UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 E LAMAR BLVD
ARLINGTON, TX 76011-4511

June 23, 2014

EA-14-008

Jeremy Browning, Site Vice President
Entergy Operations, Inc.
Arkansas Nuclear One
1448 SR 333
Russellville, AR 72802-0967

SUBJECT: ARKANSAS NUCLEAR ONE, UNITS 1 AND 2 - FINAL SIGNIFICANCE DETERMINATION OF TWO YELLOW FINDINGS AND NOTICE OF VIOLATION; NRC INSPECTION REPORT 05000313/2014008 AND 05000368/2014008

Dear Mr. Browning:

This letter provides you the final significance determination of the preliminary Red and Yellow findings identified in NRC Inspection Report 05000313/2013012; 05000368/2013012 (ML14083A409), dated March 24, 2014. A detailed description of the findings is contained in Section 4OA3.9 of that report. The findings are associated with the March 31, 2013, Unit 1 stator drop that affected safety-related equipment on both units.

At your request, a Regulatory Conference was held on May 1, 2014, to further discuss your views on these findings. A copy of your presentation provided at this meeting is attached to the summary of the Regulatory Conference (ML14128A512), dated May 9, 2014. In your presentation on the risk significance of the event related to Unit 1, you described four recovery actions that plant personnel could have implemented to establish and maintain cooling to the reactor core in the event that the emergency diesel generators were not able to supply power to the 4160V electrical buses. Three of these methods involved restoring power to 4160V safety-related electrical buses from other sources. The fourth recovery method involved providing temporary 480V ac power to a borated water recirculating pump, and establishing a source of water to the reactor from the borated water storage tank.

Based on your staff's evaluation of the probability of success of the four recovery actions, and the amount of time that existed to restore cooling to the core, your staff concluded that the change in core damage probability was 4.8×10^{-6}. As a result, you concluded that the inspection finding should be characterized as White, low-to-moderate safety significance.

In your presentation on the risk significance of the event related to Unit 2, you described three procedurally directed recovery strategies that plant personnel could have implemented to restore electrical power in the event that power was lost to vital electrical buses. These strategies involved supplying power from the Startup 2 transformer, or the alternate ac diesel generator to electrical buses, and cross connecting the vital 4160V buses to supply power to equipment. Based on your staff's evaluation of the probability of success of these three procedurally directed recovery strategies, your staff concluded that the change in conditional core damage probability was 1.8×10^{-6}. As a result, you concluded that this inspection finding should also be characterized as White, low-to-moderate safety significance.

After considering the information developed during the inspection and the information you provided at the Regulatory Conference, we have concluded that the risk significance of each finding is appropriately characterized as Yellow, substantial safety significance, for both Units 1 and 2. Our evaluation of the risk significance of each inspection finding is provided in Enclosure 2 of this letter.

You have 30 calendar days from the date of this letter to appeal the staff's determination of significance for the identified Yellow findings. Such appeals will be considered to have merit only if they meet the criteria given in Inspection Manual Chapter 0609, "Significance Determination Process," Attachment 2. An appeal must be sent in writing to the Regional Administrator, Region IV, 1600 E. Lamar Blvd., Arlington, TX 76011-4511.

The NRC has also determined that the failure to follow procedures to ensure that a temporary lift assembly was designed to support the projected load and to perform a 125 percent load test for the projected load is a violation of Title 10 of the Code of Federal Regulations (CFR) Part 50, Appendix B, Criteria V, "Instructions, Procedures and Drawings," as cited in the attached Notice of Violation. In accordance with the NRC's Enforcement Policy, the Notice is considered escalated enforcement action because it is associated with Yellow findings for Units 1 and 2.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC's review of your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

Because plant performance at the Arkansas Nuclear One facility has been determined to be beyond the "Licensee Response Column" of the NRC's Reactor Oversight Process Action Matrix, as the result of Units 1 and 2 Yellow significance findings, the NRC will use the Action Matrix to determine the most appropriate NRC response to the findings' significance. We will notify you, by separate correspondence, of that determination.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice and Procedure," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Sincerely,

/RA/

Marc L. Dapas
Regional Administrator

Dockets: 50-313; 50-368
Licenses: DPR-51; NPF-6

Enclosures:
1. Notice of Violation
2. Final Significance Determination

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DOCUMENT NAME: S:\RAS\ACES\ENFORCEMENT_EA CASES - OPEN\ANO - multiple violations - stator drop flooding\Final Action\EA-14-008_ANO Stator Drop_Final.doc
ADAMS ACCESSION NUMBER:

