



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

April 4, 2018

Mr. Jerald G. Head  
Sr. Vice-President, Regulatory Affairs  
General Electric Hitachi Nuclear Energy  
3901 Castle Hayne Road  
Wilmington, NC 28402

SUBJECT: GLOBAL NUCLEAR FUEL - AMERICAS, LLC'S NUCLEAR REGULATORY  
COMMISSION INSPECTION REPORT NO. 99901376/2018-201, AND NOTICE  
OF NONCONFORMANCE

Dear Mr. Head:

On February 26 - March 2, 2018, the U.S. Nuclear Regulatory Commission's (NRC) staff conducted an inspection at the Global Nuclear Fuel - Americas, LLC's (hereafter referred to as GNF-A) facility in Wilmington, NC. The purpose of this limited scope inspection was to assess GNF-A's 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 GNF-A's implementation of the quality activities associated with the design, fabrication, assembly, and testing of the nuclear fuel being supplied to 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 GNF-A was not fully implementing its QA program in the area of corrective action. The specific finding and references to the pertinent requirements are identified in the enclosures to this letter. In response to the enclosed Notice of Nonconformance (NON), GNF-A should document the results of the extent of condition review for this finding 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 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 (and 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,

*/RA/*

Terry W. Jackson, Chief  
Quality Assurance Vendor Inspection Branch-1  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99901376

EPID No. I-2018-201-0019

Enclosures:

1. Notice of Nonconformance
2. Inspection Report No. 99901376/2018-201

SUBJECT: GLOBAL NUCLEAR FUEL - AMERICAS, LLC'S NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 99901376/2018-201, AND NOTICE OF NONCONFORMANCE

Dated: April 4, 2018

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NRO-002

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## NOTICE OF NONCONFORMANCE

Global Nuclear Fuel - Americas, LLC  
3901 Castle Hayne Road  
Wilmington, NC 28402

Docket No. 99901376  
Report No. 2018-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the Global Nuclear Fuel - America, LLC's (hereafter referred to as GNF-A) facility in Wilmington, NC, from February 26, 2018, through March 2, 2018, GNF-A did not conduct certain activities in accordance with NRC requirements that were contractually imposed upon GNF-A by its customers or NRC licensees:

Criterion XVI "Corrective Action," 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," states, in part, that "Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected."

Contrary to the above, as of March 2, 2018, GNF-A failed to assure that conditions adverse to quality were effectively identified and corrected. Specifically, in December of 2016, GNF-A initiated a condition report (CR) to address a significant number of gages (as determined by the gage lab supervisor) that were past their calibration due date and were still on the manufacturing floor. Subsequently, in March of 2017, GNF-A initiated another CR to address a significant number of gages that were past their calibration due date and were also still on the manufacturing floor. Then, during the review of GNF-A's calibration program, the NRC inspection team identified that a large number of gages were past their calibration due date and were still on the manufacturing floor.

This issue has been identified as Nonconformance 99901376/2018-201-01.

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 Branch-1 Vendor Branch, 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 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 (SGI) 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 4<sup>th</sup> day of April 2018.

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

Docket No.: 99901376

Report No.: 99901376/2018-201

Vendor: Global Nuclear Fuel - Americas, LLC  
3901 Castle Hayne Road  
Wilmington, NC 28402

Vendor Contact: Mr. Jerald G. Head  
Sr. Vice-President, Regulatory Affairs  
Email: jerald.head@ge.com  
Phone: 1-910-233-134

Nuclear Industry Activity: Global Nuclear Fuel - Americas, LLC manufactures uranium dioxide (UO<sub>2</sub>) powder, pellets, and light water reactor fuel bundles at its Wilmington facility. The facility converts uranium hexafluoride (UF<sub>6</sub>) to UO<sub>2</sub> using a Dry Conversion Process and performs UO<sub>2</sub>, gadolinium pellet, and fuel fabrication operations.

Inspection Dates: February 26 - March 2, 2018

Inspectors: Yamir Diaz-Castillo NRO/DCIP/QVIB-1 Team Leader  
Edgardo Torres-Collazo NRO/DCIP/QVIB-1  
Richard P. McIntyre NRO/DCIP/QVIB-2  
Benjamin T. Parks NRR/DSS/SNPB  
Joshua Borrromeo NRR/DSS/SRXB  
Annie Ramirez NMSS/FCSE/PORB

Approved by: Terry W. Jackson, Chief  
Quality Assurance Vendor Inspection Branch-1  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

## **EXECUTIVE SUMMARY**

Global Nuclear Fuel - Americas, LLC  
99901376/2018-201

The U.S. Nuclear Regulatory Commission's (NRC) staff conducted a vendor inspection at the Global Nuclear Fuel - Americas, LLC's (hereafter referred to as GNF-A) facility in Wilmington, NC, 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 team also verified that GNF-A had implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance." This was the second NRC vendor inspection of GNF-A at the Wilmington facility.

This technically-focused inspection specifically evaluated GNF-A's implementation of quality activities associated with the design, fabrication, assembly, and testing of the nuclear fuel being supplied to the U.S. nuclear power plants. Specific activities observed by the NRC inspection team included:

- Automated welding and ultrasonic testing of the final weld of the fuel rod end plugs
- Condition Review Group meeting
- Pellet integrity and pellet dimensional in-process inspection and surveillances
- Receipt inspection of process tube shells
- Bundle assembly active scan, bundle assembly passive scan, and bundle assembly leak test for fuel cycle design for Peach Bottom Atomic Power Station, Unit 2

In addition to observing these activities, the NRC inspection team verified that measuring and test equipment (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.

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

#### Corrective Action

The NRC inspection team issued Nonconformance 99901376/2018-201-01 in association with GNF-A's failure to implement the regulatory requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. Nonconformance 99901376/2018-201-01 cites GNF-A for failing to assure that conditions adverse to quality were effectively identified and corrected. Specifically, GNF-A did not identify and take effective corrective actions concerning the number of gages on the manufacturing floor that were past their calibration due date.

#### Other Inspection Areas

The NRC inspection team determined that GNF-A established its programs for training and qualification, 10 CFR Part 21, design control, commercial-grade dedication, supplier oversight, manufacturing control, test control, control of M&TE, nonconforming material, parts, or components, 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 GNF-A is implementing its policies and procedures associated with these programs. No findings of significance were identified in these areas.

