

March 2, 2007

EA-07-058

Mr. David A. Christian
Senior Vice-President and
Chief Nuclear Officer
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: NRC INSPECTION REPORT 05000305/2007007; PRELIMINARY YELLOW
FINDING FOR KEWAUNEE POWER STATION

Dear Mr. Christian:

The enclosed inspection report discusses a finding that appears to have substantial safety significance (Yellow). As described in Section 4OA3 of this report, a fuel oil leak was identified on the "A" emergency diesel generator (EDG) on June 28, 2006, but not repaired until August 17, 2006. Your subsequent analysis determined that the "A" EDG was inoperable for this 51-day period. This finding was previously identified during an integrated inspection as an unresolved item, URI 05000305/2006004-02.

This finding was assessed based on the best available information, including influential assumptions, using the applicable Significance Determination Process (SDP) and was preliminarily determined to be a Yellow finding. As discussed in Section 4OA3 of this report, the failure of plant personnel to follow procedural requirements and enter the fuel leak issue into the corrective action program on June 28, 2006, when the leak was first identified, resulted in the leak not being appropriately evaluated and repaired until August 17, 2006. Testing performed on the leaking fuel oil system components indicated that they would have failed completely after 4 hours of diesel operation during an accident and would have rendered the "A" EDG inoperable. The final resolution of this finding will convey the increment in the importance to safety by assigning the corresponding color, i.e., White, a finding with low to moderate increased importance to safety that may require additional NRC inspection; Yellow, a finding with substantial importance to safety that will result in additional NRC inspections and potentially other NRC actions; or Red, a finding of high importance to safety that will result in increased NRC inspection and other NRC action.

As discussed in Section 4OA3 of the enclosed inspection report, the finding appears to have a substantial safety significance (Yellow) because the likelihood of core damage increased significantly due to a potential loss of emergency electrical power needed to ensure the plant could be safely shutdown and maintained shutdown for design and license-bases events. The finding did present an immediate safety concern in that had an accident occurred requiring the

operation of the "A" EDG, the diesel would have failed because of the fuel leak and equipment powered by the diesel would not have been available for mitigating the accident. As corrective action, you replaced the leaking components and modified the configuration of the fuel line, and emphasized to plant personnel the need to follow procedural requirements on entering issues into the corrective action program.

Associated with the finding is an apparent violation of NRC requirements that is being considered for escalated enforcement action in accordance with the Enforcement Policy, which can be found on the NRC's Web site at <http://www.nrc.gov/reading-rm/adams.html>. This apparent violation is for the failure of plant personnel on June 28, 2006, to follow the procedural requirements to enter the identified degraded condition on the "A" EDG (the fuel leak) into the corrective action program which would have directed them to complete an operability evaluation and likely would have resulted in the identification of the need to promptly repair the leak.

The circumstances surrounding this apparent violation, the significance of the finding, and the need for lasting and effective corrective action were discussed with Ms. Hartz and other members of your staff at the inspection exit meeting on February 28, 2007. As a result, it may not be necessary to conduct a regulatory conference in order for the NRC to make a final significance determination and an enforcement decision. However, before we make a final decision on this matter, we are providing you with an opportunity (1) to attend a Regulatory Conference where you can present to the NRC your perspective on the facts and assumptions the NRC used to arrive at the finding and assess its significance, or (2) submit your position on the finding to the NRC in writing. If you request a Regulatory Conference, it should be held within 30 days of the date of this letter and we encourage you to submit supporting documentation at least 1 week prior to the conference in an effort to make the conference more efficient and effective. If a Regulatory Conference is held, it will be open for public observation. If you decide to submit only a written response, such submittal should be sent to the NRC within 30 days of the date of this letter.

Please contact Mr. Patrick Loudon at (630) 829-9627 within 10 business days of the date of this letter to notify the NRC of your intentions. If we have not heard from you within 10 days, we will continue with our significance determination and enforcement decision and you will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with Inspection Manual Chapter (IMC) 0609, we intend to complete our evaluation using the best available information and issue our final determination of safety significance within 90 days of the date of this letter.

Since the NRC has not made a final determination in this matter, no Notice of Violation is being issued at this time. In addition, please be advised that the characterization of the apparent violation described in this letter may change as a result of further NRC review.

