-2000
Toll Free: (800) 815-1383
Facsimile: (781) 273-2216

21 September 2009

Mr. Eric Benner, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11555 Rockville Pike, Mailstop EBB-3D-02M
One White Flint
Rockville, MD 20852

RE: 10 CFR 71.95 report for CoC number 9027

Dear Mr. Benner:

We are making a 10 CFR 71.95 report concerning the Model 741-OP Type B package (CoC 9027) as we have determined that the material specification for the steel used in the overpack box is insufficiently specified on the descriptive drawing.

While completing routine quality inspections on incoming parts used in the fabrication of the overpack box assembly, a discrepancy was identified regarding the material specification identified on both the production and descriptive drawings. These documents called for all steel used in the construction of the overpack box to meet the criteria of SAE 1008 and to be fabricated from cold rolled steel. Based on steel availability and fabrication limitations, compliance to both these criteria is not physically possible in all cases.

The identification of this issue prompted a detailed review of all the material specifications for the steel used in fabrication of the overpack box assembly. The enclosed Technical Report describes the identified discrepancies and the typical material construction based on review of general material availability and use by steel fabricators for the components in question.

As detailed in the Technical Report, the identified material discrepancies were minor in nature. The overpack box used for the Hypothetical Accident condition testing was purchased from a tool box supplier as essentially one of their standard tool box designs with some minor feature modifications (e.g., no handles and extra hinge weld). The steel used in the off the shelf overpack box would most likely have been the same as the material we obtained for fabrication of the overpack box under our QA program since steel fabricators in both cases would have provided "commercial quality low carbon steel sheet".

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The mechanical characteristics of the in-house box fabrication will be essentially the same as the mechanical properties of the test specimens used during the Type B(U) testing since the source materials and methods of construction are most likely the same or significantly similar. The enclosed Technical Report describes the variances in mechanical properties that would be important to the steel performance as a component of this Type B(U) transport package. The differences listed were minor in nature and, as such, we believe them to have minimal impact on the overall safety or integrity of the packages currently transported under the Type B(U) certificate.

As was seen in the actual Hypothetical Accident testing performed, the test conditions of 10 CFR 71.73 are insufficient to cause failures in both the overpack box and the secondary securing systems since shield retention and source shielding integrity were maintained in all test units.

The construction of the transport box is necessary such that the box is capable of holding the internal wood in place around the inner device during transport. The wood and rigid polyurethane foam surrounding the device act as shock absorbers under impact conditions. As was again seen in testing, so long as the package is intact upon impact, the inner device can withstand the subsequent accident testing outside of the protective overpack without adversely impacting the radioactive material containment.

As has also been demonstrated since the institution of the overpack box during the last five years, the construction of the boxes are adequate to withstand, without failure, the stress related in normal lifting and transport of the package. From this it is clear that there are no significant differences in the mechanical properties of the in-house manufactured steel overpack boxes to the construction used in the test specimens. Subsequently, the boxes will remain intact around the inner package contents up until impact under the 9 m drop test condition, thereby meeting the minimum containment requirement of the overpack box in ensuring the overall package will meet the requirements of 10 CFR 71.

In all cases, it is our belief that the packages will continue to meet the regulatory requirements for a Type B package since there are no safety issues related to the corrections to be submitted for the drawings of this package. We further believe the amendment request we will submit before the end of October 2009 will be sufficient to correct all discrepancies associated with the overpack box material issues at that time. In all cases, there are no Part 21 implications as a result of any of these amendment request actions.

Since the overpack box discrepancies have no significant safety impact on the package operation, performance, or use by registered users of CoC, QSA Global, Inc. has taken no action, nor do we recommend any corrective action be taken by routine users of this package.

It is estimated that there may be over 200 packages in current use as Type B(U) transport packages both domestically and internationally. These packages are used to transport the inner devices to and from temporary industrial radiography jobsites and allow performance of non-destructive testing at these locations.

Until receipt of an amendment to this Type B(U) approval, we have stopped the manufacture of the overpack box component of this package. As noted previously, we will submit an amendment request to update the Type B(U) approval regarding the overpack box construction and we commit that we will not distribute any newly manufactured overpack boxes used under this Type B(U) approval until the appropriate amendment is approved by your Office.

