



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

September 20, 2019

Mr. Gary E. Szabatura
Manager, Quality Programs
Framatome Inc.
3315 Old Forest Road
Lynchburg, VA 24501

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION REPORT OF
FRAMATOME INC., NO. 99901300/2019-201

Dear Mr. Szabatura:

From June 24 through June 28, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at Framatome Inc. (hereafter referred to as Framatome) facility in Lynchburg, VA. This limited-scope routine inspection assessed Framatome's compliance with provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," selected portions of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," regarding Framatome's implementation of thermal conductivity degradation (TCD) modeling and with the requirements in 10 CFR 50.55a, "Codes and standards," for the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B&PV) Code Section XI, ASME Code Case N-729-4. This inspection also verified Framatome's response to the compliance with the requirements of 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements," 10 CFR 73.22, "Protection of Safeguards Information: Specific Requirements," and the Commission Order No. EA-07-231, "Order Imposing Safeguards Information Protection Requirements and Fingerprinting and Criminal History Records Check Requirements for Access to Safeguards Information," for handling Safeguards Information (SGI) related to new reactor designs.

This technically-focused inspection specifically evaluated Framatome's implementation of the quality activities associated with 1) design, analysis, and corrective actions associated with TCD in safety-related computer codes used for the U.S. nuclear power plants; 2) the evaluations, investigations, and corrective actions associated in the ultrasonic testing inspection performed at Palisades, for the upper head control rod drive penetration; 3) oversight of suppliers and commercial-grade dedication programs; and 4) effective protection of SGI. The enclosed report presents the results of the inspection. This NRC inspection report does not constitute NRC endorsement of Framatome's overall quality assurance (QA) or 10 CFR Part 21 programs.

Based on the results of this inspection, the NRC inspection team found the implementation of your QA program with regards to the treatment of TCD, oversight of suppliers and commercial-grade dedication, and the implementation of your SGI program met the applicable requirements. No findings of significance were identified.

In accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," of the NRC's "Rules of Practice," a copy of this letter, and its enclosure(s), will be made available electronically for public inspection in the NRC Public Document Room and from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

Kerri A. Kavanagh, Chief **/RA/**
Quality Assurance Vendor Inspection Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

Docket No.: 99901300

EPID No.: I-2019-201-0049

Enclosure:

1. Inspection Report No. 99901300/2019-201
and Attachment

SUBJECT: NUCLEAR REGULATORY COMMISSION VENDOR INSPECTION REPORT OF
FRAMATOME INC., NO. 99901300/2019-201, Dated: September 20, 2019

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**U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
DIVISION OF INSPECTION AND REGIONAL SUPPORT
QUALITY ASSURANCE VENDOR INSPECTION REPORT**

Docket No.: 99901300

Report No.: 99901300/2019-201

Vendor: Framatome Inc.
3315 Old Forest Road
Lynchburg, VA 24501

Vendor Contact: Mr. Gary E. Szabatura
Manager, Quality Programs
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Nuclear Industry Activity: Framatome's scope of supply includes fuel design and fabrication, engineering services, and replacement of safety-related components for U.S. operating nuclear power plants.

Inspection Dates: June 24, 2019 – June 28, 2019

Inspection Team Leader Jonathan Ortega-Luciano NRR/DIRS/IQVB

Inspectors: Andrea Keim NRR/DIRS/IQVB
Dong Park NRR/DIRS/IQVB

Technical Specialist: Stephen Cumblidge NRR/DMLR/MPHB
Carol Nove RES/DE/CIB
Josh Kaizer NRR/DSS/SNPB
Diana Woodyatt NRR/DSS/SRXB

Approved by: Kerri A. Kavanagh, Chief
Quality Assurance Vendor Inspection Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

FRAMATOME INC.
99901300/2019-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a vendor inspection at the Framatome Inc. (hereafter referred to as Framatome) facility in Lynchburg, VA, to verify that it had implemented an adequate quality assurance (QA) program that complies with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" and 10 CFR Part 21, "Reporting of Defects and Noncompliance," in addressing concerns associated with Thermal Conductivity Degradation (TCD) modeling to demonstrate compliance with 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and nondestructive examination activities associated with the requirements of Section XI, Code Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1," of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B&PV) Code. In addition, the NRC inspection team verified that Framatome had implemented a program to protect Safeguards Information (SGI) in accordance with the requirements of 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements," 10 CFR 73.22, "Protection of Safeguards Information: Specific Requirements," and Commission Order No. EA-07-231, "Order Imposing Safeguards Information Protection Requirements and Fingerprinting and Criminal History Records Check Requirements for Access to Safeguards Information" for handling of information associated related to new reactor designs. This is the fourth NRC inspection of the Lynchburg, Virginia facility, previously named AREVA Inc. The last inspection to this facility occurred in May 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17124A575).

This technically-focused inspection specifically evaluated Framatome's implementation of the quality activities associated with 1) design, analysis, and corrective actions associated with TCD in safety-related computer codes used for the U.S. nuclear power plants; 2) the evaluations, investigations, and corrective actions associated in the ultrasonic testing inspection performed at Palisades, for the upper head control rod drive penetration; 3) oversight of suppliers and commercial-grade dedication programs; and 4) effective protection of SGI.