D. Christian

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In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of NRC's document system (ADAMS) and is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Mark A. Satorius, Director
Division of Reactor Projects

Docket No. 50-305
License No. DPR-43

Enclosure: Inspection Report No. 05000305/2007007
w/Attachment: Supplemental Information

cc w/encl: L. Hartz, Site Vice President
C. Funderburk, Director, Nuclear Licensing
and Operations Support
T. Breene, Manager, Nuclear Licensing
L. Cuoco, Esq., Senior Counsel
D. Zellner, Chairman, Town of Carlton
J. Kitsembel, Public Service Commission of Wisconsin
State Liaison Officer, State of Wisconsin

D. Christian

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State Liaison Officer, State of Wisconsin

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 50-305
License No: DPR-43

Report No: 05000305/2007007

Licensee: Dominion Energy Kewaunee, Inc.

Facility: Kewaunee Power Station

Location: Kewaunee, WI 54216

Dates: February 5 - 28, 2007

Inspectors: S. Burton, Senior Resident Inspector, Kewaunee
S. Burgess, Senior Reactor Analyst
R. Orlikowski, Senior Resident Inspector, Duane Arnold

Approved by: P. Loudon, Chief
Branch 5
Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000305/2007007; 02/05/2007 - 02/28/2007; Kewaunee Power Station. Followup of Events and Notices of Enforcement Discretion.

This report covers an announced inspection by senior resident inspectors and a senior reactor analyst to assess a fuel oil leak on the "A" emergency diesel generator that was identified in June 2006 and was not repaired until August 2006. One finding, and an associated apparent violation, was identified. The finding has preliminarily been determined to have substantial safety significance (Yellow). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green" or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

- To Be Determined. A finding that was preliminarily determined to be of substantial safety significance (Yellow), and an associated apparent violation of Technical Specification 6.8, "Procedures," was identified for a fuel oil leak on the "A" emergency diesel generator (EDG) that was identified on June 28, 2006, but was not repaired until 51 days later on August 17. In December 2006, the licensee tested the fitting and copper tubing that was the source of the leak to assess the leak's effect on the operability of the diesel. The licensee concluded that the leak rendered the diesel inoperable for those 51 days. As part of corrective action, the licensee replaced the leaking fuel oil line and reinforced with plant personnel the procedural requirements to properly evaluate equipment problems. The licensee also entered the issue into its corrective action program.

The finding was more than minor because if left uncorrected it would become a more significant safety concern during use of the "A" EDG to mitigate a loss of offsite power event. Specifically, the "A" EDG would have failed after approximately four hours due to the loss of fuel oil through the failed fuel line tubing, and the systems that respond to accidents and are powered by the "A" EDG would not be available. A Significance Determination Process Phase 3 risk analysis preliminarily determined that this finding was of substantial safety significance (Yellow). This finding has a cross-cutting aspect in the area of human performance because procedures were available, but not followed, that could have resulted in the leak being promptly repaired. (Section 40A3)

B. Licensee-Identified Violations

None.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA3 Followup of Events and Notices of Enforcement Discretion (71153)

(Closed) Unresolved Item (URI) 05000305/2006004-02: Potential Inoperability of the "A" Emergency Diesel Generator (EDG) Due to a Fuel Oil Leak, and

(Closed) Licensee Event Report (LER) 05000305/2006009-00: Emergency Diesel Generator (EDG) Fuel Leak

a. Inspection Scope

The inspectors reviewed personnel performance associated with a fuel oil leak on the "A" emergency diesel generator (EDG) and the licensee's subsequent evaluation of this leak. The leak resulted in the "A" EDG being declared inoperable on August 17, 2006. NRC review of the licensee's evaluation of the leak was being tracked as URI 05000305/2006004-02. Additional NRC review of the issue has been documented in Inspection Report (IR) 05000305/2006005. During the current inspection, the inspectors' review was focused on both the operability of the EDG and the contribution to fire as a result of the fuel oil leak. The inspectors reviewed records and interviewed plant personnel for the period from June 28, 2006, when the leak was first identified, to August 18, when the leak had been repaired and the EDG was declared operable. Additionally, the inspectors reviewed records, interviewed personnel, and observed testing done as part of the licensee's subsequent efforts to assess the effects of the leak on the operability of the "A" EDG. This testing was conducted at two offsite facilities. As part of this inspection, the documents listed in the Attachment were reviewed.

b. Findings

Introduction: The inspectors identified a finding that was preliminarily determined to be of substantial safety significance (Yellow), and an associated apparent violation, for a fuel oil leak on the "A" EDG that was not adequately evaluated and repaired for 51 days.