Further, we will take the following specific actions in support of the Type B(U) approval:

- The material specifications identified on the production drawings for the overpack box steel components will be corrected..
- The descriptive drawing R741-OP will be revised to reflect the correct material specifications.
- The material properties referenced in the 741-OP SAR will be revised to more accurately reflect all applicable steel material specifications as identified in the package and the Technical Report.

Should you have any additional questions or wish to discuss this issue further prior to the submission of our amendment request, please contact me. If you feel a site visit with your staff would be beneficial and/or facilitate review of these issues, please call me and we will arrange to meet with your staff to discuss this action at your offices.

Sincerely,

Lori Podolak
Senior Regulatory Affairs Specialist
Regulatory/Quality Affairs Department
Ph: (781) 505-8241
Fax: (781) 359-9191
Email: Lori.Podolak@qsa-global.com

Enclosure: Technical Report 159

RA/QA Approval	21Sep09 Date
Engineering Approval	21Sep09 Date

QSA GLOBAL, Inc.
Engineering Department
Technical Report

Title: Part Number 97011 Overpack Box Materials Review

Prepared by: _____ Paul Rice Date: 18 Sep 09

Checked by: _____ Date: 21 Sep 09

Engineering Approval: _____ Date: 21 Sep 09

Regulatory Approval: _____ Date: 21 Sep 09

1.0 Purpose

To review and assess the materials used to fabricate QSA Part Number 97011

2.0 Introduction

QSA Part Number 97011 Rev J, "Overpack Box Weldment" is a component of the 680 Overpack, Part Number 6800P, "Model 680-OP" & the 741 Overpack, Part Number 741OP, "Model 741-OP"

The box with the addition of a series of inserts constitutes the Overpack and is a primary component of the Type B shipping container as described in QSA Descriptive Drawing R680-OP & R741-OP.

The original box was purchased from Knaack, a manufacturer of commercial jobsite storage boxes, as a modified version of their Model 2032 Classic Storage Chest.

The original QSA drawing, 97011 Rev A, specified in Note 2 that all material was "1/16 ±.006 Hot Rolled Steel" and in Note 6 that the box was to be purchased as "Rambox 203214" with "No Handles, Extra Weld on Hinge & Mill Certification Required"

It was later determined that QSA should manufacture the box themselves and drawing 97011 was revised to document the requirements.

ERF 966, dated 29 Aug 05, added fabrication details and component drawings with the component materials being specified by a sheet metal gage and "Steel".

ERF 1163, dated 20 Mar 06, created "MAT071" and revised the steel components of the box as "MAT071" and a sheet metal gage.

MAT071 Rev A Specifies "Cold Rolled Steel, Commercial Quality (SAE 1008)" with minimum material properties, see Table 1, Material Properties from Referenced Standards & Specifications.

3.0 Cause for the Review

On 28 Jul 09, in response to an E-mail from Paul Therrien @ In Metal to Ted Beagen, QSA Materials, dated 16 July 09, ERF 2201 was begun.
Paul Therrien said that SAE 1008, Cold Rolled Steel as specified in MAT071 was not available in 3/16 thickness as required for part 97011-8 and requested that the material callout on the drawing be changed.

A review of the materials available and the appropriate specifications showed that In Metals was correct about the SAE 1008 and additionally that Cold Rolled sheet metal was only commonly available in thickness under 0.130".

This prompted a material review of all of the steel components used in QSA part number 97011

4.0 Results of the Review

Descriptive drawing R97011 Rev A (circa Jan 1999) specified the box fabrication as 1/16 Hot Rolled Steel manufactured as a commercial component and described on QSA drawing 97011 Rev A as Knaack, Model RAMBOX 203214. This material description, though applicable to some of the overpack box metal fabrication, did not accurately reflect construction of all metal components on the box. Some steel items were thicker metal and in some cases the material may have been cold rolled steel, not hot rolled steel. Though the descriptive drawing material specifications for the box did not fully describe the actual construction materials, all components were manufactured and assembled by Knaack under the RAMBOX part number. Boxes purchased from Knaack as 'RAMBOX 203214' were used in the drop testing performed under Test Plans 72 and 89 for these packages and for overpack box construction up until ~ September 2004.

