



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

December 3, 2018

Russell A. Bastyr  
Vice President - Quality, Safety  
and Performance Improvement  
Westinghouse Electric Company  
Nuclear Fuel and Component Manufacturing  
5801 Bluff Road  
Columbia, SC 29209

SUBJECT: WESTINGHOUSE ELECTRIC SWEDEN AB'S NUCLEAR REGULATORY  
COMMISSION INSPECTION REPORT NO. 99901408/2018-201, AND NOTICE  
OF NONCONFORMANCE

Dear Mr. Bastyr:

On October 15-19, 2018, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the Westinghouse Electric Sweden AB facility (hereafter referred to as WES) in Västerås, Sweden. The purpose of the limited scope inspection was to assess WES' compliance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and 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."

This technically-focused inspection specifically evaluated WES' implementation of the quality activities associated with the design, fabrication, assembly, and testing of nuclear fuel assemblies and nuclear fuel assembly components for U.S. nuclear power plants. The enclosed report presents the results of this inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) or 10 CFR Part 21 programs.

During this inspection, the NRC inspection team found that the implementation of your QA program did not meet certain regulatory requirements imposed on you by your customers or NRC licensees. Specifically, the NRC inspection team determined that WES was not fully implementing its QA program in the areas of control of special processes and inspection. The specific findings and references to the pertinent requirements are identified in the enclosures to this letter. In response to the enclosed notice of nonconformance (NON), WES should document the results of the extent of condition review for these findings and determine if there are any effects on other safety-related components.

Please provide a written statement or explanation within 30 days of this letter in accordance with the instructions specified in the enclosed NON. We will consider extending the response time if you show good cause for us to do so.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public inspection a copy of this letter, its enclosure, and your response through the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response (if applicable), should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

Kerri A. Kavanagh, Chief **/RA/**  
Quality Assurance Vendor Inspection Branches 1 and 2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99901408

EPID No. I-2018-201-0046

Enclosures:

1. Notice of Nonconformance
2. Inspection Report  
No. 99901408/2018-201

SUBJECT: WESTINGHOUSE ELECTRIC SWEDEN AB'S NUCLEAR REGULATORY  
COMMISSION INSPECTION REPORT NO. 99901408/2018-201, AND NOTICE  
OF NONCONFORMANCE Dated: December 3, 2018

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<b>DATE</b>	11/27/18	11/27/18	11/27/18
<b>OFFICE</b>	NRR/DSS	NRO/DCIP	NRO/DCIP
<b>NAME</b>	BParks*	JBurke/GGalletti	KKavanagh
<b>DATE</b>	11/27/18	11/27/18	12/03/18

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## NOTICE OF NONCONFORMANCE

Westinghouse Electric Sweden AB  
Bränslegatan 1  
SE-721 63 Västerås, Sweden

Docket No. 99901408  
Report No. 2018-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Westinghouse Electric Sweden AB (hereafter referred to as WES) facility in Västerås, Sweden, from October 15-19, 2018, WES did not conduct certain activities in accordance with NRC requirements that were contractually imposed upon WES by its customers or NRC licensees:

- A. Criterion IX, "Control of Special Processes," of Appendix B, "Quality Assurance Program 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," states that "Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

Section 6.0 of WES' procedure BFE 13-110, "Handling of Filler Metal," Revision 1, dated June 14, 2014, states that "Dirt and unintentional coating on MIG/MAG, as well as TIG rod can result in porosity and other quality issues." In addition, Section 7.1 of BFE 13-110 states that "Only electrode material and filler material that is being used on an in-process welding work is stored at the welding station. It is important that only the current electrode and filler material for the current WPS be stored at the workstation." Furthermore, Section 7.5 of BFE 13-110 states that "Storage of rods shall be done without contact with water and moisture. The rod surfaces shall be protected from oil, grease, rust or other particles that attract moisture."

Paragraph 4.5 of WES' procedure QMS-A, "Quality Management System," Revision 7, dated August 23, 2013, states that "Procedures are established to specify the methods and extent of identification and traceability of items to ensure that only correct and acceptable items are installed or used in items and services." In addition, paragraph 4.5.2 of QMS-A states that "Identification of items is maintained, as necessary, to provide confidence that the correct items are used." Furthermore, paragraph 4.5.3 of QMS-A states that "Items including consumable materials and items identified as having limited calendar, shelf, or operating lives or cycles are traceable and controlled. The loss of identification on traceable items is documented and the items dispositioned in accordance with established procedures."

Contrary to the above, as of October 19, 2018, WES failed to assure that special processes were controlled and accomplished using qualified procedures in accordance with specifications and acceptance criteria. Specifically, the NRC inspection team observed filler metal rods in numerous work stations in the workshop hanging from various welding fixtures scattered throughout the workshop, and also found filler metal rods hanging from an air supply pipe in the liquid penetrant inspection booth where there was washing/hosing of penetrant with water, as well as spraying of developer and penetrant. The NRC inspection team also noted that filler metal rods in the work stations were not marked with the heat or lot number. Because filler metal rods kept in an unlocked rack in the workshop had filler metal boxes of multiple heats, no objective evidence existed to determine the heat or lot number for the filler metal rods stored in each of the different workstations. When asked for

the requirements for handling the filler metal rods, the welder and/or his supervisor were not aware of the specific requirements or about the existence of WES' procedure BFE 13-110. These filler metal rods were used to weld the control rod blades for the Brunswick Steam Electric Plant, Units 1 and 2 (hereafter referred to as Brunswick). Proper control of filler metal rods is necessary to assure that each heat of material is documented in the associated traveler/routing as well as to avoid contamination and the introduction of detrimental material to the final product which could cause degradation (i.e., cracking) that could potentially result in the component not performing its intended safety function.

This issue has been identified as Nonconformance 99901408/2018-201-01.

- B. Criterion X "Inspection," of Appendix B to 10 CFR Part 50 states, in part, that "A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. Such inspection shall be performed by individuals other than those who performed the activity being inspected. Examinations, measurements, or tests of material or products processed shall be performed for each work operation where necessary to assure quality. If inspection of processed material or products is impossible or disadvantageous, indirect control by monitoring processing methods, equipment, and personnel shall be provided."

WES' drawing No. 336028, "Absorber Cross," Revision 0, dated November 3, 2011, specifies a root gap acceptance criteria of 0.5 mm to 2.0 mm for welding the absorber cross to the velocity limiter. Section 5.2 of WES' Quality Management System, Revision 7, dated August 27, 2013, states that "Inspection and testing are performed on both purchased and manufactured items, as applicable, to verify compliance with acceptance criteria. For safety-related items and services, inspections or tests will be performed by qualified personnel who are independent of those performing the work."

Contrary to the above, as of October 19, 2018, WES failed to execute an inspection of an activity affecting quality to verify conformance with the drawing and failed to ensure that the inspection was performed by an individual other than the one who performed the activity being inspected. Specifically, WES did not inspect the fit-up of weld No. 101407 for welding the absorber cross to the velocity limiter of the control rod blades for Brunswick to verify that the dimension of the root gap was within the drawing specifications using an appropriate measuring device or gauge. Instead, the welder relied on visual estimation, based on experience only, to determine if the root gap met the required dimensions. Only after the NRC inspection team requested that the root gap be verified by an appropriate measuring device or gauge, the welder proceeded to use a calibrated 2 mm gauge to determine if the root gap was within the qualified range of 0.5 mm to 2 mm. Using the 2 mm gauge, the welder easily inserted the gauge in the root gap, which meant that the root gap exceeded the maximum qualified range of 2 mm. In addition, this dimension was not verified by the Quality Control inspector to ensure that the drawing specifications were met prior to welding. Confirming that root gaps meet the required dimensions from the drawing specifications is necessary to ensure that the welder and/or the weld procedure are properly qualified. Since weld procedures are qualified using production duplicates, dimensional deviations from those qualified can affect the overall quality, dimensions, and safety function of the control rod blade.

This issue has been identified as Nonconformance 99901408/2018-201-02.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality Assurance Vendor Inspection Branches 1 and 2, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each noncompliance: (1) the reason for the noncompliance or, if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further noncompliance; and (4) the date when the corrective action will be completed. Where good cause is shown, the NRC will consider extending the response time.

Because your response will be made available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or Safeguards Information so that the NRC can make it available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Dated this the 3rd day of December 2018.

**U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NEW REACTORS  
DIVISION OF CONSTRUCTION INSPECTION AND OPERATIONAL PROGRAMS  
VENDOR INSPECTION REPORT**

Docket No.: 99901408

Report No.: 99901408/2018-201

Vendor: Westinghouse Electric Sweden AB  
Bränslegatan 1  
SE-721 63 Västerås, Sweden

Vendor Contact: Carl Hellberg  
Email: hellbecj@westinghouse.com  
Phone: +46 21 347064

Nuclear Industry Activity: Westinghouse Electric Sweden AB manufactures nuclear fuel assemblies and nuclear fuel assembly components for new and operating reactors, including pressurized water reactors and boiling water reactors.

