Dominion Energy Kewaunee, Inc.
N490 Highway 42, Kewaunee, WI 54216-9511

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No. 07-0058
KPS/LIC/RS: RO
Docket No. 50-305
License No. DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
LICENSEE EVENT REPORT 2007-002-00

Dear Sirs:

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

Report No. 50-305/2007-002-00

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

If you have any further questions, please contact Mr. Richard Sattler at (920) 388-8121.

Very truly yours,

for Leslie N. Hartz
Site Vice President, Kewaunee Power Station

Attachment

Commitments made by this letter: NONE

IE22

cc: Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
2443 Warrenville Road
Suite 210
Lisle, IL 60532-4352

Mr. R. F. Kuntz
Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop O-7D1A
Washington, D. C. 20555

NRC Senior Resident Inspector
Kewaunee Power Station

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0066), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

Issues with AMAG/Westinghouse Calculations for Full Power Result In Reduced Power Operation

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	03	2007	2007	002	00	02	19	2007	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	99.69

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

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

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Rich Sattler	(920) 388-8121

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

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

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

ABSTRACT

This is a voluntary LER, being reported per the guidelines of Step 5.1.4 of NUREG-1022.

Kewaunee Power Station has determined that a potentially larger uncertainty exists in the feedwater flow measurement system than that assumed during initial system analysis and calibration. The feedwater flow measurement system installed in 2003 improved the accuracy of feedwater flow measurement allowing the power calorimetric uncertainty to be reduced from 2.0% to 0.6%. System data was collected and analyzed to provide a better understanding of the actual system performance and to confirm system measurement uncertainty. Based on this data, the vendor (AMAG/Westinghouse) could not support the originally assumed calorimetric error. If a larger than analyzed system measurement uncertainty is determined to have existed, the Technical Specification rated thermal power level could have been exceeded. However, at the present time there is reasonable assurance that Kewaunee has not exceeded its rated thermal power limit.

Item 2.C.1 of the Facility Operating License (Maximum Power Level) states: The licensee is authorized to operate the facility at steady-state reactor core power levels not in excess of 1772 megawatts (thermal). Additionally, TS Definition 1.0.m states: RATED POWER is the steady-state reactor core output of 1772 MWt.

Short term corrective action was taken to conservatively limit calculated steady-state reactor power to no more than 99.69% (1766.5 MWt). This limit will remain in effect pending completion of the long term corrective action.

Long-term corrective action is to perform a full system recalibration during the next refueling outage.

EVENT DESCRIPTION

Definitions:

Bypass Loop ≡ A high-accuracy (0.25%), full flow feedwater (FW) bypass loop installed in 1992, containing an ASME PTC-6 flow section (normally isolated) that was used to provide a correction factor for the A & B feedwater flow venturi [FE] meters. This improved flow measurement accuracy, and was used prior to installation of CROSSFLOW.

AMAG ≡ Advanced Measurement & Analysis Group
Company that developed and installed the CROSSFLOW system as a subcontractor for Westinghouse (who provides engineering support).

CROSSFLOW ≡ Ultrasonic Flow Measurement system (UFM)
System built by AMAG that was installed at KPS in 2003 to generate real-time corrections to the feedwater flow venturi meters. The system uses ultrasonic transducers [TD] installed in the A and B FW lines.

History

The two original feedwater flow venturi meters at Kewaunee Power Station (KPS) have a history of fouling. This reduced their accuracy and led to expensive efforts to flush and clean them during plant outages.

In 1992 the feedwater bypass loop was installed to counter the effects of this fouling. This bypass loop is normally isolated, but can be placed in service to obtain an accurate measurement of total feedwater flow. This was used to provide a correction factor for feedwater flow venturi measurements.

In 2003, KPS installed the CROSSFLOW system to allow real-time continuous corrections for the installed A & B feedwater venturi meters. The system consists of UFM transducers on each FW flow loop, along with the necessary computer hardware and software.

At KPS, the loop B feedwater piping does not meet the requirements for a standard installation (the straight lengths of piping upstream and downstream have an insufficient length to diameter ratio). However, the loop A and bypass loop piping do qualify as standard installations. Therefore, to calibrate and set up the CROSSFLOW system, a temporary CROSSFLOW system was installed on the bypass loop, and the readings from this were compared with the permanent installation. The temporary CROSSFLOW system measurements were used as the basis for determining individual loop flows mathematically, as follows: Bypass loop total flow minus loop A flow equals loop B flow.

The readings from the temporary CROSSFLOW system were also compared against those from the ASME flow section. This comparison determined that the CROSSFLOW measurement was 0.4% more conservative than the ASME flow section measurement.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

The comparison of the CROSSFLOW and bypass loop readings was done in 2003 when Rated Thermal Power (RTP) was 1650 MWt. The installation of CROSSFLOW resulted in KPS raising RTP to 1673 MWt. In 2004, another power uprate increased RTP to 1772 MWt. CROSSFLOW FW flow measurement was again confirmed during implementation of the power uprate to be within the analyzed system uncertainty. Current restrictions do not allow power above 1749 MWt unless the CROSSFLOW system is in service.

