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

May 9, 2014

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

SUBJECT: ARKANSAS NUCLEAR ONE – NRC INTEGRATED INSPECTION REPORT 05000313/2014002 AND 05000368/2014002

Dear Mr. Browning:

On March 31, 2014, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at the Arkansas Nuclear One facility, Units 1 and 2. On March 24 and April 7, 2014, the NRC inspectors discussed the results of this inspection with Mr. T. Evans, General Manager, Plant Operations, and other members of your staff. Inspectors documented the results of this inspection in the enclosed inspection report.

NRC inspectors documented three findings of very low safety significance (Green) in this report. One of these findings involved violations of NRC requirements. The NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2.a of the NRC Enforcement Policy.

If you contest the violation or significance of the non-cited violations (NCVs), you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region IV; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC resident inspector at the Arkansas Nuclear One facility.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region IV; and the NRC resident inspector at the Arkansas Nuclear One facility.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, “Public Inspections, Exemptions, Requests for Withholding,” a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC’s Public Document Room or from the Publicly Available Records (PARS) component of the NRC’s

Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Gregory E. Werner, Chief
Project Branch E
Division of Reactor Projects

Docket Nos.: 50-313, 50-368
License Nos: DPR-51; NPF-6

Enclosure:
IR 05000313/2014002 and 05000368/2014002
w/ Attachments:

1. Supplemental Information
2. Unit 1 and 2 Alternate AC Diesel Detailed Risk Assessment
3. RFI for Occupational Radiation Safety Inspection, ANO, Unit 1 and 2, March 17, 2014, through March 20, 2014, NRC IR 05000313/2014002; 05000368/2014002

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U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket:	05000313; 05000368
License:	DPR-51; NPF-6
Report:	05000313/2014002; 05000368/2014002
Licensee:	Entergy Operations Inc.
Facility:	Arkansas Nuclear One, Units 1 and 2
Location:	Junction of Hwy. 64 West and Hwy. 333 South Russellville, Arkansas
Dates:	January 1 through March 31, 2014
Inspectors:	B. Tindell, Senior Resident Inspector A. Fairbanks, Resident Inspector M. Young, Resident Inspector J. Melfi, Project Engineer C. Alldredge, Health Physicist L. Carson II, Senior Health Physicist
Approved By:	G. Werner, Chief Project Branch E Division of Reactor Projects

SUMMARY

IR 05000313/2014002; 05000368/2014002; 01/01/2014 - 03/31/2014, Arkansas Nuclear One, Units 1 and 2, Integrated Inspection Report; Surveillance Testing and Follow-up of Events and Notices of Enforcement Discretion.

The inspection activities described in this report were performed between January 1, 2014, and March 31, 2014, by the resident inspectors at Arkansas Nuclear One and inspectors from the NRC's Region IV office. Three findings of very low safety significance (Green) are documented in this report. One of these findings involved a violation of NRC requirements. The significance of inspection findings is indicated by their color (Green, White, Yellow, or Red), which is determined using Inspection Manual Chapter 0609, "Significance Determination Process." Their cross-cutting aspects are determined using Inspection Manual Chapter 0310, "Components Within the Cross-Cutting Areas." Violations of NRC requirements are dispositioned in accordance with the NRC Enforcement Policy. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process."

Cornerstone: Initiating Events

- Green. Inspectors documented a self-revealing finding for the licensee's failure to correctly install the flexible link bolted connection on phase C of the 6.9 kV non-segregated bus of the Unit 2 auxiliary transformer, which contributed to the explosion of the Unit 2 auxiliary transformer. The licensee documented the issue in Condition Report CR-ANO-2-2013-02242. The licensee aligned startup transformer 3 (preferred offsite power source) to carry the plant loads during normal power operations and restarted the plant on January 10, 2014. The transformer is scheduled to be replaced during the upcoming refueling outage starting in May.

  Inspectors concluded that the licensee's failure to correctly install the flexible link bolted connection on phase C of the Unit 2 auxiliary transformer 6.9 kV bus was a performance deficiency. The performance deficiency was more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the incorrectly installed flexible link bolted connection resulted in a reactor trip. Using Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, "Initiating Events Screening Questions," the inspectors determined that the finding was of very low safety significance (Green) because the finding did not result in a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of a trip to a stable shutdown condition.

  This finding did not have a cross-cutting aspect associated with it because the most significant contributor was not indicative of present performance. Specifically, the flexible links and insulation had been installed in this configuration since at least 1979 (Section 4OA3).

- Green. Inspectors documented a self-revealing finding for the licensee's failure to correctly land the signal wire from the Unit 2 auxiliary transformer differential relay output contacts to the main generator lockout relay, which contributed to the explosion of the Unit 2 auxiliary transformer. The licensee documented the issue in Condition Report CR-ANO-2-2013-02242. The licensee correctly landed the wire and aligned startup transformer 3 (preferred offsite power source) to carry the plant loads during normal power operations and restarted the plant on January 10, 2014.

  Inspectors concluded that the licensee's failure to correctly land the wire, in accordance with the drawing, in the common circuit for the differential current relays was a performance deficiency. The performance deficiency was more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the non-landed wire resulted in catastrophic failure of the Unit 2 auxiliary transformer after a fault occurred. Using Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, "Initiating Events Screening Questions," the inspectors determined that the finding was of very low safety significance (Green) because the finding did not result in a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of a trip to a stable shutdown condition.

  This finding did not have a cross-cutting aspect associated with it because the most significant contributor was not indicative of present performance. Specifically, the last time the wire could have been removed was 1995 (Section 4OA3).

Cornerstone: Mitigating Systems

- Green. The inspectors reviewed a self-revealing non-cited violation of 10 CFR 50.63, "Loss of all alternating current power," for the licensee's failure to maintain the alternate ac diesel generator as a power source available to withstand and recover from a station blackout. Specifically, the licensee failed to perform preventive maintenance on the governors of the diesel in accordance with the recommended vendor maintenance, which resulted in an overspeed trip of the engine during testing. The licensee repaired the governors and documented the issue in Condition Report CR-ANO-C-2013-00331.

  The inspectors determined that the failure to perform preventive maintenance on the governor of the alternate ac diesel generator in accordance with the recommended vendor maintenance was a performance deficiency. This performance deficiency was more than minor because it was associated with the equipment performance attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences, and was therefore a finding. Specifically, the reliability of the alternate ac diesel generator was adversely affected by the lack of governor maintenance so that the diesel was unavailable to respond to a postulated station blackout. Using Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," Appendix A, "The Significance Determination Process (SDP) for Findings at Power," Exhibit 2, "Mitigating

System Screening Questions," the inspectors determined that the finding required a detailed risk evaluation because it was an actual loss of function of a non-technical specification train of equipment designated as high safety-significant in accordance with the licensee's maintenance rule program for greater than 24 hours. The Region IV senior reactor analyst performed a detailed risk evaluation in accordance with Appendix A, Section 6.0, "Detailed Risk Evaluation." The risk was dominated by internal loss of offsite power initiators and fire-induced loss of offsite power scenarios. The calculated change in core damage frequency was 8.9E-7 for Unit 1 and 5.6E-7 for Unit 2. The analyst also determined that the finding would not involve a significant increase in the risk of a large, early release of radiation. This finding has been determined to be of very low safety significance (Green).

The finding was determined to have a cross-cutting aspect in the area of human performance, associated with consistent process, for the licensee's failure to use a consistent and systematic approach that incorporated risk insights to make decisions. The inspectors determined that the cause of the performance deficiency was that the licensee failed to use a consistent process that incorporated risk insights to evaluate and implement preventative maintenance on the alternate ac diesel generator governor. Although the performance deficiency initially occurred over three years ago, the licensee documented in Condition Report CR-ANO-C-2014-00166 that the alternate ac diesel generator was not maintained commensurate with its risk significance and that a contributing cause was that management had not implemented a comprehensive maintenance strategy in accordance with the risk significance of the diesel. Therefore, inspectors concluded that the cause of the performance deficiency was reflective of present performance. Specifically, the licensee failed to implement a comprehensive preventative maintenance strategy on the alternate ac diesel generator governor commensurate with its risk significance [H.13] (Section 1R22).