In Information Notices (INs) 2009-23, "Nuclear Fuel Thermal Conductivity Degradation," and 2011-21, "Realistic Emergency Core Cooling System Evaluation Model Effects Arising from Nuclear Fuel Thermal Conductivity Degradation" the NRC described updated information on fuel temperature calculations, specifically those accounting for TCD effects on emergency core cooling. IN 2009-23 states that not accounting for TCD in safety analysis can cause the predicted results to be less conservative than previously understood, specifically the peak clad temperature (PCT) may be higher than previously understood. In response to these INs, Framatome reviewed engineering data and concluded there is a reasonable assurance of safe operation. This inspection reviewed Framatome's response to the revised guidance to assure that public safety is maintained.

These regulations served as the bases for the NRC inspection:

- Appendix B to 10 CFR Part 50
- 10 CFR 50.46
- 10 CFR 50.55a
- 10 CFR Part 21
- 10 CFR Part 73

During the course of this inspection, the NRC inspection team implemented inspection procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017, IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017, IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated May 16, 2019, and IP 81811, "Protection of Safeguards Information by Design Certification Applicants and Vendors," dated September 6, 2016.

The results of the inspection are summarized below.

10 CFR Part 21

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern the implementation of its 10 CFR Part 21 program to verify compliance with 10 CFR Part 21. The NRC inspection team: (1) reviewed the 10 CFR Part 21 postings; (2) reviewed a sample of purchase orders (POs); and (3) verified that Framatome's corrective action program provides a link to the 10 CFR Part 21 program. No findings of significance were identified.

Design and Software Control

The NRC inspection team reviewed a sample of Framatome's calculation notes, guidance, and condition reports associated with assessing the effects of TCD to verify compliance with the regulatory requirements of 10 CFR 50.46 and Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. The NRC staff evaluated Framatome's modeling and simulation QA process for development and maintenance of computer software that analyzes and models nuclear fuel performance codes and the effects of TCD as addressed in IN 2009-23. No findings of significance were identified.

Control of Special Processes

The NRC inspection team reviewed Framatome's policies, implementing procedure and completed reports associated with nondestructive examination (NDE) of components to verify compliance with the regulatory requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50, ASME B&PV Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," ASME B&PV Code, Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," and ASME Section XI, Code Case N-729-4. The NRC inspection team reviewed Framatome's Root Cause Analysis (RCA) associated with Palisades' missed UT indications in control rod drive mechanism (CRDM) Nozzles #25, #33, and #36 to confirm that the full extent of both root and contributing causes were identified and evaluated.

The NRC inspection team identified an unresolved item (URI) regarding Framatome's changes to NDE procedure 54-ISI-604-013, "Automated Ultrasonic Examination of Open Tube RPV

[Reactor pressure Vessel] Closure Head Penetrations.” Ultrasonic examinations of RPV Closure Head Penetrations are required by 10 CFR 50.55(a) to meet the qualification requirements set forth in ASME B&PV Code Section XI. Section XI requires performance demonstration for procedures, personnel and equipment meeting the requirements of Appendix VIII and associated Code Cases. Upon successful performance demonstration, a Performance Demonstration Qualification Statement (PDQS) is issued for the qualified procedure. Section XI requires requalification and issuance of a revised PDQS if essential variables are changed as a result of procedure revisions. During the inspection it was determined that Revision 13 of this procedure does not have a PDQS. Further, it was not clear at the end of this inspection if the changes contained in Revision 13 possibly changed essential variables requiring requalification of the procedure, meaning that some examinations performed by Framatome may not have met the qualification requirements of Section XI and thus, may not have been in compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(D).

The NRC inspection team identified a minor issue with regards to instructions provided by NDE procedure 54-ISI-604-013. Specifically, the NRC inspection team identified that NDE procedure 54-ISI-604-013 provided inadequate programmatic direction regarding how to perform historical review of previous data in accordance with the requirements of Paragraph-3131(c) from Subsection IWB-3000, “Acceptance Standard,” of Section XI of the ASME B&PV Code. The NRC inspection team determined this issue to be minor because it was self-identified by Framatome during the investigation performed to support their root cause evaluation. Framatome initiated corrective action report 2018-9955 to address this issue.

Commercial-Grade Dedication and Oversight of Contracted Activities

The NRC inspection team reviewed Framatome’s policies and implementing procedures that govern the implementation of its commercial-grade dedication (CGD) and supplier oversight programs to determine compliance with the requirements of Criterion III, “Design Control,” Criterion IV, “Procurement Document Control,” and Criterion VII, “Control of Purchased Material, Equipment, and Services,” of Appendix B to 10 CFR Part 50. Specifically, the NRC inspection team reviewed dedication packages to assess the different elements of the CGD program, including the technical evaluation process, work package instructions, and inspection reports. The NRC inspection team evaluated the criteria for the identification of item safety functions, credible failure mechanisms/modes, selection of critical characteristics (CCs) and acceptance criteria, and the identification of verification methods to verify effective implementation of Framatome’s CGD process. No findings of significance were identified.

The NRC inspection team reviewed Framatome’s supplier qualification process, procurement process, and control of suppliers by focusing on control of key elements of the design, manufacturing, assembly, and testing, as applicable, for a sample of parts, components and services being procured. The NRC inspection team reviewed a sample of external audits performed by Framatome to verify that Framatome provides adequate oversight of its suppliers. The NRC inspection team verified that the scheduled audits were performed by qualified individuals using checklists and/or procedures and that these checklists and/or procedures include an audit plan, documented objective evidence, audit results, and a review of audit results by responsible management. The NRC inspection team verified that the audits were performed at the minimum frequency as specified in the Framatome’s requirements. No findings of significance were identified.