Description: On August 17, 2006, the monthly surveillance test (a 2-hour run) of the "A" EDG was being performed by control room operators. Following the start and loading of the diesel generator, a nuclear auxiliary operator identified a pencil-sized stream of fuel oil issuing from the connection of the copper fuel oil line tubing and a brass fitting, downstream of the engine-driven fuel oil pump. This leakage apparently was a substantial increase from leakage identified earlier, on June 28, 2006, and for which a work request had been written (WR 06-2321). Because of this increase, the Operations Shift Manager aborted the surveillance test and declared the EDG inoperable. The leaking fitting and associated tubing were subsequently replaced (and quarantined), the monthly surveillance test was successfully completed, and the EDG was declared operable on August 18.

In November 2006, the licensee performed a boroscope examination of the internal diameter of the fitting and associated tubing. This examination, which the inspectors observed, revealed a circumferential crack of approximately 330 degrees in the copper tubing just below the top of the brass fitting. Because of this, the licensee conducted additional testing. On December 14, 2006, the licensee had the tubing and fitting installed on a diesel generator at a facility in Horton, Kansas, to quantify leak rates at various diesel operating settings (this test was also observed by the inspectors). Shortly after testing began, the cracked tubing failed completely and separated from the fitting when the testing was stopped and test personnel adjusted the collection system that had been constructed to quantify the leakage. This collection system provided a physical restraint on the tubing that was not present on the tubing as installed on the Kewaunee "A" EDG.

Additional testing was subsequently conducted at a second facility to quantify leakage with two fuel oil pumps in operation (the test in Horton used only one). The licensee determined from this testing that the leak would have been approximately 5-7 gallons per minute had the tubing failed completely when installed on the "A" EDG. The licensee concluded that this loss of oil would have starved the injectors (both of lubrication and fuel) and caused failure of the EDG in a short period of time. Based on this, the licensee concluded that the "A" EDG was inoperable for the 51 days of the fuel leak.

As stated earlier, a work request had been written on June 28, 2006, when the leak was first identified. However, the issue was not entered into the corrective action program where an evaluation of the effect of the leak on operability of the EDG would have been required. This evaluation should have included an assessment of the existing and possible future leakage rates against the fuel oil and lubricating oil needs of the diesel under various accident conditions. The inspectors identified that Kewaunee general nuclear procedure GNP-08.02.01, "Work Order Processing and Planning/Work Execution and Close-out," Revision AD, stated in general note 2.3 that personnel were to "Complete an Action Request (AR) form for nonconforming conditions as required by GNP-11.08.01." GNP-11-08.01, "Action Request Process," Revision X, indicated in step 3.1.1 that an AR (i.e., a condition report) would be required for "unexpected plant equipment degradation, damage, failure, malfunction, or loss."

Analysis: The inspectors determined that the licensee's failure to complete an Action Request, as required by procedures, to evaluate the fuel oil leak on the "A" EDG on June 28, 2006, was a performance deficiency. This deficiency resulted in the "A" EDG being inoperable from June 28 to August 18, 2006. Additionally, the inspectors determined that this issue has a cross-cutting aspect in the area of human performance because procedures concerning the proper evaluation of the leak were available but were not followed by plant personnel.

Significance Determination Process Phase 1

Using IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Screening," dated November 2, 2006, the inspectors concluded that the issue was more than minor because if left uncorrected it would become a more significant safety concern if the "A" EDG were called upon to mitigate a loss of offsite power (LOOP) event. Specifically, the "A" EDG would fail after approximately 4 hours due to the loss of fuel oil through the failed fuel line tubing, and the systems that respond to initiating events and were powered by the diesel would not be available.

Using IMC 0609, "Significance Determination Process," Appendix A, "Determining the Significance of Reactor Inspection Findings for At-Power Situations," dated November 22, 2005, the inspectors determined that the finding affected the Mitigating System Cornerstone. Because the finding represents an actual loss of safety function of a single train for greater time than allowed by technical specifications (for the "A" EDG, the limit on inoperability is 7 days), a Phase 2 evaluation was required.

SDP Phase 2

In the Phase 2 SDP evaluation, the inspectors assumed that the "A" EDG was unavailable for greater than 30 days and was not recoverable. The result of the Phase 2 evaluation was a finding of high safety significance (Red). The dominant sequence involved a station blackout (SBO) condition sequence where a LOOP occurs, both EDGs fail, the turbine-driven auxiliary feedwater pump fails, and operators fail to recover offsite power within 2 hours. The RIII Senior Reactor Analyst (SRA) determined that the results of the Phase 2 evaluation were overly conservative because the Phase 2 worksheets for findings greater than 30 days were written to assume a duration of 1 year. A Phase 3 SDP evaluation was performed, which would better represent a duration of 51 days.