PLANT STATUS

Unit 1 operated at approximately 100 percent power for the entire inspection period.

Unit 2 began the inspection period in cold shutdown due to the unit auxiliary transformer explosion and subsequent failure of main steam isolation valve A to close. Unit 2 aligned startup transformer 3 to carry the plant loads during normal power operations and repaired the valve. Operators commenced reactor startup on January 10, 2014, and closed the main generator output breakers the same day. The unit achieved 100 percent power on January 12, 2014, and remained at full power for the rest of the inspection period.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R01 Adverse Weather Protection (71111.01)

Readiness for Impending Adverse Weather Conditions

a. Inspection Scope

On January 7, 2014, the inspectors completed an inspection of the station's readiness for impending adverse weather conditions. The inspectors reviewed plant design features, the licensee's procedures to respond to cold weather conditions, and the licensee's implementation of these procedures. The inspectors evaluated operator staffing and accessibility of controls and indications for those systems required to control the plant.

These activities constituted one sample of readiness for impending adverse weather conditions, as defined in Inspection Procedure 71111.01

b. Findings

No findings were identified.

1R04 Equipment Alignment (71111.04)

.1 Partial Walkdown

a. Inspection Scope

The inspectors performed partial system walk-downs of the following risk-significant systems:

- February 13, 2014, Unit 2, 2A3 and 2A4 switchgear ventilation

- February 19, 2014, Unit 2, emergency feedwater system suction from condensate storage tanks 2T-41A and 2T-41B

- February 24, 2014, Unit 2, containment spray system A while containment spray system B was inoperable for planned maintenance

The inspectors reviewed the licensee's procedures and system design information to determine the correct lineup for the systems. They visually verified that critical portions of the systems or trains were correctly aligned for the existing plant configuration.

These activities constituted three partial system walk-down samples as defined in Inspection Procedure 71111.04.

b. Findings

No findings were identified.

.2 Complete Walkdown

a. Inspection Scope

On February 18, 2014, the inspectors performed a complete system walk-down inspection of the Unit 1 auxiliary feedwater system. The inspectors reviewed the licensee's procedures and system design information to determine the correct system lineup for the existing plant configuration. The inspectors also reviewed outstanding work orders, open condition reports, in-process design changes, temporary modifications, and other open items tracked by the licensee's operations and engineering departments. The inspectors then visually verified that the system was correctly aligned for the existing plant configuration.

These activities constituted one complete system walk-down sample, as defined in Inspection Procedure 71111.04.

b. Findings

No findings were identified.

1R05 Fire Protection (71111.05)

Quarterly Inspection

a. Inspection Scope

The inspectors evaluated the licensee's fire protection program for operational status and material condition. The inspectors focused their inspection on five plant areas important to safety:

- January 6, 2014, Unit 2, fire zone 2081-HH, lower and upper north piping penetration rooms

- January 6, 2014, Unit 1, fire zone 14-EE, west decay heat removal pump room

- January 8, 2014, Unit 1, fire zone 95-O, north battery room

- January 8, 2014, Unit 1, fire zone 110-L, south battery room and direct current equipment room

- February 3, 2014, Unit 2, fire zone 2101-AA, north switchgear room

For each area, the inspectors evaluated the fire plan against defined hazards and defense-in-depth features in the licensee's fire protection program. The inspectors evaluated control of transient combustibles and ignition sources, fire detection and suppression systems, manual firefighting equipment and capability, passive fire protection features, and compensatory measures for degraded conditions.

These activities constituted five quarterly inspection samples, as defined in Inspection Procedure 71111.05.

b. <u>Findings</u>

No findings were identified.

1R06 Flood Protection Measures (71111.06)

a. <u>Inspection Scope</u>

On February 21, 2014, the inspectors completed an inspection of the station's ability to mitigate flooding due to internal causes. After reviewing the licensee's flooding analysis, the inspectors chose one plant area containing risk-significant structures, systems, and components that were susceptible to flooding:

- Unit 1, circulating water flume in the auxiliary building

The inspectors reviewed plant design features and licensee procedures for coping with internal flooding. The inspectors walked down the selected areas to inspect the design features, including the material condition of seals, drains, and flood barriers. The inspectors evaluated whether operator actions credited for flood mitigation could be successfully accomplished.

These activities constitute completion of one flood protection measures sample as defined in Inspection Procedure 71111.06.

b. Findings

No findings were identified.

1R11 Licensed Operator Requalification Program and Licensed Operator Performance (71111.11)

.1 Review of Licensed Operator Requalification

a. Inspection Scope

On March 18, 2014, the inspectors observed training of a crew of Unit 1 licensed operators in the simulator. On March 19, 2014, the inspectors observed training of a crew of Unit 2 licensed operators in the simulator. The inspectors assessed the performance of the operators and the evaluators' critique of their performance.

These activities constitute completion of two quarterly licensed operator requalification program samples, as defined in Inspection Procedure 71111.11.

b. Findings

No findings were identified.

.2 Review of Licensed Operator Performance

a. Inspection Scope

The inspectors observed the performance of on-shift licensed operators in the plant's main control room. The inspectors observed the operators' performance of the following activities:

- January 10, 2014, Unit 2, approach to criticality and reactor startup
- March 8, 2014, Unit 1, reactor downpower for turbine valve testing

In addition, the inspectors assessed the operators' adherence to plant procedures, including conduct of operations procedures and other operations department policies.

These activities constitute completion of two quarterly licensed operator performance samples, as defined in Inspection Procedure 71111.11.

b. Findings

No findings were identified.

1R12 Maintenance Effectiveness (71111.12)

a. Inspection Scope

The inspectors reviewed one instance of degraded performance or condition of safety-related structures, systems, and components (SSCs):

- March 11, 2014, Units 1 and 2, control room ventilation system after failure of emergency control room chiller B low oil pressure switch

The inspectors reviewed the extent of condition of possible common cause SSC failures and evaluated the adequacy of the licensee's corrective actions. The inspectors reviewed the licensee's work practices to evaluate whether these may have played a role in the degradation of the SSCs. The inspectors assessed the licensee's characterization of the degradation in accordance with 10 CFR 50.65 (the Maintenance Rule), and verified that the licensee was appropriately tracking degraded performance and conditions in accordance with the Maintenance Rule.

These activities constituted completion of one maintenance effectiveness sample, as defined in Inspection Procedure 71111.12.

b. Findings

No findings were identified.

1R13 Maintenance Risk Assessments and Emergent Work Control (71111.13)

a. Inspection Scope

The inspectors reviewed four risk assessments performed by the licensee prior to changes in plant configuration and the risk management actions taken by the licensee in response to elevated risk:

- February 11, 2014, Unit 2, mobile crane for containment tendon inspection
- February 27, 2014, Unit 2, removal of auxiliary transformer non-segregated bus
- March 13, 2014, Unit 1, reactor building spray pump A comprehensive testing
- March 24, 2014, Units 1 and 2, heavy equipment movement in switchyard

The inspectors verified that these risk assessments were performed timely and in accordance with the requirements of 10 CFR 50.65 (the Maintenance Rule) and plant procedures. The inspectors reviewed the accuracy and completeness of the licensee's risk assessments and verified that the licensee implemented appropriate risk management actions based on the result of the assessments.

These activities constitute completion of four maintenance risk assessments and emergent work control inspection samples, as defined in Inspection Procedure 71111.13.

b. Findings

No findings were identified.

