

September 9, 2014

MEMORANDUM TO: Anthony J. Mendiola, Chief
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Joseph J. Holonich, Senior Project Manager /RA/
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SUBJECT: SUMMARY OF THE JULY 15, 2014, MEETING WITH THE ELECTRIC
POWER RESEARCH INSTITUTE ON ITEMS RELATED TO CAST
AUSTENITIC STAINLESS STEEL AND THE MATERIALS RELIABILITY
PROGRAM-227-"A PRESSURIZED WATER REACTOR INTERNALS
INSPECTION AND EVALUATION GUIDELINES"

On July 15, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff met with representatives from the Electric Power Research Institute (EPRI) and the Boiling Water Reactor (BWR) Vessel and Internals Program to discuss issues related to MRP-227, "A Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," and cast austenitic stainless steel (CASS). Information pertaining to this meeting, including presentations by EPRI and NRC staff as well as attendees, can be found in the meeting package at Agencywide Documents Access and Management System (ADAMS) Accession No. ML14168A115.

The focus of this meeting was to address differences in the industry's and NRC's proposals to address the loss of fracture toughness due to thermal embrittlement (TE) and irradiation embrittlement (IE) of CASS reactor vessel internals (RVI) components. These are provided in ADAMS Accession Nos. ML14174A841 (see Table 5) and ML14174A719, respectively.

The meeting began with short introductory remarks from the NRC staff and EPRI representatives. As part of its remarks, the NRC staff raised the question of what is the objective of the meeting, noting that the industry's proposal and the staff's proposal for screening of irradiated CASS RVI components are very similar, with two differences. The staff further stated that the existing guidance on loss of fracture toughness of CASS is contained in the Grimes letter (Subject: License Renewal Issue No. 98-0030, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components," May 19, 2000, ADAMS Accession No. ML003717179), but industry and the staff have both proposed updates to the Grimes letter guidance to better address CASS material used in RVI. The NRC staff concluded its remarks by noting it was open to considering alternatives but that the differences between the industry and the NRC proposals needed to be addressed.

Industry, in its opening remarks, reported that it wanted to give a full view of its position then hear NRC staff's views and address any differences. The industry emphasized that it was looking for clear criteria that had a scientific basis. The industry recognized that the Grimes letter served its purpose but that there were areas in the letter that were overly conservative.

Industry also expressed that it wants consistent, but simple, screening criteria for CASS RVI for application to both pressurized water reactors and BWRs.

The EPRI and the NRC staff each made a presentation at the meeting. Copies of the slides used can be found in the ADAMS package identified in the first paragraph.

In discussions during the industry presentation, it was noted that for Action Item (AI) 7 in the MRP-227 review, that there are no "Primary" inspection category CASS components for Westinghouse reactors as compared to Babcock and Wilcox reactors. It was further stated that the wording for AI 7 could create an issue of what work would not be done under the industry alternative.

Additionally, it was stated that the industry believed its screening criteria for IE are more conservative since the industry uses a criterion of 1 displacement per atom (dpa) versus 1.5 dpa proposed by the staff. It was further identified that the NRC staff had concerns with applying the same ferrite criteria at higher irradiation levels. The basis for the concern was that the ferrite phase becomes fully embrittled at lower neutron fluences, and there is no data to support whether this has an effect on the bulk fracture toughness of the material. However it was agreed that the industry and NRC staff approaches look like they are addressing the same question in different ways.

The staff noted that one of the two differences between the staff position and the industry position is the IE criterion (discussed above). The other difference is for criteria that encompass a range of neutron fluence from 0.45 to 1 dpa, where the NRC staff would screen in for low fracture toughness CASS components with certain ferrite contents (10 to 14 percent for static cast high molybdenum CASS, and 16 to 20 percent for centrifugal cast high molybdenum CASS and static cast low molybdenum CASS). The staff noted that there is no relevant data for CASS materials within this range of neutron fluence levels and ferrite contents.

During the meeting, the staff noted that, although the Grimes letter provides criteria for CASS being "potentially susceptible" or "not susceptible" to thermal embrittlement, these terms are actually misnomers because large losses of fracture toughness can still occur at ferrite contents that meet the screening criteria but would be designated as "not susceptible" TE.

The staff also noted that the criteria for "not susceptible" material are actually based on the toughness of CASS exceeding a certain toughness level that corresponds to the driving force for cracks in a pressure boundary component. Based on these facts, the staff stated that the required fracture toughness level for RVI components may be lower than that for pressure boundary components used to develop the criteria in the Grimes letter. Therefore an evaluation of the required toughness level for RVI components could provide one mechanism to define RVI-specific criteria that would be appropriate for irradiated CASS materials.

At the end of the meeting the NRC staff and industry noted that there was agreement on TE. The NRC staff also offered that because the actions proposed by the NRC staff and in the industry alternative were the same, the difference in the screening criteria should not matter. Two actions were identified as part of this discussion.

First, the industry agreed to expand the BWRVIP-234, "Thermal Aging and Neutron Embrittlement Evaluation of Cast Austenitic Stainless Steel For BWR Internals," responses to the NRC staff Requests for Additional Information (RAI) to address the screening criteria. Industry would let the NRC staff know by the end of July if it would expand the RAI responses.

Second, the NRC staff agreed to provide clarification on what was needed to address AI 7 in the MRP-227 review.

The action items from the meeting were:

- 1) By the end of July 2014, the industry will provide information to the staff if it plans to expand the BWRVIP-234 RAI responses.
- 2) The NRC staff will provide clarification on what is needed to address AI 7 for MRP-227 by the end of July 2014.

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Second, the NRC staff agreed to provide clarification on what was needed to address AI 7 in the MRP-227 review.

The action items from the meeting were:

- 3) By the end of July 2014, the industry will provide information to the staff if it plans to expand the BWRVIP-234 RAI responses.
- 4) The NRC staff will provide clarification on what is needed to address AI 7 for MRP-227 by the end of July 2014.

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