NNSA Supplemental Responses to NRC Request for Additional Information

Docket No. 71-9370
Model No. 380-B

A teleconference between the applicant (DOE-NNSA) and NRC was held on July 6, 2017 to discuss the NRC's request for supplemental responses for the subject docket. The teleconference was summarized in an email from Norma Garcia-Santos of the NRC to Chad Thompson of NNSA on July 10. The following paragraphs provide the requested supplemental information, based on the email summary. Where necessary, changes have been made to the SAR, which has been reissued as Revision 2. Verbatim SAR changes are provided in the revised responses, below.

RAI M-4 Revise Section 7 of the application to add a requirement to verify that the sources (payload) as well as the packaging cavity are dry prior to loading. Provide revisions to the application as part of your response.

M-4 Supplemental Response: The applicant notes that the NCT and HAC pressure evaluations in Section 3.3.2 and 3.4.3.1, respectively, and the radiolysis evaluation in Section 5.5.4 conservatively do not rely on a limitation of the amount of water in the cask cavity. However, a new step 12 has been added to Section 7.1.2 (which reinforces and expands on the existing step 7 of that section) as follows:

"12. Prior to placing the shielded device into the cask, verify that the device and the cask cavity are dry."

RAI M-5 Since the applicant removed the term "forging" from the description of items in the drawings, revise the application to ensure that the term "forging" (as applicable to the components described in the drawings) is removed from the application, as applicable. For graphics related to code runs including the word "forging," the applicant can add a clarification note to ensure that terms are used consistently through the application or can re-run the code, if appropriate. Examples in which the term "forging" that refers to either the upper or base forging or "forgings" that refers to both the upper and base forgings appear in Revision 1 of the application are the following:

1. Section 2.7.1.2, page 2.7-8
2. Section 2.12.4.4.7, page 2.12.4-12
3. Figure 2.12.4-40, page 2.12.4-42
4. Figure 2.12.4-44, page 2.12.4-44
5. Figure 2.12.4-44a, page 2.12.4-45
6. Figure 2.12.4-44b, page 2.12.4-45
7. Figure 2.12.4-66, page 2.12.4-57
8. Table 5.3-1, page 5.3-3

Provide revisions to the application as part of your response.

M-5 Supplemental Response: The SAR was examined and it was found that the eight items listed above constitute the only instances where the word 'forging' was inaccurately used. Each instance has been corrected to use the appropriate terminology. For the noted figures, text has been added in the figure caption to clarify the meaning, without changing the software-supplied text within the figure.

RAI M-6 Provide the proper justification for the temperature dependent material properties of ASTM A276. Provide revisions to the application as part of your response.

M-6 Supplemental Response: The applicant has not found any elevated temperature data that explicitly references the ASTM A276, Type 304 material specification. However, the close similarity of alloy content and product form between ASTM A276 and ASTM A479, as presented in the expanded discussion below, is sufficient to establish the validity of the assumption made. Note that the importance of alloy content and product form to material properties relies on an explicit, published reference. Note also that the argument made does not interpret the ASME Code nor does it attempt to predict how the relevant ASME Code committee would view the matter. It simply makes a technically valid observation utilizing the ASME Code data as publicly referenceable data. The following changes have been made to the SAR:

1. Change Table 2.2-1 footnote to read: "Properties in this table apply to ASTM A276, Type 304 material, as justified in Section 2.2.1, *Material Properties and Specifications*."
2. Add a new second paragraph to Section 2.2.1 which reads: "As stated in General Note 12 of drawing 1916-02-02-SAR and General Note 15 of drawing 1916-02-03-SAR, ASTM A276, Type 304 (hereinafter, A276) is considered equivalent to, and may be substituted for, ASTM A240 or ASTM A479, Type 304 material (hereinafter, A240 or A479, respectively). In contrast to A240 and A479, the elevated temperature properties of A276 are not given in ASME B&PV Code, Section II, Part D. However, as stated in footnote (7) of Table 2.2-1, the elevated temperature properties of A276 may be assumed to be the same as those of A240 and A479. According to [45], page 932, "The elevated-temperature properties of any of these materials [i.e., stainless steels listed in Table 1 of the reference] are influenced to some extent by the form of the product; these properties depend largely on the specific alloy characteristics…" Of note, the chemical composition (i.e., the alloy characteristics) of A276 is essentially identical to that of A240 or A479. Furthermore, the product form of A276 is the same as A479. Therefore, the assumption stated in footnote (7) of Table 2.2-1 is justified."
3. Add a new reference to Section 2.12.1:
   45. ASM Handbook® (Formerly Tenth Edition, Metals Handbook), Volume 1, *Properties and Selection: Irons, Steels, and High-Performance Alloys*, ASM International.

RAI M-13 Provide a complete response to the application including explaining the changes in the application to address this question.

M-13 Supplemental Response: The thermal analysis has been revised in Revision 1 of the SAR to identify the maximum temperature of the closure bolts. Table 3.1-1 now shows the peak closure bolt temperature under NCT and HAC as 133 °F and 570 °F, respectively. The response to RAI M-8 provides a justification for the use of 800 °F for the allowable temperature for the bolting material. Thus, significant temperature margins exist for NCT and HAC. Consequently, no deterioration of the leaktight condition will occur.

RAI M-16 Since the applicant changed its approach, provide the information identified in NUREG\CR-3854, Section 3.2.1, "Acceptance Testing for the Gamma Shield." This information needs to be incorporated into the information.

M-16 Supplemental Response: To provide more details about the conduct of the shielding acceptance test, each of the seven points in NUREG\CR-3854, Section 3.2.1 will be addressed in the SAR. To that end, Section 8.1.6.1 has been revised to read:

"The poured lead shielding shall be tested to confirm its integrity. The shop test procedure shall include the following elements and requirements:

1. The test technique shall be a gamma scan using a hand held surface probe.
2. The gamma source shall be Co-60. Source strength shall be sufficient to provide a dose reading on the cask surface which is sufficiently above the background dose and is within the calibrated range of the measuring equipment.
3. The source strength shall be recorded at the time of the test.
4. The grid pattern shall be a maximum of four inches square.
5. The type of gamma sensor used for measurements shall be recorded. All equipment shall be calibrated per manufacturer's instructions.
6. The gamma scan test shall be performed according to a written procedure. The cask outer surface shall be marked with a grid which extends over the length of the side lead shield. A chart shall be made corresponding to the gridded surface, where each row of the table represents a circumferential ring of grid squares. The source shall be placed at one end of the cask cavity while the surface is scanned around its circumference. The source shall then moved to the next axial grid position and the corresponding circumference scanned again. This sequence shall be repeated until the entire cask outer surface is scanned. The maximum dose rate from each grid square shall be recorded on the chart.
7. Acceptance criteria for each grid square will be established using the dose rate results of the analytical shielding model from Chapter 5, *Shielding Evaluation*. The analytical model will be revised to account for the presence of a test lid and test base shielding, but the poured lead thickness shall be the same as in Chapter 5. The model dose rate results shall be calibrated to the actual test source and detector characteristics using a calibration fixture. A computer model of the calibration fixture shall be created, and a ratio of the predicted dose rate to the measured dose rate of the fixture shall be used to adjust the analytical model dose rate results and create the acceptance criteria for the test measurements. Optionally, the un-collided gamma count may be used instead of the dose rate."

Additional Change made to Revision 2 of the SAR: on page 3.3-2, fourth paragraph, at the end of the fourth line of text, reference to Figure 3.3-7 and Figure 3.3-8 have been changed to Figure 3.3-6 and Figure 3.3-7, respectively, due to a typographical error in Revision 1.