1R15 Operability Determinations and Functionality Assessments (71111.15)

a. Inspection Scope

The inspectors reviewed four operability determinations that the licensee performed for degraded or nonconforming SSCs:

- January 12, 2014, Unit 2, operability determination for main steam isolation valve A after piston ring replacement and hand buffing of the valve internal body

- January 13, 2014, Unit 2, operability determination for main steam isolation valve B after seating force determined to be inadequate

- January 21, 2014, Unit 2, operability determination for the startup 2 and startup 3 transformers after insufficient bus clearance was identified

- January 22, 2014, Units 1 and 2, operability determination for auxiliary building external flood protection

The inspectors reviewed the timeliness and technical adequacy of the licensee's evaluations. Where the licensee determined the degraded SSC to be operable, the inspectors verified that the licensee's compensatory measures were appropriate to provide reasonable assurance of operability. The inspectors verified that the licensee had considered the effect of other degraded conditions on the operability of the degraded SSC.

These activities constitute completion of four operability and functionality review samples, as defined in Inspection Procedure 71111.15.

b. Findings

No findings were identified.

1R18 Plant Modifications (71111.18)

a. Inspection Scope

On February 14, 2014, the inspectors reviewed a permanent modification to maintain Unit 2 battery operability during cold weather.

The inspectors reviewed the design and implementation of the modification. The inspectors verified that work activities involved in implementing the modification did not adversely impact operator actions that may be required in response to an emergency or other unplanned event. The inspectors verified that post-modification testing was adequate to establish the operability of the SSCs as modified.

These activities constitute completion of one sample of permanent modifications, as defined in Inspection Procedure 71111.18

b. Findings

No findings were identified.

1R19 Post-Maintenance Testing (71111.19)

a. Inspection Scope

The inspectors reviewed four post-maintenance testing activities that affected risk-significant SSCs:

- January 6-8, 2014, Unit 2, main steam isolation valve A and B diagnostic tests after piston ring replacement

- January 14, 2014, Unit 2, emergency diesel generator exhaust fan 2VEF-24B after cleaning, inspection, lubrication, and meggering

- January 15, 2014, Unit 1, high pressure injection pump A after suction relief valve replacement

- February 21, 2014, Unit 2, 2B5, and 2B6 bus undervoltage relay calibration and test

The inspectors reviewed licensing and design-basis documents for the SSCs and the maintenance and post-maintenance test procedures. The inspectors observed the performance of the post-maintenance tests to verify that the licensee performed the tests in accordance with approved procedures, satisfied the established acceptance criteria, and restored the operability of the affected SSCs.

These activities constitute completion of four post-maintenance testing inspection samples, as defined in Inspection Procedure 71111.19.

b. Findings

No findings were identified.

1R20 Refueling and Other Outage Activities (71111.20)

a. Inspection Scope

During the Unit 2 outage that concluded on January 10, 2014, the inspectors evaluated the licensee's outage activities. The inspectors verified that the licensee considered risk in developing and implementing the outage plan, appropriately managed personnel fatigue, and developed mitigation strategies for losses of key safety functions. This verification included the following:

- Review of the licensee's outage plan
- Verification that the licensee maintained defense-in-depth during outage activities
- Monitoring of heat-up and startup activities

These activities constitute completion of one outage activities sample, as defined in Inspection Procedure 71111.20.

b. Findings

No findings were identified.

1R22 Surveillance Testing (71111.22)

a. Inspection Scope

The inspectors observed six risk-significant surveillance tests and reviewed test results to verify that these tests adequately demonstrated that the SSCs were capable of performing their safety functions:

In-service tests:

- January 9, 2014, Unit 1, turbine driven emergency feedwater pump bearing cooling return check valve CS-1198

- February 2, 2014, Unit 1 and Unit 2, nitrogen supply check valve N2-156 and vacuum degasifier recycle pump check valve 2CS-841 to quality condensate storage tank

Other surveillance tests:

- January 8, 2014, Unit 1, D06 and D07 weekly battery surveillance test

- February 10, 2013, alternate ac diesel generator quarterly test

- February 25, 2014, Unit 1, emergency feedwater initiation and control system channel D 18-month calibration

- February 26, 2014, Unit 2, high pressure safety injection valve 2CV-5056-2 test

The inspectors verified that these tests met technical specification requirements, that the licensee performed the tests in accordance with their procedures, and that the results of the test satisfied appropriate acceptance criteria. The inspectors verified that the licensee restored the operability of the affected SSCs following testing.

These activities constitute completion of six surveillance testing inspection samples, as defined in Inspection Procedure 71111.22.

b. Findings

Introduction. The inspectors documented a Green self-revealing non-cited violation of 10 CFR 50.63, "Loss of all alternating current power," for the licensee's failure to maintain the alternate ac diesel generator as a power source available to withstand and recover from a station blackout. Specifically, the licensee failed to perform preventive maintenance on the governors of the diesel in accordance with the recommended vendor maintenance, which resulted in an overspeed trip of the engine during testing.

Description. On February 10, 2013, the alternate ac diesel generator tripped on overspeed during a quarterly test per station procedure OP-2104.037, "Alternate AC Diesel Generator Operations," Revision 24.

The licensee determined, through an apparent cause evaluation, that two degraded conditions led to the overspeed trip. The first was that the electronic governor, the normal control for diesel speed, failed to the maximum fuel position following the previous test. The second was that the mechanical governor, the backup control for diesel speed in case the electric portion fails, was also set in the maximum fuel position. Therefore, when the alternate ac diesel generator started, the diesel sped up until the overspeed trip actuated, shutting the engine down automatically.

For the alternate ac diesel generator electronic governor, the licensee determined that an output capacitor had failed due to age-related degradation, which resulted in the maximum fuel demand. In 2001, the licensee received notification from Woodward, the governor manufacturer, that the electronic governors used in the safety-related emergency diesel generators and the alternate ac diesel generator should be replaced on a five-to-seven year frequency, which was documented in Condition Report CR-ANO-C-2001-00504. A replacement schedule for the emergency diesel generator governors was established at that time, but the licensee failed to take action for the alternate ac diesel generator because, they reasoned, it was classified as nonsafety-related. The alternate ac diesel generator electronic governor was in service for 18 years before it failed. This was beyond the five to seven year replacement recommendation. To correct the degraded condition, the licensee replaced the electric governor and established a replacement frequency.

For the mechanical governor, the licensee determined that the speed setting was incorrectly set to the maximum fuel position, and it had not been set properly since the engine installation in 1995. The vendor manual, "Caterpillar Service Manual for Engine Serial Number 1PD00116," dated August 31, 2006, described recommended maintenance. The vendor manual stated, in part, to set the mechanical governor speed control 15 revolutions per minute above the electronic governor setting, and to check the governor settings every three years. However, the licensee failed to set up the mechanical governor during engine installation or check the governor's settings during maintenance. To correct the degraded condition, the licensee set the mechanical governor speed control to act as a backup control to the electric governor, and established a maintenance frequency.

The inspectors determined that the cause of the alternate ac diesel generator electronic and mechanical governors degraded conditions was a single performance deficiency. The performance deficiency was the failure to perform adequate preventive maintenance on the governors in accordance with the recommended vendor maintenance. In order to implement 10 CFR 50.63, "Loss of all alternating current power," the licensee committed to NUMARC-8700, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," dated November 23, 1987. NUMARC-8700 stated, in part, that maintenance procedures for the alternate ac system shall be implemented considering manufacturer's recommendations. For both the electronic and mechanical governors, the licensee received recommendations to perform maintenance which would have prevented the overspeed trip, but failed to implement them.

This issue was documented in Condition Report CR-ANO-C-2013-00331. The licensee repaired the governor and returned the alternate ac diesel generator to service on February 18, 2013, following a successful test. The previous successful surveillance was completed on November 9, 2013; therefore, the alternate ac diesel generator was unavailable to respond to a station blackout for a total of 101 days.

