UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

October 6, 2010

EA-10-084

David J. Bannister, Vice President
and Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station FC-2-4
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: FINAL SIGNIFICANCE DETERMINATION FOR A YELLOW FINDING AND NOTICE OF VIOLATION, NRC INSPECTION REPORT 05000285/2010007, FORT CALHOUN STATION

Dear Mr. Bannister:

The purpose of this letter is to provide you the final significance determination of the preliminary Yellow finding identified in our previous communication dated July 15, 2010, which included the subject inspection report. The inspection finding was assessed using the Significance Determination Process and was preliminarily characterized as a Yellow finding with substantial importance to safety that may result in additional NRC inspection and potentially other NRC action. This Yellow finding involved the failure to maintain procedures for combating a significant flood as required by Technical Specification 5.8.1.a, "Procedures."

At your request, a regulatory conference was held on August 18, 2010, to further discuss your views on this issue. During the regulatory conference, your staff described your assessment of the significance of the finding, detailed corrective actions, and the root-cause analysis of the finding. Additionally, you requested that the NRC reconsider its evaluation of the finding's risk significance based on six specific arguments. By letter dated September 23, 2010, you also provided supplemental information, clarifying information provided during the conference.

We have reviewed your arguments and our evaluation of each is provided in Enclosure 2 of this letter. After considering the information developed during the inspection, and the information that you provided at the conference, the NRC has concluded that the finding is appropriately characterized as Yellow, a finding with substantial importance to safety that will result in additional NRC inspection and potentially other NRC action.

You have 30 calendar days from the date of this letter to appeal the staff's determination of significance for the identified Yellow finding. Such appeals will be considered to have merit only if they meet the criteria given in NRC Inspection Manual Chapter 0609, Attachment 2.

As discussed above, the NRC has determined that the failure to maintain procedures for combating a significant flood is a violation of Fort Calhoun Station Technical Specification 5.8.1.a, as cited in the enclosed Notice of Violation. The circumstances surrounding the violation are described in detail in the subject inspection report. In accordance with the NRC Enforcement Policy, the Notice of Violation is considered an escalated enforcement action because it is associated with a Yellow finding.

You are required to respond to this letter. Please follow the instructions specified in the enclosed Notice of Violation when preparing your response.

Because plant performance for this issue has been determined to be in the degraded cornerstone band, we will use the NRC Action Matrix to determine the most appropriate NRC response for this event. We will notify you, by separate correspondence, of that determination.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosures and your response will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at www.nrc.gov/reading-rm/adams.html.

Sincerely,

/RA/

Elmo E. Collins
Regional Administrator

Docket: 50-285
License: DPR-40

Enclosures:
1. Notice of Violation
2. Fort Calhoun Flooding Issue –
   Final Significance Determination

cc w/Enclosures:
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ADAMS	☐ No	☒ Yes		☒SUNSI Review Complete	Reviewer Initials: GAG
☒ Publicly Available		☐Non-publicly Available		☐Sensitive	☒ Non-sensitive
Category – **KEYWORD**: A.#					

RIV/DRS-EB1	RIV/DRS-C:EB1	RIV/DRS-SRA	RIV/D:DRP	RIV/D:DRS
GAGeorge	TAFarnholtz	DPLoveless	KMKennedy	RCaniano
/RA/	/RA/	/RA/	/RA/	/RA/
09/17/10	09/17/10	09/17/10	09/20/10	09/21/10

RIV/ACES	Regional Counsel	DRA	NRR/DRA	OGC
RKellar	KFuller	CACasto	LJames	
/RA/ BJones for	/RA/ C Boote for E	/RA/	/RA/ E	
09/28/10	09/27/10	09/30/10	09/27/10	

OE	RIV/ORA			
GBowman	EECollins			
/RA/ E	/RA/			
09/28/10	09/06/10			

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NOTICE OF VIOLATION

Omaha Public Power District
Fort Calhoun Station

Docket No.: 05000285
License No.: DPR-40
EA-10-084

During an NRC inspection conducted from January 1 to June 21, 2010, one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

> Technical Specification 5.8.1.a, "Procedures," states, "Written procedures and administrative policies shall be established, implemented, and maintained covering the following activities: (a) The applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, 1978." NRC Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," Appendix A, "Typical Procedures for Pressurized Water Reactors and Boiling Water Reactors," Section 6, recommends procedures for combating emergencies and other significant events. Section 6.w, "Acts of Nature," includes, in part, procedures for combating floods.
>
> Contrary to Technical Specification 5.8.1.a, since 1978, written procedures and administrative policies were not maintained covering the applicable procedures recommended by NRC Regulatory Guide 1.33, Revision 2, Appendix A. Specifically, the licensee failed to maintain written procedures for combating a significant external flood as recommended by NRC Regulatory Guide, Appendix A, Section 6.w, "Acts of Nature." The licensee's written procedures did not adequately prescribe steps to mitigate external flood conditions in the auxiliary building and intake structure up to 1014 feet mean sea level, as documented in the Updated Final Safety Analysis Report.

