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Dominion®

JUN 15 2009

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

Serial No. 09-387
LIC/JG/RO
Docket No.: 50-305
License No.: DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
LICENSEE EVENT REPORT 2009-006-00

Pursuant to 10 CFR 50.73, Dominion Energy Kewaunee, Inc., hereby submits the following Licensee Event Report applicable to Kewaunee Power Station.

Report No. 50-305/2009-006-00

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

If you have any further questions, please contact Mr. Jack Gadzala at (920) 388-8604.

Very truly yours,

Michael [illegible] For

Stephen E. Scace
Site Vice President, Kewaunee Power Station

Attachment

Commitments made by this letter: NONE

IE22
NRR

cc: Regional Administrator, Region III
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NRC Senior Resident Inspector
Kewaunee Power Station

NRC FORM 366 U.S. NUCLEAR REGULATORYCOMMISSION
(9-2007)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE
Protection Instruments Not Calibrated to Individual Technical Specification Set Point Limits

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	16	2009	2009	- 006 -	00	06	15	2009	FACILITY NAME	

9. OPERATING MODE: **N**

10. POWER LEVEL: **100**

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (*Check all that apply*)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☒ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (*include Area Code*)
Kristin K Zastrow	**920-388-8574**

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

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

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

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

On April 16, 2009, during review of an instrumentation calibration procedure, Dominion Energy Kewaunee (DEK) staff identified that the procedure for calibrating low steam line pressure safety injection lead/lag circuitry units was not adequate to ensure that Technical Specification (TS) setpoint requirements were met. Calibration methodology used a vendor supplied calibration graph of a composite output from the lead and lag circuit module to determine acceptance criteria. However, Kewaunee Power Station (KPS) TS specified individual setting limits for the lead and lag time constants.

A review of this condition determined that, while the composite output met acceptance criteria per the calibration procedure, the individual lag time constants did not meet TS acceptance criteria. Consequently, all six channels of the Low Steam Pressure/Line Safety Injection signal were declared inoperable. TS required the plant to be placed in Hot Shutdown as soon as practicable for this condition, which was achieved at 2356 CDT. While the plant was shutdown, an extent of condition review identified that the lead/lag circuitry units on the Overtemperature ΔT instruments similarly did not meet TS acceptance criteria.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(A), as the completion of any nuclear plant shutdown required by the plant's TS. Additionally, this event also meets the reporting criteria of 10 CFR 50.73 (a)(2)(i)(B), any operation or condition which was prohibited by the plant's TS.

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NARRATIVE

Event Description:

At 1828 (CDT) on April 16, 2009, during review of an instrumentation [JE] calibration procedure, Dominion Energy Kewaunee (DEK) staff identified that the procedure for calibrating low steam line pressure [PI] safety injection lead/lag circuitry units [EM] was not adequate to ensure that Technical Specification (TS) setpoint requirements were met. Calibration methodology used a vendor supplied calibration graph of a composite output from the lead and lag circuit module (with time constants set to 12 second lead and 2 second lag times) to determine acceptance criteria. However, Kewaunee Power Station (KPS) TS Table 3.5-1, Item 4, specified individual setting limits for the lead and lag time constants for the low steam line pressure input to the engineered safety features (ESF) initiation instrument.

After the procedure deficiency was discovered, data from the most recent calibrations of the pressure channels was reviewed. While the lead/lag unit composite output met acceptance criteria per the calibration procedure, the individual lag time constants did not meet TS acceptance criteria. Consequently, all channels of the Low Steam Line Pressure Safety Injection signal were declared inoperable in accordance with Technical Specification Table TS 3.5-3, Item 1c.

TS 3.5, Instrumentation System, states:

a. Setting limits for instrumentation which initiate operation of the engineered safety features shall be as stated in Table TS 3.5-1.

b. For on-line testing or in the event of failure of a subsystem instrumentation channel, plant operation shall be permitted to continue at RATED POWER in accordance with Tables TS 3.5-2 through TS 3.5-5.

c. If for Tables TS 3.5-2 through TS 3.5-5, the number of channels of a particular subsystem in service falls below the limits given in Column 3, or if the values in Column 4 cannot be achieved, operation shall be limited according to the requirement shown in Column 6, as soon as practicable.