## REPORT DETAILS

### 1. Nonconforming Materials, Parts, or Components and Corrective Action

#### a. Inspection Scope

The NRC's inspection team reviewed GNF-A's policies and implementing procedures that govern the implementation of its control of nonconforming materials, parts or components; and corrective action programs to verify compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," 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."

GNF-A's process for controlling nonconforming material is based on the issuance of inspection reports (IRs). The NRC inspection team reviewed a sample of IRs to verify that GNF-A: (1) dispositioned the IRs in accordance with the applicable procedures, (2) documented an appropriate technical justification for various dispositions, and (3) took adequate corrective action with regard to the nonconforming items. For IRs that were dispositioned use-as-is, the NRC inspection team confirmed that the technical justifications were documented to verify the acceptability of the nonconforming item. The NRC inspection team also verified that GNF-A's IRs provide a link to the 10 CFR Part 21, "Reporting of Defects and Noncompliance," program.

GNF-A's process for corrective actions is based on the issuance of condition reports (CRs). The NRC inspection team reviewed a sample of CRs to ensure that conditions adverse to quality were promptly identified and corrected. In addition, the NRC inspection team verified the CRs 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 GNF-A's CRs provide a link to the 10 CFR Part 21 program.

The NRC inspection team also observed a Condition Review Group (CRG) meeting. This is a daily meeting designed to discuss GNF-A's CRs and prioritize the CRs from A through D (A being the highest priority and D the lowest). Depending on the priority assigned to the CR by the initiator, the CRG assigns a team to review, analyze, and implement the correctives actions determined for the CR. The CRG monitors the completion of the CRs through an internal condition reporting system. The CRG meeting also monitors the pending actions and the implementation of the corrective actions. The CRG ensures that all of the CRs' corrective actions are adequately dispositioned and closed in a timely manner. The NRC inspection team observed the screening of seven CRs by the CRG.

The NRC inspection team also discussed the nonconforming materials, parts, or components and corrective action programs with GNF-A's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Corrective Action Associated with Nonconformance No. 99901376/2008-201-01

Following the September 2008 inspection of GNF-A, the NRC issued Nonconformance No. 99901376/2008-201-01 for GNF-A's failure to: (1) maintain GNF-A's Policy and Procedure (P&P) No. 70-42, "Reporting Defects and Non-Compliance Under 10 CFR Part 21," consistent with the definitions in 10 CFR Part 21; and (2) incorporate specific requirements in P&P 70-42 regarding the individual responsible for the corrective action and the length to complete the action.

In a follow-up response dated November 25, 2008, GNF-A stated, in part, that the cause of the nonconformance was a procedural revision process that was not adequate to ensure equivalent procedures maintained by separate organizations [i.e. General Electric Hitachi Nuclear Energy (GEH), and GNF-A] were updated concurrently. At the time of the NRC inspection, GEH and GNF-A maintained separate versions of P&P No. 70-42. There was a gap in the process by which one of the P&Ps could be changed without the review and approval of members of the other organization. In this case, the GEH version of P&P No. 70-42 was revised correctly when a revision of 10 CFR Part 21 occurred in 2007. While there was a communication made of this change to the GNF-A team, there was no follow-up to ensure that the equivalent procedure was revised. GNF-A's duplicate P&P No. 70-42 was maintained by separate owners and was not revised at that time. GNF-A's corrective actions included the consolidation of the two versions of P&P No. 70-42 into one version, and removing the modification of the revision and approval process for P&P No. 70-42.

The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions and reviewed the consolidated procedure for 10 CFR Part 21, Work Instruction (WI) No. 16-108-07, "Reporting Defects and Noncompliance and Respective Condition Reports," Revision 4, dated November 14, 2017. The NRC inspection team also confirmed that WI-16-108-07 was revised to be consistent with 10 CFR Part 21. Based on this review, the NRC inspection team closed Nonconformance 99901376/2008-201-01.

b.2 Implementation of GNF-A's Corrective Action Program

During the review of GNF-A's calibration program, the NRC inspection team noted that there were a significant number of gages that were past their calibration due date but were still on the manufacturing floor. During discussions with GNF-A staff, the NRC inspection team learned that in December 2016 and in March 2017, GNF-A initiated two CRs (Nos. 23261 and 25109, respectively) to address an issue identified with a significant number of gages that were past their calibration due date and were still on the manufacturing floor. At the time of the inspection, these CRs were closed and the corrective actions were marked as completed. The corrective actions consisted of the responsible staff finding and adequately disposing of the gages. The NRC inspection team noted that both CRs were marked as Priority C (Broke/Fix) and the actions assigned to each CR were closed. GNF-A failed to recognize and correct the deficiency in the calibration program that would alert staff to instruments going past their calibration due date; hence the repeat occurrences of a large number of gages past their calibration due date on the manufacturing floor. The NRC inspection team identified this issue as an example of Nonconformance 99901376/2018-201-01 for GNF-A's failure to assure

that conditions adverse to quality were effectively corrected. GNF-A initiated CR No. 28026 to address this issue.

c. Conclusion

The NRC inspection team concluded that GNF-A established its nonconforming materials, parts, or components program in accordance with the regulatory requirements of Criterion XV of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that GNF-A is implementing its policies and procedures associated with the control of nonconforming materials, parts, or components program. No findings of significance were identified.

Regarding corrective actions, the NRC inspection team issued Nonconformance 99901376/2018-201-01 in association with GNF-A's failure to implement the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Nonconformance 99901376/2018-201-01 cites GNF-A for failing to assure that conditions adverse to quality were effectively identified and corrected. Specifically, GNF-A did not identify and take effective corrective actions concerning the number of gages on the manufacturing floor that were past their calibration due date.

2. 10 CFR Part 21 Program

a. Inspection Scope

The NRC inspection team reviewed GNF-A's policies and implementing procedures that govern the implementation of its 10 CFR Part 21 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 GNF-A's purchase orders (PO) 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 GNF-A's nonconformance and corrective action procedures provide a direct link to the 10 CFR Part 21 program.

Furthermore, for a sample of 10 CFR Part 21 evaluations performed by GNF-A, the NRC inspection team verified that GNF-A had effectively implemented the requirements for evaluating deviations and failures to comply. The NRC inspection team verified the notifications were performed in accordance with the requirements of 10 CFR 21.21, as applicable.