<u>Analysis</u>. The inspectors determined that the failure to perform adequate preventive maintenance on the governor of the alternate ac diesel generator in accordance with the recommended vendor maintenance was a performance deficiency. This performance deficiency was more than minor because it was associated with the equipment performance attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences, and was therefore a finding. Specifically, the reliability of the alternate ac diesel generator was adversely affected by the lack of governor maintenance so that the diesel was unavailable to respond to a postulated station blackout. Using Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings at Power," Exhibit 2, "Mitigating System Screening Questions," the inspectors determined that the finding required a detailed risk evaluation because it was an actual loss of function of a non-technical specification train of equipment designated as high safety-significant in accordance with the licensee's maintenance rule program for greater than 24 hours. The Region IV senior reactor analyst performed a detailed risk evaluation in accordance with Appendix A, Section 6.0, "Detailed Risk Evaluation." The risk was dominated by internal loss of offsite power initiators and fire-induced loss of offsite power scenarios. The calculated change in core damage frequency was 8.9E-7 for Unit 1 and 5.6E-7 for Unit 2. The analyst also determined that the finding would not involve a significant increase in the risk of a large, early release of radiation. This finding has been determined to be of very low safety significance (Green). Refer to Attachment 2 for the detailed risk evaluation.

The finding was determined to have a cross-cutting aspect in the area of human performance, associated with consistent process, for the licensee's failure to use a consistent and systematic approach that incorporated risk insights to make decisions. The inspectors determined that the cause of the performance deficiency was that the licensee failed to use a consistent process that incorporated risk insights to evaluate and implement preventative maintenance on the alternate ac diesel generator governor. Although the performance deficiency initially occurred over three years ago, the licensee documented in Condition Report CR-ANO-C-2014-00166 that the alternate ac diesel generator was not maintained commensurate with its risk significance and that a contributing cause was that management had not implemented a comprehensive maintenance strategy in accordance with the risk significance of the diesel. Therefore, inspectors concluded that the cause of the performance deficiency was reflective of present performance. Specifically, the licensee failed to implement a comprehensive preventative maintenance strategy on the alternate ac diesel generator governor commensurate with its risk significance [H.13].

<u>Enforcement</u>. Title 10 CFR 50.63(a)(1), states, in part, that each light water cooled nuclear power plant must be able to withstand for a specified duration and recover from a station blackout. Title 10 CFR 50.63(c)(2) states, in part, that the alternate ac power source will constitute acceptable capability to withstand station blackout provided an analysis is performed which demonstrates that the plant has this capability from onset of the station blackout until the alternate ac source and required shutdown equipment are started and lined up to operate. Additionally, 10 CFR 50.63(c)(2) states, in part, that if the alternate ac source is available to power the shutdown buses within 10 minutes of the onset of a station blackout, then no coping analysis is required.

Contrary to the above, between November 9, 2012, and February 18, 2013, the licensee failed to be able to withstand and recover from a station blackout as a result of the inability to provide power to the shutdown buses from the alternate ac diesel generator within 10 minutes of the onset of a station blackout. Specifically, on February 10, 2013, the alternate ac diesel generator tripped during startup because of a failed governor. The failure of the governor resulted from the licensee's failure to follow vendor recommended preventative maintenance. The previous successful surveillance was completed on November 9, 2013. The licensee repaired the governors and returned the alternate ac diesel generator to service on February 18, 2013, following a successful test. Because this finding is of very low safety significance and has been entered into the corrective action program as Condition Report CR-ANO-C-2013-00331, this violation is being treated as a non-cited violation consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000313/2014002-01; 05000368/2014002-01, "Failure to Maintain Alternate ac Diesel Generator Governor."

Cornerstone: Emergency Preparedness

1EP6 Drill Evaluation (71114.06)

Emergency Preparedness Drill Observation

a. Inspection Scope

The inspectors observed an emergency preparedness drill on March 19, 2014, to verify the adequacy and capability of the licensee's assessment of drill performance. The inspectors reviewed the drill scenario, observed the drill from the simulator and attended the post-drill critique. The inspectors verified that the licensee's emergency classifications, offsite notifications, and protective action recommendations were appropriate and timely. The inspectors verified that any emergency preparedness weaknesses were appropriately identified by the licensee in the post-drill critique and entered into the corrective action program for resolution.

These activities constitute completion of one emergency preparedness drill observation sample, as defined in Inspection Procedure 71114.06-05.

b. Findings

No findings were identified.

2. RADIATION SAFETY

Cornerstones: Public Radiation Safety and Occupational Radiation Safety

2RS2 Occupational ALARA Planning and Controls (71124.02)

a. Inspection Scope

The inspectors assessed licensee performance with respect to maintaining occupational individual and collective radiation exposures as low as is reasonably achievable (ALARA). During the inspection, the inspectors interviewed licensee personnel and reviewed licensee performance in the following areas:

- Site-specific ALARA procedures and collective exposure history, including the current 3-year rolling average, site-specific trends in collective exposures, and source-term measurements

- ALARA work activity evaluations/post-job reviews, exposure estimates, and exposure mitigation requirements

- The methodology for estimating work activity exposures, the intended dose outcome, the accuracy of dose rate and man-hour estimates, and intended versus actual work activity doses and the reasons for any inconsistencies

- Records detailing the historical trends and current status of tracked plant source terms and contingency plans for expected changes in the source term due to changes in plant fuel performance issues or changes in plant primary chemistry

- Radiation worker and radiation protection technician performance during work activities in radiation areas, airborne radioactivity areas, or high radiation areas

- Audits, self-assessments, and corrective action documents related to ALARA planning and controls since the last inspection

These activities constitute completion of one sample of occupational ALARA planning and controls as defined in Inspection Procedure 71124.02.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity, Emergency Preparedness, Public Radiation Safety, Occupational Radiation Safety, and Security

4OA1 Performance Indicator Verification (71151)

.1 Unplanned Scrams per 7000 Critical Hours (IE01)

a. Inspection Scope

The inspectors reviewed licensee event reports (LERs) for the period of January 1, 2013 through December 31, 2013 to determine the number of scrams that occurred. The inspectors compared the number of scrams reported in these LERs to the number reported for the performance indicator. Additionally, the inspectors sampled monthly operating logs to verify the number of critical hours during the period. The inspectors used definitions and guidance contained in Nuclear Energy Institute Document 99-02, “Regulatory Assessment Performance Indicator Guideline,” Revision 7, to determine the accuracy of the data reported.

These activities constituted verification of the unplanned scrams per 7000 critical hours performance indicator for Units 1 and 2, as defined in Inspection Procedure 71151.

b. Findings

No findings were identified.

.2 Unplanned Power Changes per 7000 Critical Hours (IE03)

a. Inspection Scope

The inspectors reviewed operating logs, corrective action program records, and monthly operating reports for the period of January 1, 2013 through December 31, 2013 to determine the number of unplanned power changes that occurred. The inspectors compared the number of unplanned power changes documented to the number reported for the performance indicator. Additionally, the inspectors sampled monthly operating logs to verify the number of critical hours during the period. The inspectors used definitions and guidance contained in Nuclear Energy Institute Document 99-02, "Regulatory Assessment Performance Indicator Guideline," Revision 7, to determine the accuracy of the data reported.

These activities constituted verification of the unplanned power outages per 7000 critical hours performance indicator for Units 1 and 2, as defined in Inspection Procedure 71151.

b. Findings

No findings were identified.

4OA2 Problem Identification and Resolution (71152)

.1 Routine Review

a. Inspection Scope

Throughout the inspection period, the inspectors performed daily reviews of items entered into the licensee's corrective action program and periodically attended the licensee's condition report screening meetings. The inspectors verified that licensee personnel were identifying problems at an appropriate threshold and entering these problems into the corrective action program for resolution. The inspectors verified that the licensee developed and implemented corrective actions commensurate with the significance of the problems identified. The inspectors also reviewed the licensee's problem identification and resolution activities during the performance of the other inspection activities documented in this report.

b. Findings

No findings were identified.