☐ SUNSI Review By:		ADAMS ☑ Yes ☐ No	☑ Publicly Available ☐ Non-Publicly Available		☑ Non-Sensitive ☐ Sensitive		Keyword:
OFFICE	SPE:PBE	SRA:TSB	SRRA:NRR/ DRA/APHB	SES:ACES	C:ACES	RC:ORA	C:PBE
NAME	MBloodgood	DLoveless	JMitman	RBrowder	VCampbell	KFuller	GWerner
SIGNATURE	/RA/ jm for	via email	via email	/RA/	/RA/	/RA/	/RA/ TRF for
DATE	06/4/14	06/12/14	06/12/14	06/2/14	06/4/14	06/3/14	06/12/14
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SIGNATURE	via email	/RA/	/RA/	via email	via email	/RA/	
DATE	06/12/14	06/12/14	06/13/14	06/13/14	06/18/14	6/23/14	

OFFICIAL RECORD COPY

Letter to Jeremy Browning from Marc L. Dapas dated June 23, 2014

SUBJECT: ARKANSAS NUCLEAR ONE, UNITS 1 AND 2 - FINAL SIGNIFICANCE DETERMINATION OF TWO YELLOW FINDINGS AND NOTICE OF VIOLATION; NRC INSPECTION REPORT 05000313/2014008 AND 05000368/2014008

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NOTICE OF VIOLATION

Entergy Operations, Inc.
Arkansas Nuclear One, Units 1 and 2

Dockets: 05-313, 05-368
Licenses: DRP-51, NPF-6
EA-14-008

During an NRC inspection conducted between July 22, 2013, and February 10, 2014, a violation of NRC requirements was identified. In accordance with the NRC's Enforcement Policy, the violation is listed below:

> 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures and Drawings," states, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings.
>
> Quality Procedure EN-MA-119, "Material Handling Program," Section 5.2[7], "Temporary Hoisting Assemblies," Step (a) states, in part, that vendor supplied temporary overhead cranes or supports, winch-driven hoisting or swing equipment, and other assemblies are required to be designed or approved by engineering support personnel. The design is required to be supported by detailed drawings, specifications, evaluations, and/or certifications.
>
> Quality Procedure EN-MA-119, "Material Handling Program," Section 5.2[7], "Temporary Hoisting Assemblies," Step (b) states, in part, that the assembly shall be designed for at least 125 percent of the projected hook load and should be load tested and held for at least 5 minutes at 125 percent of the actual load rating before initial use. The assembly shall be load tested in all configurations for which it will be used.
>
> Contrary to the above, on March 31, 2013, the licensee did not accomplish the Unit 1 main turbine generator stator lift and move, an activity affecting quality, as prescribed by documented instructions and procedures. Specifically:
>
> A. The licensee approved a design for the temporary hoisting assembly that was not supported by detailed drawings, specifications, evaluations, and/or certifications. The licensee failed to identify the load deficiencies in vendor Calculation 27619-C1, "Heavy Lift Gantry Calculation," and the incorrectly sized component in the north tower structure of the temporary hoisting assembly. In addition, the temporary hoisting assembly was not designed for at least 125 percent of the projected hook load.
>
> B. The licensee failed to perform a load test in all configurations for which the temporary hoisting assembly would be used.
>
> As a result, on March 31, 2013, while lifting and transferring the Unit 1 main turbine generator stator, the temporary overhead crane collapsed causing the 525-ton stator to fall on and extensively damage portions of the plant, affecting safety-related equipment.

This violation is associated with a Yellow (Unit 1) and a Yellow (Unit 2) significance determination finding.

Pursuant to the provisions of 10 CFR 2.201, Entergy Operations, Inc., 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 at the facility that is the subject of this Notice, 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-14-008" 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's Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that 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.

Dated this 23rd day of June 2014

Arkansas Nuclear One Dropped Stator
Final Significance Determination

During the regulatory conference held on May 1, 2014, your staff described their assessment of the significance of the finding for each unit. Specifically, your staff discussed differences for Units 1 and 2 that existed between the NRC's preliminary significance determination and Arkansas Nuclear One's risk assessment. The differences for each unit were evaluated and are discussed below.

Unit 1

1. Your staff specified a time to boil of 12 hours and a time to core uncovery of 115 hours versus NRC values of 11 hours and 96 hours, respectively.

   We determined that the change in the time to boil had minimal impact on the risk evaluation. Using the 115 hours for time to core uncovery, the total conditional core damage probability was reduced from 3.8×10^{-4} to 2.6×10^{-4}.

2. Your staff described three success paths to recover offsite power, and that during the actual event, Entergy Operations, Inc., personnel were successful in establishing a temporary electrical connection between the switchyard and the 4160V safety buses within 4.4 days of the event initiation, contrary to the NRC using 6 days in our preliminary risk analysis. As part of their analysis, your staff developed an estimated probability of successful recovery of 97 percent.

   After reviewing the information that your staff provided during the regulatory conference, we agree that the recovery of offsite power was feasible within the time to core uncovery. It is important to note that there was an extended period of time before core uncovery would occur and this was the primary reason that we determined you could recover offsite power with a high chance of success. Accordingly, we determined that a 90 percent probability of success for recovering electrical power best reflects the broader spectrum of possible scenarios that could be present during a station blackout where the environmental conditions would be degraded; fewer personnel would be available to respond based on the escalation of emergency action level classification; and a higher level of stress would be imposed on those planning, implementing, testing, and approving the new and non-procedural modifications for recovering offsite power. Using this high probability of success, we determined that the risk estimate should be reduced to 6×10^{-5}.