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

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that GNF-A 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 GNF-A 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 GNF-A's policies and implementing procedures that govern the implementation of its 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 GNF-A's design processes as applied to the fuel cycle design for Peach Bottom Atomic Power Station (hereafter referred to as Peach Bottom), Unit 2, Refueling Cycle No. 22.

GNF-A's process for implementing design control activities is governed by Common Procedure (CP) No. 03-100, "Design Process," Revision 4.1, dated November 2017. CP-03-100 identifies the steps for planning, performing, validating, releasing, changing, and documenting a design. For planning the design, the procedure includes instructions for initiating work, identifying and documenting design inputs, developing a verification plan, defining the work scope, and determining the design tools to be used. CP-03-100 also includes an appendix providing guidance for documentation at all steps of the design process.

The NRC inspection team reviewed additional procedures and checklists specifically applicable to ensuring that the procedures contained in CP-03-100 are followed during a plant-specific fuel cycle design process. Given the repetitive nature of fuel cycle design, a series of procedures and guidelines are catalogued for use to reduce the effort required to plan the design, such that the specific steps and requirements in CP-03-100 are addressed across many documents. These procedures and guidelines include customer input, specify documentation and verification requirements, and provide instructions to capture all necessary design and validation records in GNF electronic archives.

The NRC inspection team interviewed personnel responsible for the design process used to develop the fuel cycle design for the recent Peach Bottom operating cycle. The general application of the common procedure is reflected in Technical Design Procedure No. 0002, "Fuel Cycle Analysis," Revision 7, dated August 2017. Design inputs are provided in a record that includes an initial recommendation by GNF-A, allows for customer input and verification, and presents the final, verified design inputs chosen by the vendor, with discussion for any deviations from a customer specification and a confirmation that the customer accepted the deviation.

The NRC inspection team reviewed the archive containing applicable design documentation and discussed the archive with the responsible manager and engineer. An umbrella document known as Analysis Guide No. 0048, "Fuel Cycle Work Outline," Revision 8, dated July 2015, provides a general overview of the design process with cross references to additional records when necessary. Examples include links to locate design inputs, procedures used to perform the design, and guides used to perform the design verification. The cycle design itself relies on a number of outputs from other designs, such as specific fuel bundle designs. Methods used include the TGBLA lattice

physics code and the PANACEA steady-state core simulator. When design analysis is performed using engineering computer packages (ECPs) like TGBLA and PANACEA, the code output reflects pertinent information such as the method used, the version of the ECP, and the computer system used to run the code. The NRC inspection team observed that these elements of documentation are in accordance with the documentation appendix to CP-03-100.

The NRC inspection team also discussed the design validation process with the responsible manager and engineer and reviewed documents associated with the design validation for the Peach Bottom fuel cycle design. The NRC inspection team identified that design validation is accomplished by a variety of means. The verifier checks that the inputs are valid, the appropriate methods are used in accordance with limitations thereto, and the results appear correct. The validation effort is assisted by the use of a series of checklists appropriate for each specific task associated with the design. The NRC inspection team reviewed pertinent portions of the design record file to confirm that checklist results are preserved as validation documentation and discussions appropriate for each unexpected checklist result, as well as a disposition, are preserved in the documentation.

The manager maintains a technical proficiency matrix to ensure those performing or validating designs are qualified to do so, and that new staff are given on-the-job training by those with expert-level proficiency in the specific design task. The NRC inspection team reviewed the matrix and confirmed the staff who performed the fuel cycle design for Peach Bottom was appropriately qualified.

The NRC inspection team also reviewed a sample of completed design and test records for the development of the IBNDL02P software, documentation of Boiling Water Reactor fuel bundles, including the GNF2 fuel design, to determine if the design and the associated tests were performed in accordance with GNF-A's procedures. The IBNDL02P software is used for enabling the interactive graphical design evaluation of the fuel. In addition, the NRC inspection team reviewed error reporting and associated updates to the PANAC11 core simulator software to determine if the software updates and associated tests were performed in accordance with GNF-A's procedures. The PANAC11 software is used for core design each reload, and its results are used for downstream inputs into safety analyses.

The NRC inspection team focused its review primarily on the software development, software design changes, and error identification and processing. The NRC inspection team reviewed a sample of representative examples of software development activities from IBNDL02P and software error identification and processing, and software updates for PANAC11 to verify the requirements for software planning, development, verification, and maintenance were developed, documented, and verified in accordance with the requirements GNF-A's procedures for both IBNDL02P and PANAC11.

For the IBNDL02P computer program, the NRC inspection team reviewed various software development, testing, and verification documents including the Acceptance Test Report (ATR) for IBNDL02P. The ATR includes numerous tests for verifying that IBNDL02 adequately performs all of its intended safety functions. The acceptance testing included, but is not limited to, benchmarking to results from previous qualified IBNDL02A code versions to ensure consistent results and tests that the code could appropriately handle abnormal input conditions.

For the PANAC11 computer code, the NRC inspection team reviewed various documents relating to the code error and associated software change, testing, and verification packages. The PANAC11 error that was reviewed related to an error of the critical power ratio (CPR) calculation using GEH's critical heat flux correlation when starting a restart file. This error was captured in CR No. 8725. The NRC inspection team reviewed the software test plan and report which contained the necessary updates and associated tests to ensure successful code updates to correct the error. The tests contained a comparison of the CPR results from an updated code to a run with a verified correct CPR calculation to ensure the results were consistent. In addition, the tests contained a review of the restart file to ensure that the appropriate data was generated to calculate the CPR. The NRC inspection team also reviewed the "PANAC11A/P Error Correction 10 CFR 50.59 Evaluation Bases" document which ensured that the updates to PANAC11 fell within the approved evaluation model for PANAC11.

The NRC inspection team also discussed the design control program with GNF-A's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that GNF-A 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 GNF-A is implementing its policies and procedures associated with the design control program. No findings of significance were identified.