Inspection Dates: October 15-19, 2018

Inspectors: Yamir Diaz-Castillo NRO/DCIP/QVIB-1 Team Leader  
Nicholas Savvoir NRO/DCIP/QVIB-1  
John Honcharik NRO/DEI/MCB  
Benjamin T. Parks NRR/DSS/SNPB  
Laurent Foucher Observer from the French  
Nuclear Safety Authority (ASN)  
Jean-Dominique Loiseau Observer from ASN  
Caroline Dunn Interpreter

Approved by: Kerri A. Kavanagh, Chief  
Quality Assurance Vendor Inspection Branch-1 & 2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

## **EXECUTIVE SUMMARY**

Westinghouse Electric Sweden AB  
99901408/2018-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a vendor inspection at the Westinghouse Electric Sweden AB (hereafter referred to as WES) facility in Västerås, Sweden, 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." In addition, the NRC inspection also verified that WES implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance." This was the second NRC inspection of WES at the Västerås facility.

This technically-focused inspection specifically evaluated WES' implementation of quality activities associated with the design, fabrication, assembly, and testing of nuclear fuel assemblies and nuclear fuel assembly components for U.S. nuclear power plants. WES is currently under contract with Duke Energy Progress, LLC, for the supply of control rod blades to the Brunswick Steam Electric Plant, Units 1 and 2 (hereafter referred to as Brunswick). Specific activities associated with the fabrication of the control rod blades for Brunswick observed by the NRC inspection team included:

- helium leak test of a control rod blade assembly
- calibration of the measuring and testing equipment (M&TE) used for the helium leak test
- mechanized Gas Tungsten Arc Welding (GTAW) for a control rod blade edge weld
- robotic cold metal transfer Gas Metal Arc Welding (GMAW) using laser guidance on an absorber cross
- fit-up for a weld for welding the absorber cross to the velocity limiter of a control rod blade
- manual GTAW (seal welding of montage cross) on the absorber cross
- manual GTAW for a plug hole weld on a control rod blade
- dimensional and liquid penetrant (PT) inspection of an absorber cross
- post weld heat treatment of an absorber cross

In addition to observing these activities, the NRC inspection team verified that M&TE was properly identified, marked, calibrated, and used within its calibrated range.

These regulations served as the bases for the NRC inspection:

- Appendix B to 10 CFR Part 50
- 10 CFR Part 21

During the course of this inspection, the NRC inspection team implemented Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012; IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017; and IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017.

Prior to the NRC inspection, WES notified the NRC that while preparing for the inspection it had identified several issues with the implementation of its QA program in the areas of Procurement



Document Control, Control of Purchased Equipment, Materials, and Services, and Commercial Grade Dedication. As a result, WES initiated Issue Report No. 2018-14374, dated August 21, 2018, to document the issue and take corrective actions. These actions included, for example, issuing two stop work orders for procurement and shipment, notifying affected United States' customers, performing a product assessment, initiating a root cause analysis (ongoing at the time of the exit meeting), and completing an evaluation under 10 CFR Part 21. Both the product assessment and the 10 CFR Part 21 evaluation concluded that the issues were programmatic in nature and had no adverse physical or functional impact on the components that had been delivered. As such, the sample of documents reviewed by the NRC inspection team in the areas identified above was limited in nature and focused on those documents not affected or undergoing review by the ongoing activities taken by WES in response to the corrective actions.

With the exception of the nonconformances described below, the NRC inspection team concluded that WES' QA policies and procedures comply with the applicable requirements of Appendix B to 10 CFR Part 50 and 10 CFR Part 21, and that WES' personnel are implementing these policies and procedures effectively. The results of this inspection are summarized below.

#### Manufacturing Control

The NRC inspection team issued Nonconformance 99901408/2018-201-01 in association with WES' failure to implement the regulatory requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50. Nonconformance 99901408/2018-201-01 cites WES for failing to assure that special processes were controlled and accomplished using qualified procedures in accordance with specifications and acceptance criteria. Specifically, the NRC inspection team observed filler metal rods in numerous work stations in the workshop hanging from various welding fixtures scattered throughout the workshop, and also found filler metal rods hanging from an air supply pipe in the liquid penetrant inspection booth where there was washing/hosing of penetrant with water, as well as spraying of developer and penetrant. These filler metal rods were bent at one end, and simply hung on any convenient place, but not in the original package or handling case. The NRC inspection team also noted that filler metal rods in the work stations were not marked with the heat or lot number. In addition, because filler metal rods kept in an unlocked rack in the workshop had filler metal boxes of multiple heats, no objective evidence existed to determine the heat or lot number for the filler metal rods stored in each of the different workstations. When asked for the requirements for handling the filler metal rods, the welder and/or his supervisor were not aware of the specific requirements or about the existence of WES' procedure BFE 13-110, "Handling of Filler Metal," Revision 1, dated June 14, 2014.

#### Inspection

The NRC inspection team issued Nonconformance 99901408/2018-201-02 in association with WES' failure to implement the regulatory requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. Nonconformance 99901408/2018-201-02 cites WES for failing to execute an inspection of an activity affecting quality to verify conformance with the drawing and failing to ensure that the inspection was performed by an individual other than the one who performed the activity being inspected. Specifically, WES did not inspect the fit-up of weld No. 101407 for welding the absorber cross to the velocity limiter of the control rod blades for Brunswick to verify that the dimension of the root gap was within the drawing specifications using an appropriate measuring device or gauge. Instead, the welder relied on visual estimation based on experience only to determine if the root gap met the required dimensions. In addition,

this dimension was not verified by the Quality Control inspector to ensure that the drawing specifications were met prior to welding.

#### Other Inspection Areas

The NRC inspection team determined that WES is implementing its programs for 10 CFR Part 21, training and qualification, design control, commercial-grade dedication, procurement document control, control of equipment, materials, and services, test control, control of M&TE, nonconforming material, parts, or components, corrective action, and internal audits in accordance with the applicable regulatory requirements of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed and activities observed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with these programs. No findings of significance were identified in these areas.

## REPORT DETAILS

### 1. Manufacturing Control

#### a. Inspection Scope

The NRC inspection team reviewed Westinghouse Electric Sweden AB's (hereafter referred to as WES) 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," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," and with the applicable requirements of ISO-15613, "Specification and Qualification of Welding Procedures for Metallic Materials - Qualification Based on Pre-Production Welding Tests," dated 2004.

WES is currently under contract with Duke Energy Progress, LLC, for the supply of control rod blades to the Brunswick Steam Electric Plant, Units 1 and 2 (hereafter referred to as Brunswick). Specific activities associated with the fabrication of the control rod blades for Brunswick observed by the NRC inspection team included:

- mechanized Gas Tungsten Arc Welding (GTAW) for a control rod blade edge weld
- robotic cold metal transfer Gas Metal Arc Welding (GMAW) using laser guidance on an absorber cross
- fit-up for a weld for welding the absorber cross to the velocity limiter of a control rod blade
- manual GTAW (seal welding of montage cross) on the absorber cross
- manual GTAW for a plug hole weld on a control rod blade
- dimensional and liquid penetrant (PT) inspection of an absorber cross
- post weld heat treatment of an absorber cross

The NRC inspection team verified that the weld procedure specifications (WPSs) used in the welding activities above were qualified in accordance with the requirements of ISO-15613, and the applicable procedure qualification records (PQRs). The NRC inspection team also verified that the PQRs met the requirements of ISO-15613. For a sample of completed welding activities, the NRC inspection team verified the routing/shop travelers, WPSs, supporting PQRs, Data Reports, and the calibration certificates of the welding equipment met the applicable requirements.

The NRC inspection team verified that the applicable welding data such as weld material and heat/lot number, WPS, inspection procedures used, and that the final inspection results were recorded in accordance with the applicable WES procedures and instructions. The welding procedure was recorded on the associated routing/shop traveler for each weld joint along with the applicable NDE results.

For the heat treatment of an absorber cross, the NRC inspection team verified that the heat treatment procedure was qualified for post weld heat treating of 316L stainless steel for dimensional stability. The procedure included the time and temperature values for post weld heat treatment consistent with the grade of the material being heat treated and the thermocouple locations. The NRC inspection team verified that the chart recorder

and the thermocouples used were properly calibrated and that the process implemented the appropriate material traceability controls and identified the heat treatment start time and end time.

For the dimensional and PT inspection of an absorber cross, the NRC inspection team reviewed the applicable WES procedures and verified they were consistent with the applicable requirements of ISO 3452, "Non-Destructive Testing-Penetrant Testing."

The NRC inspection team also discussed the manufacturing control program with WES' management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observation and Findings

During a walkthrough of the fabrication area, the NRC inspection team observed filler metal rods used for the control rod blades for Brunswick in numerous work stations in the workshop hanging from various welding fixtures scattered throughout the workshop, and also found filler metal rods hanging from an air supply pipe in the liquid penetrant inspection booth where there was washing/hosing of penetrant with water, as well as spraying of developer and penetrant. These filler metal rods were bent at one end, and simply hung on any convenient place, but not in the original package or handling case.