4OA3 Follow-up of Events and Notices of Enforcement Discretion (71153)

(Closed) Licensee Event Report 05000368/2013-004-00, Fire and Explosion of the Unit Auxiliary Transformer Resulted in an Automatic Scram and Initiation of the Emergency Feedwater System

On December 9, 2013, Unit 2 experienced an electrical fault on the unit auxiliary transformer 2X-02 buses, which resulted in the catastrophic failure of the transformer and a fire. This caused an automatic reactor and turbine trip of Unit 2, lockout of startup transformer 3 (Unit 2 preferred offsite power source), and a loss of power to startup transformer 1 (Unit 1 preferred offsite power source). Unit 1 remained at 100 percent reactor power. The loss of one of the two offsite power supplies for Unit 2 resulted in an automatic start of emergency diesel generator B to supply vital bus 2A-4, and the initiation of the emergency feedwater system. The licensee determined that the fault originated on the 6.9 kV phase C flexible link bolted connection for the auxiliary transformer. The auxiliary transformer protective relays were designed to isolate the fault, but due to a disconnected wire, the auxiliary transformer catastrophically failed. The licensee determined that the root cause of the bus fault was improper installation of the 6.9 kV phase C flexible link bolted connection, which led to insulation breakdown. The licensee determined that the root cause of the explosion was improper installation of a differential current relay output wire due to a human performance error. The issues were entered into the corrective action program as Condition Report CR-ANO-2-2013-02242. The licensee aligned startup transformer 3 to carry the plant loads during normal power operations and restarted the plant on January 10, 2014. As a part of this review, the inspectors documented two Green self-revealing findings, which are documented below.

These activities constitute completion of one event follow-up sample, as defined in Inspection Procedure 71153.

.1 Failure to Correctly Install Flexible Link Bolted Connection on Phase C of 6.9 kV Bus

Introduction. The inspectors documented a Green self-revealing finding for the licensee's failure to correctly install the flexible link bolted connection on phase C of the 6.9 kV non-segregated bus of the Unit 2 auxiliary transformer.

Description. On December 9, 2013, electrical faults occurred on the Unit 2 auxiliary transformer 4.16 kV and 6.9 kV buses and the transformer exploded and caught fire. This resulted in an automatic reactor and turbine trip of Unit 2 and lockout of the switchyard autotransformer and startup transformer 3. The train A non-vital 4.16 kV buses were fast transferred to the shared Unit 1 and 2 offsite power source, startup transformer 2.

The loss of the Unit 2 auxiliary transformer was the direct result of a phase-to-ground fault on phase C of the 6.9 kV non-segregated bus. Physical evidence supported that the initial fault occurred at the flexible link located just inside the Unit 2 turbine building wall. The resulting electrical fault consumed the flexible link and phase C bus bar section immediately adjacent to the link, and blew out the 6.9 kV bus duct as well as the 4.16 kV bus duct that was located directly below. This resulted in a phase-to-phase fault on the 4.16 kV bus.

Because the flexible link and the attached bus bar were vaporized, the licensee was not able to determine the actual root cause of the failure. The licensee determined that the most probable root cause of the bus faults was improper installation of the phase C 6.9 kV flexible link inside the turbine building void area. Inspections of the bolting around the phase A and phase B flexible links revealed that very little semiconducting putty, if any, had been applied around the bolt heads. Technical Manual TD P295.0050, “Installation Instructions for Delta-Star Metal Enclosed Bus”, Revision 0, Page 16, states, “After checking to see that bolts have been sufficiently tightened, fill area around bolt heads and any other irregular surface or voids with ‘Duxseal’ to obtain a smooth surface.” The technical manual then requires electrical tape be applied evenly such that no voids occur. The lack of putty around the bolt heads resulted in voids underneath the tape insulation, which may have resulted in partial discharge, or corona, across the air gap and caused degradation of the insulation. The flexible links and insulation had been installed in this configuration since at least 1979.

The licensee also identified two contributing causes for the bus fault that the inspectors reviewed. The first contributing cause was an inadequate design of the bus duct for not meeting the minimum National Electrical Code for an air gap clearance of 4 inches. The inspectors determined that the licensee was not committed to this code for the non-safety-related 6.9 kV bus duct design. The second contributing cause was a lack of inspection of the flexible connection, bus, and bus duct. The inspectors reviewed the disposition of various preventive maintenance tasks and operating experience reports associated with bus and transformer failures and determined that the licensee followed their process when they determined that the lack of accessibility and the high number of man-hours needed for the inspections were the reason for not conducting inspections on the flexible links.

The auxiliary transformer differential relays should have tripped the main generator lockout relay to isolate the fault and prevent failure of the transformer. The licensee’s root cause evaluation determined that the cause of the explosion was a non-landed wire in the common circuit for the differential current relays. Unit 2 would have tripped without explosion of the auxiliary transformer, and without subsequent loss of power to startup transformers 1 and 3, if the differential relay wire had been correctly landed.

The licensee documented the failure of the transformer in Condition Report CR-ANO-2-2013-02242. The licensee aligned startup transformer 3 (preferred offsite power source) to carry the plant loads during normal power operations and restarted the plant on January 10, 2014. The transformer is scheduled to be replaced during the upcoming refueling outage starting in May.

Analysis. The inspectors concluded that the licensee’s failure to correctly install the flexible link bolted connection on phase C of the Unit 2 auxiliary transformer 6.9 kV bus was a performance deficiency. The performance deficiency was more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the incorrectly installed flexible link bolted connection resulted in a reactor trip. Using Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, "Initiating Events Screening Questions," the inspectors determined that the finding was of very low safety significance (Green) because the finding did not result in a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of a trip to a stable shutdown condition.

This finding did not have a cross-cutting aspect associated with it because the most significant contributor was not indicative of present performance. Specifically, the flexible links and insulation had been installed in this configuration since at least 1979.

Enforcement. This finding does not involve enforcement action because no violation of a regulatory requirement was identified. The licensee entered this finding into the corrective action program as Condition Report CR-ANO-2-2013-02242. Because this finding did not involve a violation and was of very low safety significance, it is identified as FIN 05000368/2014002-02, "Failure to Correctly Install Flexible Link Bolted Connection on Phase C of 6.9 kV Bus."

.2 Failure to Land Signal Wire from Differential Relay Output to Generator Lockout Relay

Introduction. The inspectors documented a Green self-revealing finding for the licensee's failure to correctly land the signal wire from the Unit 2 auxiliary transformer differential current relay output contacts to the main generator lockout relay.

Description. On December 9, 2013, electrical faults occurred on the Unit 2 auxiliary transformer 4.16 kV and 6.9 kV buses and the transformer exploded and caught fire. This resulted in an automatic reactor and turbine trip of Unit 2 and lockout of the switchyard autotransformer and startup transformer 3. The train A non-vital 4.16 kV buses were fast transferred to the shared Unit 1 and 2 offsite power source, startup transformer 2.

The loss of the Unit 2 auxiliary transformer was the direct result of a phase-to-ground fault on phase C of the 6.9 kV non-segregated bus. Physical evidence supported that the initial fault occurred at the flexible link located just inside the Unit 2 turbine building wall. The resulting electrical fault consumed the flexible link and phase C bus bar section immediately adjacent to the link, and blew out the 6.9 kV bus duct as well as the 4.16 kV bus duct that was located directly below. This resulted in a phase-to-phase fault on the 4.16 kV bus.