4. Commercial-Grade Dedication

a. Inspection Scope

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

GNF-A's process for implementing commercial-grade dedication activities is governed by CP-07-104, "Customer Purchase Order Technical Evaluation and Dedication of Commercial Grade Items and Services," Revision 6, dated October 12, 2016. The NRC inspection team noted that CP-07-104 provided 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 seven dedication packages for the following safety-related fuel assembly components: upper tie plate, upper and lower fuel rod end plug pieces, pre-finished water rod tube blank, and natural uranium dioxide (UO<sub>2</sub>) pellets. The dedication packages contained documents such as vendor POs, commercial-grade surveys, the Dedication Specification (DS), the Receiving Inspection

Quality Control Inspection Instruction, the Certificate of Quality documentation for dimensional inspections, and material mechanical and chemical properties testing. The DS includes the technical evaluation for the identification and documentation of the basis and justification for the selection of the critical characteristics, acceptance methods, acceptance criteria, and sampling plans.

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 GNF-A's dedication process.

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

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that GNF-A 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 GNF-A 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 GNF-A's 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. The NRC inspection team reviewed GNF-A's Approved Suppliers List (ASL), a sample of POs, external and internal audits, and receipt inspection records to verify compliance with the applicable regulatory and technical requirements.

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 [e.g., receipt inspection reports, Certificates of Conformance, Certificate of Calibration, and Certified Material Test Reports (CMTRs)], these records were (1) reviewed by GNF-A for compliance with the requirements of the POs, and (2) the records contained the applicable technical and regulatory information.

GNF-A 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 quality program that meets the requirements of Appendix B to 10 CFR Part 50 or American Society of Mechanical Engineers' NQA-1, "Quality Assurance Requirements for Nuclear Facility Applications," and accept 10 CFR Part 21. NIAC develops and maintains procedures and processes necessary to plan, guide, and share supplier audits with its members. GNF-A uses NIAC audits to support the qualification and maintenance of suppliers. Once a NIAC audit is received, GNF-A's Quality Program Manager reviews the audit for completeness and adequacy, evaluates the audit report in accordance with GNF-A's QA program and the appropriateness of the scope, and approves the audit report as the basis for including the vendor on the ASL.

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 GNF-A's responsible management. In addition, the NRC inspection team also 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 GNF-A's lead auditors and confirmed that auditing personnel had completed all the required training and had maintained the applicable qualification and certification in accordance with GNF-A's policies and procedures.

The NRC inspection team also witnessed the receipt inspection of process tube shells as well as pellet integrity and pellet dimensional in-process inspection and surveillances. The NRC inspection team confirmed that the Quality Control inspector performed these activities in accordance with the applicable procedures and adequately completed the inspection and surveillance reports with his acceptance stamp and/or signature and date of inspection.

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

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that GNF-A 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 GNF-A is implementing its policies and procedures associated with the supplier oversight and internal audits programs. No findings of significance were identified.

## 6. Manufacturing Control

### a. Inspection Scope

The NRC inspection team reviewed GNF-A's policies and implementing procedures that govern the implementation of its control of special processes program to verify compliance with the regulatory requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50.

GNF-A's process for implementing welding activities is governed by Process Specification (PS) No. P8AYP5, "General Welding Procedure for Zirconium Alloys," Revision 35, dated December 2015. PS No. P8AYP5 defines the general engineering requirements for the welding of zirconium alloys and specific zirconium alloy weldments (e.g., tube to end plug welds, spacer welds, fuel channel seam welds, fuel channel clip welds, tab to water rod welds, and adapter plate to channel welds). Welding is not done to any known industry standard, but rather to engineering specifications developed by GNF-A's engineering personnel. The welding process is qualified and any changes to the weld parameters, weld equipment, materials, or material configuration requires a complete or partial requalification.

The NRC inspection team observed the automated final weld of the lower end plugs. The NRC inspection team verified that (1) the welder operator was qualified to operate the welding station, (2) the welding procedures were appropriately qualified and contained the required information (e.g., welding parameters, etc.), and (3) the equipment used in the welding stations was within calibration.

GNF-A utilizes a Multi-Inspection and Data Acquisition System (MIDAS) to perform ultrasonic testing (UT) on the fuel rods after fabrication. The NRC inspection team observed UT of the lower end plugs. The UT instrumentation is calibrated every eight hours. The NRC inspection team verified that the NDE procedures used by GNF-A met the applicable requirements. No relevant indications were identified by the operator. In addition, a Level II NDE inspector verifies 100 percent of all UT examination results for each lot. The NRC inspection team verified that the operator performed the examinations in accordance with the applicable qualified procedures and the appropriate acceptance criteria using calibrated instruments.

The NRC inspection team also reviewed a sample of welder training and qualification records to confirm that welders had completed the required training and had maintained their qualifications in accordance with the applicable GNF-A procedures.

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

### b. Observation and Findings

No findings of significance were identified.

c. Conclusion

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

7. Test Control

a. Inspection Scope

The NRC inspection team reviewed GNF-A's policies and implementing procedures that govern the implementation of its test control program to verify compliance with the requirements of Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50. The NRC inspection team observed fuel bundle production testing underway for Refueling Cycle No. 22 for Peach Bottom.

The NRC inspection team observed three types of production testing: (1) bundle assembly active scan; (2) bundle assembly passive scan; and (3) bundle assembly helium leak test. The bundle assembly active scan is performed to verify that as-fabricated, the non-gadolinia bearing fuel rods contain the correct fuel inventory, and the fuel pellets within the fuel rods are correctly aligned. The bundle assembly passive scan is similar to the active scan, but is performed for the gadolinia-bearing fuel rods. The leak test is performed to verify that each bundle, once assembled, does not have any leaking fuel rods.

In addition to observing the tests described above, the NRC inspection team reviewed testing procedures, acceptance criteria, and quality notes related to the bundle assembly active scanning. The NRC inspection team confirmed that the procedures address startup, normal, off-normal and emergency operations. The test procedures also contain environmental, safety, and industrial hygienic requirements.

The NRC inspection team reviewed documentation indicating that the scanner capabilities are specified in a Process/Product Quality Plan (PPQP), and that the scanner is re-qualified for new fuel designs and when a substantial hardware change is made to the testing system. The PPQP provides details concerning the technical capability of the scanner for each type of measurement it takes, for example, fuel pellet gap dimensional tolerance. The NRC inspection team also reviewed the plan and results for re-qualification of the scanner for GNF-2 fuel design, and results for re-qualification after the Californium source that is used in the detector was replaced.