The NRC inspection team also noted that filler metal rods in the work stations were not marked with the heat or lot number. In addition, because filler metal rods kept in an unlocked rack in the workshop had filler metal boxes of multiple heats, no objective evidence existed to determine the heat or lot number for the filler metal rods stored in each of the different workstations. When asked for the requirements for handling the filler metal, the welder and/or his supervisor were not aware of the specific requirements or about the existence of WES' procedure BFE 13-110, "Handling of Filler Metal," Revision 1, dated June 14, 2014. BFE 13-110 states, in part, that "Dirt and unintentional coating on MIG/MAG, as well as TIG rod can result in porosity and other quality issues." In addition, Section 7.1 of BFE 13-110 states that "Only electrode material and filler material that is being used on an in-process welding work is stored at the welding station. It is important that only the current electrode and filler material for the current WPS be stored at the workstation." Furthermore, Section 7.5 of BFE 13-110 states that "Storage of rods shall be done without contact with water and moisture. The rod surfaces shall be protected from oil, grease, rust or other particles that attract moisture." Proper control of filler metal rods is necessary to assure that each heat of material is documented in the associated traveler/routing as well as to avoid contamination and the introduction of detrimental material to the final product which could cause degradation (i.e., cracking) that could potentially result in the component not performing its intended safety function.

The NRC inspection team identified these issues as an example of Nonconformance 99901408/2018-201-01 for WES' failure to assure that special processes were controlled and accomplished using qualified procedures in accordance with specifications and acceptance criteria. WES initiated Issue Report (IR) No. 2018-17755, "Control of Weld Filler Material at Control Rod Work Shop," dated October 17, 2018, to address this issue.

While preparing to weld absorber cross No. 101407 to the velocity limiter for a control rod blade for Brunswick, the NRC inspection team noted that the welder did not verify that the dimension of the root gap was within the drawing specifications using an appropriate measuring device or gauge. Instead, the welder relied on visual estimation, based on experience only, to determine if the required dimensions were met. Calibrated gauges were available in the workshop but were not used since the welder stated he never measures the root gap. Only after the NRC inspection team requested that the root gap be verified by an appropriate measuring device or gauge, the welder proceeded to use a calibrated 2 mm gauge to determine if the root gap was within the qualified range of 0.5 mm to 2 mm. Using the 2 mm gauge, the welder easily inserted the gauge in the root gap, which meant that the root gap exceeded the maximum qualified range of 2 mm. The gauge, a go/no-go gauge, is specifically used to determine whether the gap is acceptable or not, and does not provide an actual measurement. In addition, this dimension was not verified by the Quality Control inspector to ensure that the drawing dimension was met prior to welding. Confirming that root gaps meet the required dimensions from the drawing specifications is necessary to ensure that the welder and/or the weld procedure are properly qualified. Since weld procedures are qualified using production duplicates, dimensional deviations from those qualified can affect the overall quality, dimensions, and safety function of the control rod blade.

The NRC inspection team identified this issue as an example of Nonconformance 99901408/2018-201-02 for WES' failure to execute an inspection of an activity affecting quality to verify conformance with the drawing and for their failure to ensure that the inspection was performed by an individual other than the one who performed the activity being inspected. WES initiated IR No. 2018-17670, "Insufficient Verification of Component Set-up when Welding Velocity Limiter to Absorber Cross," dated October 16, 2018, to address this issue.

During the review of the Level II and Level III non-destructive examination (NDE) personnel training and qualification records, the NRC inspection team noted that WES uses the NDT Training Center AB, part of the Sweden Accreditation Service, to train, examine, and certify NDE personnel according to ISO 9712:2012, "Non-destructive Testing - Qualification and Certification of NDT Personnel." Upon further review of the purchase orders (PO) issued to WES, the NRC inspection team discovered that PO No. 4500758009, "BWR Control Blade - Brunswick," dated October 9, 2018, from Westinghouse Electric Company (WEC) to WES, under contract No. WE 02003382, "Westinghouse Electric to Duke Energy," dated March 13, 2001, as amended September 17, 2018, states, in part, that "ASME NQA-1-1994 Edition Part 1 (basic and supplemental) applies." Section 2.1, "Applicable Documents," of Supplement 2S-2, "Supplementary Requirements for the Qualification of Nondestructive Examination Personnel," of the American Society of Mechanical Engineers (ASME) standard NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications," states that "The American Society of Nondestructive Testing Recommended Practice No. SNT-TC-1a, 1980 Edition, and its applicable supplements shall apply as requirements to NDE personnel covered by this Supplement."

NDE personnel at the WES facility performing safety-related activities are qualified in accordance with ISO 9712:2012 in lieu of SNT-TC-1a, 1980 Edition, as required by the PO. Although the NRC inspection team identified some differences in the training and qualification requirements between ISO 9712:2012 and SNT-TC-1a, 1980 Edition; the

NRC inspection team did not find any issues with the quality and workmanship of the NDE reviewed. As such, the NRC inspection team determined that this issue was not more than minor. WES initiated IR No. 2018-17814, "SNT-TC-1A Qualification of NDT Inspectors (Brunswick PO)," dated October 18, 2018, to address this issue.

c. Conclusion

The NRC inspection team issued Nonconformance 99901408/2018-201-01 in association with WES' failure to implement the regulatory requirements of Criterion IX of Appendix B to 10 CFR Part 50. Nonconformance 99901408/2018-201-01 cites WES for failing to assure that special processes were controlled and accomplished using qualified procedures in accordance with specifications and acceptance criteria.

The NRC inspection team also issued Nonconformance 99901408/2018-201-02 in association with WES' failure to implement the regulatory requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. Nonconformance 99901408/2018-201-02 cites WES for failing to execute an inspection of an activity affecting quality to verify conformance with the drawing and failing to ensure that the inspection was performed by an individual other than the one who performed the activity being inspected.

2. 10 CFR Part 21 Program

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the 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 WES' 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 WES' nonconformance and corrective action procedures and processes provide a link to the 10 CFR Part 21 program.

Furthermore, for a sample of 10 CFR Part 21 evaluations performed by WES, the NRC inspection team verified that WES 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.

Prior to the NRC inspection, WES notified the NRC that while preparing for the inspection it had issued two stop work due to several issues identified with the implementation of its quality assurance (QA) program in the areas of Procurement Document Control, Control of Purchased Equipment, Materials, and Services, and Commercial Grade Dedication. As a result, WES initiated IR No. 2018-14374, dated August 21, 2018, to document the issue and take corrective actions which included a 10 CFR Part 21 evaluation. The NRC inspection team reviewed the evaluation and confirmed that the issues were programmatic in nature and had no adverse physical or functional impact on the components that had been delivered.

The NRC inspection team also discussed the 10 CFR Part 21 program with WES' 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 that WES established 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 WES is implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

3. Design Control

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the design control program to verify compliance with the regulatory requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. The NRC inspection team focused its review on the implementation of WES' design processes as applied to the design of the D-lattice control rod blade assemblies of the Westinghouse CR 99 design for Brunswick. NRC-approved licensing topical reports (TRs) WCAP-16182-P-A, "Westinghouse BWR Control Rod CR99 Licensing Report," Revision 0, dated March 2005, and WCAP-16182-P-A, "Westinghouse BWR Control Rod CR99 Licensing Report - Update to Mechanical Design Limits," Revision 3, November 2017; describe the CR 99 control rod blade design. These TRs specify critical design attributes for the Brunswick licensing basis for control rod blade design.

The NRC inspection team verified that the design requirements specified in both TRs were appropriately translated into the design specifications and drawings. The NRC inspection team also verified that the nuclear design of the control rod blades were supported by adequate analysis. Control rod blade nuclear performance was analyzed using two Westinghouse Electric Company (WEC) proprietary engineering computer programs: XYBDRY and PHOENIX4. WEC developed both of these engineering computer programs under its safety-related QA program. PHOENIX4 is a nuclear design code used to verify the nuclear characteristics of the Brunswick control rod blade design, while XYBDRY is an auxiliary code used to perform control rod burnup calculations. The NRC inspection team verified that the applicable releases of both software programs were subject to verification through regression testing to previous software versions known to be acceptable, and that the calculations supported conclusions that the control rod blade assemblies conformed to the applicable critical attributes and design criteria contained in WCAP-16182-P-A. In addition, the NRC inspection team observed that, at the time the control rod blade worth calculations were performed, WES personnel had recently changed the methods used to perform the analytic design verification. This change was associated with the way the XYBDRY and PHOENIX4 computer codes were used to verify the nuclear characteristics of the control rod blades. Upon further discussion with the engineering staff, the NRC inspection team

confirmed that this change represented a switch to a direct analytic calculation of a critical design attribute.

The NRC inspection team reviewed a request for software release and a Simplified Computer Application Turnaround (SCAT), which is a document that summarizes the software modification and its assessment. These documents were related to the release of version 2.3.4 of PHOENIX4. The release request described the specific issues that the new PHOENIX4 release was intended to address, and the SCAT documented the testing that was performed, which ensured that the software release addressed the issues documented in the request, and that version 2.3.4 of PHOENIX4 continued to perform acceptably. In particular, the SCAT documented the results of regression testing of a comparison to the results of version 2.3.4-based analyses to the results of a prior version that was known to be acceptable. The regression testing indicated consistent performance between the two releases. Note that while the NRC inspection team reviewed a recent software change to PHOENIX4, the NRC inspection team did not review any such recent changes to XYBDRY because the design verification by analysis discussed above had been accomplished between 2007 and 2009.