Corrective Action

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern the implementation of its corrective actions program to determine compliance with the requirements of Criterion XVI, "Corrective Action," of Appendix to 10 CFR Part 50. Specifically, the NRC inspection team reviewed the corrective actions taken by Framatome to address the TCD and NDE issues to verify compliance with the regulatory requirement of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed Framatome's documentation associated with their analysis to determine the applicability and reportability of the TCD issue under 10 CFR Part 21 as well as a sample of corrective action reports, corrective action program and training reports, root cause analyses, and corrective action commitments. The NRC inspection team also reviewed the implementation of the corrective actions proposed in response to a finding identified during the 2011 NRC inspection. No findings of significance were identified

Safeguards Information (SGI) Program

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern the implementation of its program for the protection of SGI in accordance with the applicable requirements of 10 CFR 73.21, 10 CFR 73.22, and the Commission's Order No. EA-07-231. Since the Commission's Order No. EA-07-231 pre-dates the Vendor and Design Certification applicant rulemaking for 10 CFR 73.21 and 10 CFR 73.22, it was the original requirement for applicants to complete the SGI protection requirements which were later codified in 10 CFR Part 73. The NRC inspection team: (1) reviewed Framatome's implementing procedures for controlling and protecting SGI; (2) interviewed Framatome's SGI program personnel; (3) inspected the SGI secured location and locked SGI security containers; (4) reviewed a sample of SGI hardcopy materials for proper markings and storage; (5) verified labeling of electronic media such as SGI hard drives and laptops; and (6) reviewed a sample of logs, access lists, program self-assessments, and corrective actions. The NRC inspection team also reviewed a sample of personnel files regarding personnel conditions for access to SGI material. No findings of significance were identified.

REPORT DETAILS

1. 10 CFR Part 21 Program

a. Inspection Scope

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern Framatome's Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," program to verify compliance with the regulatory requirements. In addition, the NRC inspection team evaluated the 10 CFR Part 21 postings and a sample of Framatome's purchase orders (POs) for compliance with the requirements of 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and its Evaluation," and 10 CFR 21.31, "Procurement Documents." The NRC inspection team also verified that Framatome's corrective action procedure provide a link to the 10 CFR Part 21 program. Furthermore, for a sample of 10 CFR Part 21 evaluations performed by Framatome, the NRC inspection team verified that Framatome had effectively implemented the requirements for evaluating deviations and failures to comply. The NRC inspection team verified that the notifications were performed in accordance with the requirements of 10 CFR 21.21, as applicable.

The NRC inspection team also discussed the 10 CFR Part 21 program with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded Framatome is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Framatome is implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

2. Design and Software Control

a. Inspection Scope

The NRC inspection team reviewed a sample of Framatome's calculation notes, guidance, issue reports (IRs), and inter-design group correspondence associated with assessing the effects of thermal conductivity degradation (TCD) to verify compliance with the regulatory requirements of 10 CFR 50.46 and Criterion III, "Design Control," of Appendix B to 10 CFR Part 50.

The NRC staff described TCD and the potential effects it can cause in Information Notices (INs) 2009-23, "Nuclear Fuel Thermal Conductivity Degradation," and 2011-21, "Realistic Emergency Core Cooling System Evaluation Model Effects Arising from Nuclear Fuel Thermal Conductivity Degradation." IN 2009-23 states that not

accounting for TCD in safety analysis can cause the predicted results to be less conservative than previously understood, specifically the peak clad temperature may be higher than previously understood.

The NRC inspection team reviewed Framatome's condition reports associated with the identification, impact, and safety assessment of TCD on the TACO3 and GDTACO computer codes. The NRC inspection team verified the effectiveness of Framatome's corrections to, and maintenance of, the evaluation model which used these computer codes to properly account or compensate for the effects of TCD.

The NRC inspection team reviewed Framatome's condition report (CR) 2009-4152 which evaluated the effects of TCD in TACO3 and GDTACO which were used to verify compliance with 10 CFR 50.46. The analysis contained in CR 2009-4152 compared the predictions of the codes to validation data from two test rods. The results of the analysis showed conservative predictions of TACO3 and GDTACO compared to test data for the high-power data and an underprediction of fuel temperatures with the low rod powers and high gap conductance data. In the low rod powers and high gap conductance case, Framatome implemented a conservatism which accounted for the model differences from the exhibited TCD changes in fuel. The NRC staff reviewed the analysis conducted by Framatome and agrees that the conclusion was supported by the known data.

In 2014, Framatome became aware of additional information relevant to their prior evaluation of the impacts of TCD. The information was discovered during review of a different fuel parameter calculation. Framatome promptly re-evaluated the effects of TCD in their analysis codes and determined that additional conservatisms were warranted. Framatome informed their customers of the conservatisms to be implemented. The effect of the conservatisms to the NRC licensed Framatome customers was within their fuel operating window and therefore, was of minor impact. The NRC inspection team determined that Framatome took proper actions in a timely manner with the detection of this new information.

The NRC inspection team also discussed the design and software control programs as applicable to the TCD issue with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed and the staff interviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Framatome implemented its design and software control programs with respect to the issues identified with TCD in accordance with the regulatory requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 and 10 CFR 50.46. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Framatome is implementing its policies and procedures associated with the design and software control. No findings of significance were identified.

3. Control of Special Processes

a. Inspection Scope

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern the control of special processes to verify compliance with the regulatory requirements of Criterion IX, "Control of Special Processes," in Appendix B to 10 CFR Part 50, Code Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1." and Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel (B&PV) Code and 10 CFR 50.55a.