The transformer differential relays should have tripped the main generator lockout relay to initiate a prompt opening of the main generator output breakers and the exciter field breaker, which would have isolated the fault and prevented failure of the transformer. The licensee's root cause evaluation determined that the cause of the explosion was a non-landed wire in the common circuit for the differential current relays. Drawing E-2134, "Generator Protection and Lockout Relays," Sheet 2, Revision 16, required the wire to be landed to trip the generator lockout relay. The licensee was not able to determine when the circuit had last been manipulated, but noted that the last time the circuit had been inspected was 1995.

The licensee determined that the most probable root cause of the bus faults was improper installation of the phase C 6.9 kV flexible link inside the turbine building void area. A fault would not have originated in phase C of the 6.9 kV bus of the auxiliary transformer if the flexible link had been correctly installed; the non-landed differential current relay wire only served to increase the likelihood of transformer explosion in the event of a fault on the 6.9 kV bus.

The licensee documented the failure of the transformer in Condition Report CR-ANO-2-2013-02242. The licensee landed the wire, aligned startup transformer 3 to carry the plant loads during normal power operations, and the plant was restarted on January 10, 2014.

Analysis. The inspectors concluded that the licensee's failure to correctly land the wire, in accordance with the drawing, in the common circuit for the differential current relays was a performance deficiency. The performance deficiency was more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, the non-landed wire resulted in catastrophic failure of the Unit 2 auxiliary transformer after a fault occurred. Using Inspection Manual Chapter 0609, Attachment 4, "Initial Characterization of Findings," and Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 1, "Initiating Events Screening Questions," the inspectors determined that the finding was of very low safety significance (Green) because the finding did not result in a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of a trip to a stable shutdown condition.

This finding did not have a cross-cutting aspect associated with it because the most significant contributor was not indicative of present performance. Specifically, the last time the wire could have been removed was 1995.

Enforcement. This finding does not involve enforcement action because no violation of a regulatory requirement was identified. The licensee entered this finding into the corrective action program as Condition Report CR-ANO-2-2013-02242. Because this finding did not involve a violation and was of very low safety significance, it is identified as FIN 05000368/2014002-03, "Failure to Land Signal Wire from Differential Relay Output to Generator Lockout Relay."

4OA6 Meetings, Including Exit

Exit Meeting Summary

On March 20, 2014, the inspectors presented the radiation safety inspection results to Mr. T. Evans, General Manager, Plant Operations, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

On March 24, 2014, the inspectors presented the inspection results to Mr. T. Evans, General Manager, Plant Operations, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

On April 7 and May 7, 2014, the inspectors re-exited and presented the inspector results to Mr. T. Evans, General Manager, Plant Operations, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Browning, Site Vice President
P. Butler, Supervisor, Systems Engineering
T. Evans, General Manager, Plant Operations
K. Gaston, Senior Lead, Engineering
B. Greeson, Procurement Manager, Engineering
M. Hall, Licensing Specialist, Regulatory Assurance
D. James, Director, Regulatory and Performance Department
S. Pyle, Manager, Regulatory Assurance
A. Remer, Project Manager, Regulatory Assurance

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

05000313/2014002-01; 05000368/2014002-01	NCV	Failure to Maintain Alternate ac Diesel Generator Governor (Section 1R22)
05000368/2014002-02	FIN	Failure to Correctly Install Flexible Link Bolted Connection on Phase C of 6.9 kV Bus (Section 4OA3.1)
05000368/2014002-03	FIN	Failure to Land Signal Wire From Differential Relay Output to Generator Lockout Relay (Section 4OA3.2)

Closed

05000368/2013-004-00	LER	Fire and Explosion of the Unit Auxiliary Transformer Resulted in an Automatic Reactor Scram and Initiation of the Emergency Feedwater System (Section 4OA3)

LIST OF DOCUMENTS REVIEWED

Section 1R01: Adverse Weather Protection

Procedures

Number	Title	Revision
OP-1203.025	Natural Emergencies	45
OP-2104.029	Service Water System Operations	96

Drawing

Number	Title	Revision
C-2067	Emergency Cooling Reservoir Pipe Intake and Discharge	16

Miscellaneous

Number	Title	Revision
ER-002583R101	Establish Min/Max Log Values for U-1 Safety Sysems CR-1-99-186-5	0

Condition Reports (CRs)

CR-ANO-C-2010-00013 CR-ANO-C-2000-00381

Section 1R04: Equipment Alignment

Procedures

Number	Title	Revision
OP-2106.006	Emergency Feedwater System Operations	84
OP-2203.014	Alternate Shutdown	28
OP-2104.005	Containment Spray	70

Drawing

Number	Title	Revision
M-204	Piping and Instrument Diagram, Condensate Feedwater	55

Miscellaneous

Number	Title	Revision
ER-ANO-2006-0389-000	U2 EFW Alignment to QCST Evaluation	0
EC-3543	Unit 1 Auxiliary Feedwater (AFW) Pump P-75 Automatic Recirc Control Valve CV-2823 Modification	0

Condition Reports (CRs)

CR-ANO-1-2010-00099 CR-ANO-1-2010-00128

Section 1R05: Fire Protection

Procedures

Number	Title	Revision
2b-335-2081-hh	Unit 2 Prefire Plan for Lower and Upper North Piping Penetration Rooms	2
1b-317-14-ee	Unit 1 Prefire Plan for West (A) Decay Heat Removal Pump Room	2
1a-372-95-o	Unit 1 Prefire Plan for North Battery Room	2
1A-372-110-L	Unit 1 Prefire Plan for South Battery Room & DC Equipment Room	2

Drawings

Number	Title	Revision
FZ-2020	Fire Zone Detail Access and Pump Area, Pump Room, and Auxiliary Building Elevator, Lower North Piping Penetration Area	2
FZ-2052	Fire Zone Detail Plant Heat Boiler Room, Office Area, Heating Boiler Day Tank Area, Stair No. 2055, & Piping Penet. Room	4
FZ-1068	Fire Zone Detail East and West Decay Heat Removal Pump Room, and Tendon Gallery Access Area	2
FZ-1016	Fire Zone Detail Stair No. 1, Comm. Rm., Turbine Bldg. Tank Rm., No. Battery Rm., 7 Controlled Access	2
FZ-1045	Fire Zone Detail So. Battery Rm., No. Switchgear Rm. & So. Switchgear Room	3

Miscellaneous

Number	Title	Revision
FHA	Fire Hazards Analysis	15

Section 1R06: Flood Protection Measures

Drawings

Number	Title	Revision
3-EFW-112	Emergency Feedwater Pump Recirculation to Discharge Flume	3
2HBD-26-2	Service Water Headers	1

Section 1R11: Licensed Operator Requalification Program and Licensed Operator Performance

Procedures

Number	Title	Revision
OP-2102.016	Reactor Startup	21
OP-2102.004	Power Operation	56
OP-2203.012C	Annunciator 2K03 Corrective Action	31
OP-2203.012J	Annunciator 2K10 Corrective Action	39
OP-1015.001	Conduct of Operations	101
COPD-030	ANO Reactivity Management Program	7

Training Course

Number	Title	Revision
A1SPGLOR140401	Crew Performance Evaluation	0
A2SPGLOR140402	Shutdown Cooling Operations	0

Section 1R12: Maintenance Effectiveness

Procedure

Number	Title	Revision
EN-LI-102	Corrective Action Process	23

Condition Reports (CRs)

CR-ANO-C-2013-03171 CR-ANO-2-2014-00125

Section 1R13: Maintenance Risk Assessments and Emergent Work Control

Procedures

Number	Title	Revision
COPD-024	Risk Assessment Guidelines	48
OP-1104.005	Reactor Building Spray System Operation	71

Section 1R15: Operability Determinations and Functionality Assessments

Condition Reports (CRs)