While observing the production testing, the NRC inspection team interviewed test equipment operators and confirmed that they were knowledgeable with the applicable operating procedures and qualified to perform the testing underway. The NRC inspection team also reviewed the operators' training and qualification records to confirm that the operators had completed all the required training and had maintained the applicable qualification and certification in accordance with GNF-A's policies and procedures. Finally, the NRC inspection team verified that observed testing was being performed in accordance with the applicable procedures.

The NRC inspection team discussed the test control program with GNF-A's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that GNF-A 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 GNF-A is implementing its policies and procedures associated with the test control program. No findings of significance were identified.

8. Control of Measuring and Test Equipment

a. Inspection Scope

The NRC inspection team reviewed GNF-A's policies and implementing procedures that govern the implementation of its 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 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 identified as being out of calibration, the M&TE is removed from use and segregated to prevent further usage. GNF-A then initiates an Out-of-Tolerance report and a CR until the out-of-tolerance condition is reviewed and dispositioned. Through the CR, GNF-A performs an evaluation to identify which items have been accepted using this equipment since the last valid calibration date and perform an extent of condition review.

The NRC inspection team also discussed the M&TE program with GNF-A's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

With the exception of the Nonconformance documented in Section 1.b.2 of this report, the NRC inspection team concluded that GNF-A 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 GNF-A is implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

9. Entrance and Exit Meetings

On February 26, 2018, the NRC inspection team discussed the scope of the inspection with Mrs. Tammy G. Orr, Senior Vice President Nuclear Oversight, and other members of GNF-A's management and technical staff. On March 2, 2018, the NRC inspection team presented the inspection results and observations during an exit meeting with Mrs. Orr and other members of GNF-A's 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

Name	Title	Affiliation	Entrance	Exit	Interviewed
Tammy G. Orr	Senior Vice President (VP) Nuclear Oversight	Global Nuclear Fuel - Americas (GNF-A)	X	X	
Jerald Head	Senior VP Regulatory Affairs	GNF-A	X	X	X
Carmen Alonso	VP Quality Oversight & Programs	GNF-A	X	X	X
Adam Hilton	Plant Manager	GNF-A	X		
Brian R. Moore	General Manager (GM) Core & Fuel Engineering	GNF-A	X		
James Burke	GM Engineering	GNF-A			X
Stanley E. Griffin	Quality Program Manager	GNF-A		X	X
Anne Murray	Corrective Action Program Manager	GNF-A			X
David Miller	Equipment Maintenance Manager	GNF-A			X
Glen Wafford	Chief Engineer	GNF-A	X		
Glenn Warmkessel	Quality Manager	GNF-A			X
Russell Stachowski	Chief Consulting Engineer	GNF-A	X	X	
Collins E. Watson	Lead Supplier Quality Engineer	GNF-A			X
Alex Peklaris	ASME & Quality Program Leader	GNF-A			X
Randy Eubanks	Senior Software Quality Lead	GNF-A			X
Greg Huff	Software Quality Lead	GNF-A			X

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Joshua Finch	PANACEA Responsible Engineer	GNF-A			X
Charles Lamb	Engineering Services	GNF-A			X
Weston Cundiff	Fuel Engineer	GNF-A			X
David Morgan	Quality Leader	GNF-A	X	X	X
Gregory K. Bixby	Quality Leader	GNF-A			X
Steven Leopold	Gage Lab Quality Control Leader	GNF-A		X	X
Dwight Estes	Senior Quality Engineer	GNF-A			X
Devin Tiernan	Quality Engineer	GNF-A			X
David Black	Quality Assurance Engineer	GNF-A			X
Lee Robinson	Quality Inspector	GNF-A			X
Yang Pi-Lin	Senior Engineer	GNF-A			X
John Hudson	Manufacturing Engineer	GNF-A			X
Stephen Leopold	Service Component Operations Leader	GNF-A			X
Ben Hackney	Global Commodity Leader - Fabrications	GNF-A			X
Rhonda Riverbank	Quality Surveillance Controller	GNF-A			X
Paul Ragan	Supplier Quality	GNF-A	X	X	X
Bill Cline	Senior Staff Project Manager	GNF-A			X
Rich Augi	Pressurized Water Reactor (PWR) Fuel - Program Manager	GNF-A			X
Dewanna Murphy	Operator	GNF-A			X

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Gwendolyn Murphy	Operator	GNF-A			X
Terry Hansley	Operator	GNF-A			X
Phillip Wengloski	PWR Core Design	Exelon Generation			X
James R. Wingfield Jr.	Vendor Auditor	Exelon Generation			X
Yamir Diaz-Castillo	Inspection Team Leader	NRC	X	X	
Richard P. McIntyre	Inspector	NRC	X	X	
Edgardo Torres-Collazo	Inspector	NRC	X	X	
Annie Ramírez	Inspector	NRC	X	X	
Benjamin T. Parks	Technical Specialist	NRC	X	X	
Joshua Borromeo	Technical Specialist	NRC	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>
99901376/2008-201-01	CLOSED	NON	Criterion V
99901376/2018-201-01	OPENED	NON	Criterion XVI

#### 4. DOCUMENTS REVIEWED

##### Policies and Procedures

- Nuclear Engineering Design Operations No. 11209, GE Hitachi Nuclear Energy Quality Assurance Program Description, Revision 13, dated August 4, 2016
- Common Procedure (CP) No. 03-100, "Design Process," Revision 4.1, dated November 2017
- CP 04-105, "Purchase Order Receiving," Revision 7.1, dated December 21, 2017
- CP-04-206, "Creating a Purchase Order," Revision 4, dated October 26, 2017
- CP-04-210, "Purchase Order Maintenance," Revision 1.1, dated October 23, 2017
- CP-07-02, "Supplier Approval," Revision 29, dated September 15, 2017
- CP-07-03, "Supplier Selection and Management," Revision 7.2, dated March 16, 2017
- CP-07-04, "Supplier Surveillance," Revision 1, dated March 18, 2015
- CP-07-106, "Receiving Inspection Procedure and Routines," Revision 1.1, dated October 27, 2017
- CP-07-102, "Supplier Product/Process Qualification," Revision 7, dated February 14, 2018
- CP-07-104, "Customer Purchase Order Technical Evaluation and Dedication of Commercial Grade Items and Services," Revision 6, dated October 12, 2016
- CP-10-105, "Inspection Requirements for Procured Items," Revision 13, dated March 1, 2017
- CP-07-202, "Supplier Source Inspections for Product Release," Revision 13, dated August 15, 2017
- CP-11-03, "Production Test - FMO and FCO"
- CP-12-101, "Calibration Control Program," Revision 5, dated January 24, 2018
- CP-12-102, "Calibration Program for Instrumentation and Controls," Revision 2.1, dated November 18, 2016
- CP-12-104, "Scale and Balance Program," Revision 1, dated October 6, 2014
- CP-15-104, "Material Review Process," Revision 5, dated November 30, 2016
- CP-16-100, "Trending Analysis," Revision 2.1, dated November 8, 2017