Beginning in September 2004, fabrication of the overpack box changed from the commercial component to a fabricated component manufactured in-house under our QA program. The current descriptive drawing for the 680-OP package, R680-OP Rev K, Model 680-OP, Sheet 2, Note 9 states; "Unless Otherwise Specified, All Steel to be Cold Rolled Steel, Commercial Quality (SAE 1008)". Sheet 5 details a number of the sheet metal components and they are all specified by a thickness, either gage or fractional, and "CRS" with no alloy specification. (Similar statements/requirements exist on the current descriptive drawing for the Model 741-OP package.) Based on the current descriptive notes, all of the box components should be manufactured from "SAE 1008 Cold Rolled Steel". Again, this statement does not accurately reflect construction of all steel components used in the overpack box since some items are manufactured from hot rolled steel not the specified cold rolled steel.

A review of the production component drawings confirmed that MAT071 (SAE 1008) was specified in all cases, it was also determined that this could not be the material used for parts 97011-7, 97011-8 & 97011-15 as they are all thicker than 0.130" which is the thickest commonly available SAE 1008 Cold Rolled Sheet. These parts correspond to Item 11 latch on R680-OP Rev K sheet 1 and the 4X Bar 3/16 CRS on R680-OP Rev K sheet 5. (The same references appear on R741-OP Rev G).

A review of available SAE standards showed that, although it is still commonly used, SAE 1008 is obsolete and has been superseded by a series of AISI standards that are similar to, but do not exactly equal the original SAE 1008 standard.

The SAR for the device lists "Metals Handbook P 4-20" as the steel reference for the values given in Table 2.2.A, this reference is for steel plate, not sheet metal as used for all the steel components in both the 680-OP and 741-OP packages. Page 4-24 Table 2 is the correct reference listing AISI/SAE 1008-1012 in both Hot Rolled Commercial Quality and Cold Rolled Commercial Quality sheet. Additionally, AISI/SAE 1008-1012 are listed as a group rather than specified as independent alloys. Page 4-25 states in part; "Commercial quality (CQ) low-carbon steel sheet.... Commercial quality material is not subject to any other mechanical requirements and it is not expected to have exceptionally uniform chemical composition or mechanical properties...."

A review of materials availability from manufacturer websites showed that AISI/SAE 1008 was most commonly available in thinner gages and that thicker materials were more commonly AISI/SAE 1010, 1011 or 1012. In most cases the manufacturers reserved the right to use these alloys interchangeably. (ref; Mead Metals, Eagle Steel and others).

The material certifications supplied to QSA by the box manufacturers were reviewed and the information supplied was compared to that specified in MAT071. Although standards other than SAE 1008 were referenced, (ASTM, AISI, etc.) all of the information available for review met the specified material properties requirements with the exception of Hot Rolled Steel being substituted for Cold Rolled Steel.

ASTM Standards were researched and three were found that cover the materials in question (See Table 1). The requirements of these standards most closely represent both the SAE 1008 standard and material properties referenced in MAT071 as well as the material certifications supplied to QSA by the box manufacturers.

Table 1: Material Properties from Referenced Standards & Specifications

	SAR 2.2 Table 2.2.A	QSA MAT071 Min Properties	SAE 1008 (Properties From Matweb)	ASTM A1008 CS Types A, B & C Cold Rolled	ASTM A1011 CS Types A, B & C Hot Rolled	ASTM A1018 CS Types A, B & C Hot Rolled
Tensile Ultimate	57 ksi	42 ksi	44-52 ksi	*Not Specified*	*Not Specified*	*Not Specified*
Tensile Yield	42 ksi	22 ksi	26-35 ksi	20 to 40 Ksi	30 to 50 ksi	30 to 50 ksi
Elongation	36%	30%	42-48%	≥30%	≥25%	≥25%
Thickness Range	All	*Not Specified*	.063 - .228 in	.027 - .142 in	.027 - .230 in	.230 - 1.00 in
				These specifications cover all alloys in the SAE range 1008 – 1012, CS denotes 'Commercial Steel'		

5.0 Summary of the Review

The original material specification on QSA drawing 97011 Rev A that stated the material was "Hot Rolled Steel" was likely correct for most if not all of the components of the original box, however, based on material availablity some of the thinner sheet material components may have been fabricated using cold rolled steel" (e.g., 1/16" sheet for overpack body).