The NRC inspection team reviewed the Framatome Root Cause Analysis (RCA), "Palisades Missed UT [Ultrasonic Testing] Indications in CRDM [Control Rod Drive Mechanism] Nozzles #25, #33, and #36," to confirm that the full extent of both root and contributing causes were identified and evaluated.

In addition, the NRC inspection team reviewed Framatome's Nondestructive Examination (NDE) procedures, "Automated Ultrasonic Examination of Open Tube RPV [Reactor Pressure Vessel] Closure Head Penetrations," 54-ISI-604, Revisions 11 and 13, (54-ISI-604-011 and 54-ISI-604-013 respectively) to ensure conformance to ASME B&PV Code Section XI, Code Case N-729-4 and 10CFR 50.55a requirements.

The NRC inspection team also discussed the special process program with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Root Cause Analysis Evaluation

During the review of the RCA, the NRC inspection team noted that Framatome identified the Root Cause to be "Misjudgement" as the UT indications from inner diameter (ID) initiated flaws were not interpreted correctly as primary water stress corrosion cracking (PWSCC) flaws.

The NRC inspection team found that the RCA satisfactory documents and explains the rationale for Framatome's identification of the root cause and seven contributing causes. The RCA also emphasizes the unique geometry of the Palisades nozzles (thin walled, with prominent areas of shrinkage on the ID, and ID score marks) as a factor that caused the analysts to initially call the indications weld shrinkage. The RCA explains Framatome's practice as it relates to the Palisades inspection, which was to compare data collected during the current outage to the data collected at the last outage. Since the Palisades head was examined every outage (at approximately 18 months intervals), the flaw growth was not apparent in the outage-to-outage comparisons. Further, the RCA explains that with only slight changes in the UT signals (including those from the leak path assessment) from inspection to inspection, there was nothing to trigger the analyst to reassess the indication and call it anything other than what it was dispositioned before, weld shrinkage.

Framatome's RCA also evaluated their Just in Time Training (JITT) provided to their analysts. According to Framatome's assessment, the entire focus of the training was on OD flaws in response to the 2012 Shearon Harris missed OD flaw, resulting in the analysts' mindset being focused on the nozzle OD. Thus, though the inspection method was capable of detecting ID flaws and had been qualified to do so, lack of recent operating experience for ID flaws coupled with the attention on OD flaws created a situation where the analysts were not focused appropriately on ID flaws.

One of the contributing causes identified by the RCA has to do with cognitive overload. To get a better understanding of how this was assessed as a contributing cause the NRC inspection team discussed this contributing cause with UT Level III. Framatome UT Level III personnel reviewed Nozzle #25 ultrasonic data collected in 2007, 2009, 2010, 2012, 2014, 2015, 2017, and 2018 with the NRC inspection team. The Framatome personnel explained the rationale for their assessments of the UT indications and what led them to mis-interpret the flaw signals over 11 years of upper head examinations. The Level III showed how the unique configuration of the Palisades CRDMs (thin tube wall combined with areas of shrinkage due to welding on the OD surface) caused the flaw to be interpreted as shrinkage rather than an ID-connected flaw. It was explained to the NRC inspection team that the Palisades reactor vessel upper head examinations were conducted with an "open tube" procedure that incorporates data collected from 6 transducer pairs rather than the typical 2 pairs of transducers. It was emphasized that due to the shrinkage in the tubes, rescanning areas was often necessary to acquire adequate data for each CRDM. Thus, significant amounts of complex data which had to be assessed by the analysts was generated. Further, the Level III demonstrated how small growth of the flaw between outages was not observed but would have been obvious if comparisons were made to data collected from 3 outages back. Additionally, the Level III reviewed the leak path data for the 2007-2018 examinations and explained that changes that are typically associated with leakage ("river bed" features) were not present in the data for Nozzle #25; however, general background amplitude changes were present that should have been identified as a leak path response. This information provided by the Level III supports Framatome's identification of cognitive overload as a contributing cause.

Framatome's RCA also assesses extent of condition and generic implications. In terms of the extent of condition at Palisades, the RCA documents that the UT data on the other 52 relevant nozzles (beyond Nozzle #25 that had the leak) was re-reviewed by Framatome. Four additional nozzles were then identified for further review by a third party, Electric Power Research Institute (EPRI), and of these four nozzles, one was determined to be acceptable, one was determined to have an indication of PWSCC, and two required surface eddy current to provide conclusive evidence of the presence (or lack) of PWSCC. In terms of the extent of condition for other (not Palisades) reactor vessel heads examined by Framatome since 2013, the RCA provides an adequate analysis showing that there is no reason to believe that the root cause "misjudgement" (UT signals that result from ID initiated PWSCC being incorrectly characterized as shrinkage) would be a generic issue at other plants since typical CRDMs do not present with the same configuration and complexity as Palisades to create situations similar to those observed at Palisades, "condition for misjudgement."

Furthermore, as part of the review of the RCA, the NRC inspection team evaluated Framatome's action plan which includes revising procedures and JITT with information obtained from the Palisades event and found it adequate to address the root cause and contributing causes identified, and to prevent future examinations of RPV head nozzles from failing to correctly identify indications of ID PWSCC and ultrasonic leak paths.

b.2 Nondestructive Examination Procedure Evaluation

The NRC Inspection team reviewed Performance Demonstration Qualification Summaries (PDQS): #717 for Procedure 54-ISI-604-011, "Automated Examination of Open Tube RPV Closure Head Penetrations," PDQS Revision 4, qualified on September 24, 2010; and (2) personnel qualification for Procedure 54-ISI-604-11 (Revision 11), "Automated Examination of Open Tube PRV Closure Head Penetrations," and concluded that the personnel were appropriately qualified to 54-ISI-604-11. Also, the NRC inspection team reviewed Framatome's procedure "Written Practice for the Qualification and Certification of NDE Personnel for ASME B&PV Code Section XI" (54-ISI-30-023) and confirmed the procedure was consistent with the requirements of ASME B&PV Code, Section XI.