This is violation is associated with a Yellow significance determination process finding in the Mitigating Systems Cornerstone.

Pursuant to the provisions of 10 CFR 2.201, Omaha Public Power District is hereby required to submit 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 Regional Administrator, Region IV, and a copy to the NRC Resident Inspector - Fort Calhoun Station, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation; EA-10-084" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC's website at www.nrc.gov/reading-rm/pdr.html or www.nrc.gov/reading-rm/adams.html, to the extent possible, it 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, 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 withholding of such material, 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 will 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.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days.

Dated this 6th day of October 2010

Fort Calhoun Station Flooding Issue
Final Significance Determination

During the regulatory conference held on August 18, 2010, your staff described your assessment of the significance of the finding, as summarized in Table 2. Specifically, we discussed four differences that existed between the NRC's preliminary significance determination (Table 1) and your staff's risk assessment. Your staff also requested that we consider two additional areas prior to making a final significance determination. Those six areas were considered as follows:

1. Your staff stated that the flood hazard from precipitation, runoff and snow melt for the Fort Calhoun site, as studied by Jack Benjamin and Associates, supported your original flood hazard curve and indicated that this curve presented a bounding case.

   The Jack Benjamin and Associates curve is actually slightly higher than your original flood hazard curve in most of the area of interest. Also, the NRC analysts determined that none of the analyses show a bounding flood hazard for the site. However, we agree with your assessment that the original extrapolated curve represents a best estimate of the flood hazard for the site. Therefore, no modification to the preliminary significance determination was necessary.

2. Your staff stated that the best available information for the baseline core damage probabilities conditioned upon an external flood occurring was that published in the Individual Plant Examination of External Events for Fort Calhoun Station (IPEEE) submitted to the agency on June 30, 1995.

   The method used in the Significance Determination Process for assessing risk is the calculation of the change in core damage frequency caused by the performance deficiency. This can only be accomplished by comparing the total risk given the performance deficiency exists against the risk without the performance deficiency. The case documented in the IPEEE does not meet the intent of the Significance Determination Process for the case without the performance deficiency. Therefore, no modification to the preliminary significance determination was necessary.

   However, as part of a sensitivity study, documented in Table 3 of this enclosure, the NRC analysts used the values from the IPEEE. Please note that the values provided by your staff at the regulatory conference had been incorrectly translated from the IPEEE. Therefore, the values used in our sensitivity study were the actual values published in the IPEEE submittal.

3. Your staff asserted that an Omaha Public Power District expert panel conducted on August 2, 2010, and comprised of maintenance and engineering personnel, identified ways of hardening the facility in a manner different from that documented in your procedures that could protect the auxiliary building above 1010 feet mean sea level (MSL) and that the analysis should indicate credit for such actions. Additionally, we reviewed a video that you prepared and forwarded to us on September 7, 2010, illustrating methods you would use to weld steel plates over some of the auxiliary building doors.

   From the identification of the deficiency in December 2009 through April 9, 2010, your staff indicated that following the procedural requirements would properly protect the facility from the known flooding hazard. This hesitance to consider other methods for hardening the facility against external floods during this period did not support crediting the organization

with understanding the need for and developing a different strategy during a postulated flooding scenario. If your procedures were to be followed, it is not clear that attempts to further harden the facility would be made until water levels reached the point that the defenses were breached. Therefore, no modification to the preliminary significance determination was considered appropriate.