Table TS 3.5-1, Engineered Safety Features Initiation Instrument Setting Limits, states (in part):

NO.	FUNCTIONAL UNIT	CHANNEL	SETTING LIMIT
4	Low Steam Line Pressure	Safety injection[1]	≥ 500 psig
		Lead time constant	≥ 12 seconds
		Lag time constant	≤ 2 seconds

[1] Initiates containment isolation, feedwater line isolation, shield building ventilation, auxiliary building special vent, and starting of all containment fans. In addition, the signal overrides any bypass on the accumulator valves.

Table TS 3.5-2, Instrument Operation Conditions for Reactor Trip, states (in part):

		1	2	3	4	5	6
No.	Functional Unit	No. of Channels	No. of Channels to Trip	Minimum Operable Channels	Minimum Degree of Redundancy	Permissible Bypass Conditions	Operator Action If Conditions of Column 3 or 4 Cannot Be Met
5	Overtemperature ΔT	4	2	3	1		Maintain HOT SHUTDOWN

Table TS 3.5-3, Emergency Cooling, states (in part):

		1	2	3	4	5	6
No.	Functional Unit	No. of Channels	No. of Channels to Trip	Minimum Operable Channels	Minimum Degree of Redundancy	Permissible Bypass Conditions	Operator Action If Conditions of Column 3 or 4 Cannot Be Met
1	Safety Injection						
	c. Low Steam Pressure/ Line	3	2	2	-	Primary pressure < 2000 psig	HOT SHUTDOWN(1)
	d. Pressurizer Low Pressure	3	2	2	-	Primary pressure < 2000 psig	HOT SHUTDOWN(1)

(1) If minimum conditions are not met within 24 hours, steps shall be taken to place the plant in COLD SHUTDOWN condition.

Table TS 4.1-1, "Minimum Frequencies For Checks, Calibrations And Test Of Instrument Channels", requires a channel calibration of Steam generator pressure once per refueling cycle. The TS definition is: "CHANNEL CALIBRATION consists of the adjustment of channel output as necessary, such that it responds with acceptable range and accuracy to known values of the parameter that the channel monitors. Calibration shall encompass the entire channel, including alarm and/or trip, and shall be deemed to include the CHANNEL FUNCTIONAL TEST."

Table TS 3.5-1 (Engineered Safety Features Initiation Instrument Settings Limits), Item No. 4, Low Steam Line Pressure requires a lead time constant of ≥12 seconds and a lag time constant of ≤2 seconds.

The safety injection (SI) signal was calibrated per Procedure SP 06-34B-1/06-34B-2/06-34B-3/06-34B-4, Steam Generator Flow Mismatch and Steam Pressure Instrument Channel (1/2/3/4) Calibration. The methodology for calibration of the lead/lag circuitry units in SP 06-34B-1/06-34B-2/06-34B-3/06-34B-4 did not ensure that TS settings were met.

The lead/lag units were calibrated based upon an input step change and ramp change. A plot of the outputs from the lead/lag units were then compared to the calibration graphs that had been developed by Nuclear Services Corporation (NSC) which depicted minimal acceptable outputs to ensure fulfillment of the instruments' safety function. Provided that the lead/lag box outputs were on the conservative side of the graph, the lead/lag units would have been properly calibrated per the surveillance procedure.

DEK staff determined that the procedure for calibrating low steam line safety injection lead/lag units did not ensure that the individual lead and lag time constant setting limits in Table TS 3.5-1, Item #4 were met. Procedures utilized an ideal composite output from the lead and lag circuit module (rather than the individual TS setting limits for lead and lag times) as acceptance criteria. Although the measured composite output met acceptance criteria per the calibration procedure, the individual time constants did not meet the allowed TS limits. Consequently, all six low steam line pressure channels were declared inoperable per Table TS 3.5-3 at 1828 (CDT) on April 16, 2009.

With the steam pressure channels inoperable, TS 3.5.c required the plant to be placed in Hot Shutdown as soon as practicable. Negative reactivity insertion was commenced at 2004 (CDT) on April 16, 2009, and hot shutdown was achieved at 2356 CDT.

While the plant was shutdown, a prompt extent of condition evaluation was performed to identify whether other instruments were similarly affected. The Overtemperature ΔT instruments (TM-401B, TM-402B, TM-403B, and TM-404B) [TI] required by Table TS 3.5-2, Item 5, incorporate lead and lag signal conditioning circuits [EM]. The extent of condition evaluation identified that the time setpoints for these lead/lag units were also found to be outside the limits specified in Section 2.9, Overtemperature ΔT Setpoint, of Technical Requirements Manual (TRM) 2.1, Core Operating Limits Report (COLR), as required by TS 2.3.a.3.A. Because the reactor was already shutdown at the time of this discovery, no further action was required for this condition by TS.