During this inspection the NRC inspection team concentrated their efforts in evaluating NDE procedure 54-ISI-604-013, "Automated Ultrasonic Examination of Open Tube RPV [Reactor pressure Vessel] Closure Head Penetrations," which was the procedure used for upper head examinations at Palisades in November 2018. The NRC inspection team performed a comparison between 54-ISI-604, Revisions 11 and 13, (54-ISI-604-011 and 54-ISI-604-013 respectively) to understand the changes made by Framatome to the procedure. The NRC inspection team noted that some of the changes from Revision 11 to Revision 13 can be categorized as changes to essential variables related to how data is analyzed. Ultrasonic examinations of RPV Closure Head Penetrations are required by 10 CFR 50.55(a) to meet the qualification requirements set forth in ASME B&PV Code Section XI. Section XI requires performance demonstration for procedures, personnel and equipment meeting the requirements of Appendix VIII and associated Code Cases. Upon successful performance demonstration, a PDQS is issued for the qualified procedure. Section XI requires requalification and issuance of a revised PDQS if essential variables are changed as a result of procedure revisions.

During the inspection it was determined that Revision 13 of this procedure (54-ISI-604-013) does not have a PDQS. Further, it was not clear at the end of this inspection if the changes contained in Revision 13 possibly changed essential variables requiring requalification of the procedure, meaning that some examinations performed by Framatome may not have met the qualification requirements of Section XI, and thus, may not have been in compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(D). The NRC inspection team identified this issued as unresolved item (URI) 99901300/2019-201-01.

Furthermore, during the review of 54-ISI-604-013, the NRC inspection team noted that some of the instruction provide by the procedure to perform the analysis were not clearly interpreted for the UT inspection at Palisades. Specifically, the instruction contained in the procedure to review the previous examination data come from the requirements contained in Paragraph-3131(c) from Subsection IWB-3000, "Acceptance Standard," of Section XI, "Rules for Inspection and Testing of Components of Light-Water-Cooled Plants," of the ASME B&PV Code. Paragraph-3131(c) states that "Volumetric and

surface examination results shall be compared with recorded results of the preservice examination and prior inservice examinations. Acceptance of components for continued service shall be in accordance with IWB-3132, IWB-3133, and IWB-3134.” The NRC inspection team noted that the instructions in the procedure in conjunction with Palisades’ unique nozzle configurations, which is a highly complex ultrasonic examination, and that these inspections are performed every outage (18 months intervals), could result in the inability to detect flaw growth in outage to outage data comparisons. Based on this, the NRC inspection team concluded that the instructions in the procedure are not adequate for Palisades upper head examinations. Specifically, Framatome only evaluated and compared the indications resulting from the 2018 UT examinations of the upper head nozzles to the result from the last examination (2017). By not comparing the 2018 Palisades’ results to those obtained more than one outage back, Framatome failed to identify changes in growth of an indication previously identified, resulting in a leakage path of Nozzle #25 of the Palisades Reactor Vessel Head.

The NRC inspection team noted that this issue was documented in the RCA as contributing cause. The RCA identifies this as “Another complication occurred as a result of the historical review of previous data; that is reviewing the previous outage for comparative purposes. Because of the frequency of inspection was approximately 18 months, the change associated with the indications was not detected as a function of changing ID PWSCC as it was misinterpreted as transducer tracking issues as a function of weld shrinkage. Thus, a contributing cause of “Misinterpretation of Information” is assigned.” Furthermore, the RCA also states that “There was inadequate programmatic direction (i.e., insufficient program design in the UT procedure used for this examination) regarding “the need for” an “how to” perform a comparison of potential UTLP [ultrasonic test leak path] indications with previous UT examination indications. Namely, the discussion of what a “significant” change in a UTLP indication is, and how historical data is to be implemented was not clear within the procedure or the JITT. While the procedural term “meandering pattern” is a descriptive means to describe UT leak path phenomena, it is subjective and open to individual interpretation.” Taking into consideration the configuration of Palisades’ reactor vessel head and the high level of technical difficulty of this UT inspection the NRC inspection team agreed with Framatome’s RCA conclusion that the procedure provided inadequate programmatic direction. As such the RCA states that “the procedure needs to be revised to provide requirements for ID initiated PWSCC indications to be compared to indications seen back further than just the last examination, since reviewing the currently found indications to only the last examination was shown to be an unreliable method of detecting change. For back wall interference fit data, the current data will need to be compared to both recent examinations (for rapid change) and any historical examinations (departures from a consistent pattern from previous examination) for detecting the occurrence of UTLP.” Based on the Framatome’s evaluation as documented in the RCA and the immediate corrective action taken, the NRC inspection team determined this to be a minor issue. Corrective action 2018-9955, dated December 12, 2018 was initiated to address this issue.

c. Conclusion

The NRC inspection team concluded that, with the exception of the URI and the minor issue identified, Framatome conducted the ultrasonic inspections of Palisades’ reactor pressure vessel closure head penetrations in accordance with the regulatory

requirements of Criterion IX, "Control of Special Processes," in Appendix B to 10 CFR Part 50.