However, as part of a sensitivity study, the NRC analysts used the data from the expert panel, quantifying, in part, the welding methods shown in your video to assess the potential impact on the risk of the subject performance deficiency. The data was applied in the following two ways:

a. The expert panel incorrectly incorporated the failure probability of their own estimations into the analysis using a weakest link assumption. The expert panel used a 0.19 failure probability of protecting the auxiliary building to 1010.8 feet MSL and a 0.235 probability up to 1014 feet MSL. The analysts noted that the success probabilities for protecting each door in the auxiliary building were developed based on the specific characteristics of the door and surrounding areas. With time, resource and logistical dependencies, the data is better handled as independent failure probabilities. The analysts properly incorporated the expert panel data using appropriate statistical methods. The actual values should have been 0.31 and 0.40, respectively.

b. The use of the expert panel results in your risk assessment included an assumption that plant personnel would always use the expert panel approach as opposed to following your written flood protection procedures. However, during one of two drills performed by your staff, plant personnel used sandbags which would have prohibited the use of steel gates and would not likely have been successful based on limited time and insufficient numbers of sandbags. Therefore, the NRC analysts used the SPAR-H method to calculate the probability that plant personnel would fail to approach hardening the facility in the manner that the expert panel documented. This failure probability was calculated to 0.34.

4. Your staff suggested that, despite the documented approach to using the portable gasoline-powered pumps, the reactor could be properly cooled with only one of the portable pumps. They stated that additional pumps could be procured after failure of the first. Given these conditions, your risk assessment used only the operator error probability for the failure probability of your alternative mitigating strategy. Additionally, your staff stated that the site fire engine could be lifted onto the turbine deck and used to pump flood waters from the turbine building into the emergency feedwater storage tank and/or directly to the steam generators. We made the following determinations:

   a. The use of a single portable pump required using it to pump flood waters from the flood elevation, to the emergency feedwater storage tank, then disconnecting and moving the pump to the 81-foot elevation, and using it to pump from the emergency feedwater storage tank to the steam generators. For this scenario, your staff failed to identify that the human error rate would be significantly higher. With one pump failed, plant personnel would no longer have extra time to establish and maintain flow from the flood waters to the steam generator. The actions required would now be continuous, greatly increasing the likelihood of failure. Additionally, it is unclear how long a single pump

could pump from the emergency feedwater storage tank taking suction through a fire hose without maintaining the tank essentially full. Therefore, we determined that the best estimate of the failure probability for the portable gasoline-powered pumps was that used in our preliminary significance determination.

However, as part of a sensitivity study, adjusting only the time available performance shaping factor, NRC analysts calculated the higher human error rate and requantified the fault tree. This resulted in a failure rate about 3 times higher than used by your risk assessment, but 2 times lower than the NRC's preliminary value.

b. During the time that operators would be performing the actions in Item a, your staff stated that they could procure additional pumps from the local area. You did not provide sources for such pumps, nor account for the likelihood that such pumps in the area would be in high demand by many industries and private consumers during the postulated flooding scenarios. Plant personnel would only have approximately 12 hours to procure a pump should single-pump operations fail. Additionally, your risk analysis did not account for common cause failure. These reasons supported the use of the preliminary significance determination as our best-estimate failure probability.

c. The senior resident inspector has inspected the data related to your fire truck and determined that it could not draw water as deep as the flood waters from the turbine deck. Additionally, it is not clear that power would be available to the crane given the flooding of the building and the loss of offsite power. Therefore, we assumed that this option would fail.

5. During the regulatory conference, your staff requested that we consider that there would be sufficient time to harden the facility prior to flood waters affecting the site, and that your emergency response organization should be given credit for successful activities both differing from and in addition to your written flood protection procedures.

It is clear that a robust and well performing emergency response organization is a vital part of the defense-in-depth approach required by the NRC, and our decision here does not reflect a concern that the emergency response organization at the Fort Calhoun Station is not capable of the kind of forward-thinking and protective response that we require of power reactor licensees. However, the Agency has not traditionally provided credit for possible solutions that could be provided by the emergency response organization unless the actions were proceduralized and/or provided in clear planning guidance. While the NRC Inspection Manual and the Risk Assessment of Operational Events Handbook are silent on the subject, we do not consider short-term planning in advance of an external initiator to be a valid input to a risk evaluation used to disposition an enforcement action in accordance with the Significance Determination Process.