A new methodology, which verifies the specific lead/lag time constants, was developed to calibrate the lead lag units in accordance with the individual TS time setting limits. Both the steam line pressure and Overtemperature ΔT instruments were successfully calibrated and their respective channels were returned to service. The reactor was returned to power operation on April 20, 2009.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(i)(A), as the completion of any nuclear plant shutdown required by the plant's TS. Additionally, this event also meets the reporting criteria of 10 CFR 50.73 (a)(2)(i)(B), any operation or condition which was prohibited by the plant's TS. This event was initially reported to the NRC via the Emergency Notification System (ENS) on April 16, 2009 (EN 44994).

This event was initially reported as a condition that resulted in the nuclear plant being in an unanalyzed condition that significantly degrades plant safety and as a condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident. However, subsequent evaluation determined that the instruments would have functioned as designed even though the methodology used for their calibration did not ensure compliance with the lead/lag setpoints required by TS.

Event and Safety Consequence Analysis:

Instrumentation for steam line pressure and overtemperature ΔT is provided to sense accident conditions and to initiate operation of the engineered safety features.

Low main steam line pressure in either loop automatically initiates safety injection, which provides protection against a steam line break accident. The steam line low-pressure signal is lead/lag compensated and its setpoint is set well above the pressure expected in the event of a large steam line break accident as shown in the safety analysis. In the event of a steam line break, the steam line isolation valve of the affected line is automatically isolated to prevent continuous, uncontrolled steam release from more than one steam generator. The steam lines are isolated on Hi-Hi containment pressure or high steam flow in coincidence with Lo-Lo T_{avg} and Safety Injection or Hi-Hi steam flow in coincidence with Safety Injection.

The overtemperature ΔT reactor trip provides core protection against departure from nucleate boiling (DNB). The area of permissible reactor operation (power, pressure, and temperature) is bounded by the following combination of reactor trips: high neutron flux (fixed setpoint), high pressurizer pressure (fixed setpoint), low pressurizer pressure (fixed setpoint), overpower ΔT (variable setpoint) and overtemperature ΔT (variable setpoint).

The instrument trip setpoints of the steam line pressure and overtemperature ΔT instruments themselves (i.e., pressure and temperature setpoints) were not affected by this condition and had been properly calibrated to TS requirements. Only the anticipatory trip associated with these instruments (controlled by the lead/lag time constants), which initiates a trip prior to the setpoint being reached, was affected. The purpose of lead/lag circuitry is to provide an anticipatory trip for the parameter being monitored, in advance of the setpoint actually being reached.

The previous methodology for calibrating the steam line pressure and overtemperature ΔT instrument lead/lag circuitry used a vendor supplied calibration graph of an ideal composite output from the lead and lag circuit module to determine lead/lag module performance. This calibration graph was based on time constants set to 12 second lead and 2 second lag for steam line pressure, and 30 second lead and 4 second lag for overtemperature. These base time constant values were in accordance with TS requirements. Since this methodology only required measuring a composite signal output, it unknowingly permitted the individual lead and lag circuitry time constants associated with these instruments to be set outside of the individual TS setting limits for these time constants. However, because the composite calibration curve was developed with appropriate base time constants (in accordance with TS limits), the anticipatory trip feature of the lead/lag circuit was provided as designed. Even though the individual time constants were outside the TS limits, the composite output signal of the lead/lag time constant module was set such that the anticipatory trip would have actuated as designed for ensuring protection against low steam pressure and overtemperature ΔT.

Additionally, conservatisms in the analysis provided further margin. The safety analysis conservatively models the trip functions by using conservative setpoints. For low steam line pressure, the safety analysis specifies the safety injection actuation setpoint at 480 psig, whereas the actual plant setpoint is conservatively set at 514 psig. For overtemperature ΔT the safety analysis specifies the setpoint gain at 1.30, whereas the actual plant setpoint is conservatively set at 1.1825. There is margin between the assumed safety analysis limit and the TS values after accounting for all uncertainties for the given protection functions. Therefore, there was minimal safety significance associated with this event.

Cause:

A root cause evaluation concluded that organizational and programmatic processes and interfaces were not established to adequately challenge vendor information that was used to maintain and ensure that safety related instrumentation incorporating lead/lag time constants were within the limits of KPS Technical

Specifications.