The QSA drawing 97011 Rev A "1/16 ± 006" reference was incorrect This thickness would appear to be based only on the major components of the box and the tolerance does not match SAE or ASTM specifications.

The MAT071 specification of "Cold Rolled Steel" was an error. Parts over 0.142 thick could not have been made from Cold Rolled as it is not manufactured in the thicker gages. There is no documented explanation or justification supporting this change in the ERF file for the drawing.

The MAT071 specification of "SAE 1008" was an error for the overpack components. Although some of the components may be SAE 1008, it is likely the thicker components were made from AISI/SAE 1010, 1011 or 1012 as these alloys are more readily available from the manufacturers of steel sheet. These alloys have similar properties and are treated as a 'family' of alloys by ASTM and the manufacturers referenced above (See Table 1). There is no documented explanation or justification supporting this change in the ERF file.

The values used for steel in 'Table 2.2.A: Mechanical Properties of Principal Package Materials' of the SAR are incorrect. This reference is for steel plate and does not include SAE 1008 or other sheet steel alloys. There is no documentation on file which indicates the origin of this reference, but these values have been referenced in the SAR since the original Type B(U) approvals in May/June 1999.

6.0 Conclusions

The Overpack box is a Quality Class B, 'sacrificial' container intended to absorb an impact rather than transmitting it to the package's 680/741 inner device. The design assumes that, during the 30 ft drop test, the steel container will crush and the inner packaging (wood and foam) will protect the 680/741 from significant impact damage that could cause containment failure during subsequent accident condition testing. In the Type B testing these assumptions proved to be true, because the box damage prevented significant damage to the 680 device after the hypothetical accident condition testing.

Though full material certification was not available in all cases it is reasonable to assume, based on the available information and general material availability as provided by steel manufacturers, that sheet steel meeting the requirements of SAE 1008 and the minimum properties as specified in QSA drawing MAT071 was used in both the original tested box construction as well as fabrication of the overpack box under our QA program.

The variations in alloy (AISI/SAE 1008-1012) and CRS vs HRS should have no effect on the results of the hypothetical accident condition testing since these properties are all well within the Commercial Steel range originally and currently used in the fabrication of these containers (See Table 1). The primary material concerns related to the overpack box construction would be the weldablity, formability (cracking when bent) and cold temperature properties of the materials used. This family of alloys, both CRS and HRS are specifically intended for the fabrication of devices like this box. They are specified as highly formable, 180 degree bends are possible without cracking, and low carbon steels of this type may be welded by most common processes. The cold temperature properties of these alloys are also very similar throughout the range of alloys and for both hot rolled and cold rolled sheet, therefore use of any of these materials in the construction of the overpack box would produce results similar to those seen in the actual testing performed under Test Plan Reports 72 and 89.

Based on the material records available and a review of past and current standards for sheet steel production methods and properties, the current QSA Part No 97011 boxes meet the original service and Type B testing requirements.

7.0 Recommendations

The material specifications for the component parts of these boxes should be corrected prior to fabrication of any additional units.

The Descriptive Drawings, R680-OP & R741-OP require a revision to reflect the correct material specifications.

The material properties referenced in the 680-OP and 741-OP SAR documents should be revised to more accurately reflect all applicable steel material specifications as identified in this report.

Based on the available information on materials used for fabrication, the current fleet of QSA Part No 97011 Overpack boxes are fit to remain in service.

Note: QSA Regulatory must review the status of the 97011 Overpack box with the NRC prior to any final decision on the use of existing units or additional fabrication.