UNITED STATES
NUCLEAR REGULATORY COMMISSION
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March 16, 2020

MEMORANDUM TO: Raj Iyengar, Chief
Component Integrity Branch
Division of Engineering
Office of Nuclear Regulatory Research

FROM: Jeffrey Poehler, Sr. Materials Engineer ***/RA/***
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SUBJECT: SUMMARY OF PUBLIC MEETING TO DISCUSS RESOLUTION OF NRC STAFF COMMENTS ON CODE CASE N-830-1

On January 13, 2020, the NRC staff met with representatives from industry to discuss the resolution of NRC staff comments on Code Case N-830-1, "Direct Use of Fracture Toughness for Flaw Evaluations of Pressure Boundary Materials in Class 1 Ferritic Steel Components (Section XI, Division 1)," and its associated technical basis document, Electric Power Research Institute report, "Technical Basis for ASME Code Case N-830, Revision 1 (MRP-418) Direct Use of Master Curve Fracture Toughness Curve for Pressure-Retaining Materials of Class 1 Vessels, Section XI." The industry's presentation can be found at Agencywide Documents Access and Management System (ADAMS) accession number ML20013D394. Attachment 1 contains the list of meeting attendees.

The intent of Code Case N-830-1 is to provide a complete and self-consistent suite of best estimate fracture toughness models for ferritic steels used in nuclear plants, all linked to a single parameter, T_0, which is determined by a standardized test method. As such, the code case provides models for the lower shelf, transition region, and upper shelf, and is intended as an alternative to the methods of determining transition region and upper shelf toughness allowed by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Nonmandatory Appendixes A and K. The NRC staff reviewed an initial draft of Code Case N-830-1 in early 2018 and provided comments to the industry. The industry has addressed those comments and made revisions to the code case and the associated technical basis document. A revised version of the technical basis document, Technical Basis for ASME Code Case N-830-1, Revision 1 (MRP-418, Revision 1): Direct Use of Master Curve Fracture Toughness for Pressure-Retaining Materials of Class 1 Vessels, Section XI, was provided to the NRC. Appendix D of MRP-418, Revision 1 addresses the resolution of each of the NRC comments in detail.

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Some of the most significant NRC comments related to how uncertainties are addressed in the code case. The industry explained that these concerns have been addressed by using 5% lower bound models for the temperature versus fracture toughness, for both the transition region and upper shelf, and by adjusting the value of T_0 by adding two standard deviations to the mean value. However, the industry explained the revised code case does not correct for uncertainties in the linkage models of T_0 to T_{US} (the temperature at which upper shelf behavior is considered to start) and T_0 to T_{Kia} (the reference temperature for the crack-arrest toughness curve), because that would result in double counting of uncertainties and unrealistically conservative predictions of toughness in some cases.

Another major NRC concern related to a need for additional validation of the J_{IC} (ductile crack initiation toughness) and J-R (ductile crack extension) models. The industry provided results for additional test data that was compared to the model predictions, which showed good agreement with the model predictions.

During the meeting, the NRC staff asked some additional questions based on the industry's presentation. The first additional question was, are there materials for which the models do not work as well, for example high copper or highly irradiated materials, or some other characteristic such as materials with lower upper shelf energy? The second additional question was, did the working group evaluate the effect of material strength on the T_0/T_{Kia} correlation using the expanded Hein dataset? In response the industry indicated that none of these sub-bins were predicted substantially worse than others. In response, the industry indicated that over the range of RPV steels included in CC N-830-1, the effect of yield strength is insignificant.

The industry indicated it would like to hold a vote on Code Case N-830-1 at either the February or May ASME Code meetings. The NRC indicated it was in the process of reviewing the resolution of the comments and would let the industry know if it had additional comments.

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ADAMS Accession No.: ML20066H835

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NAME	J. Poehler
DATE	03/16/2020

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Attachment 1 – List of Attendees

Name	Organization
Marjorie Erickson	PEAI
Mark Kirk	PEAI
Bill Server	ATI Consulting
Tim Hardin	EPRI
Brian Hall	Westinghouse
Matt DeVan *	Framatome
Russ Cipolla *	Intertek
Rob Tregoning	NRC/RES
Jeff Poehler	NRC/RES
Dave Rudland	NRC/NRR
Allen Hiser	NRC/NRR
David Dijamco	NRC/NRR
Hipo Gonzalez	NRC/NRR
Michael Benson	NRC/NRR

*- Attended by phone