SDP Phase 3

Internal Events

For the Phase 3 SDP evaluation, the SRA used the NRC's simplified plant analysis risk (SPAR) model for Kewaunee, Revision 3.31, to estimate the risk associated with the finding. The "A" EDG was assumed to be failed from the date of the maintenance tag to the time the EDG was returned to service after repair of the leaking fuel line, which was approximately 51 days. Since the "A" EDG was run for approximately 4 hours during monthly surveillance tests during the 51 days, the SPAR model was adjusted to account for the additional 4 hours where the EDG was available for recovery of offsite power given a LOOP event. No credit was given to recovering the EDG once failed after 4 hours. The results of the internal events analysis was a Δ CDF (delta core damage frequency) of 9.6 E-6/year. The dominant sequence involved a LOOP, followed by the failure to recover any of the EDGs, followed by a failure to recover offsite power within 8 hours. To conservatively bound the analysis, the SRA assumed that the "A" EDG would fail within 1 hour if called upon within the 51-day period. This resulted in a Δ CDF of 2.1 E-5/year.

Large Early Release Fraction (LERF)

None of the key sequences that are affected by this event result in containment bypass. Per IMC 0609, Appendix H, "Containment Integrity Significance Determination Process," dated May 6, 2004, SBO sequences for large dry containments are screened as insignificant from a LERF perspective. Therefore, the internal Δ CDF is limiting.

External Events and Internal Flooding

Seismic

The SRA reviewed the licensee's IPEEE (Individual Plant Examination of External Events) and determined that the seismic hazard curve was very low at Kewaunee, resulting in a low seismic risk. The Δ CDF of a seismically-induced LOOP with a random failure of the "B" EDG for a 51-day period was in the $1 \text{ E-}8/\text{year}$ range. The seismic contributor is insignificant relative to the internal events result.

Internal Flooding

The SRA did not perform a separate flooding analysis. Given that Kewaunee has done an extensive update of its internal flooding probabilistic risk analysis (PRA), the SRA reviewed the licensee's top cutsets involving flooding (service water line breaks) to determine if the licensee's initiating event frequencies were similar to those used by the NRC in past studies. The initiating event frequencies used by the licensee were similar to ones recognized by the NRC through other studies. Although there were some differences between the flooding initiating event frequencies used by the licensee and the NRC, the differences would not result in this becoming a more significant finding (i.e., color) or exceed the licensee's White result for flooding contribution. The SRA determined that the licensee's flood evaluation was adequate with the Δ CDF contributor for flooding to be estimated at $2.0 \text{ E-}6/\text{year}$.

Fire

The Kewaunee IPEEE fire calculations assumed that, given a fire that causes a LOOP, the operators would immediately isolate offsite power, induce an SBO, then reload the EDGs. However, based on Kewaunee's current operating procedures, this is no longer the proceduralized course of action. Procedure E-FP-08, "Emergency Operating Procedure," is used until it is determined that control of equipment and critical parameter indication is lost. Given that, failure of the offsite power supply to the unaffected emergency bus would also have to occur before losing both trains of emergency power. Using the fire PRA based on the IPEEE, and comparing it to the in-progress update of their fire PRA, the licensee estimated that the change in operating strategy (not inducing an SBO) would result in a reduction of the fire risk by a factor of 5. After reviewing the licensee's justification, the SRA determined that this large reduction may not be reasonable given the licensee's optimistic HEPs (Human Error Probabilities) for recovering the only "good" remaining bus after the postulated fire. However, the SRA agreed that some reduction in fire risk was reasonable to assume, so the SRA reduced the NRC's estimate for the fire risk result by a factor of 2, which yielded a Δ CDF due to fire of $5.2 \text{ E-}5/\text{year}$.

SDP Conclusion

Considering internal and external factors, the total best estimated Δ CDF was 6.36 E-5/year, an issue having substantial safety significance (Yellow). The risk was dominated by the fire contribution.

Licensee's Risk Evaluation

The licensee also performed a risk evaluation of the finding. Since fire was the dominant contributor to this finding, the licensee performed a sensitivity analysis where they did not apply a fire multiplier and used the results from their IPEEE study, which was considered conservative. The licensee's overall Δ CDF of 8.4 E-5/year (Yellow) was similar to the SDP Phase 3 result given the differences in the risk models and analyses.

