10CFR50.73

Virginia Electric and Power Company
North Anna Power Station
1022 Haley Drive
Mineral, Virginia 23117

November 12, 2014

Attention: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Serial No.: 14-519
NAPS: RAP
Docket No.: 50-339
License No.: NPF-7

Dear Sirs:

Pursuant to 10CFR50.73, Virginia Electric and Power Company hereby submits the following Licensee Event Report applicable to North Anna Power Station Unit 2.

Report No. 50-339/2014-002-00

This report has been reviewed by the Facility Safety Review Committee and will be forwarded to the Management Safety Review Committee for its review.

Sincerely,

Gerald T. Bischof
Site Vice President
North Anna Power Station

Enclosure

Commitments contained in this letter: None

cc: United States Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector
North Anna Power Station

IE22
NRR

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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4. TITLE

Failed Fuel Assembly

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	15	2014	2014	- 002	- 00	11		2014	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
Defueled	☒ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☒ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
000	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Gerald T. Bischof, Site Vice President	(540) 894-2101

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On September 15, 2014, with Unit 2 defueled, debris that had the potential to be fuel fragments was located on the core plate directly below the B11 core location, where fuel assembly 4Z9 resided during Cycle 23. Video inspection of fuel assembly 4Z9 identified that the top springs of two fuel pins were dislodged. Due to the fact that the fuel damage exceeded expected conditions, at 1454 on September 15, 2014, this event was reported as an eight hour report as per 10 CFR 50.72(b)(3)(ii)(A), any event or condition that results in the condition of the nuclear plant, including its principle safety barriers, being seriously degraded. Detailed video inspections estimated that 15 fuel pellets were dislodged from fuel assembly 4Z9. During efforts to identify and recover the fuel pellets, 7 fuel pellets worth of material were not found and have already or are expected to granulate into fine particles that will dissolve in low flow areas of the primary plant systems, or be removed by normal purification processes. Since the specific location of the 7 fuel pellets is undesignated and because those pellets contain licensed material in a quantity greater than 10 times the quantity specified in App. C of 10 CFR 20, a report was made at 1227 on September 30, 2014, pursuant to 10 CFR 74.11(a) and to 10 CFR 20.2201(a)(ii). The health and safety of the public were not affected by this event.

NARRATIVE

1.0 DESCRIPTION OF THE EVENT

At 0900 on September 15, 2014, with Unit 2 defueled, debris that had the potential to be fuel fragments was located on the core plate (EIIS System – AC) directly below the B11 core location. Ten pieces of material, approximately 1/8" in diameter, were found. The material was near the edge of the outer flow hole and partially under the gap between the baffle plate and the core plate. Fuel assembly (EIIS System – AC) 4Z9 was located at the B11 location during Cycle 23. Video inspection of fuel assembly 4Z9 identified that the top springs of two fuel pins were dislodged.

Due to the fact that the fuel damage exceeded expected conditions, at 1454 on September 15, 2014, this event was reported as an eight hour report as per 10 CFR 50.72(b)(3)(ii)(A), any event or condition that results in the condition of the nuclear plant, including its principle safety barriers, being seriously degraded.

Detailed video inspections estimated that fifteen (15) fuel pellets were dislodged from fuel assembly 4Z9. For reference, the reactor core contains approximately 15 million fuel pellets. During efforts to identify and recover the fuel pellets, debris fragments estimated to represent five (5) fuel pellets were found in the damaged fuel assembly that is currently in the Spent Fuel Pool (SFP) (EIIS System – DA). In addition, an estimated three (3) pellets worth of material was retrieved by the foreign object search and retrieval (FOSAR) efforts in the reactor vessel and are now located in the SFP. The remaining seven (7) fuel pellets have already or are expected to granulate into fine particles that will dissolve in low flow areas of the primary plant systems or be removed by normal purification processes. However, since the specific location of the seven (7) fuel pellets is undesignated, a report was made at 1227 on September 30, 2014, pursuant to 10 CFR 74.11(a) for the loss of special nuclear material (SNM). At that same time, a report was made pursuant to 10 CFR 20.2201(a)(ii) because the seven (7) fuel pellets contain licensed material in a quantity greater than 10 times the quantity specified in Appendix C of 10 CFR 20.

10 CFR 20.2201(b) requires a written report after the initial notification for the occurrence of any lost, stolen, or missing licensed material that was reported under 10 CFR 20.2201(a)(ii) for licensed material in a quantity greater than 10 times the quantity specified in Appendix C of 10 CFR 20. The following topics are required to be addressed:

(i) A description of the licensed material involved, including kind, quantity, and chemical and physical form:

Fuel Pellet Description – Based on the review of the video of the recovered material, the possibility that these fuel pellets have remained intact is very low.

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Type of Special Nuclear Material	Uranium dioxide pellets initially enriched to 4.45%
Length of fuel pellet	0.4 inches nominal
Pellet diameter	0.3225 inches
Total Uranium in the 7 fuel pellets	32.3 grams (Sept 2014)
Total Uranium 235 in the 7 fuel pellets	0.4 grams (Sept 2014)
Total Plutonium in the 7 fuel pellets	0.4 grams (Sept 2014)
Total Fissile Plutonium in the 7 fuel pellets	0.3 grams (Sept 2014)
Activity Level	266 Ci
Average Burnup of Assembly 4Z9	46733 MWD/MTU
Effective Full Power Days (EFPD) of Assembly 4Z9	1160 EFPD

(ii) A description of the circumstances under which the loss or theft occurred:

The fuel pellet loss occurred as a result of baffle jetting on the fuel assembly. The affected fuel rods had their top springs dislodged and fuel pellets were able to escape the fuel rod. Fragments of fuel pellets were found within the associated fuel assembly and on the core plate. However, about seven (7) fuel pellets worth of material were not located and have already or are expected to granulate into fine particles that will remain in low flow areas of the primary plant systems or be removed by normal purification processes. The possibility of theft is not plausible because of the plant's radiation monitoring instrumentation, physical security measures, and the size and type of container required for transporting nuclear material of this nature.