- CP- 16-101, “Lessons learned/Operating Experience Program,” Revision 7, January 25, 2018
- CP-16-108, “Corrective Action Program,” Revision 10.1, dated August 9, 2017
- CP-17-101, “Product Quality Assurance Records,” Revision 7, dated October 13, 2017
- CP-18-02, “Supplier Audits and Commercial Grade Surveys,” Revision 14, dated January 15, 2018
- CP-18-03, “Lead Auditor Certification and Audit Team Training, Revision 4.1, dated May 3, 2017
- CP-18-100, “Quality Assurance Internal Audits Requirements,” Revision 8, dated January 15, 2018
- CP-18-202, “Focused Self-Assessments,” Revision 10.1, dated July 7, 2017
- CP-20-05-F16, “Manufacturing NDE Written Practice,” Revision 4, dated April 18, 2017
- CP-23-400, “Engineering Computer Projects,” Revision 2.2, September 28, 2017
- Gage Inspection Standard No. A-07, “Lost or Damaged M&TE Control,” Revision 6, dated April 19, 2016
- Operating Procedure (OP) No. 1040.12, “UO2 Pellet Grinder,” Revision 47
- OP No. 1070.47, “GAD Pellet Grinding,” Revision 36
- P8AYP5, “General Welding Procedure for Zirconium Alloys,” Revision 35, dated December 2015
- Quality Inspection Standard (QIS) No. P121, “Guidelines for GNF-A/SCO Receipt Inspection Activities,” Revision 3, dated August 19, 2014
- QIS No. P356, “Receiving Inspection Sampling Plan,” Revision 2, dated November 17, 2016
- QIS No. P358, “Receiving Inspection Sampling Plan based on EPRI TR-017218-R1,” Revision 0, dated June 24, 2013
- QIS No. P359, “Receiving Inspection Sampling Plan for Destructive Testing,” Revision 0, dated October 8, 2001
- Quality Notice (QN) No. 00364, “Qualification of Welder #6 for Resistance Weld and Inspection of Fuel Rod Upper End Plugs,” Revision 1, dated November 19, 2004
- QN-01831, “Instructions for Dedication of Natural Pellets that are Not Purchased as Safety-Related,” Revision 1, dated February 1, 2017

- QN-01378, "Sampling Requirements for GE-H-C Natural Pellet Dedication," Revision 0, dated
- Quality Control Plan No. A-208, "Zirconium and Zircaloy," Revision 4, dated August 18, 2000
- Visual Standard Inspection No. PL-1, Revision 15, dated May 2, 2013
- Work Instruction (WI) No. 03-100-10, "Safety-Related Classification of Equipment and Services," Revision 3, dated April 25, 2017
- WI-03-100-30 "Design Verification," Revision 3.2, dated November 2017
- WI-15-100-02, "Non-Conforming Material Control," Revision 3, dated September 23, 2015
- WI-16-108-04, "Cause Analysis," dated October 26, 2017
- WI-16-108-07, "Reporting of Defects and Noncompliance Under 10 CFR Part 21," Revision 4, dated November 14, 2017
- WI-16-108-07-J01, "10 CFR Part 21 Schedule Requirements," Revision 0, dated October 21, 2013
- WI-16-108-07-F01, "GEH 10 CFR Part 21 Screening & Evaluation Form," Revision 1, dated December 20, 2016
- WI-20-106-06, "Corrective Action Program Qualification," Revision, August 8, 2016
- WI-23-400-01, "Engineering Computer Programs Transition to Engineering Computer Project," Revision 1.0, dated August 13, 2015
- 003N2282, "Safety classification of GNF Fuel Assembly and Related Components," Revision 1
- 003N9811, "Critical Characteristics of GNF Safety-Related Fuel Assembly Components, Revision 0

#### Design and Commercial-Grade Dedication Records

- Analysis Guide No. AG-0048, "Analysis Guide Fuel Cycle Work Outline," Revision 8, dated July 2015 [applies to Peach Bottom Atomic Power Station (PBAPS) Unit 2, Cycle 22]
- Bundle Design Report (BDR) No. 002N6784, "Bundle Creation DVG," Revision 13, dated November 2015 (applies to PBAPS Unit 2, Cycle 22)
- BDR-4368-002N6784, "Bundle Design Report - EDB #4368"
- BDR-4425-002N6784, "Bundle Design Report - EDB #4425"

