



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 15, 2020

MEMORANDUM TO: Kerri A. Kavanagh, Chief
Quality Assurance and Vendor Inspection Branch
Division of Reactor Oversight
Office of Nuclear Reactor Regulation

FROM: Jonathan Ortega-Luciano, Reactor Operations Engineer /RA/
Quality Assurance and Vendor Inspection Branch
Division of Reactor Oversight
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF MAY 28, 2020, CLOSED MEETING WITH
FRAMATOME INC. REGARDING EVALUATIONS OF THE
FLEXIBLE CERAMIC PAD HEATER POST-WELD HEAT
TREATMENT DEVIATION OF WELD REQUIREMENTS FROM
TECHNICAL STANDARDS

On May 28, 2020, a closed meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of Framatome Inc. (Framatome) to discuss the Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21 evaluation related to the post weld heat treatment (PWHT) deviation. Framatome presented background, discovery, experimental results and analyses for the welds affected in large components in six U.S. plant sites. The plants include Callaway (steam generators), ANO 1 (steam generators), St. Lucie 1 (pressurizer), St. Lucie 2 (steam generators), Salem 2 (steam generators), Prairie Island 2 (steam generators) and Millstone 2 (pressurizer).

Through a combination of numerical analyses and mock-up testing, Framatome concluded that PWHT of the welds in question may have been outside the required American Society of Mechanical Engineers (ASME) code limits per 10 CFR 50.55a. Using historical data, recently generated data, and analyses, Framatome conservatively demonstrated that sufficient margin to structural failure exists. During their presentation Framatome stated that only the outside diameter (OD) of the weld component would be considered for the flaw evaluation because the weld residual stresses are on the OD due to the welding progression finishing on the OD. The NRC staff noted that Framatome should evaluate whether there were weld repairs made on the inside diameter (ID) of the weld component which would then increase the weld residual stresses on the ID, thereby invalidate their assumption of only performing flaw evaluation from the OD.

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The NRC staff also provided comments related to what impact under-PWHT 932°F (500°C) tempering has on the heat affected zone (HAZ) of the welds. This included that the submerged arc welding (SAW) process does not temper (nor is qualified to temper) the HAZ of the affected welds. Tempering of the HAZ (which consists of martensite) is accomplished by performing the PWHT tempering. In addition, the statement that the SAW process re-austenizes the martensite in the HAZ is not valid or supported by evidence or qualifications. However, Framatome's plan to perform material testing to validate that the HAZ has adequate fracture toughness equal to the base metal using test welds that simulates the conditions of the affected welds would provide reasonable assurance that the under-PWHT 932°F (500°C) tempering still provides sufficient fracture toughness in the HAZ of the material.

The NRC staff asked for the basis for both the OD magnitude and the linear behavior of the weld residual stress assumption in the Appendix G of the ASME Code Section III calculations. Framatome replied they thought that the linear behavior was the best approximation of the residual stress distribution. They also explained that the 29ksi on the OD was developed from stress relaxation experiments at the heat treatment temperature.

The NRC staff questioned the reason for using different PWHT processes during fabrication on the same component. Framatome stated that due to situations regarding scheduling and/or workload the PWHT is outsourced to different contractors. Furthermore, Framatome explained that different contractors used different processes.

During their closure statement, Framatome informed the NRC staff that they will continue to perform systematic review of PWHT processes. Additional testing will be performed to validate assumptions made in the Part 21 evaluations. The NRC staff questioned if Framatome would revisit their Part 21 assessment conclusions after the planned experiments and analyses were complete, and they responded yes.

Based on this meeting and a review of the Part 21 evaluation, the NRC staff concluded there is no substantial safety hazard, and Framatome's assessment is appropriate. The NRC staff will follow up with a review of each licensee's operability determination and in-service inspection results for the affected components under the baseline inspection program.

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FRAMATOME INC. REGARDING EVALUATIONS OF THE FLEXIBLE
CERAMIC PAD HEATER POST-WELD HEAT TREATMENT DEVIATION OF
WELD REQUIREMENTS FROM TECHNICAL STANDARDS

Dated: June 15, 2020

Enclosure: List of Attendees

DISTRIBUTION:

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BCaldwell
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CMiller
MMitchell
DRudland
SBloom
HGonzalez
RGuzman
NJordan
RKuntz
TWengert
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GSuber
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OFFICE	NRR/DRO/IQVB	NRR/DRO/IQVB
NAME	JOrtega-Luciano	KKavanagh
DATE	6/12/2020	6/15/2020

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List of Attendees

Meeting with Framatome Regarding Evaluations of the Flexible Ceramic Pad Heater Post-Weld Heat Treatment Deviation of Weld Requirements from Technical Standards

May 28, 2020

Name	Organization
Chris Miller	NRC
Kerri Kavanagh	NRC
Jonathan Ortega-Luciano	NRC
John Honcharik	NRC
Gregory Suber	NRC
Nik Floyd	NRC
Aaron Armstrong	NRC
Steven Bloom	NRC
Edison Fernandez	NRC
David Rudland	NRC
Allen Hiser	NRC
Anna Bradford	NRC
David Dijamco	NRC
Hipo Gonzalez	NRC
Justin Fuller	NRC
Robert Kuntz	NRC
Isaac Anchondo-Lopez	NRC
John Tsao	NRC
Mel Holmberg	NRC
Natreon Jordan	NRC
Robert Davis	NRC
Bob Caldwell	NRC
Allen Hiser	NRC
Anna Bradford	NRC
David Dijamco	NRC
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Bob Caldwell	NRC
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Enclosure

Ann Marie Stone	NRC
Natreon Jordan	NRC
Victor Montalbano	Framatome
Brian Haibach	Framatome
Gary Peters	Framatome
Yves Cariou	Framatome
Mike Street	Framatome
Tim Wiger	Framatome
David Rabau	Framatome
Eric Augier	Framatome
Francois Roch	Framatome
Phil Opsal	Framatome
David Cofflin	Framatome
Pierre Challot	Framatome
Ben Grambau	Framatome
Christophe Mouret	Framatome
Jeff Enneking	Framatome
Ashok Nana	Framatome
Dana Knee	Dominion
Stephanie Banker	Ameren
Robert Clark	Entergy
Stephanie Pyle	Entergy
Joe Weicks	Entergy
Steve Brown	Entergy
Jasmyn Bone	Entergy
Jeff Lanum	Entergy
Andy Justice	Entergy
Brian Thomas	PSEG
Kris Garg	PSEG
Scott Boggs	FP&L
Lora Drenth	Xcel Energy