4. Commercial-Grade Dedication and Supplier Oversight

a. Inspection Scope

The NRC inspection team reviewed Framatome's policies and implementing procedures that govern the implementation of its commercial-grade dedication (CGD) and supplier oversight programs to verify compliance with the requirements of Criterion III, "Design Control," Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50.

Framatome is a member of Nuclear Industry Assessment Committee (NIAC), which consists of companies who supply components and services to the nuclear industry based on a quality assurance (QA) program that meets the requirements of Appendix B to 10 CFR Part 50 and accept 10 CFR Part 21. The NRC inspection team confirmed that once a NIAC audit or commercial-grade survey is received, Framatome's QA Manager reviews them for completeness and adequacy. These documents are evaluated in accordance with Framatome's QA program and if found to be acceptable, the QA Manager will document and use these evaluations as the basis for including these suppliers on Framatome's Approved Suppliers List (ASL).

The NRC inspection team reviewed a sample of CGD plans, checklists, reports, associated POs, and commercial-grade surveys of several vendors on Framatome's ASL. The NRC inspection team evaluated a sample of technical evaluations and concluded that the technical evaluations in the dedication plans appropriately identify the critical characteristics (CCs) and technical attributes necessary to provide reasonable assurance that the services would perform their intended safety function.

The NRC inspection team reviewed a sample of external audits to verify the implementation of Framatome's supplier oversight program. The NRC inspection team verified that Framatome had prepared and approved plans that identify the audit scope and applicable checklist criteria before the initiation of the audit activity. The NRC inspection team confirmed that the audit reports contained objective evidence of the review of the relevant QA criteria of Appendix B to 10 CFR Part 50. For audits that resulted in findings, the NRC inspection team verified that the supplier had established a plan for corrective action and that Framatome had reviewed and approved the corrective action and verified its satisfactory completion and proper documentation. The NRC inspection team verified that the POs included, as appropriate: the scope of work, right of access to facilities, and extension of contractual requirements to subcontractors. In addition, the NRC inspection team confirmed that the reviewed safety-related POs invoked the requirements of Appendix B to 10 CFR Part 50 and 10 CFR Part 21.

The NRC inspection team also reviewed a sample of training and qualification records of lead auditors and verified that auditing personnel had completed the required training and maintained qualification and certification in accordance with Framatome's policies and procedures.

The NRC inspection team discussed the CGD and supplier oversight programs with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

b. Observation and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Framatome is implementing its CGD program and oversight of contracted activities in accordance with the regulatory requirements of Criterion III, Criterion IV, and Criterion VII, respectively, of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed and activities observed, the NRC inspection team determined that Framatome is implementing its policies and procedures associated with CGD program and oversight of contracted activities. No findings of significance were identified.

5. Corrective Action

a. Inspection Scope

The NRC inspection team reviewed Framatome's policies and implementing procedures governing corrective actions to verify compliance with the requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspection team also reviewed Framatome's actions associated with its response to Notice of Nonconformance contained in NRC Inspection Report No. 99901359/2011-201. In addition, the NRC inspection team reviewed the corrective actions taken by Framatome to address the TCD and NDE issues. The NRC inspection team reviewed Framatome's documentation associated with their analysis to determine the applicability and reportability of the TCD issue and NDE issues under 10 CFR Part 21 as well as a sample of corrective action reports including training reports, root cause analyses, and objective evidence of corrective action implementation.

The NRC inspection team discussed the corrective action program with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

b. Observation and Findings

Corrective Actions Associated with Nonconformance No. 99901359/2011-201-1

Following the June 2011 inspection of Framatome (previously AREVA Inc.), the NRC issued Notice of Nonconformance (NON) 99901359/2011-201-1 for Framatome's failure to ensure that equipment purchased through a contractor conformed to the purchase order. Specifically, Framatome's audit of Flowserve-Limitorque's CGD program failed to verify that Flowserve-Limitorque had appropriate provisions to control the critical characteristics of the item been procured. Framatome responded to the NRC inspection report by letter dated August 4, 2011, (ADAMS Accession No. ML11217A110). As part of their corrective actions Framatome conducted an indoctrination training that included

emphasis on auditing techniques, and audit preparation to ensure more effective and comprehensive audits. Also, Framatome issued an operating instruction, which established expectations for pre-audit briefings for internal, supplier, customer, and third-party audits.

The NRC inspection team reviewed the documentation that provided the objective evidence for the completion of the corrective actions and supplemental documentation supporting the closure and effectiveness review of these corrective actions. Based on the review, the NRC inspection team closed NON 99901359/2011-201-1.

c. Conclusion

The NRC inspection team concluded that Framatome is implementing its corrective action programs in accordance with the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that Framatome is effectively implementing its policies and procedures associated with the corrective action programs. No findings of significance were identified.

6. Safeguards Information Program

a. Inspection Scope

The NRC inspection team reviewed Framatome's policies and implementing procedures to verify that Framatome's information protection system effectively protects Safeguards Information (SGI), as defined in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements," and 10 CFR 73.22, "Protection of Safeguards Information: Specific Requirements," and prevents unauthorized disclosure.