(iii) A statement of disposition, or probable disposition, of the licensed material involved:

During efforts to identify and recover the fuel pellets, debris fragments estimated to represent five (5) fuel pellets were found in the damaged fuel assembly that is currently in the SFP. In addition, an estimated three (3) pellets worth of material was retrieved by the FOSAR efforts in the reactor vessel and are now located in the SFP. The remaining seven (7) fuel pellets have already or are expected to granulate into fine particles that will dissolve in low flow areas of the primary plant systems or be removed by normal purification processes.

(iv) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas:

No unauthorized exposure to radiation occurred to the plant staff or members of the public because the fuel pellet fragments either remain in the SFP or granulated into fine particles that will dissolve in low flow areas of the primary

plant systems or be removed by normal purification processes.

(v) Actions that have been taken, or will be taken, to recover the material:

During efforts to identify and recover the fuel pellets, debris fragments estimated to represent five (5) fuel pellets were found in the damaged fuel assembly that is currently in the SFP. In addition, an estimated three (3) pellets worth of material was retrieved by the FOSAR efforts in the reactor vessel and are now located in the SFP. The remaining seven (7) fuel pellets have already or are expected to granulate into fine particles that will dissolve in low flow areas of the primary plant systems, or be removed by normal purification processes.

(vi) Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material:

Westinghouse fabricated and delivered a low-enrichment RFA-2 fuel assembly armored with seven (7) stainless steel rods in place of fuel rods which could be affected by jets from baffle gaps for core location B11 in cycle 24. A similar modification to that of the reactor vessel upflow conversion design change that was performed on Unit 1, DC NA-95-001, will be developed and implemented on Unit 2.

2.0 SIGNIFICANT SAFETY CONSEQUENCES AND IMPLICATIONS

No significant safety consequences resulted from this event because the reactor coolant system activity levels during Unit 2 Cycle 23 were well within the requirements of Technical Specification (TS) 3.4.16, Reactor Coolant System Specific Activity. After Cycle 24 startup, the activity remains well within the requirements of TS 3.4.16. The health and safety of the public were not affected by this event.

3.0 CAUSE

The direct cause of the event was due to baffle jetting. Baffle jetting is the process by which water on the outside of the core baffle plate is forced through small openings in the baffle seams and onto the fuel assemblies. During Unit 2 Cycle 23, baffle jetting caused two rods in assembly 4Z9, located in core position B11, to begin rotating and vibrating. This movement resulted in fuel rod wear and eventual mechanical failure and rod separation. Once separated, a maximum of 15 fuel pellets were released from the two affected fuel rods. The Root Cause of the failed fuel assembly was the change in material properties of the baffle plates and bolting due to aging mechanisms resulting in the gap widening at the baffle joint. Stress, temperature, and irradiation since initial plant start-up have resulted in relaxation, creep, and loss of pre-load in the bolting and baffle plates. The changes in material properties allowed the gap in the corner baffle joint,

adjacent to location B11, to widen when subjected to the relatively high differential pressure, approximately 25 psi, associated with the baffle-barrel downflow configuration in North Anna Unit 2.

4.0 IMMEDIATE CORRECTIVE ACTION(S)

Westinghouse fabricated and delivered a low-enrichment RFA-2 fuel assembly armored with seven (7) stainless steel rods in place of fuel rods which could be affected by jets from baffle gaps for core location B11 in cycle 24. Visible debris on the core plate from 4Z9 was found and retrieved. An inspection of the baffle was performed with no anomalies noted. An inspection of the fuel assembly that was previously located at B11 for fuel cycle 22 was performed and no indications of baffle jetting were noted. An inspection was performed of other cycle 23 fuel assemblies in other baffle locations for baffle jetting damage. Ten of the other assemblies exhibited some indications at the center injection locations ranging from slight marks on a mid-grid adjacent to rod 15 or rod 3 to some slight surface erosion or buffing of the grid at the same locations. Other than being in the proper location for where center injection would be expected to occur, it was not clear whether the indications were due to baffle jetting or to some other interaction such as fuel handling or wear from a bowed assembly rubbing against the baffle plates. The indications were reviewed by Dominion's Nuclear Analysis and Fuel (NA&F) Fuel Performance Analysis (FPA) group, and it was determined that no further action was required. Both AREVA and Westinghouse reviewed the video of 4Z9 and concluded that the cause was baffle jetting. A revised Reload Safety Evaluation (RSE) incorporating the replacement fuel assembly for location B11 was completed and approved. An Operability Determination, OD000600, was completed for baffle jetting.

5.0 ADDITIONAL CORRECTIVE ACTIONS

No additional corrective actions were identified by the Root Cause Team.

6.0 ACTIONS TO PREVENT RECURRENCE

A modification similar to the reactor vessel upflow conversion design change that was performed on Unit 1, DC NA-95-001, will be developed and implemented on Unit 2.

7.0 SIMILAR EVENTS

Unit 2 has operated without indications of baffle jetting for 34 years and Unit 1 has operated without baffle jetting since 1996 when the upflow conversion was performed. While Unit 1 did have baffle jetting issues prior to 1996, the baffle jetting issues were from the center joints. Whereas the Unit 2 baffle jetting was from a corner joint. Additionally, Unit 2 has a different bolting configuration that made it less susceptible to the baffle jetting experienced on Unit 1.

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8.0 ADDITIONAL INFORMATION

Unit 1 continued operating in Mode 1, 100 percent power during this event.