- BDR-4426-002N6784, "Bundle Design Report - EDB #4426"
- BDR-4427-002N6784 "Bundle Design Report - EDB #4427"
- BDR-4428-002N6784 "Bundle Design Report - UDB #4428"
- "CP-03-100 Road Map for 002N6782 Peach Bottom 2 Cycle 22 Fuel Management Summary," dated February 2018
- Dedication Specification (DS) No. 002N4117, "Calibration Services Dedication," Revision 3, dated January 30, 2018
- DS No. 002N4117 for asset No. W03537, dated January 11, 2017
- DS No. 003N9115, "Natural UO2 Pellets - Minimum Sampling Frequency Dedication Requirements," Revision 0, dated June 15, 2010
- DS No. 0000-0146-7645, "Upper Tie Plate," Revision 1, dated May 21, 2012
- DS No. 001N1989, "Fuel Rod End Plugs," Revision 2, dated September 22, 2017
- DS No. 26A8507, "Water Rod Pre-finished Water Rod Tube Blank," Revision 2, dated September 30, 2015
- Drawing No. 234C5376, "Rod Assembly," Revision 8, dated February 17, 2003
- Drawing No. 234C5382, "Upper Partial End Plug," Revision 7, dated January 20, 2014
- Engineering Work Authorization (EWA) No. HE2MR21, Revision 4 (applies to PBAPS Unit 2, Cycle 22)
- EWA No. HE2MR22, Revision 1 (applies to PBAPS Unit 2, Cycle 23)
- "Fuel Bundle Information Report for Peach Bottom Unit 2 Reload 21 Cycle 22," 002N6786, Revision 0
- Specification No. 002N6782, "Fuel Cycle RCCH," Revision 9, dated May 2015 (applies to PBAPS Unit 2, Cycle 22)
- "Fuel Cycle DRF Administration and Workplan," (applies to PBAPS Unit 2, Cycle 22)
- "Fuel Cycle Kickoff Meeting Summary" (applies to PBAPS Unit 2, Cycle 22)
- 002N6782, "Fuel Management Summary Report Peach Bottom 2 Cycle 22," Revision 0, dated January 2016
- "Nuclear Fuels Transmittal of Design Information, Peach Bottom Unit 2 Cycle 23"
- "Nuclear Fuels Transmittal of Design Information, Peach Bottom Unit 2 Cycle 22"

- “PANACEA Cold ShutDown Margin Verification Checklist Verification of GRETA Results,” DBR 002N6782 ECO-0020462 (applies to PBAPS Unit 2, Cycle 22)
- Specification No. 002N7070 Work Authorization - Project Work Plan, “Peach Bottom Unit 2 Cycle 22/ Reload 21 Fuel Reload Engineering”
- Specification No. 004N2741 Work Authorization - Project Work Plan “Peach Bottom Unit 2 R22/C23 Fuel Reload Engineering”
- Verification Package No. ECO-0020462, “Peach Bottom 2 Release Fuel Cycle 22”
- PERM Notice No. 201510161013-L2, dated August 20, 2015
- DBR-0014153/ECO-0018850, “IBNDL02P ECP Acceptance Technical Review (Level 2),” dated October 13, 2015
- PLM Part No. 0000-009-7749 Rev.0 / PLM Design Basis DBR-0011552 Rev.1, “IBNDL02P ECP Design Test Report (DTR),” Revision 1, dated September 2015
- PLM Part No. 0000-0009-7749 Rev.0 / PLM Design Basis 002N2328, “ECP Acceptance Test Report (ATR),” Revision 0, dated October 2015
- PLM Part No. 0000-0009-7749 Rev.0 / PLM Design Basis DBR-0007329 Rev. 0, “IBNDL02P ECP Software Design Description (SDD),” Revision 0, dated April 2015
- “IBNDL02P Software Management Plan,” Revision 1, dated January 2009
- “Reload Design Analysis Individual Proficiency Records,” PLM 000N1548
- Report No. 0000-0026-6307, “Software Test Plan for PANAC1111A and PANAC1111P,” Revision 6, dated November 15, 2013
- Report No. 0000-0009-7749, “IBNDL02P Hardware/Software System Specification,” Revision 1, dated January 2009
- Report No. 002N4937, “PANAC11A/P Error Correction 10 CFR 50.59 Evaluation Bases,” dated March 2015
- Report No. 2013-97, “PANAC11P Type A Problem Notification,” dated December 5, 2013
- Report No. 001N2789, “Software Test Report for PANAC1111A and PANAC1111P,” dated February 2015
- “Supplemental Reload Licensing Report for Peach Bottom Unit 2 Reload 21 Cycle 22,” 002N6785, Revision 1
- Technical Design Procedure No. 0002 “Fuel Cycle Analysis,” Revision 7, dated August 2017

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

- OP No. 1050.40.100 “Bundle Assembly Active Scanner - General Information”
- OP No. 1050.40.101, “Bundle Assembly Active Scanner - MC&A”
- OP No. 1050.40.201, “Bundle Assembly Active Scanner - Startup”
- OP No. 1050.40.202, “Bundle Assembly Active Scanner - Normal Operations”
- OP No. 1050.40.203, “Bundle Assembly Active Scanner - Abnormal Operations”
- OP No. 1050.40.204, “Bundle Assembly Active Scanner - Emergency Operations”
- OP No. 1050.40.300, “Bundle Assembly Active Scanner - Process Information”
- Bundle Assembly Active Scanner Test Results from February 28, 2018
- Bundle Assembly Active Scanner Qualification Records
- Certificate of Calibration No. 17-EC0DU-40-1 for a gage block, serial No. W03537, Revision 0, dated December 15, 2017
- Certificate of Conformance for a Teflon cap gasket for part No. BA00VB55-000, dated October 9, 2017
- Certified Material Test Report (CMTR) for the process tube shells, traveler No. 71068, Revision 0, dated February 20, 2018
- CMTR for the process tube shells, traveler No. 71143, Revision 0, dated February 20, 2018
- CMTR for the process tube shells, No. 71154, Revision 0, dated February 20, 2018
- Certification of Calibration for a digital caliper 24-inches, calibrated on January 10, 2018, due July 12, 2018
- Certification of Calibration for a height gage 12-inches, calibrated on October 19, 2017, due April 20, 2018
- Certification of Calibration for an CYL ring 0.9850, calibrated on December 13, 2017, due June 14, 2018
- Certification of Calibration for an CYL plug 1.27”, calibrated on November 15, 2017, due May 17, 2018
- Certification of Calibration for an outside diameter micrometer 0-1-inches, calibrated in January 22, 2018, due July 24, 2018