Conclusion

The finding is preliminarily considered to have substantial safety significance (Yellow) as determined by the results of the SDP Phase 3 and the licensee's risk evaluation. This result is considered bounding given several conservative assumptions in the analysis. The largest conservative assumption is the fire analysis, which assumes the licensee will induce a LOOP/SBO condition, which is no longer the proceduralized action.

Enforcement: Technical Specification 6.8, Subsection (a), states that written procedures and administrative policies shall be established, implemented, and maintained that meet the requirements and recommendations of Section 5.2.2, 5.2.5, 5.2.15, and 5.3 of American National Standards Institute (ANSI) N18.7-1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants." Section 5.2.2 of ANSI N18.7-1976 states that "Procedures shall be followed, and the requirements for use of procedures shall be prescribed in writing." Contrary to these requirements, on June 28, 2006, the licensee failed to initiate an AR as required by procedure GNP-08.02.01, "Work Order Processing and Planning/Work Execution and Close-out," and by GNP-11.08.01, "Action Request Process," when a fuel oil leak on the "A" EDG was identified. Pending final determination of the safety significance, this failure to follow procedures is considered an apparent violation of NRC requirements (AV 05000305/2007007-01).

Corrective actions to date included modifications of the fuel oil lines on both EDGs and reinforcement with plant personnel of the procedural requirements to properly evaluate equipment problems. The issue was entered into the licensee's corrective action program as CAP036104. As of the conclusion of the inspection, the licensee was conducting a root cause evaluation from which additional corrective actions may be taken.

4OA6 Meetings

Exit Meeting

The inspectors presented the inspection results to Ms. Hartz and other members of licensee management on February 28, 2007. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

L. Hartz, Site Vice-President
L. Armstrong, Site Engineering Director
T. Webb, Director, Licensing and Safety
M. Crist, Director, Operations and Maintenance
K. Davison, Director of Recovery
T. Breene, Nuclear Licensing Manager

Nuclear Regulatory Commission

P. Loudon, Chief, Division of Reactor Projects, Branch 5

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000305/2007007-01	AV	Failure to Evaluate Operability of the "A" EDG When a Fuel Oil Leak was Identified (Section 4OA3)
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Closed

05000305/2006004-02	URI	Potential Inoperability of the "A" EDG Due to a Fuel Oil Leak (Section 4OA3)
05000305/2006009-00	LER	Emergency Diesel Generator (EDG) Fuel Leak (Section 4OA3)

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspectors reviewed the documents in their entirety but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection reports.

Section 4OA3: Followup of Events and Notices of Enforcement Discretion

CAP036104; CAPS Not Initiated for Diesel Generator "A" Fuel Oil Leaks
CAP036307; Lessons Learned CAP for Quarantine of Parts
MPR-3012; Past Operability Evaluation for Kewaunee Emergency Diesel Generator fuel Oil Leakage; Revision 0
SP-33-110; Diesel Generator Automatic Test; Revision AQ
OPERM 213-9; Operation Flow Diagram - Diesel Generator Startup Air Compressor A and B
OPERM 220; Operation Flow Diagrams - Fuel Oil System; Revision AH
Management Expectations; Pre-Job Briefing Checklist for an IPTE
OPERM 220 Operation Flow Diagrams - Fuel Oil System; Revision AH
Management Expectations; Pre-Job Briefing Checklist for an IPTE
Memorandum from Richard J Liebermann, to Paul G. Detemple, Subject: Draft Text for DG Oil Leakage Operability; August 18, 2006
43A587; Stationary Power Operators Manual, Electro-Motive Diesel Generators

LIST OF ACRONYMS USED

AR	Action Request
AV	Apparent Violation
CAP	Corrective Action Program
Δ CDF	Delta Core Damage Frequency
CFR	Code of Federal Regulations
EDG	Emergency Diesel Generator
GNP	General Nuclear Procedure
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IPEEE	Individual Plant Examination of External Events
IR	Inspection Report
LCO	Limiting Condition for Operation
LER	Licensee Event Report
LOOP	Loss of Offsite Power
NRC	U.S. Nuclear Regulatory Commission
PRA	Probabilistic Risk Analysis
SBO	Station Blackout
SDP	Significance Determination Process
SPAR	Simplified Plant Analysis Risk
SRA	Senior Reactor Analyst
URI	Unresolved Item
USAR	Updated Safety Analysis Report
WO	Work Order