The NRC inspection team also discussed the design control program with WES' 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 that WES established its design control program in accordance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with the design control. No findings of significance were identified.

4. Commercial-Grade Dedication

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the commercial-grade dedication program to verify compliance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50.

WES' process for implementing commercial-grade dedication activities is governed by W2-9.5-102, "Commercial Dedication Process," Revision 1, dated October 17, 2016. The NRC inspection team noted that W2-9.5-102 provides the appropriate level of requirements and responsibilities for the dedication of commercial-grade items procured for use in safety-related applications.

The NRC inspection team reviewed a sample of dedication packages for the following safety-related fuel assembly components: springs, control rod components, control rod handle, boron carbide pins, boron carbide powder, 316L stainless steel plates and wire



for the control rods, and stainless steel castings for the velocity limiters. In addition, the NRC inspection team reviewed a sample of dedication packages for calibration and testing services for accredited and non-accredited laboratories. The dedication packages contained documents such as vendor POs, commercial-grade surveys, Commercial Dedication Instructions (CDIs), receipt inspection records, and testing certificates, as applicable. The CDIs included the technical evaluation for the identification and documentation of the basis and justification for the selection of the critical characteristics, acceptance methods, and acceptance criteria.

The NRC inspection team evaluated the criteria for the identification of item functions, credible failure mechanisms/modes, selection of critical characteristics and acceptance criteria, and the identification of verification methods to verify effective implementation of WES' dedication process.

The NRC inspection team also reviewed WES' measures established for the use of accreditation in lieu of performing commercial-grade surveys for procurement of calibration and testing services as part of the commercial-grade dedication process. WES' QA Manual allows for the use of the International Laboratory Accreditation Cooperation (ILAC) accreditation process in lieu of performing commercial-grade surveys for domestic and international calibration and testing services. WES currently implements this process as described in the Nuclear Energy Institute (NEI) document No. 14-05A, "Guidelines for the Use of Accreditation in Lieu of Commercial Grade Surveys for Procurement of Laboratory Calibration and Test Services," Revision 1, which was recognized for use by the NRC in a safety evaluation report (SER) dated February 9, 2015 (Agencywide Documents Access Management System Accession (ADAMS) No. ML14322A535).

The NRC inspection team also discussed the commercial-grade dedication program with WES' management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

During the review of a sample of commercial-grade surveys, the NRC inspection team noted that these commercial suppliers were further subcontracting calibration and testing services to laboratories accredited under the ILAC accreditation process without any additional oversight. Essentially, the commercial suppliers were inadequately using the approach as described and approved by the NRC in its SER of NEI 14-05A. By allowing the commercial supplier to further subcontract calibration and testing activities to another commercial supplier, WES is inadequately accepting tests and inspection results provided by a commercial supplier to determine conformance with the applicable requirements.

Laboratories accredited under the ILAC accreditation process are implementing a QA program based on the International Standard Organization (ISO)/International Electrotechnical Commission (IEC) 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," which the NRC has previously reviewed and recognized with the imposition of certain conditions in the POs. However, the NRC's approval for using the ILAC accreditation process in lieu of performing commercial-grade surveys, and the acceptance of inspection and tests results to determine conformance with the applicable requirements, can only be implemented by a supplier who has a QA

program that meets the applicable requirements of Appendix B to 10 CFR Part 50. Subsequent use of the ILAC accreditation process by commercial sub-suppliers is inadequate and should be adequately controlled irrespective of the fact that the commercial sub-suppliers are implementing the same QA program based on ISO 17025. As such, the NRC inspection team determined that this issue was not more than minor. WES initiated IR-2018-17805, "Meeting NEI 14-05A," dated October 18, 2018, to address this issue.

During the review of the CDI for the boron powder used in the control rod blade assembly, Report No. BTM 15-0908, "Commercial Dedication Instruction for Boron Carbide Powder Manufactured at 3M Technical Ceramics," Revision 1, dated October 11, 2018, the NRC inspection team noted that the critical characteristic for isotope analysis was not listed, although Revision 0 of BTM 15-0908 did include isotope analysis as a critical characteristic. Isotope analysis is used to determine the amount of B-10 in the powder, which is used to fabricate the boron carbide pins. Upon further discussions with WES' technical staff, WES stated that the isotope analysis was removed during a recent revision to the CDI. Since Revision 1 of the CDI had not yet been used to procure any boron powder, the NRC inspection team determine that this issue was not more than minor. WES initiated IR-2018-17615, "BTM 15-0908 Commercial Dedication Instruction for Boron Powder Missing Critical Characteristic for Isotope Analysis," dated October 16, 2018, to address this issue.

No other findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that WES established its commercial-grade dedication program in accordance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with the commercial-grade dedication program. No findings of significance were identified.

5. Supplier Oversight and Internal Audits

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the implementation of its supplier oversight and internal audits programs to verify compliance with the requirements of Criterion IV, "Procurement Document Control," Criterion VII, "Control of Purchased Material, Equipment, and Services," and Criterion XVIII, "Internal Audits," of Appendix B to 10 CFR Part 50.

For the sample of POs reviewed, the NRC inspection team verified that the POs included, as appropriate, the applicable technical and quality requirements. In addition, the NRC inspection team verified that for the sample of receipt inspection records reviewed, these records were (1) reviewed by WES for compliance with the requirements of the POs, and (2) the records contained the applicable technical and regulatory information.

The NRC inspection team noted that WES is a member of the Nuclear Industry Assessment Committee (NIAC), which consists of companies who supply goods and services to the nuclear industry based on a QA program that meets the requirements of Appendix B to 10 CFR Part 50 or ASME standard NQA-1, and accept 10 CFR Part 21. NIAC develops and maintains procedures and processes necessary to plan, guide, and share supplier audits with its members. WES uses NIAC audits to support the qualification and maintenance of suppliers. The NRC inspection team confirmed that once a NIAC audit is received, WES' QA Program Manager reviews the audit for completeness and adequacy, evaluates the audit report in accordance with WES' QA program and the appropriateness of the scope, and approves the audit report as the basis for including the vendor on the Qualified Suppliers List.

For the sample of external and internal audits reviewed, the NRC inspection team verified the audit reports included an audit plan, any findings identified, adequate documented objective evidence of compliance with the applicable requirements, and a review by WES' responsible management. In addition, the NRC inspection team verified that the external and internal audits were performed by qualified auditors and, in the case of the internal audits, that these audits were performed by personnel not having direct responsibilities in the areas being audited. Furthermore, the NRC inspection team reviewed a sample of training and qualification records of WES' lead auditors and confirmed that auditing personnel had completed all the required training and had maintained the applicable qualification and certification in accordance with WES' policies and procedures.

The NRC inspection team also discussed the supplier oversight and internal audits programs with WES' management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

During the review of a sample of POs, the NRC inspection team noted that a PO for independent testing analysis of material used in safety-related applications did not impose the requirements of Appendix B to 10 CFR Part 50 and 10 CFR Part 21. The PO referenced the supplier's IEC/ISO 17025 accreditation with the following statement: "Items included herein are nuclear safety-related in accordance with the quality requirements invoked in this purchase order." Upon further discussions with WES' technical staff, WES clarified that the intent was to leverage both the supplier's safety-related QA program as well as their IEC/ISO 17025 program, however, during the translation of these requirements into the PO, Appendix B to 10 CFR Part 50 and 10 CFR Part 21 were excluded. Since the supplier used by WES is a well-known supplier in the nuclear industry of safety-related components and services, the NRC inspection team determined that this issue was not more than minor. WES initiated IR-2018-17601, "Discrepancies with Purchase Order (PO) Requirements," dated October 16, 2018, to address this issue.

WES developed Specification No. QP 13-067, "SQSR - Supplier Quality System Requirements," Revision 2, dated February 15, 2018, which contains additional requirements for commercial suppliers of materials, components, machining, and other services with QA programs based on ISO 9001, "Quality Management Systems - Requirements." The NRC inspection team noted that one of the requirements listed in QP 13-067 was 10 CFR Part 21, which is only applicable when procuring safety-related

components and services from suppliers with QA programs that meet Appendix B to 10 CFR Part 50. While vendors are free to impose any requirements they see fit in their POs, imposing the requirements of 10 CFR Part 21 to commercial suppliers is not correct as 10 CFR Part 21 does not apply. Since there are no technical concerns associated with imposing 10 CFR Part 21 to a commercial supplier, the NRC inspection team determined that this issue was not more than minor. WES initiated IR-2018-17794, "Identified SQSR-B Wrongly Imposed 10 CFR 21 Conflicting Requirements," dated October 15, 2018, to address this issue.

No other findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that WES established its supplier oversight and internal audits programs in accordance with the regulatory requirements of Criterion IV, Criterion VII, and Criterion XVIII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with the supplier oversight and internal audits programs. No findings of significance were identified.

6. Test Control

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the test control program to verify compliance with the requirements of Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50.