- Qualification Notice No. 00398, “Fat Albert Qualification Test Plan for GNF2 Fuel”
- QN-00412, “Fat Albert Qualification Results for GNF2 Fuel Rods”
- QN-01625, “Fat Albert Qualification Results for GNF-2 Fuel Rods after 2014 Source Change”
- Record of Calibration for a digital caliper 6-inches, asset number W16830, dated February 28, 2018
- Report No. 209A4290, “Welding Requirements,” Revision 7, April 23, 1996
- Out of tolerance report Nos. 167604971, 171830758, 17634535, 176928756, 176934428, 176934903, and 176935501
- Pellet Dimensional Surveillance Summary for grinder Nos. 261, 262, 263, 264, 265, February 28, 2018
- Pellet Integrity Surveillance Summary for pellet tray ID Nos. 3953ZK1494, 2401ZK4712, 3953ZK1530, 3953ZK1506, 490CZK6006, 490CZK6030, 490CZK6018, 490CZK6042, 49025J0790, 49025J0827, 49025J0802, and 49025J0815
- Process Quality Plan No. 4.0.5.1, “End Plug Welding,” Revision 36, dated December 1, 2004
- Quality Control Inspection Instruction (QCII) for the receipt inspection of process tube shells, dated March 26, 2013
- QCII for the receipt inspection of zirconium alloy channel strips, dated August 29, 2013
- QCII for the receipt inspection of water rod pretubes, dated August 11, 2014
- QCII for the receipt inspection of 316 stainless steel strip, dated April 12, 2013
- QQCII for upper partial end plug, dated September 30, 2014
- QCII receipt inspection for verification of critical characteristics, dated June 16, 2016
- Statement of Conformity No. 52178-0001 for water rod pretubes

Purchase Orders, Audit Reports, and Commercial-Grade Surveys

- Global Nuclear Fuels - Americas Approved Suppliers List
- Purchase Order (PO) No. 437099960 for a 316 strip lock tab washer, Revision 3, dated May 17, 2016
- PO No. 437109235 for testing services, Revision 4, dated April 21, 2017
- PO No. 437113419 for process tube shells, Revision 3, dated February 5, 2018

- PO No. 437102293 for an upper tie plate, Revision 19, dated January 31, 2018
- PO No. 437112396 for ultrasonic testing services, Revision 5, dated February 8, 2018
- PO No. 437109605 for a tube body, Revision 0, dated May 24, 2017
- PO No. 437111294 for repair services, Revision 0, dated July 21, 2017
- PO No. 437108042 for calibration services, Revision 0, dated December 19, 2016
- PO No. 437114512 for helium gas, Revision 0, dated February 22, 2018
- PO No. 437111747 for a cylinder valve, Revision 0, dated September 5, 2017
- PO No. 437111280 for channel strips, Revision 6, dated February 12, 2018
- PO No. 437112193 for non-destructive examination services, Revision 0, dated October 13, 2017
- PO No. 437112847 for engineering services, Revision 7, dated February 5, 2018
- Audit report No. ULB-2017-01 for an audit performed May 23-25, 2017
- Audit report No. 20087 for an audit performed April 14-16, 2015
- Audit report No. GSC-2015-01 for an audit performed March 10-12, 2015
- Audit report No. SDI-22015 for an audit performed May 18-19, 2017
- Audit report No. SL-2017-01 for an audit performed June 26-28, 2017
- Audit report No. VER-2016-01 for an audit performed April 26-28, 2017
- Audit report No. AFS-SE-2017-018 for an audit performed June 12-16, 2017
- Audit report No. CEZ-2015-01 for an audit performed October 12-23, 2015
- Audit report No. 21077 for an audit performed February 8-11, 2016
- Audit report No. STU-2017-01 for an audit performed June 26 through July 7, 2017
- Audit report No. 20148 for an audit performed April 21-23, 2015
- Commercial-grade survey Nos. ARN 2015-01 and AVKO-2017-01
- Internal audit report No. NQA-1-2017-04, "Corrective Action Program," performed May 30, 2017 through June 9, 2017

- Internal audit report No. NQA-2017-13, “X,” performed October 31, 2017 through November 2, 2017
- Supplier Quality Program Evaluation for a supplier of software support, dated September 6, 2017
- Supplier Quality Program Evaluation for a supplier of calibration services, dated June 27, 2017

Nonconformance Reports

1771, 3601, 3725, 3727, 3731, and 3734

Corrective Action Reports

12283, 8725, 17889, 17903, 17904, 17911, 17955, 18112, 18614, 19361, 19406, 19424, 19625, 20293, 20310, 21613, 21873, 25109, 25394, 27272, 27292, 27314, 27345, 27380, 27392, 27579, 27583, 27706, 27796, 27903, and 47149

Corrective Action Requests Opened During the NRC Inspection

28020, 28021, 28022, 28023, 28025, and 28026

10 CFR Part 21 Evaluations

16-01, 16-02, 16-11, 16-14, 16-16, 16-17, 17-01, 17-07, 17-08, 17-10, and 17-11

Training and Qualification Records

- Lead auditor Certificates of Qualification and associated training records for Gregory K. Bixby, Maria E. Pfeffer, James R. Eubanks, Christopher A. Cruz, and Marc R. Sloan
- Quality Control Inspectors Certificates of Qualification and associated training records for William McCormick, Joseph Johnson, and Ken Rocha
- Fuel Rod First Flush Welding No. 807, Certification for Carlos Flowers, dated February 13, 2018
- Fuel Manufacturing Operations (FMO) Leak Detection Fuel Assemblies No. 118, Level I Certification for Terry Hansley, dated December 20, 2017
- Ultrasonic Microscope Level II FMO No. 825 Certification for Jeffrey P. Johnson, dated September 8, 2016
- Fuel Rod Final Resistance Welding No. 812 Certification for Laura Mott, dated March 3, 2015
- FMO Leak Detection Fuel Assemblies No. 118 and Helium Leak Detection No. 217, Level III Certifications for Dave Wazybok, dated November 30, 2017

- Ultrasonic Testing and Eddy Current Level III Certifications for Mike Kiernan, dated June 21, 2017
- FMO Radiography Tests No. 114 and FMO Leak Detection Fuel Assemblies No. 118 Level I Certifications for Amos Bellamy, dated November 27, 2017

## 5. ACRONYMS

ASL	Approved Suppliers List
ATR	Acceptance Test Report
CMTRs	Certified Material Test Reports
CP	Common Procedure
CPR	Critical Power Ratio
CRs	Condition Reports
CRG	Condition Review Group
DS	Dedication Specification
ECPs	Engineering Computer Packages
GEH	General Electric Hitachi
GNF-A	Global Nuclear Fuel - Americas
IRs	Inspection Reports
MIDAS	Multi-Inspection and Data Acquisition System
M&TE	Measuring and Test Equipment
NIAC	Nuclear Industry Assessment Committee
NRC	Nuclear Regulatory Commission
POs	Purchase Orders
PPQP	Process/Product Quality Plan
P&P	Policy and Procedure
WI	Work Instruction