The NRC inspection team: (1) reviewed Framatome's implementing procedures for controlling and protecting SGI; (2) interviewed Framatome's SGI program personnel; (3) inspected the SGI secured location and locked SGI security containers; (4) reviewed a sample of SGI hardcopy materials for proper markings and storage; (5) verified labeling of electronic media such as SGI hard drives and laptops; and (6) reviewed a sample of logs, access lists, program self-assessments, and corrective actions. The NRC inspection team also reviewed a sample of personnel files regarding personnel conditions for access to SGI material.

The NRC inspection team also discussed the SGI program with Framatome's management and technical staff. The attachment to this inspection report lists the documents reviewed and the staff interviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that Framatome established its SGI protection program in accordance with the applicable requirements of 10 CFR 73.21, 10 CFR 73.22, and the Commission's Order No. EA-07-231. Based on the limited sample of

documents reviewed and activities observed, the NRC inspection team determined that Framatome is implementing its policies and procedures associated with the SGI program in accordance with the regulatory requirements of 10 CFR 73.21 and 10 CFR 73.22. No findings of significance were identified.

7. Entrance and Exit Meetings

On June 24, 2019, the NRC inspection team discussed the scope of the inspection with Victor Montalbano, Vice President, Quality & Performance and other members of Framatome's management and technical staff. On June 28, 2019, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Montalbano and other members of Framatome's management and technical staff. On August 9, 2019, during a conference call with Mr. Montalbano the NRC inspection team performed a second exit meeting, to discuss changes made to the results previously presented during the June 28 exit meeting. The attachment to this report lists the attendees of the entrance and exit meetings, as well as those individuals whom the NRC inspection team interviewed.

ATTACHMENT

1. Entrance/Exit Meeting Attendees and Persons Interviewed

Name	Title	Affiliation	Entrance	Exit	Interviewed
Jonathan Ortega-Luciano	Inspection Team Leader	NRC	X	X	
Andrea Keim	Inspector	NRC	X	X	
Dong Park	Inspector	NRC	X	X	
Stephen Cumblidge	Technical Specialist	NRC	X	X	
Carol Nove	Technical Specialist	NRC	X	X	
Josh Kaizer	Technical Specialist	NRC	X	X	
Diana Woodyatt	Technical Specialist	NRC	X	X	
Amy St. John*	Quality Specialist	Framatome		X	
Breanna Deheny	Engineer	Framatome			X
Cathy Campbell	Manager, Records Management	Framatome		X	
Clayton Scott*	Deputy Sales I & C	Framatome		X	
Craig Chiodo	Corrective Actions	Framatome			X
Dave Zimmerman	NDE Certification Administrator	Framatome			X
David Borcik*	Quality Specialist	Framatome		X	
David Short*	Manager of Manufacturing Operations	Framatome	X	X	
Duane Newman	Quality Specialist, Quality Programs	Framatome	X	X	X
Gary Mignogna	President & CEO	Framatome	X	X	
Gary Peters	Director Licensing & Regulatory Affairs	Framatome		X	
Gary Szabatura	Manager of Quality Programs	Framatome	X	X	
John Klingenfus	Advisory, Engineering	Framatome	X	X	
Jonathan Scruggs	NDE Services Manager	Framatome	X	X	X
Kent Abel	V&V	Framatome			X
Laurie Brownson*	Operational Excellence	Framatome		X	

Name	Title	Affiliation	Entrance	Exit	Interviewed
Lawrence French	Quality Assurance Manager	Framatome	X	X	
Mark Elsishans	Manager of Engineering & Technical Operations	Framatome		X	X
Mark Harvey*	Quality Director I & C	Framatome		X	
Mike Key	Level III UT	Framatome	X	X	X
Pam Nichols*	Quality & Performance Administrative Assistant	Framatome		X	
Paul Garcia	Fuels QA Manager	Framatome	X	X	X
Philip Opsal	Regulatory Program Director	Framatome	X	X	X
Richie McKay*	I & C Corrective Action Manager	Framatome		X	
Ron Legrand*	VP I & C	Framatome		X	
Ronda Lane	Advisory Engineering, US Regulatory Recovery Manager	Framatome	X	X	X
Ryan Joschak*	Quality Specialist	Framatome		X	
Scott Breiholz*	Manager of NDE Certification	Framatome			
Tim Mabry	SGU Coordinator	Framatome	X	X	X
Tom Delorey*	Manager of Fuels Engineering	Framatome		X	
Tom Deponty*	Director Government Affairs & Advocacy	Framatome		X	
Victor Montalbano	VP Quality & Performance	Framatome	X	X	X
Warren Grout	Fuels QA	Framatome		X	X
Will Maxon*	Manager of Fuels Engineering	Framatome	X	X	
Gayle Elliot	Director, Licensing & Regulatory Affairs	Framatome	X	X	X
Debra Shilale*	Software Configuration Administrator	Framatome		X	

*Teleconference call

2. INSPECTION PROCEDURES USED

- Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated May 16, 2019
- IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017
- IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017
- IP 81811, "Protection of Safeguards Information by Design Certification Applicants and Vendors," dated September 6, 2016.