CR-ANO-2-2013-02502	CR-ANO-2-2013-02563	CR-ANO-C-2014-00078
CR-ANO-2-2013-02555	CR-ANO-C-2014-00259	

Section 1R18: Plant Modifications

Procedure

Number	Title	Revision
OP-2106.032	Unit Two Freeze Protection Guide	23

Drawing

Number	Title	Revision
M-2263	Piping and Instrument Diagram Air Flow Diagram HVAC Aux. Bldg. – Misc. Rooms	13

Miscellaneous

Number	Title	Revision
ER-ANO-2002-0006-000	Operation of ABHV Supply Fans (2VSF-7A/B) with Plenum Doors Open	0

Condition Reports (CRs)

CR-ANO-2-2013-02502 CR-ANO-2-2014-00345

Section 1R19: Post-Maintenance Testing

Procedures

Number	Title	Revision
OP-2104.036	Emergency Diesel Generator Operations	86
OP-2416.031	Unit 2 2B5 and 2B6 Undervoltage Relay Calibration	3
OP-2305.053	2B5 and 2B6 Undervoltage Test	5

Miscellaneous

Number	Title	Revision/Date
RAL-70123	MSIV Closing Forces	January 7, 2014
98-R-1022-01	Unit 1 AOV Program Valves	1
98-R-2016-01	Unit 2 AOV Program Valves	1
TDB455 0110	Instructions for ASEA Brown Boveri Single Phase Voltage Relays, Type 27N High Accuracy Undervoltage Relay, Type 59N High Accuracy Overvoltage Relay	1
ULD-0-TOP-11	ANO Unit 1 and 2 Degraded Grid Voltage	9
ULD-2-SYS-17	ANO Unit 2 480 VAC Distribution System	3
MU-012-P-36A	Clearance 1C25-1, P-36A	February 14, 2014
Calc-ANO1-SE-08-2	Unit 1 HPI Generic Letter 08-01 Gas Intrusion Review	0

Condition Reports (CRs)

CR-ANO-2-2013-02502	CR-ANO-2-2014-0005	CR-ANO-1-2011-02922
CR-ANO-1-2014-00295		

Work Orders

52455394-05	52455394-04	50241709-04	52355943-01	52355944-01

Section 1R20: Refueling and Other Outage Activities

Miscellaneous

Number	Title	Revision/Date
RAL-70123	MSIV Closing Forces	January 7, 2014
98-R-1022-01	Unit 1 AOV Program Valves	1
98-R-2016-01	Unit 2 AOV Program Valves	1

Condition Report (CR)

CR-ANO-2-2013-02502

Section 1R22: Surveillance Testing

Procedures

Number	Title	Revision
OP-1307.063	Unit 1 D06 and D07 Battery Surveillance	27
OP-5120.010	Unit 1 & Unit 2 MOV Testing	18
OP-1412.001	Preventative Maintenance of Limitorque SB/SMB Motor Operators	37
OP-1412.001	Preventative Maintenance of Limitorque SB/SMB Motor Operators	41
OP-1106.006	Emergency Feedwater Pump Operation	89
OP-1304.101	Unit 1 EFIC Channel D Calibration	26
SEP-ANO-2-IST-1	ANO Unit 2 IST Bases Document	2
SEP-ANO-1-IST-1	ANO Unit 1 IST Bases Document	2
SEP-ANO-2-IST-2	ANO Unit 2 Inservice Testing Plan	2
SEP-ANO-1-IST-2	ANO Unit 1 Inservice Testing Plan	3

Condition Reports (CRs)

CR-ANO-2-2013-01729	CR-ANO-1-2011-00350	CR-ANO-C-2008-02168
CR-ANO-C-2013-00331	CR-ANO-C-2013-00332	

Work Orders

52464043	86841-2	5239911-2	52447090

Section 1EP6: Drill Evaluation

Title	Date
Arkansas Nuclear One Full Scale Drill	March 19, 2014

Section 2RS2: Occupational ALARA Planning and Controls

Procedures

Number	Title	Revision
EN-RP-105	Radiological Work Permits	13
EN-RP-109	Hot Spot Program	3
EN-RP-110	ALARA Program	12
EN-RP-110-01	ALARA Initiative Deferrals	1
EN-RP-110-02	Elemental Cobalt Sampling	0
EN-RP-110-03	Collective Radiation Exposure (CRE) Reduction Guidelines	3
EN-RP-110-04	Radiation Protection Risk Assessment Process	4
EN-RP-110-05	ALARA Planning and Controls	2
EN-RP-110-06	Outage Dose Estimating and Tracking	1

Radiation Work Permit Packages

Number	Title	Date
2013-2304	Forced outage, Routine Maintenance Activities – Unit 2	February 13, 2013 – December 31, 2013
2013-1401	Radiation Protection Activities – 1R24	March 24, 2013 – August 7, 2013
2013-1405	Tours and Inspections in support of 1R24	March 1, 2013 – August 7, 2013

Radiation Work Permit Packages

Number	Title	Date
2013-1430	Refueling Path Activities to Include R/R RVCH, R/R Reactor Internals, Support Activities for Refueling path, Remove and Install RVCH O-Rings, Clean and Inspect RVCH Studs	March 24, 2013 – August 12, 2013
2013-1415	Change Out Spent Plant Process Filters – Unit 1	March 6, 2013 – August 7, 2013
2013-1427	P-32D Replace Mechanical Seal	March 24, 2013 – May 30, 2013
2013-1059	Refurbish or Replace the Unit 1 H-4 Fuel Transfer Mechanism Assembly to Include Support Activities	February 11, 2013 – March 24, 2013

Condition Reports (CRs)

CR-ANO-1-2010-01896	CR-ANO-1-2013-00342	CR-ANO-1-2013-00395
CR-ANO-1-2013-00493	CR-ANO-1-2013-00524	CR-ANO-1-2013-00780
CR-ANO-1-2013-01145	CR-ANO-1-2013-01227	CR-ANO-1-2013-01477
CR-ANO-1-2013-01506	CR-ANO-1-2013-01754	CR-ANO-1-2013-02071
CR-ANO-1-2013-02993		

Title	Revision
1R24 ALARA Report	
5-Year Exposure Reduction Plan	0

Section 4OA1: Performance Indicator Verification

Procedure

Number	Title	Revision
EN-LI-114	Performance Indicator Process	6

Condition Report (CR)

CR-ANO-C-2013-00888

Section 4OA2: Problem Identification and Resolution

Procedure

Number	Title	Revision
EN-LI-102	Corrective Action Process	23

Condition Reports (CRs)

CR-ANO-2-2013-02242	CR-ANO-C-2012-01480	CR-ANO-1-2013-02065

Section 4OA3: Follow-up of Events and Notices of Enforcement Discretion

Drawing

Number	Title	Revision
E-2134	Schematic Diagram Generator Protection and Lockout Relays	16

Miscellaneous

Number	Title	Date
TD P295.0050	Installation Instructions for Delta-Star Metal Enclosed Bus	March 7, 1973

Condition Report (CR)

CR-ANO-2-2013-02242

Unit 1 and Unit 2 Alternate AC Diesel Detailed Risk Assessment

The Region IV senior reactor analyst performed a detailed risk evaluation in accordance with Appendix A, Section 6.0, “Detailed Risk Evaluation.” The analyst utilized the Standardized Plant Analysis Risk (SPAR) model, Versions 8.19 and 8.21 (Units 1 and 2) to quantify the conditional risk of this finding. Additionally, a spreadsheet was used to calculate the change in core damage frequency for both units affected. The influential assumptions in the evaluation were:

- The capacitors in the electronic controls portion of the diesel were left in a condition such that they would have failed during any demand over the exposure period. This resulted in an exposure time of 102 days.

- The human reliability analysis for feed and bleed operations in both units was evaluated assuming more time available than credited in the SPAR model. This resulted in a lower failure rate and was based on an evaluation of the licensee’s procedures and time to core damage.

