

Responses to NRC Follow-up Questions on the 435-B Package, Docket 71-9355

The following questions were taken from an email to Max Barela (NNSA) from Norma Garcia-Santos (NRC) on April 4, 2014. The responses were prepared by AREVA Federal Services LLC (AFS) after a phone conversation with the reviewers on April 9, 2014.

Thermal Evaluation:

1. QA thermal shield and impact limiter quality categorization (Category B versus Category A). SAR Table 3.1-1: If the thermal shields is removed, containment boundary would be exposed to the fire [temperature may be over the limit for the containment shell (1300 F).

Response: Table 2 of NUREG-6407 defines Cat A items as those for which "failure of a single item could cause loss [of containment, shielding, or criticality control]". Cat B items are those "whose failure or malfunction could indirectly result in a condition adversely affecting public health and safety. The failure of a Cat B item, in conjunction with the failure of an additional item, could result in an unsafe condition." This implies that if the failure of just a single component results in an unsafe condition, then the component should be Category A, but if a failure of two components must occur before an unsafe condition is reached, then the first component should be Category B. We acknowledge that Table 5 of the NUREG lists the thermal shield and impact limiter components as Category A, but we believe that the NUREG is internally inconsistent and that some of the contents of Table 5 are not consistent with the principles laid down in Table 2, nor the principles expressed in Appendix A of Reg. Guide 7.10.

However, in response to the request made during the phone conversation, the Quality Category will be set to Cat A for the thermal shield material, the thermal shield wire, and the internal impact limiter components (aluminum plate, crush tubes, tube inner plates, and tube stabilizer sheet). Note: the attachment screws (drawing 1916-01-01-SAR, item 32) will remain at Cat B since they do not have an important safety function. They hold the tube assembly to the aluminum plate only for handling purposes. These changes in Quality Category will appear in a revision of Table 9.2-2 of the SAR.

2. Consideration of thermal isolation as initial condition for the thermal analysis. Explain if this was considered as an initial condition.

Response: Although not subject to a regulatory requirement to include insulation before the fire, the conditions specified in IAEA, TS-R-1, paragraph 728 were considered. This paragraph includes the statement: "Alternately, any of these parameters are allowed to have different values prior to and during the test, provided due account is taken of them in the subsequent assessment of package response." The initial condition of the 435-B fire analysis included decay heat, but not insulation. Subsequently, an analysis of the steady-state temperature increase due to insulation was performed, and the maximum temperatures of critical components were calculated and discussed in Section 3.4.3 of the SAR, Revision 1. Thus, a conservative assessment of the effect of insulation before the fire has been made.

However, in response to the request made during the phone conversation, the thermal analysis will be revised to include insulation before the fire in the thermal model. The appropriate tables and text in Chapter 3 of the SAR will be revised.

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Materials Evaluation:

RAI-2

On the last bullet of the revisions the SAR would state that “The main structural members of the devices are made of carbon steel, stainless steel, or, in the case of the GC-40, a limited portion of cast iron.”

1. Does this statement imply that the “limited portion of cast iron” is the only “main structural” material of the GC-40?

Response: No, only the inner conical shell and associated flange are made of cast iron. The outer conical shell and the cylindrical shell are made of wrought carbon steel. A cross section of the GC-40 is shown in Figure 2.7-2. The outer conical shell is more clearly shown in the photograph of Figure 1.2-16. Thus, cast iron constitutes a relatively minor part of the shell of the GC-40.

Section 2.7.1.6 of the SAR will be revised FROM: “The main structural members of the devices are made of carbon steel, stainless steel, or, in the case of the GC-40, a limited portion of cast iron.” TO: “The structural members of Group 1 shielded devices consist of carbon steel or stainless steel. For Group 3, the main structural members of the device (the cylindrical shell, flat ends, and outer conical section) are made from carbon steel. The inner conical shell is made from cast iron.”

2. Is corrosion/rusting of the carbon steel addressed? contact with other materials?

Response: Since the devices are only present for transportation, corrosion of the shell of the devices cannot present a risk. Further, the package is loaded and shipped in the dry condition as required by Section 7.1.2.2, step 7b, which states: “Ensure that the cavity of the IC is clean and dry...”. For shipping, the interior cavity is evacuated and backfilled with helium for purposes of leakage rate testing. Thus, corrosion is unlikely to occur at all, and cannot occur to a detrimental level.

3. Are these materials a permanent part of packaging or just for transport as part of payload?

Response: The materials are part of the payload as noted above.

RAI-3

The SAR states that “different blocking/dunnage (b/d) arrangements may be used.” Clarify the meaning of the phrase “different arrangement.” The SAR mentioned that the b/d could use different materials (between metallic or the polymeric foam) but not different arrangements.”