WES performs a helium leak test for each control rod blade assembly to verify the mechanical integrity by confirming that the blades do not leak helium, and also performs a pin loading verification test to ensure the appropriate location and orientation of each pin and the total weight of the pins loaded into a control blade assembly. The NRC inspection team observed WES personnel perform a helium leak test on a control rod blade. The NRC inspection team confirmed that applicable test procedures and specifications were located at the testing station. The helium leak detector is calibrated prior to conducting each test, and the NRC inspection team observed the inspector perform the calibration in accordance with the procedures located at the testing station. The NRC inspection team interviewed the test inspector and confirmed that the test inspector was familiar with the test apparatus, procedures, and the acceptance criteria. In addition, the NRC inspection team reviewed recent test results for the control rod blades, including the test observed by the NRC inspection team, and confirmed that no recent control blade assemblies exhibited evidence of leaking helium and that the tests were performed in accordance with the applicable technical requirements. Although no boron carbide pin verification testing was being performed during the week of the inspection, the NRC inspection team discussed the applicable test procedures with the quality coordinator for the control rod blade shop. The procedures included illustrated test instructions and acceptance criteria, and WES records, including those pertaining to completed tests for Brunswick, included a means to verify that each control rod blade assembly that proceeded onward in fabrication had been checked for pin location, orientation, and weight. The NRC inspection team confirmed that the tests were performed in accordance with the applicable technical requirements.

The NRC inspection team also reviewed the inspectors' training and qualification records and confirmed that the inspectors had completed all the required training and had maintained the applicable qualification and certification in accordance with WES' policies and procedures.

The NRC inspection team discussed the test control program with WES' 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 that WES established its test control program in accordance with the regulatory requirements of Criterion XI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with the test control program. No findings of significance were identified.

7. Control of Measuring and Test Equipment

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the measuring and test equipment (M&TE) program to verify compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50.

For a sample of M&TE, the NRC inspection team determined that the M&TE had the appropriate calibration stickers and current calibration dates, including the calibration due date. The NRC inspection team also verified that the M&TE had been calibrated, adjusted, and maintained at prescribed intervals prior to use. In addition, the calibration records reviewed by the NRC inspection team indicated the as-found or as-left conditions, accuracy required, calibration results, calibration dates, and the due date for recalibration. The NRC inspection team also verified that the selected M&TE was calibrated using procedures traceable to known industry standards. The NRC inspection team also verified that when M&TE equipment is found to be out of calibration, WES generates a nonconformance report to identify items that have been accepted using this equipment since the last valid calibration date and to perform an extent of condition review.

The NRC inspection team also discussed the M&TE program with WES' 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 that WES established its M&TE program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that WES is implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

8. Nonconforming Materials, Parts, or Components and Corrective Action

a. Inspection Scope

The NRC inspection team reviewed WES' policies and implementing procedures that govern the control of nonconformances to verify compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

Nonconforming fuel assembly components are often dispositioned as scrap due to customer specifications. WES uses a uranium recovery process which has the ability to recycle uranium and return it to the fuel cycle. The NRC inspection team confirmed that scrap and hold materials are segregated, tagged, and labeled appropriately in designated areas. In addition, the NRC inspection team discussed the process for accepting and rejecting control rod blades and the evaluation of scanned fuel rods after rejections due to deviations. Furthermore, the NRC inspection team also verified that WES' nonconformance reports process provides a link to the 10 CFR Part 21 program.

The NRC inspection team also reviewed a sample of corrective action reports (CARs) and IRs to ensure that conditions adverse to quality were promptly identified and corrected. CARs and IRs document corrective actions, however, the nomenclature differs due to WEC's implementation of a new system for tracking corrective actions. The NRC inspection team verified the CARs and/or IRs provided: (1) adequate documentation and description of conditions adverse to quality, (2) an appropriate analysis of the cause of these conditions and the corrective actions taken to prevent recurrence, as applicable, (3) direction for review and approval by the responsible authority, (4) a description of the current status of the corrective actions, and (5) the follow-up actions taken to verify timely and effective implementation of the corrective actions. In addition, the NRC inspection team verified that WES' CARs/IRs provide a link to the 10 CFR Part 21 program.

The NRC inspection team observed an Issue Review Committee (IRC) meeting that is conducted once a week. Prior to the IRC, a quality engineer screens the CARs and/or IRs for the appropriate significance level: low, medium, or high. The IRC members are the leads of manufacturing, planning and logistics, quality and process, and quality engineers. The IRC reviews CARs/IRs generated during the week, verifies any potential CARs/IRs that could have been misclassified as being of low significance, and reviews CARs/IRs that are past their due date. The NRC inspection team also engaged WES' staff regarding their "Enhetens Lendnings Gropp" (ELG) meetings. The ELG is also known as Workshop Management Team meetings where issues are documented, tracked, and dispositioned prior to the IRC meeting.

In addition, the NRC inspection team reviewed the implementation and closure of the corrective actions taken in response to the Notice of Nonconformances documented in the NRC's inspection report No. 99901408/2011-201, dated November 4, 2011 (ADAMS Accession No. ML11300A148).

The NRC inspection team also discussed the nonconforming materials, parts, or components and corrective action programs with WES' 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 Corrective Action Associated with Nonconformance No. 99901408/2011-201-01

Following the September 2011 inspection of WES, the NRC issued Nonconformance 99901408/2011-201-01 for WES' failure to prescribe an appropriate procedure to ensure the timely identification and evaluation of deviations and failures to comply that could create a substantial safety hazard. Specifically, Westinghouse Engineering Services (ES) procedure 21.1, "WEC 21.0 Level 3 Implementation Procedure," Revision 1, dated December 6, 2010; included a 30 day discovery phase evaluation timeframe that could be extended for two weeks at a time, thus inappropriately delaying discovery and initiation of the evaluation required by 10 CFR Part 21.21(a)(1).

In its response dated December 2, 2011 (ADAMS Accession No. ML11340A004), WES stated that ES 21.1 would be revised to eliminate the provision for an extension of the 30 day limit. In addition, if discovery cannot be completed within 30 days, it would be conservatively assumed that a deviation or failure to comply exists and WES would proceed with the evaluation.

The NRC inspection team reviewed the documentation that provided the objective evidence for the completion of the corrective actions. The NRC inspection team confirmed that WES revised procedure ES 21.1 to eliminate the internal provision extension which could potentially delay discovery and initiation of the evaluation required by 10 CFR Part 21.21(a)(1). Based on its review, the NRC inspection team closed Nonconformance 99901408/2011-201-01.

b.2 Corrective Action Associated with Nonconformance No. 99901408/2011-201-02

The NRC also issued Nonconformance 99901408/2011-201-02 for WES' failure to appropriately dedicate commercially procured software in accordance with WEC 7.2, "Dedication of Commercial Grade Items," Revision 1, dated August 3, 2009. Specifically, WES did not conduct a technical evaluation to identify safety function, critical characteristics, and acceptance methods for a commercially procured version of the ANSYS finite-element analysis software.

In its response dated December 2, 2011, WES stated that during discussions with ANSYS Inc., it was revealed that there were no known physical, mathematical, or other differences in the commercially procured ANSYS version and the version purchased with the QA package. WES stated they would work with the local ANSYS provider to purchase the appropriate ANSYS QA package and use ANSYS versions purchased with the QA package that are available on servers in the United States. In addition, WES

stated that EP-313, "Third Party Software," Revision 8, dated August 14, 2009; would be updated to reference WEC 7.2, "Dedication of Commercial Grade Items," Revision 1, dated August 3, 2009, and would perform other procedural clarifications and improvements.

The NRC inspection team reviewed the documentation that provided objective the evidence for the completion of the corrective actions. The NRC inspection team confirmed that EP-313 and WEC 7.2 were superseded by W2-8.6-105, "External Computer Software," Revision 1, dated September 4, 2018 and W2-9.5-102, "Commercial Dedication Process," Revision 1, dated October 17, 2016. The NRC inspection team confirmed that WES incorporated technical evaluations to identify safety function, critical characteristics, and acceptance methods in W2-8.6-105, and W2-9.5-102. In addition, for customers in the United States, WES uses ANSYS versions purchased with the QA package that are available on servers in the United States to perform the required calculations. Based on its review, the NRC inspection team closed Nonconformance 99901408/2011-201-02.

b.3 Corrective Action Associated with Nonconformance No. 99901408/2011-201-03

The NRC also issued Nonconformance 99901408/2011-201-03 for WES' failure to identify the acceptance criteria in test plans for computer software verification and validation tests. Specifically, for tests supporting changes to the BISON and POLCA-T evaluation models in documents SET 10-165, "WCAP-17202-P, Supplement 4 to BISON Topical Report RPA 90-90-P-A," dated June 2010, and SET 09-248, "POLCA-T Qualification Against Peach Bottom 2 EOC 2 Turbine Trip Tests 1 and 2 (no date provided)."

In its response dated December 2, 2011, WES stated that it would update the software test plans and testing documentation to include the acceptance criteria. In addition, WES stated that it would provide refresher training and that the requirements shall be met whenever the acceptance criteria cannot be defined in the test plan. WES also stated that it would identify, evaluate, and update the codes and versions that were missing the acceptance criteria in the software test documentation.