In 1973, Nuclear Services Corporation (NSC) provided KPS with information to summarize calculations and setpoints to incorporate into reactor protection and safeguards surveillance procedures. This information was referred to in the calibration procedure as "Kewaunee Lead/Lag Calc Book". The NSC information was relied on to calibrate the instruments and had been used since original plant operation until discovery of this condition in 2009. If the data obtained from performance of the surveillance procedure was on the conservative side of the curve, calibration was considered acceptable. The NSC information was not controlled through procedures or through the vendor manual process.

KPS staff relied on this vendor information for testing these units. This reliance was based on a belief that the information provided by NSC appropriately factored in the individual TS limits for lead and lag time, which it did not. Consequently, the resulting methodology did not ensure that the individual lead and lag time constants complied with TS.

An analysis was performed to review the KPS lead/lag calibration book curves to determine whether the curves within the book would ensure surveillance testing complied with Technical Specifications. The procedure step evaluated was Procedure SP-06-034B-1, Rev 11, "Steam Generator Flow Mismatch and Steam Pressure Instrument Channel 1(Red) Calibration"; Step 6.6.17, "Compare the plotter traces with the Kewaunee LEAD/LAG CALIBRATION book for PM-468A."

The analysis compared the instrument output (plotter traces) to the vendor normalized curves (KPS Lead/Lag Calibration Book). The process for determining whether the low steam line pressure instrumentation was properly calibrated involved comparing the instrument output to vendor calibration curves within the KPS Lead/Lag Calibration Book. These vendor supplied calibration curves, which were developed by NSC, were stated in the book as being based on instrument manuals and KPS Technical Specifications. The NSC calibration curves for the low steam line pressure instrumentation were set to a 12 sec lead and 2 sec lag time. The NSC manual stated that "The test curve must lie on or above this normalized curve." This was the only instruction provided in the book to evaluate the curves. KPS TS stated that the low steam line pressure instrumentation lead must be ≥12 sec and the lag must be ≤2 sec. However, the procedure did not contain any additional acceptance criteria and did not reference these TS values.

In analyzing this condition, DEK staff evaluated the curves to determine whether the TS requirements could be maintained for various instrument outputs. The determination was that an instrument output could meet the acceptance criteria of "on or above the curve", and not meet the TS requirement of a lag time ≤2 sec.

In summary, based on the NSC curves and the evaluation instruction provided in the KPS Lead/Lag Calibration Book, the low steam line pressure calibration process would not ensure that TS setting limits were met. An analysis of the plots showed occurrences of instrument output that met the calibration procedure acceptance criteria of "on or above the curve", but did not meet the TS requirement of lag time ≤2 sec. Failure to verify the vendor's assumptions since original plant operation resulted in using a calibration methodology that was not sufficient to assure compliance with TS instrument setting limits for low steam pressure and overtemperature ΔT.

Corrective Actions:

As short term corrective action, new methodology was developed for calibrating the steam pressure instrument lead/lag circuitry units that ensured compliance with TS setting limits (Calculation C11874,

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Revision 0, "Determination of Ramp Acceptance Curves for Steam Pressure Lead/Lag Dynamic Box Calibrations"). New acceptance criteria were generated by this methodology. The new acceptance criteria for low steam pressure instruments were incorporated into Procedures SP-06-34B-1, -2, -3, and -4. The procedures were successfully performed on April 17 and 18, 2009. Following completion of instrument calibration, the channels were returned to service.

New methodology was also developed for calibrating the overtemperature ΔT instrument lead/lag circuitry units that ensured compliance with TS setting limits (Calculation C11875, Revision 0, "Determination of Ramp Acceptance Curves for OT Delta T Dynamic Box Calibrations"). The new acceptance criteria for overtemperature ΔT instruments were incorporated into Procedures SP-47-011 A, B, C and D. Following completion of instrument calibration, the channels were returned to service.

Upon restoring the instrument channels to operable status, the reactor was started up and returned to full power operation.

A long term corrective action was initiated to establish an auditable program/process and interface that verifies methodologies for maintaining, testing, and calibration of safety related equipment required to meet TS (i.e., Surveillance Testing Program). This program is also intended to include verification that each Technical Specification has a corresponding Surveillance Procedure and to ensure that amendments to Technical Specifications are reviewed to incorporate relevant changes in the corresponding Surveillance Procedure.

Similar Events:

A review of Licensee Event Reports covering the past three years identified the following similar events.

LER 2006-006-00 SI Accumulator level to volume correlation and alarm setpoints non-conservative
LER 2006-010-00 Inadequate calibration of Radiation Monitor R-19