- The SPAR model results were adjusted to account for recovery of ac power in initiating events other than loss of offsite power. The additional risk from consequential loss of offsite power events was not significant.

- Realistic fire scenarios that result in a loss of offsite power, but do not result in the loss of the alternate ac diesel directly, were evaluated for change in risk resulting from the failure of the alternate ac diesel generator.

- Fire-induced loss of offsite power initiators were considered nonrecoverable unless Startup Transformer 2 remained available throughout the postulated scenario. In eleven scenarios evaluated for recovery, the licensee had procedures that would restore offsite power to the necessary busses.

<u>Internal Events</u>

The dominant sequences from the at-power SPAR model were characterized as follows:

- 64 percent of the risk for Unit 1 and 69 percent for Unit 2 were from the following station blackout sequences:

    - Failure to Maintain Subcooling, Failure to Recover ac power within 8 hours, Failure to Manually Control Emergency Feedwater, and Failure to Depressurize the Steam Generators

    - Failure of Emergency Feedwater, and Failure to Recover ac Power within 8 hours

- 20 percent of the risk for Unit 1 and 29 percent for Unit 2 were from other losses of offsite power:
    - Failure of all Emergency Feedwater and Failure of Once-Through-Cooling

The analyst developed a change set to account for those changes discussed under the influential assumptions. The quantification from the model provided the risk from internal initiators. The total internal change in core damage frequency calculated was 7.2 x 10-7 for Unit 1 and 4.5 x 10-7 for Unit 2.

Fire Initiators

The analyst determined that the subject performance deficiency would affect the core damage frequency related to internal fire initiators. The analyst noted that the dominant risk would result when the postulated fire scenario resulted in a loss of offsite power. The licensee provided the analyst with a listing of 445 postulated fire scenarios that would result in a fire-induced loss of offsite power. These scenarios represented postulated fires from eight fire areas.

The analyst identified and evaluated the fire risk for 11 of the dominant fire scenarios from Unit 1 Fire Areas B-1 and G. For each of these fire scenarios, the licensee provided information and applicable procedures to indicate that offsite power could be recovered, following the fire-induced loss of offsite power, using plant process equipment. For each of these scenarios, the analyst utilized a screening value of 0.1 for offsite power nonrecovery. This resulted in a total fire-induced change in core damage frequency of 1.3 x 10-7 for Unit 1 and 8.2 x 10-8 for Unit 2.

High Winds

The analyst determined that the subject performance deficiency would affect the core damage frequency related to tornado initiators. The analyst noted that the dominant risk would result when the postulated tornado resulted in a loss of offsite power. The analyst estimated the tornado occurrence rate to assess the risk impact of the subject performance deficiency using data from the Tornado History Project database. The calculational method developed a point-strike frequency. Therefore, depending on the scenario, qualitatively the change in core damage frequency would be higher. However, the alternate ac diesel generator is not qualified for tornado-force winds. In a rigorous evaluation, the conditional probability of striking the site, but not striking and damaging the alternate ac diesel generator would need to be calculated. Qualitatively, the analyst determined that using the point-strike frequency would slightly under estimate the risk, but would account for the conditional probability of failure. Therefore, the best estimate for the impact of the performance deficiency on tornado risk is 3.8 x 10-8 for Unit 1 and 1.7 x 10-8 for Unit 2.

Siesmic Events

The analyst determined that the subject performance deficiency would affect the core damage frequency related to seismic events. The analyst noted that the dominant risk would result when the seismic event was large enough to cause a loss of offsite power from failure of the switchyard insulators. The analyst calculated the likelihood of a seismically-induced loss of offsite power using the seismic hazard defined in NUREG-1488, “Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains.” The analyst then quantified the risk increase caused by the failure of the alternate ac diesel generator. The results of the seismic analysis are documented in Table 6. The change in core damage frequency from a seismic event was 1.0 x 10-8 for Unit 1 and 4.6 x 10-9 for Unit 2.

Total Estimated Change in Core Damage Frequency

The analyst summarized the results of this evaluation and the total estimated change in core damage frequency in Table 1.

Table 10

Total Estimated ΔCDF

		Licensee	NRC
Unit 1	Internal	1.69E-07	7.18E-07
	Seismic	N/A	1.00E-08
	Fire	N/A	1.28E-07
	High Winds	N/A	3.77E-08
	ΔCDF	1.69E-07	**8.93E-07**
Unit 2	Internal	4.57E-07	4.54E-07
	Seismic	N/A	4.57E-09
	Fire	N/A	8.19E-08
	High Winds	N/A	1.71E-08
	ΔCDF	4.57E-07	**5.58E-07**

Therefore, this finding has been determined to be of very low safety significance (Green).

The following items are requested for the
Occupational Radiation Safety Inspection
at Arkansas Nuclear One
March 17 – 20, 2014
Integrated Report 2014002

Inspection areas are listed in the attachments below.

PAPERWORK REDUCTION ACT STATEMENT
This letter does not contain new or amended information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing information collection requirements were approved by the Office of Management and Budget, control number 3150-0011.

The following items are requested for the Occupational Radiation Safety: ALARA & Access Control Inspection at ANO from March 17-20, 2014, Inspection Report Number 05000-313 & 368/2014-002.

Please provide the requested information to Louis C. Carson II and Casey Alldredge in the Region IV Arlington Office by **March 10, 2014**. *In an effort to keep the requested information organized please submit the information to us **using the same numbering/lettering system below.** Thank you for your support.*

Inspection areas are listed in the attachments below.

Please submit this information using the same lettering system as below. For example, all contacts and phone numbers for Inspection Procedure 71124.02 should be in a file/folder titled "1- A," applicable organization charts in file/folder "1- B," etc.

If information is placed on ***ims.certrec.com***, please ensure the inspection exit date entered is at least 30 days later than the onsite inspection dates, so the inspectors will have access to the information while writing the report.

In addition to the corrective action document lists provided for each inspection procedure listed below, please provide updated lists of corrective action documents at the entrance meeting. The dates for these lists should range from the end dates of the original lists to the day of the entrance meeting.

If more than one inspection procedure is to be conducted and the information requests appear to be redundant, there is no need to provide duplicate copies. Enter a note explaining in which file the information can be found.

If you have any questions or comments, please call me at 817-200-1221 or email: Louis.Carson@nrc.gov or Casey.Alldredge@nrc.gov ; 817-200-1547.

1. Occupational ALARA Planning and Controls (71124.02)

Date of Last Inspection: July 17, 2013

A. List of contacts and telephone numbers for ALARA program personnel

B. Applicable organization charts

C. Copies of audits, self-assessments, and LERs, written since date of last inspection, focusing on ALARA

D. Procedure index for ALARA Program

E. Please provide specific procedures related to the following areas noted below. Additional Specific Procedures may be requested by number after the inspector reviews the procedure indexes.
   1. ALARA Program
   2. ALARA Committee
   3. Radiation Work Permit Preparation

F. A summary list of corrective action documents (including corporate and subtiered systems) written since date of last inspection, July 17, 2013, related to the ALARA program. In addition to ALARA, the summary should also address Radiation Work Permit violations, Electronic Dosimeter Alarms, and RWP Dose Estimates

   NOTE: The lists should indicate the significance level of each issue and the search criteria used. Please provide in document formats which are "searchable" so that the inspector can perform word searches.

G. List of work activities greater than 1 rem, since date of last inspection

   Include original dose estimate and actual dose.

H. Site dose totals and 3-year rolling averages for the past 3 years (based on dose of record)

I. Outline of source term reduction strategy

J. A major focus of this inspection will be the results of the power upgrade outage, please provide the following:

   Annual ANO ALARA Report for 2013

   Last post Refueling-Outage Reports, since July 2013

   List of ALARA Package that Exceeded the Original Dose Projections

   Provide Written Justifications if Dose were Exceeded by 50 percent & 5 Person-Rem