The NRC inspection team reviewed the documentation that provided objective the evidence for the completion of the corrective actions. The NRC inspection team confirmed that BISON and POLCA-T evaluation models software test plan and testing documentation were updated to include the acceptance criteria. In addition, the NRC inspection team confirmed that WES provided software refresher training and that additional requirements for circumstances where acceptance criteria cannot be defined in the test plan. The NRC inspection team also reviewed WES' extent of condition for software test documentation that were missing the acceptance criteria. Based on its review, the NRC inspection team closed Nonconformance 99901408/2011-201-03.

c. Conclusion

The NRC inspection team concluded that WES established its nonconforming materials, parts, or components and corrective action programs in accordance with the regulatory requirements of Criterion XV and 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 WES is implementing its policies and procedures associated with the nonconforming



materials, parts, or components and corrective action programs. No findings of significance were identified.

9. Entrance and Exit Meetings

On October 15, 2018, the NRC inspection team discussed the scope of the inspection with Mr. Aziz Dag, WES President, and other members of WES' management and technical staff. On October 19, 2018, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Dag and other members of WES' management and technical staff. 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

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Aziz Dag	President	Westinghouse Electric Sweden (WES)	X	X	
Johan Lundberg	Managing Director Nuclear Fuel Operations	WES	X	X	X
Tage Tarkpea	Director Fuel Engineering	WES	X	X	
Evelina Bennstrom	Manager Customer Quality	WES	X		
Louise Lidén	Manager Quality & Process	WES	X	X	X
Christopher Willman	Manager Fuel Materials	WES			X
Mattias Lodin	Manager Software & Fuel Rod Design	WES	X		X
Asa Larsson	Manager Quality Programs	WES	X	X	
Asa Jonsson	Product Manager Software Projects	WES			
Peter Sergel	Manager Planning & Logistics	WES	X	X	X
Johan Lowkvist	Manager Pelletizing	WES	X	X	
Henrik Tejne	Manager Thermal Hydraulic Testing & Mechanical Design	WES	X		
Annette Kelvinius	Manager Global Supply Chain Solutions	WES	X	X	

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Mikael Pelholk	Manager Quality, Environment, Health & Safety	WES	X		X
Jan Brangeliff	Manager Good & Receipt Warehouse	WES	X		
Andrea Montani	Contract Manager	WES		X	
Kristina Ryttersson	Manager Components & Material	WES	X	X	X
Per Seltborg	Manager Welding & Testing	WES	X	X	
Bjorn Rebensdorf	Production Manager Boiling Water Reactor (BWR) Control Rods	WES			X
Juan Casal	Manager BWR Methods & Technology	WES			X
Pernilla Wennlo	Team Lead Material & Production Planning	WES	X	X	
Carl Hellberg	Quality & Performance Improvement Lead	WES	X	X	X
Anders Wallander	Functional Lead for Fuel Engineering & Mechanical Design	WES	X	X	X
Tomas Ohlin	Fellow Engineer Safety Plant Design	WES	X	X	X
Anders Karlsson	Manager Asset Manufacturing	WES			X
John Hasselberg	Manager Asset	WES			X
Jonah Lowkvist	Workshop Manager	WES			X
Mattias Puide	Principal Engineer Materials & Fuel Performance	WES			X

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Lisa Lindefelt	Senior Quality Engineer	WES	X	X	X
Bjork Thornston	Senior Quality Engineer	WES	X	X	X
Anders Eriksson	Senior Engineering Technical	WES			X
Tahereh Safvati	Process Engineer	WES			X
Lärs Gardin	Quality Control (QC) Engineer	WES	X	X	X
Anders Imerdone	QC Engineer	WES			X
Sofia Eriksson	Quality Assurance (QA) Coordinator	WES			X
Anders Karlsoon	QA Analyst	WES			X
Vershin Gardin	Quality Engineer	WES	X		
Anders Eriksson	Quality Engineer	WES			X
Anders Imer	Quality Engineer	WES			X
Kershin Gardin	Quality Engineer	WES		X	X
Ann-Charlotte Anlgist	Quality Engineer	WES			X
Pernilla Kistiffwesson	Quality Engineer	WES			X
Christen Ericsson	Quality Inspector	WES			X
Jan Samuelson	Welding Engineer	WES			X
Fredrik Tu vesson	Welding Engineer	WES			X
Pasi Vitasalo	Welder	WES			X
Jari Kauppinen	Inspector	WES			X
Hoesin Nikoui Komsavi	Heat Treat Technician	WES			X
Helen Komperud	Level III Examiner	WES			X

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Russel Bastyr	Vice President - Quality, Safety, & Performance Improvement	Westinghouse Electric Company (WEC)	X	X	X
Michael J. Stefanchik	Nuclear Procurement QA Manager	WEC	X	X	X
Paul A. Russ	Director, Licensing & Regulatory Affairs	WEC			X
Ronald Wessel	Global Quality	WEC	X	X	X
Steven Slowik	Principal Engineer	WEC			X
Stephane Rambert	Manager Customer Account	WEC France	X	X	
Paula Madill	Director Europe, Middle East, Africa Fuel & Manufacturing Sourcing	WEC United Kingdom		X	
Ove Nilsson	Section Head Operation Decommissioning of Nuclear Facilities	Swedish Radiation Safety Authority		X	
Yamir Diaz-Castillo	Inspection Team Leader	Nuclear Regulatory Commission (NRC)	X	X	
Nicholas Savvoir	Inspector	NRC	X	X	
John Honcharik	Inspector	NRC	X	X	
Benjamin T. Parks	Inspector	NRC	X	X	
Laurent Foucher	Observer	French Nuclear Safety Authority (ASN)	X	X	
Jean-Dominique Loiseau	Observer	ASN	X	X	

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Caroline Dunn	Interpreter	Caroline Dunn Consulting	X	X	

2. INSPECTION PROCEDURES USED

Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012

IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017

IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

<b>Item Number</b>	<b>Status</b>	<b>Type</b>	<b>Description</b>
99901408/2011-201-01	CLOSED	NON	Criterion V
99901408/2011-201-02	CLOSED	NON	Criterion III
99901408/2011-201-03	CLOSED	NON	Criterion XI
99901408/2018-201-01	OPENED	NON	Criterion IX
99901408/2018-201-02	OPENED	NON	Criterion X

4. DOCUMENTS REVIEWED

Policies and Procedures

- Westinghouse Electric Company (WEC) Quality Management System, Revision 7, dated August 27, 2013
- Westinghouse Electric Sweden AB (WSE) Management System Description, Revision 4, dated April 4, 2017
- B 52-1, "Document Control," Revision 49, dated June 19, 2018
- B 54-1, "Handling of Nonconformities and Incidents During Manufacturing," Revision 28.1, dated May 3, 2018
- B 83-2, "Marking and Separation of Non-approved Materials and Products," Revision 14.4, dated June 14, 2018
- B 50-1, "Customer Interviews," Revision 9, dated November 12, 2012

- B 82-4, "Enhetens Lendnings Gropp (ELG) Workshot Management Team- Procedures," dated June 13, 2018
- Quality Assurance (QA) 2.8, "Qualification of Audit Personnel," Revision 1, dated December 13, 2016
- W2-2.5-200, "Personnel Qualification and Certification," Revision 1, dated May 22, 2018
- W2-4.2-101, "Internal Quality Assurance Audits," Revision 3.1, dated December 27, 2017
- W2-5.1-101, "Westinghouse Corrective Action Program," Revision 6, dated July 2, 2018
- W2-5.1-102, "Issue Review Committee," Revision 6, dated July 2, 2018
- W2-5.1-103, "Root Cause Analysis," Revision 3.2, dated July 2, 2018
- W2-5.1-201, "Identification and Reporting of Conditions Adverse to Nuclear Safety," Revision 0.1, dated September 9, 2016
- W2-8.1-100, "Design and Development Process," Revision 1, dated February 29, 2016
- W2-8.1-101, "Design and Development," Revision 3.1, dated February 27, 2018
- W2-8.3-102, "Failure Mode and Effects Analysis," Revision 1, dated August 15, 2016
- W2-8.6-105, "External Computer Software," Revision 1, dated September 4, 2018
- W2-9.12-102, "Certificate of Conformance," Revision 1, dated March 21, 2017
- W2-9.4-101, "Control of Purchased Items and Services," Revision 6, dated December 27, 2017
- W2-9.5-101, "Supplier QA Program Qualification and Assessment," Revision 1, dated March 21, 2017
- W2-9.5-102, "Commercial Dedication Process," Revision 1, dated October 17, 2016
- W2-9.5-104, "Supplier Oversight," Revision 2, dated June 5, 2018
- W2-9.5-105, "Control of Suppliers on the ASL and QSL," Revision 2, dated October 17, 2017
- W2-9.5-106, "Supplier Corrective Action Request Procedure," Revision 2, dated August 14, 2018
- W2-9.7-103, "Inspection," Revision 2, dated June 12, 2018
- W2-9.8-100, "Calibration," Revision 1, dated December 13, 2016