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Status	Type	Description
99901300/2019-201-01	Open	URI	
99901359/2011-201-01	Closed	NON	Criterion VII

4. DOCUMENTS REVIEWED

Policies and Procedures

- D02-ARV-01-101-817, "Framatome Integrated Management System Manual," Revision D, dated February 12, 2018
- FS1-0011462, "10 CFR 71, Subpart H Quality Assurance Program Description for Packaging and Transportation of Radioactive Materials for US Fuel," Revision 5, dated March 29, 2018
- 0401, "Evaluation and Reporting per 10 CFR 21," Revision 25, dated July 31, 2018
- 1707-01, "Implementation of 10 CFR 21," Revision 050, dated February 6, 2019
- 1719-22, "Quality Assurance Audits and Commercial Grade Surveys of Suppliers," Revision 034, dated October 31, 2018
- 1719-23, "Qualification of Quality Assurance Audit Personnel," Revision 029, dated February 20, 2019
- OI No. 2A826-1382, "Evaluation of Nuclear Industry Assessment Committee (NIAC) and Third-Party Assessments," Revision 12, dated November 2, 2018
- Information Transmittal Regarding Requested White Papers on the Treatment of Expose Dependent Fuel Thermal Conductivity Degradation in RODEX Fuel Performance Codes and Methods
- 0908-23, "US Fuel Development of Engineering Applications Software," Revision 9, dated December 13, 2018
- 1703-77, "US Fuel Corrective Action Program," Revision 41, dated November 14, 2018
- AP-0402-01, "Calculations," Revision 52, dated March 12, 2018
- AP-0902-23, "US Fuel Development of Engineering Applications Software," Revision 9, dated December 13, 2018
- AP-0902-28, "Development of Engineering Applications Software," Revision 9, dated February 12, 2019

- AP-1717-06, "Corrective Action Program," Revision 14, dated January 3, 2019
- AP 1902-14, "Control of Safeguards Information," Revision 10, dated May 23, 2019
- FSOP-07, "Design Analysis," Revision 7.0, dated April 12, 2017
- FSOP-21, "Developing Computer Codes," Revision 3.0, dated February 24, 2014

Documents related to the Palisades's Ultrasonic Testing

- 130-9295585-000, "Palisades Missed UT Indications in CRDM Nozzles #25, #33, #36 Root Cause Analysis," Revision 0, dated March 6, 2019
- 130-9295585-001, "Palisades Missed UT Indications in CRDM Nozzles #25, #33, #36 Root Cause Analysis" Revision 1
- 130-9295585-002, "Palisades Missed UT Indications in CRDM Nozzles #25, #33, #36 Root Cause Analysis," Revision 2, dated June 28, 2019
- 20190604-001, "EPRI Performance Demonstration Review of Procedure Changes Between 54-ISI-604-011 and 54-ISI-604-013," Revision 0, dated June 4, 2019
- 51-9209808-001, "CRDM UT Data Analysis Pre-Job Brief & 'Just in Time' Training," Revision 0, dated November 20, 2012
- 180-9291895-000, "Tab 1: October 31, 2018 Briefing," Revision 0
- 180-9291895-000, "Tab 2: November 11, 2018 Briefing," Revision 0
- 180-9291895-000, "Executive Summary of Palisades Final Report," Revision 0
- 19-01304, "Response to Letter 20190604-001- EPRI Performance Demonstration Review of Procedure Changes between 54-ISI-604-011 and 54-ISI-604-013," Revision 0, dated April 20, 2019
- 10538899, "Entergy Nuclear Operations, Inc. for Palisades RVCH Penetration Inspection for RF26 and RF27," Revision 0, dated February 27, 2018
- 54-ISI-604-011, "NONDESTRUCTIVE EXAMINATION PROCEDURE Automated Ultrasonic Examination of Open Tube RPV Closure Head Penetrations 54-ISI-604-013," Revision 11, dated August 31, 2012
- 54-ISI-604-013, "NONDESTRUCTIVE EXAMINATION PROCEDURE Automated Ultrasonic Examination of Open Tube RPV Closure Head Penetrations 54-ISI-604-013," Revision 13, dated August 24, 2015

Corrective Action Reports/Condition Reports (CRs)

CR 2009-4152	CR 2011-4144	CR 2011-4205
CR 2014-6492	CR 2015-5563	CR 2017-1726
CR 2017-3274	CR 2018-10211	CR 2018-9955
CR 2019-164	CR 2019-2052	CR 2019-2101
CR 2019-2198	CR 2019-2355	CR 2019-2736
CR 2019-2803	CR 2019-2817	CR 2019-2825
CR 2019-372		

Corrective Actions generated during this inspection

CR 2019-2815, "Procedure 1707-01 Section 4.1.1.1.e – Reword "reset" of the 60-day clock"
 CR 2019-2817, "Use of Thumb drives on SGI Computers"

Procurement Documents (PO)

- PO 2700005025, Sonic Systems International, Inc to Areva Inc, dated August 23, 2016

- PO 1019019954, Structural Integrity Associates to Framatome Inc, dated April 19, 2019
- PO 1017026026, Superheat FGH Services, Inc to Areva Inc, dated April 25, 2017
- PO 1018047206, Tioga Pipe Supply Co, Inc to Framatome Inc, dated October 16, 2018
- PO 1018004770, Velan Incorporated to Framatome Inc, dated January 30, 2018
- PO 1017016775, Zetec-Snoqualmie to Areva Inc, dated March 10, 2017
- PO 00378101 from Palisades to AREVA for Eaton Relay, Revision 3, dated June 5, 2008

Commercial-Grade Surveys/Audit Reports

- Audit 435-5 dated September 2017
- Audit 411-6 dated November 2016
- Audit 492-6 dated April 2018
- Audit 176-23 dated May 2018
- Audit 176-22 dated April 2017
- Audit 396-9 dated July 2018
- Audit 82-21 dated April 2018
- Audit 268-12 dated July 2017
- 173-9237922-004, "Commercial Grade Dedication Plan Mechanical Seals," Revision 4, dated September 12, 2018