Response: Different blocking arrangements will be needed to reflect the different shapes of the payload devices. This is clear from the photographs given as Figures 1.2-12 through 1.2-16.

...“This includes the loading of b/d that may be needed.” Explain when the loading of b/d would not be needed.

Response: Blocking/dunnage is used to reduce the space between the payload device and the inner container. It will always be needed since the payload devices are much smaller than the IC. The statement was not intended to imply that blocking/dunnage is completely optional. SAR Section 7.1.2.2, Step 7, begins with the sentence: “Prepare the blocking/dunnage.” Thus, the use of blocking/dunnage is not optional in the SAR. The sentence “This includes the loading of b/d that may be needed.” is not

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found in the SAR but only in the initial RAI responses. AFS does not believe that a change to the SAR is warranted in this case.

RAI-4

Explain if detrimental effects, if applicable, of the adhesive have been considered and addressed.

Response: The applicability of silicone adhesive for use with metal has been evaluated. Silicone adhesives typically list their applicable substrates to include "metals", which would include stainless steel. The common grades of silicone generate a small amount of acetic acid upon cure, but no corrosion has been noted in our experience. Type 304 stainless steel is in fact recommended for acetic acid service. The use of silicone adhesive to adhere the same two materials (ceramic paper to ¼" thick 304 stainless) has been done for several years by our company for licensed packages that are currently in use (for example, the TRUPACT-II) with no ill effects. Thus, the compatibility of silicone adhesive with the materials of the packaging have been addressed.

RAI-10

Does the glue have a detrimental effect on materials?

Response: Loctite 30537 (and its equivalent, defined by Flag Note 27 on sheet 1 of drawing 1916-01-01-SAR) is specifically designed for use with rubber and metal. The material hardens and becomes inert after 24 hours. Its solubility in water is negligible. No detrimental effects of the adhesive are expected. Furthermore, location of the adhesive is accessible to visual inspection prior to loading, since it is used to attach the rubber cushions to the lodgment. If any affects are present, they can be noted and corrected prior to use.

RAI-5

Bullet 1, "Equivalent must be a refractory material..." Although they describe the characteristics the materials should have to be defined as "equivalent." What are the recognized standards for the "equivalent" materials?

Response: Drawing 1916-01-01-SAR, Flag Note 51 (which pertains to item 18, the insulation sheet) defines the properties that the equivalent material must possess. The Standard Review Plan (NUREG-1609) Section 2.5.2.1, provides for the case where no recognized standards are available: "If no standard is available, the application should provide adequately documented material properties and specifications for the design and fabrication..." The requirements stated in the added Flag note meet this criteria.

RAI-7

"The all-around circle does not..." How could it be "all-around" but not a continuous weld? The "on center" implies intermittent welds for the entire length. Also, the standard is AWS A2.4, not D2.4. Clarify the standards used.

Response: As you have noted, the correct standard is A2.4. However, that error only appears in the initial RAI response, and does not occur in the SAR, so no change to SAR text is needed. Drawing 1916-01-01-SAR will be revised to remove the all-around symbol from the weld symbol.

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RAI-8

Does this foam have an adhesive bond with the metal it contacts or is there a primer used or other material between the foam and metal?

Response: No primer or other material is applied to the interior of the impact limiter shell. The foam generally does not bond to the steel shell. Benchmarking of the test data using the computer model used a coefficient of friction (implying allowed displacement) and did not assume bonding. The benchmarking is fully discussed in SAR Appendix 2.12.4.

To clarify this point, SAR Section 2.12.4.3.1.1 will be revised. The revision will occur in the ninth paragraph, which begins "The FEA model includes a wide array of structural interfaces and contacts." The tenth sentence of this paragraph reads: "However, a significant number of contact interfaces have a coefficient of friction 0.40, such as all the contacts involving foam and internal impact limiters." A sentence will be added after the tenth sentence of this paragraph as follows: "Bonding between the foam and the external impact limiter shell has not been assumed."

Thus, Revision 2 of the 435-B SAR will be issued with the following revisions:

1. Revised quality categories for certain components (Table 9.2-2)
2. Revised thermal analysis with changes to tables and text of Chapter 3
3. Clarification of the material of the GC-40 shell (Section 2.7.1.6)
4. Clarification concerning the non-bonding of the polyurethane foam to the impact limiter shell (Section 2.12.4.3.1.1)
5. Revised weld symbol on drawing 1916-01-01-SAR

Please confirm the completeness and adequacy of the foregoing list at your earliest opportunity.