- WEC 21.0, "Level 3 Implementation Procedure ES 21.1," Revisions 1, 2, and 4.1, dated December 6, 2010, January 24, 2013, and October 30, 2015, respectively
- WSE 2.32.1, "List of Controlling Procedures," Revision 1.2, dated March 15, 2018
- WSE 6.30, "Supplier QA Program Qualification and Assessment," Revision 3, dated January 10, 2017
- WSE 14.7, "Reporting of Defects and Noncompliances in Delivered Products (10 CFR Part 21)," Revision 5.2, dated April 3, 2018

#### Design and Commercial-Grade Dedication Records

- AA 285 092, "Material Specification Boron Carbide Powder For Hot Isostatic Pressing (HIP)," Revision 3, dated May 14, 2008
- AA 222 379, "Specification for Spring," Revision 6, dated January 27, 2011
- AA 263 116, "Material Specification HIPed Boron Carbide Pins," Revision 8, dated September 9, 2010
- AA 285 092, "Material Specification Boron Carbide Powder for Hot Isostatic Pressing (HIP), Revision 3, dated May 14, 2005
- AA 249 624, "Material Specification Stainless Steel (316L) Plates for Control Rods," Revision 4, dated January 1, 2009
- AA 227 537, "Material Specification Stainless Steel Castings," Revision 3, dated December 22, 2004
- AA 301607E, "Specification for Control Rod," Revision 3, dated June 16, 2011
- AA 960233, "Brunswick Control Rod CR 99 Product Specification," Revision 1, dated May 22, 2015
- AS-CR-900, "Operator Instructions for Pin Drilling and Filling (from Swedish: Borfylining pinnar, Styrstav)," Revision 4, dated August 23, 2017
- B 72-6, "Change Management for Fuel and Control Rod Components," Revision 0, dated March 26, 2012
- B 72-7, "Processes for Design Work and Manufacturing Documents," Revision 15.1, dated April 30, 2015
- BTD 14-1147, "SFE [Sweden Fuel Engineering] Software Life Cycle View," Revision 2, dated June 21, 2017
- BTD 17-0183, "PHOENIX4 Version 2.3.4 - Request for Software Release," Revision 0, dated February 7, 2017



- BTD 17-0183, "PHOENIX4 Version 2.3.4 - SCAT [Simplified Computer Application Turnaround]," Revision 0, dated March 2, 2017
- BTF 06-1584, "Nuclear Design Characteristic of Westinghouse Control Rod CR 99 for BWR 2/3/4 D-Lattice Reactors," Revision 0, dated January 4, 2007
- BTF 05-050, "Control Rod NEOL [Nuclear End of Life] - Methodology Update of Equivalent B-10 Depletion," Revision 0, dated September 30, 2009
- "CR99 CRB [Control Rod Blade] Offer for Brunswick Units 1 and 2," Revision 1, dated January 22, 2014
- Commercial Dedication Instruction (CDI) No. MFRD-18-24, "Testing at ISO 17025 Certified Laboratory in Support of Design," Revision 0, dated March 21, 2018
- Drawing No. AA 301359, Revision 2, dated October 17, 2013
- Drawing No. AA 301524, Revision 0, dated November 11, 2006
- Drawing No. AA 336029, "Blade Assembly," Revision 0, dated November 3, 2011
- Drawing No. AA 336030, "Blade," Revision 1, dated June 3, 2014
- Drawing No. AA 336554, "Brunswick Control Rod CR 99," Revision 0, dated June 16, 2011
- Drawing No. AA 336401, "D-Lattice CR 99 Control Rod Drawing," Revision 0, dated March 28, 2013
- Drawing No. 336028, "Absorber Cross," Revision 0, dated November 3, 2011
- EP-310, "Computer Software Development and Maintenance," Revision 31.5, dated October 27, 2016
- "IPS [Inspection Specification] - Helium Leak Testing of Control Rods Blades," Revision 3, dated October 28, 2014
- KI-CR-900-05, "Filling Control (from Swedish: Kontroll av fylning)," Revision 0, dated June 29, 2011
- KI-CR-900-06, "Filled Blade Weight Control and Reporting in MES (from Swedish: Kontroll av vägning (fylit blad) & rapportering i MES)," Revision 0, dated June 29, 2011
- Report No. BTM 15-080, "Commercial Dedication Instruction for Springs Manufactured by Spinova," Revision 0, dated September 29, 2015
- Report No. BTM 18-0737, "Commercial Dedication Instruction (CDI) For Material Testing," Revision 0, dated September 9, 2018

- Report No. BTM 15-0884, “Commercial Dedication Instruction for Boron Carbide Pins,” Revision 1, dated September 9, 2018
- Report No. BTM 15-0908, “Commercial Dedication Instruction for Boron Carbide Powder Manufactured at 3M Technical Ceramics,” Revision 0, dated December 2, 2015, and Revision 1, dated October 11, 2018, respectively
- Report No. BTM 15-0980, “Commercial Dedication Instruction for Stainless Steel Type 316L Plates and Wire for Control Rods from TKM Austria and Bohler Edelstahl,” Revision 2, dated June 19, 2018
- Report No. BTM 15-0982, “Commercial Dedication Instruction for Stainless Steel Type 1.4306 Castings for Velocity Limiters from Zollern GmbH,” Revision 0, dated October 30, 2015
- Report No. BFE 17-037, “Commercial Dedication Instruction for Control Rod Handle Manufactured by Rabe Tooling,” Revision 0, dated September 13, 2017
- Report No. BFE 16-082, “Commercial Dedication Instruction for Control Rod Components Manufactured by Bror Tonsjo AB,” Revision 0, dated December 19, 2016
- Report No. BQM 14-048, “Commercial Dedication Instruction for Calibration Services by Accredited Laboratory,” Revision 1, dated June 16, 2015
- Report No. BQM 14-049, “Commercial Dedication Instruction for Calibration Services by Non-Accredited Laboratory,” Revision 1, dated June 16, 2015
- Report No. BQM 15-007, “Commercial Dedication Instruction for Field Calibration Services Performed by Non-Accredited Laboratory On-Site at Westinghouse,” Revision 1, dated February 11, 2015
- Report No. BQM 14-048, “Critical Characteristics (C1 to C6) for Acceptance using Method 1 - Inspection,” for PO No. 4500750723, item No. 394-72, dated August 29, 2018
- Report No. BQM 14-048, “Critical Characteristics (C1 to C6) for Acceptance using Method 1 - Inspection,” for PO No. 4500750723, item No.394-202, dated August 20, 2018
- Report No. BQM 14-048, “Critical Characteristics (C1 to C6) for Acceptance using Method 1 - Inspection,” for PO No. 4500746058, item No. T63-7, dated May 28, 2018
- Report No. BQM 15-0884, “Critical Characteristics (C1 to C7) for Acceptance using Method 1 - Inspection,” for PO No. 6000011450, boron carbide pins, dated June 15, 2018
- “Qualification Report Valid for Helium Leak Testing of Control Rod Blades,” Revision 3, dated October 17, 2014

- WCAP-16182-P-A, “Westinghouse BWR Control Rod CR99 Licensing Report,” Revision 0, dated March 2005
- WCAP-16182-P-A, “Westinghouse BWR Control Rod CR99 Licensing Report,” Revision 3, dated November 2017

Calibration, Heat Treatment, Non-Destructive Examination, Inspection, Welding, and Test Records

- B 42-1, “Written Practice,” Revision 15, dated June 13, 2018
- B 93-0, “Description of the Procedure for Calibration and Functionality Control,” Revision 4.2, dated June 1, 2018
- B 93-1, “Registration and Periodic Control of Special Gauges within the Fuel Factory,” Revision 27.2, dated June 1, 2018
- BFE 13-110, “Handling of Filler Metal,” Revision 1, dated June 14, 2014
- Calibration Certificate No. 0076-18342:1 for a thermometer, dated May 28, 2018
- Calibration Certificate No. 0076-18342:2 for a thermocouple, dated June 6, 2018
- Calibration Certificate No. SIR1808-142 for a torque, dated August 29, 2018
- Calibration Certificate No. SIR1808-141 for a torque, dated August 29, 2018
- Calibration Certificate No. BHTG19/CHK/2296443 for a flow meter, dated April 6, 2017
- Calibration Certificate No. BHTG19/CHK/2296446 for a flow meter, dated April 6, 2017
- Calibration Certificate No. S-QV-2018144 for a vision unit, dated April 25, 2018
- Calibration Report for Instrument No. I141-015, dated January 11, 2018 (no revision number)
- Calibration Report for Tungsten Inert Gas Weld Machine No. I711-290, dated May 2018
- Calibration Report for Cold Metal Transfer Weld Machine I711-291, dated May 2018
- Data Report for Control Rod No. 101394 for Susquehanna Steam Electric Station, dated 2018
- Data Report for Control Rod No. 101399 for Brunswick Steam Electric Plant, dated 2018
- Inspection Report: “Leak Detection Blade Assembly Tests,” for tests performed on October 12, 15, 17, 2018 (no revision number)
- Inspection Certificate No. WES/01/2017, Revision 0, dated February 2, 2015