In further assessing the time available to the facility during a postulated flood scenario, we noted that, although the flood scenarios currently being analyzed would take at least 5-6 days to develop, the windows available to make major changes in plant protection against postulated flooding are much shorter. The following examples are provided:

a. Once flooding reaches 1004-feet MSL, water will be onsite and the ability to move around the site will significantly degrade.

b. Once water level is above 1004.5-feet MSL, water will be on the lower floodgates, prohibiting their removal and making welding to the gates or door frames more difficult.

c. Once water level is above 1008.5-feet MSL, your technical support center will be inundated, further complicating emergency response.

d. Water level at 1009.5-feet MSL would be the first opportunity for the organization to identify that your proceduralized protection scheme was not working. At this point, it would be difficult to change the approach used to harden the facility.

e. At or before a water level of 1010-feet MSL, flood waters would enter the auxiliary building basement, shorting power and submerging pumps. The plant could then experience a station blackout with core damage estimated within 15 to 18 hours without makeup to the steam generators.

6. After the regulatory conference, your staff requested that we explore using Inspection Manual Chapter 0609, Appendix M, "Significance Determination Process using Qualitative Criteria," and providing discretion for the finding characterization.

   a. The first step in Appendix M is to calculate a bounding change in core damage frequency (ΔCDF). The NRC analysts calculated a bounding value that indicated the finding would be no higher than substantial safety significance or Yellow (6.4E-5).

   b. The second step in Appendix M is to evaluate the level of impact to defense-in-depth elements. This finding results in all plant process equipment being lost. Therefore, the portable pumps and the emergency response organization are the only defense-in-depth elements remaining.

   c. Based on these two items alone, the finding is Yellow using the guidance of Appendix M.

The NRC's analysts performed a sensitivity study, as documented in Table 3 of this enclosure, in response to your proposed differences documented above. The analysts revised the baseline to the IPEEE values, gave credit for hardening the facility over a 2-day period using the revised calculations from the expert panel's data, revised the failure rate for the gasoline-powered pumps, and corrected an "artifact" of your staff's analysis that resulted in a negative change in risk for the second bin. The resulting change in core damage frequency was 1.1E-5 or Yellow.

After considering the information you provided at the conference, the NRC has concluded that the finding is appropriately characterized as being of substantial safety significance (Yellow). Additionally, not withstanding your comments and information provided at the conference, we have concluded that the agency's preliminary evaluation as documented in NRC Inspection Report 05000285/2010007, indicating that the change in core damage frequency for the finding was 3.2E-5, remains the best estimate of risk for the subject finding.

Table 1 NRC Preliminary Significance Determination						
Bin	Flood Elevations	Lambda	CCDP Current	CCDP Base	Gas-Powered Pumps	Delta/Bin
1	1008 - 1009.5	3.2E-03	1.3E-03	1.0E-03	2.6E-02	1.9E-08
2	1009.5 - 1010	4.0E-04	1.3E-03	1.1E-03	2.6E-02	2.1E-09
3	1010 - 1010.8	8.0E-04	1.00	1.0E-03	2.6E-02	2.1E-05
4	1010.8 - 1014	5.0E-04	1.00	1.1E-01	2.6E-02	1.1E-05
					Delta CDF	**3.2E-05**

Table 2 OPPD Risk Assessment						
Bin	Flood Elevations	Lambda	CCDP Current	CCDP Base	Gas-Powered Pumps	Delta/Bin
1	1008 - 1009.5	3.2E-03	1.3E-03	1.0E-03	4.0E-03	2.9E-09
2	1009.5 - 1010	4.0E-04	1.3E-03	1.0E-02	4.0E-03	-1.4E-08
3	1010 - 1010.8	8.0E-04	0.19	1.0E-02	4.0E-03	5.8E-07
4	1010.8 - 1014	5.0E-04	0.235	1.0E-01	4.0E-03	2.7E-07
					Delta CDF	**8.4E-07**

Table 3 NRC Sensitivity Study						
Bin	Flood Elevations	Lambda	CCDP Current	CCDP Base	Gas-Powered Pumps	Delta/Bin
1	1008 - 1009.5	3.2E-03	1.3E-03	1.0E-03	1.3E-02	9.5E-09
2	1009.5 - 1010	4.0E-04	3.0E-03	1.8E-03*	1.3E-02	6.5E-09
3	1010 - 1010.8	8.0E-04	0.65	1.8E-03*	1.3E-02	6.7E-06
4	1010.8 - 1014	5.0E-04	0.74	1.0E-01	1.3E-02	4.1E-06
					Delta CDF	**1.1E-05**

* In your letter dated September 23, 2010, your staff argued that 1.0E-02 would be an appropriate value for the baseline CCDP for these two bins. However, the analysis is insensitive to this change, and the resulting Delta CDF would be 1.1E-05.