On 8/27/2005, during a downpower to replace a heater drain pump, a power dependency was noticed on the correction factor for loop A. The loop A correction factor showed a change of approximately 0.75% from 100% power to 92% power. Using improved analytical software, this was determined to originate from flow noise (acoustic noise generated in the FW piping), and caused loop A flow to indicate greater than its actual flow when reducing power. When increasing power, the opposite is true; the correction factors applied will cause loop A flow to indicate less than its actual flow.

On 11/2/2005, KPS received a letter from AMAG documenting an analysis of the CROSSFLOW system performance and calibration, and stating that the method for setting the B correction factor dictated that any bias seen on loop A would be recovered as equal and opposite bias on loop B. Therefore the analysis concluded that total flow remained accurate to within the system's analyzed uncertainty, and the system remained fully operational.

On 8/25/2006, while planning for a future CROSSFLOW recalibration, (which would perform another comparison with the ASME flow section), it was determined that previous disassembly of the ASME flow section may have disturbed the relationship between the nozzle and diffuser, thereby invalidating its calibration.

A KPS refueling outage occurred between 9/2/2006 and 10/26/2006.

A 10/23/2006 letter from Westinghouse indicated the existence of additional system uncertainty due to the flow noise. This prompted KPS to limit calculated steady-state reactor power on the restart to 99.5% to envelope the additional uncertainty.

A 12/20/2006 engineering assessment from Westinghouse provided upper and lower bounds on the nominal system uncertainty. This assessment also provided reasonable assurance that the accuracy of the flow section was insignificantly compromised by the previous disassembly, and suggested the use of the 0.4% measured conservatism between CROSSFLOW and the ASME nozzle as a basis to return to 100% power. Instead of using the 0.4% measured conservatism, KPS requested that Westinghouse update the calculation to its originally analyzed uncertainty to allow power restoration to 100%. However, based on the new uncertainty bands, KPS did increase its calculated steady-state reactor power limit from 99.5% to 99.69%

On 1/3/2007 Westinghouse responded that, while the flow section readings are still considered accurate, they now require independent assurance that the flow profile in the bypass loop is fully developed or conservative. Therefore, a recalibration of the flow section, (to restore its ASME qualification), is required before updating the calculation or performing the new CROSSFLOW calibration.

Therefore, this voluntary LER is being written to indicate that a potentially larger uncertainty exists in the FW flow measurement system than that assumed during initial system analysis and calibration.

EVENT ANALYSIS

Preliminary vendor analysis of the correction factor power dependency has indicated the acoustic noise in the FW piping may have added up to a 0.31% non-conservative bias to the FW flow measurement. However, since the CROSSFLOW calibration to the ASME flow section demonstrated an overall conservative bias of 0.4% for the system, there is reasonable assurance that Kewaunee has not exceeded its RTP limit, (confirmed by both Westinghouse and AMAG). KPS has elected to take the conservative action of reducing the calculated steady-state reactor power limit to 99.69% of the RATED POWER limit, (to account for the possible non-conservative bias), pending a full system recalibration during the next refueling outage.

This is a voluntary LER, being reported per the guidelines of Step 5.1.4 of NUREG-1022.

SAFETY SIGNIFICANCE

Although the success criteria and human interaction timings in the PRA model assume 1772 MWt, margin is built into the model. The maximum 0.31% difference is well within the uncertainty inherent in the PRA model. Therefore, the current PRA model bounds the actual configuration.

The KPS safety analyses are performed using conservative input assumptions. It is expected that acceptable results would be obtained from an evaluation of the impact of this condition on plant operation (with the CROSSFLOW system) from the perspective of plant safety analyses. Conservative values for total peaking factor (F_Q) and enthalpy rise hot channel factor ($F_{\Delta H}$) have been employed in the safety analyses, and core performance results demonstrate adequate margin to limits between actual peaking factors and the values assumed in safety analyses. A conservative value for reactor coolant system (RCS) flow is also used in the safety analyses. RCS flow measurements performed each cycle have demonstrated adequate margin between actual RCS flow and the value assumed in the safety analyses. Therefore, margins built into the safety analyses are expected to be sufficient to cover the potential overpower condition.

The reload safety evaluation for cycle 28, (the current cycle), was performed assuming a design burnup window for the end of cycle 27. The actual end of cycle 27 burnup, including an additional 0.31% for the potential overpower condition, was well within this design burnup window. Therefore the cycle 28 reload safety evaluation remains valid. In addition, all cycle 28 startup physics test measurements were acceptable indicating that the core analysis predictive models are accurate and the predicted core physics characteristics for cycle 28 are valid. Cycle 28 core operation is expected to remain within established core operating limits.

Based on the above, there is no safety significance associated with this event.

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CAUSE

The FW flow noise appears to be inherent in the KPS feedwater and flow measurement system, but was unrecognized by the vendor during initial installation. It was first identified during a downpower that occurred in late summer 2005 and was subsequently confirmed using improved analytical software. The flow noise introduces additional uncertainty in the flow measurement. However, due to the overall conservative bias of the system, there is reasonable assurance that Kewaunee has not exceeded its RTP limit.

CORRECTIVE ACTIONS

Short term corrective action was to limit calculated steady-state reactor power to no more than 99.69% (1766.5 MWt). This limit will remain in effect pending completion of the long term corrective action.

Long-term corrective action is to perform a full system recalibration, using the calibrated ASME flow nozzle, during the next refueling outage.

PREVIOUS SIMILAR EVENTS

None