- Inspection Report No. 33603001/02 for the control rod blades
- IPS-PT-002, "Inspection of Control Rod with Visible Dye Penetrant," Revision 6, dated June 1, 2015
- OPS-VB-011, "Heat Treatment of Absorber Cross," Revision 7, dated August 22, 2010 with Qualification Report KR 222-002, Revision 7, dated August 21, 2018
- Report No. BTM1 18-0786, "Technical Requirements for Additional Testing," Revision 0, dated September 13, 2018
- Report No. BT-18-0863, "Independent Testing of Materials to Verify Commercial Suppliers Certificate Test Results," Revision 0, dated October 10, 2018
- Welding Procedure Specification (WPS) No. 172, "Welding of Handle and Velocity Limiter," dated November 19, 2009 with Procedure Qualification Record (PQR) Nos. 222-59, 222-083, 222-088, 222-111, 22-128, and 222-157
- WPS No. 174, "Seal welding of SF5 (corner weld)," Revision 6, dated week 47-2016, with PQR Nos. 222-053, 083-088, 222-130, and 222-159
- WPS No. 176, "Seal Welding of SF12 and SF36," Revision 6, dated week 41, 2009, with PQR Nos. 222-055, 222-083, 222-088, 222-134, and 222-153
- WPS No. 177, "Manual GTAW welding of Leak Detection Hole (gas fill hole), Revision 9, dated week 16, 2006 with PQR No. 222-159
- WPS No. 192, "Longitudinal Welding of Control Rod Blade SF12," Revision 9, dated week 19, 2017 with PQR Nos. KR 222-087, KR 222-118, KR 222-122, KR 222-155, and KR 222-166
- WPS No. 203, "Montage Welding of Cross," Revision 1, dated week 7, 2009 with PQR Nos. 222-130, and 222-159
- WPS No. 207, "Cold metal transfer (CMT) Gas Metal Arc Welding (GMAW) for Weld SF4," Revision 1, dated February 28, 2015 with PQR No. 222-149

#### Purchase Orders, Audit Reports, and Commercial-Grade Surveys

- Purchase order (PO) No. 4500758009, "BWR Control Blade - Brunswick," dated October 9, 2018 from WEC to WES under contract No. WE 02003382, "Westinghouse Electric to Duke Energy," dated March 13, 2001, amended on September 17, 2018
- PO No. 6000013187 for testing services, dated September 11, 2018
- PO No. 450061980 for testing services, dated December 22, 2017
- PO No. 4500747367 for calibration services, dated May 14, 2018
- PO No. 4500750723 for calibration services, dated June 29, 2018

- PO No. 4500719502 for calibration services, dated April 20, 2017
- PO No. 4500746058 for calibration services, dated April 25, 2018
- PO No. 4500754307 for calibration services, dated August 22, 2018
- PO No. 6000013082 for boron carbide pins, dated August 20, 2018
- PO No. 6000011450 for boron carbide pins, dated May 31, 2017
- PO No. 6000012594 for springs, dated March 23, 2018
- PO No. 6000010309 for boron carbide powder, dated October 5, 2016
- PO No. 600008713 for stainless steel (316L) plates, dated October 7, 2015
- PO No. 6000010364 for velocity limiter castings, dated October 12, 2016
- PO No. 6000002877 for filler material, dated November 11, 2011
- PO No. 6000005642 for stainless steel 304L material, dated September 6, 2013
- PO No. 6000005860 for machining services, dated October 10, 2013
- PO No. 600007810 for Nickel base alloy bar, dated March 13, 2015
- PO No. 6000010364 for a velocity limiter, dated October 2, 2016
- PO No. 6000010662 for a sleeve, dated December 19, 2016
- External Audit Report No. WES-2017-160, Revision 0, for an audit conducted November 28 through December 1, 2017
- External Audit Report No. QP 17-110, Revision 0, dated December 12, 2017
- External Audit Report No. QP 18-221, Revision 0, dated August 3, 2018
- External Audit Report No. WES-2012-125, Revision 0, for an audit conducted April 17-18, 2012
- Commercial Grade Survey (CGS) Report No. QP 18-029, Revision 0, dated March 12, 2018
- CGS Report No. QP 15-070, Revision 0, dated December 1, 2015
- CGS Report No. QP 18-240, Revision 0, dated September 10, 2018
- CGS Report No. QP 17-111, Revision 0, dated December 15, 2017

- CGS Report No. QP 17-104, Revision 0, dated November 4, 2017
- CGS Report No. QP 18-023, Revision 0, dated April 26, 2018
- CGS Report No. QP 18-024, Revision 0, dated April 26, 2018
- CGS Report No. QP 15-053, Revision 0, dated October 26, 2015
- CGS Report No. QP 15-003, Revision 0, dated January 9, 2015
- CGS Report No. QP 15-016, Revision 0, dated March 17, 2015
- CGS Report No. QP 16-035, Revision 0, dated May 12, 2016
- CGS Report No. QP 15-053, Revision 0, dated October 26, 2015
- CGS Report No. QP 14-049, Revision 0, dated July 16, 2014
- Supplier Evaluation No. QP 13-056, Revision 1, dated April 29, 2016
- Supplier Evaluation No. QP 18-031, Revision 0, dated February 21, 2018
- Supplier Evaluation No. QP 14-035, Revision 0, dated May 6, 2014
- Supplier Evaluation No. QP 17-080, Revision 0, dated September 25, 2017
- Supplier Evaluation No. QP 14-089, Revision 1, dated September 11, 2017
- Internal Audit Report No. WEC-17-41, "Westinghouse Sweden (Västerås): ECoE (Engineering Center of Excellence), OPB (Operating Plant Business), and DDR & WM (Decontamination, Decommissioning, Remediation, and Waste Management)," audit dates April 3-7, 2018
- Internal Audit Report No. WEC-17-06, "Westinghouse Nuclear Fuel - Västerås Sweden," audit dates November 6-10, 2017
- Internal Audit Report No. WEC-18-41, "Westinghouse Sweden (Västerås): GES (Global Enterprise Services), GIC (Global Instrumentation Control), and DDR & WM," audit dates May 14-18, 2018
- Internal Audit Report No. WEC-18-06, "Westinghouse Nuclear Fuel: Sweden Fuel Operations," audit dates May 14-18, 2018

#### Corrective Action Reports/Issue Reports

- Corrective Action Report Nos. 100353915, 100014690, 100341809, 100204986, 100086122, 100204858, 100089441, 100204351, and 100204352
- Issue Report (IR) Nos. 2018-14374, 2018-16227, and 16973

### Issue Reports Opened During the NRC Inspection

- IR-2018-17601, "Discrepancies with Sandvik Purchase Order (PO) Requirements," dated October 16, 2018
- IR-2018-17615, "BTM 15-0908 Commercial Dedication Instruction for Boron Powder Missing Critical Characteristic for Isotope Analysis," dated October 16, 2018
- IR-2018-17670, "Insufficient Verification of Component Set-up when Welding Velocity Limiter to Absorber Cross," dated October 16, 2018
- IR-2018-17755, "Control of Weld Filler Material at Control Rod Work Shop," dated October 17, 2018
- IR-2018-17794, "Identified SQSR-B Wrongly Imposed 10 CFR 21 Conflicting Requirements," dated October 15, 2018
- IR-2018-17805, "Meeting NEI 14-05A," dated October 18, 2018
- IR-2018-17814, "SNT-TC-1A Qualification of NDT Inspectors (Brunswick PO)," dated October 18, 2018

### Training and Qualification Records

- Internal and external lead auditors
- Test personnel
- Blade assembly personnel

### Miscellaneous

- BD 16-006, "Westinghouse CR/CR 82M-1- White Paper," Revision 1, dated October 7, 2016
- BD16-008, "Continued operation of CR 82M-1 in US BWRs," Revision 0, February 12, 2016
- BTK 14-1038, "Brunswick 2. Analysis of Control Rods Manufacturing Inspection Data," Revision 1, dated October 9, 2014
- BTK 15-0359, "CR 82M-1 Inspection in Brunswick Unit 2," Revision 0, dated April 2, 2015
- BQ 18-286, "Product Assessment WSE procurement controls," Revision 0, dated October 10, 2018
- EP-310 "Refresher Software Training," dated April 27, 2012
- EP-310 "Power Point test plan and testing requirements," dated April 27, 2012

- LTR-SRC-15-97, "PD-1323 Closeout, "Customer Suspicion of CRB Boron Leakage in Brunswick Unit 2" (Brunswick)," Revision 1, dated January 6, 2016
- LTR-SRC-16-37, "Closeout Request for PI 16-004, "BWR Control Rod Blade (CRB) Leakage" (Nine Mile Point and Browns Ferry)," Revision 1, dated April 28, 2016
- LTR-SRC-18-97, "Closeout Request for PI-18-21, Procurement Control of Fuel-Related Components," dated October 15, 2018
- Report No. BQ 18-286, "Product Assessment, WSE Procurement Controls Are Not Meeting 10 CFR 50 Appendix B Requirements, CAP IR-2018-14374," Revision 0, dated October 10, 2018
- Specification QP 13-067, "SQSR - Supplier Quality System Requirements," Revision 2, dated February 15, 2018
- Stop Work Order No. BQ 18-259, Revision 0, dated August 23, 2018