3. Your staff also described a success path to restore power to the borated water recirculation pump for reactor coolant system makeup.

   During the conference, your staff indicated that temporary 480V power could be supplied to the borated water recirculation pump and water could be supplied to the reactor from the borated water storage tank; however, your staff discussed that restoration of the 4160V buses would be the priority because of the varied equipment that could be powered and used to keep the core covered. Although at the regulatory conference, your staff presented power restoration to the borated water recirculation pump as a potential success path to establishing makeup water to the reactor, they indicated that this option was not evaluated, during the event. Similar to the three success paths for recovering offsite power

referenced above, temporary power cables would have to be run from an offsite power source into the plant in order to energize the 480V bus associated with the borated water recirculation pump. This evolution would need to be conducted during challenging adverse plant conditions associated with flood water accumulation from a ruptured fire protection header, as well as reduced lighting and elevated room temperatures resulting from a station blackout. These adverse plant conditions, in our view, would affect the probability of success in pursuing this path to provide for reactor coolant system makeup, and as such, the appropriate probability of success is 90 percent. Consequently, we determined that this was affectively another method of restoring offsite power, so no additional credit was warranted.

In summary, we reduced our Unit 1 preliminary risk assessment to 6×10^{-5} (Yellow) because we determined a high likelihood of success (90 percent) existed for recovering electrical power based on the time available to complete those actions prior to core uncovery.

Unit 2

Your staff stated during the regulatory conference, that there were three methods of restoring vital power to risk-important equipment that were not credited by the NRC in the preliminary significance determination:

1. Your staff indicated that Switchgear 2A2, while not powered throughout the event, was always capable of being restored via the Startup 2 transformer. Additionally, your staff stated that changes in your probabilistic risk model of record were made to account for operator actions specifically related to the load shed breakers on 4160V Bus 2A2. This change added a non-recovery probability for operators to manually manipulate the breakers should they fail to operate automatically.

   We reviewed the NRC's standardized plant analysis risk model and determined that operators aligning Bus 2A2 to offsite power (Startup 2 transformer) and the human error probability of operators failing to align 4160V Bus 2A2 to offsite power under conditions following the stator drop were already incorporated into our preliminary significance determination. The environmental conditions of debris and water surrounding the switchgear area after the load drop event and the increased stress level of operations personnel could complicate recovery. Taking these factors into account would increase the probability of non-recovery of 4160V Bus 2A2. Therefore, we determined that no additional reduction of the human error probability for recovery of 4160V Bus 2A2 involving manual action to manipulate the associated load shed breakers, relative to the human error probability used in our preliminary significance determination, was warranted.

2. Your staff indicated that the alternate ac diesel generator and the 4160V Bus 2A9 supply to Unit 2 buses were damaged, but available throughout the event. Your staff also stated that Unit 2 control room operators would have used the alternate ac diesel generator in the event of a station blackout because they were unaware of any damage to 4160V Bus 2A9.

   We determined that plant staff were aware of the potential damage to 4160V Bus 2A1, located next to Bus 2A9, and operators at both units would have been notified of damage to 4160V Bus 2A9, in accordance with site procedures. This is based on the fact that Unit 1 operators were aware of the damage to alternate ac diesel generator output electrical connections to Bus 2A9 for Unit 1, and that Procedure 2104.037, “Alternate AC Diesel

Generator Operations," contains a number of steps for the Unit 2 operators to notify and coordinate with the Unit 1 operators before starting and loading the alternate ac diesel generator. We believe that the Unit 1 operators would have informed the Unit 2 operators of the damage to electrical buses. We further concluded that it was reasonable to assume that the Unit 2 operators would have requested an investigation of the bus condition before using the alternate ac diesel generator.

We determined that investigation, repair, and/or testing of the bus condition by maintenance personnel would have taken longer than the time to core damage following a postulated station blackout with failure of the turbine-driven emergency feedwater pump. Therefore, no recovery credit was applied to short (1 hour) core damage sequences. However, we did determine that applying recovery credit for 8-hour sequences would reduce the conditional core damage probability to 1.2×10^{-5} (Yellow).

3. Your staff indicated that the ability to cross-tie vital 4160V Buses 2A3 and 2A4 was available to the operators and not credited in the NRC's preliminary significance determination.

   We determined that the ability to cross-tie the 4160V vital buses would not significantly impact the final results. In the dominant accident sequence, having one energized vital bus was already considered "electrical success," and any additional electrical system recovery to power the opposite vital bus would have a minimal impact on the overall risk assessment result.

In summary, we concluded that our Unit 2 preliminary risk assessment of 2.8×10^{-5} (Yellow) appropriately characterized the risk significance of the finding and that the information presented at the regulatory conference did not appreciably change the final risk determination.