KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Friday, April 22, 2016 12:40 PM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Jungho Kim (jhokim082 @gmail.com); Andy Jiyong Oh; Christopher Tyree
Cc: Yeshnik, Andrew; Mitchell, Matthew; Wunder, George; Williams, Donna
Subject: APR1400 Design Certification Application RAI 469-8578 (09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling)
Attachments: APR1400 DC RAI 469 MCB 8578.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

09.01.01-36: 45 days
09.01.01-37: 30 days
09.01.01-38: 45 days
09.01.01-39: 45 days
09.01.01-40: 30 days

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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United States Nuclear Regulatory Commission
Protecting People and the Environment

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 521

Mail Envelope Properties (96bc742279234b6e94f7745c7f2bad9c)

Subject: APR1400 Design Certification Application RAI 469-8578 (09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling)
Sent Date: 4/22/2016 12:40:05 PM
Received Date: 4/22/2016 12:40:11 PM
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Files	**Size**	**Date & Time**
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APR1400 DC RAI 469 MCB 8578.pdf	124860	
image001.jpg	5040	

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Priority: Standard
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REQUEST FOR ADDITIONAL INFORMATION 469-8578

Issue Date: 04/22/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
Application Section: 9.1.1

QUESTIONS

09.01.01-36

In response to RAI 8421, Question 28811 (09.01.01-27) the applicant stated the following:

> The lower parts of the fuel storage cells are installed within the cell pitch tolerance of [proprietary value] on the rack baseplate. And the upper parts of the cells are fixed by the gap spacers (Region I) and the connecting bars (Region II) so that the cell pitches are maintained within the tolerance of [proprietary value]. The form tolerance, which is applied to the outermost surfaces of the rack, does not affect the cell pitch.

The applicant has stated that the fuel storage cells will utilize the material specification SA-240. The plate, sheet, or strip material will be formed and welded into the square tube required by the design. The welding of SA-240 Type 304 often results in significant distortion of the material.

Experience has shown that welding of fuel storage cells must include careful planning to prevent distortion of the cells. Insufficient controls can result in fuel storage cells that are “banana shaped.” If the new fuel rack storage cells are fabricated with a curve, the cell pitch at the top and bottom of the fuel rack may be different than the cell pitch at the mid-plane of the fuel rack.

This will not impact the Region I and Region II spent fuel racks: the Region I spent fuel racks have spacer bars to ensure consistent spacing along the height of the spent fuel rack and the Region II design does not have flux traps. This would only impact the new fuel racks.

Additionally, it is not necessary for the applicant to describe how the distortion will be prevented during fabrication.

How does the criticality evaluation account for fuel storage cells that are not straight?

09.01.01-37

In response to RAI 8421, Question 28812 (09.01.01-28) the applicant provided the staff with a clarification on the material tolerances for the fuel rack storage cells.

The applicant has committed to updating technical report APR1400-Z-A-NR-14011 with the tolerance information in response to RAI 179-8190 Question 27770 (09.01.01-23).

The staff notes that one table (Table 2.1-1) was not indicated as “to be revised.”

Update Table 2.1-1 to match the responses to Questions 09.01.01-23 and 09.01.01-28.

09.01.01-38

In response to RAI 364-8421, Question 28814 (09.01.01-30) the applicant justified the use of Metamic after the material was exposed to elevated temperatures. The staff reviewed the response and found that the approach was acceptable based upon precedence (SER for Turkey Point Units 3&4, License Amendment Request 178).

In the RAI response the applicant described a mockup used for determining the temperature that the Metamic was exposed to. The staff reviewed the mockup design and the results of the mockup testing and found that the mockup was inadequate. The applicant

also described the fabrication of the spent fuel racks which included the use of a gap tool. The staff concludes that the use of a gap tool as described by the applicant is not feasible.

However, the staff also determined that additional information on gap tool and the mockup would involve: 1) such high details of the design that regulating the details would venture into prescriptive regulation rather than performance based regulation and 2) incorporating aspects into the standardized design which have limited safety significance.

The staff has determined that a revision to the FSAR or Technical Report is required for the staff to come to a reasonable assurance finding and to close this RAI.

The FSAR or Technical Report revision shall address the following:

> A COL applicant shall create a weld mockup that realistically represents the spent fuel pool racks. During welding of the mockup the applicant shall monitor the temperature of the fuel rack to determine the maximum temperature which the Metamic material is exposed to. The WPS used for the mockup shall be used for fabrication and the fabrication welds shall not exceed the heat input of the mockup welds. If the heat input is exceeded during fabrication the Metamic shall be treated as non-conforming. The non-conformance would be acceptable following requalification which includes a mockup to determine if the new heat input results in Metamic being eposed to temperatures exceeding 900 F.

This may be implemented as a COL item or a license condition.

For clarity, the staff provides the following comments on the mockup and use of a gap tool. These comments do not need to be addressed in a response to this RAI.

The staff determined that the mockup does not replicate the configuration of the spent fuel racks for the following reasons:

1) The sheath has the wrong thickness (2.5 mm in the mockup vs. 0.6mm in the design)
2) The sheath configuration is not correct (the sheath is perpendicular to the Metamic in the mockup but is surrounding the Metamic plate in the design).
3) The applicant states that a spacer bar will be used during welding of the spent fuel rack; the bar ensures a 5mm gap between the edge of the sheath and the Metamic plate. A spacer bar was not used in the mockup.
4) The applicant places the thermocouple on the opposite side of the “fuel storage cell” plate in relation to the Metamic plate. There is no justification why this location is conservative or representative of the temperatures that the Metamic material will experience.

The staff determined that the use of a gap tool during fabrication may not be feasible for the following reasons:

Figure 1, “Box Assembly,” indicates that the sheath will be attached to the fuel storage cell with 2.5mm fillet welds. Considering that the sheath in the design is 0.6 mm thick, the staff is concerned that the fillet weld will melt through the sheath and weld the 5mm gap tool to the sheath/fuel storage cell.

Additionally, the staff questions the feasibility of using a 5mm gap tool. The applicant states that this tool will be removed after welding. However, austenitic stainless steel contracts significantly after solidification and will probably cause the gap tool to get stuck in the assembled fuel storage cell. Because the gap tool is very thin (assumed 2.5 mm x 5 mm), it is almost certain that a stuck gap tool will break during an attempt to remove the tool.

09.01.01-39

In response to RAI 364-8421, Question 28814 (09.01.01-30) the applicant justified the use of Metamic after the material was exposed to elevated temperatures.

The KHNP proposed coupon monitoring program utilizes as-fabricated coupons. The as-fabricated condition is no longer the only condition of the Metamic material (i.e. Metamic exposed to elevated temperatures during welding). There is insufficient operating experience on Metamic material exposed to elevated temperatures after fabrication to conclude that an additional degradation mechanism is not introduced.

The applicant must revise the coupon monitoring program include coupons that are exposed elevated temperatures.

09.01.01-40

In response to RAI 8421, Question 28827 (09.01.01-33) the applicant provided the staff details on the acceptance criteria for the neutron absorber coupon monitoring program.

The staff found the response technically acceptable, however one additional statement needs to be added to the FSAR (FSAR text is in blue, additional text is in red):

"Of the measurements to be performed on the neutron absorbing material surveillance coupons, the most important are (1) the neutron attenuation measurements (to verify the continued presence of the boron) and (2) the thickness measurement (as a monitor of potential swelling). Surveillance measurements shall be compared to each coupon's pre-immersion baseline measurements. Acceptance criteria for these measurements are as follows:"


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