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10 CFR 50.73

June 14, 2001

LTR: BYRON 2001-0087  
File: 3.03.0800

United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

Byron Station, Units 1 and 2  
Facility Operating License Nos. NPF-37 and NPF-66  
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Licensee Event Report (LER) 454-2001-001-00

Enclosed is an LER involving the licensed reactor power limit for each Unit being slightly exceeded due to improperly calculated feedwater mass flowrate utilized in reactor power calorimetric. This is considered an operating license condition violation and consequently reportable to the NRC in accordance with Section 2 of each Unit's operating license. The root cause investigation for this event is still in progress. A supplement to this LER will be submitted by June 29, 2001.

If you need any additional information concerning this report, please contact P. Reister, Regulatory Assurance Manager, at (815) 234-5441, extension 2280.

Sincerely,



Richard P. Lopriore  
Site Vice President  
Byron Nuclear Generating Station

RPL/JL/rf/dpk

Enclosures: LER 454-2001-001-00

cc: Regional Administrator – NRC Region III  
NRC Senior Resident Inspector – Byron Station  
NRC Project Manager – NRR – Byron Station  
Office of Nuclear Facility Safety – Illinois Dept. of Nuclear Safety

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**LICENSEE EVENT REPORT (LER)**

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the information and Records Management Branch (t-6 f33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office Of Management And Budget, Washington, DC 20503. If 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.

FACILITY NAME (1) Byron, Unit 1

DOCKET NUMBER (2) 05000454

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TITLE (4) Reactor Power Limit Exceeded Due to Improperly Calculated Feedwater Mass Flowrate Utilized in Reactor Power Calorimetric

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)					
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER				
05	15	2001		2001- 001	-00	06	14	01	Byron, Unit 2	STN 05000455				
									FACILITY NAME	DOCKET NUMBER				
OPERATING MODE (9)		MODE 1		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)										
POWER LEVEL (10)		98												
			<input type="checkbox"/>	20.2201(b)		<input type="checkbox"/>	20.2203(a)(3)(i)		<input type="checkbox"/>	50.73(a)(2)(iii)		<input type="checkbox"/>	73.71(b)	
			<input type="checkbox"/>	20.2203(a)(1)		<input type="checkbox"/>	20.2203(a)(3)(ii)		<input type="checkbox"/>	50.73(a)(2)(iv)		<input type="checkbox"/>	73.71(c)	
			<input type="checkbox"/>	20.2203(a)(2)(i)		<input type="checkbox"/>	20.2203(a)(4)		<input type="checkbox"/>	50.73(a)(2)(v)		<input checked="" type="checkbox"/>	OTHER	
			<input type="checkbox"/>	20.2203(a)(2)(ii)		<input type="checkbox"/>	50.36(c)(1)		<input type="checkbox"/>	50.73(a)(2)(vii)		(Specify in Abstract below or in NRC Form 366A)		
			<input type="checkbox"/>	20.2203(a)(2)(iii)		<input type="checkbox"/>	50.36(c)(2)		<input type="checkbox"/>	50.73(a)(2)(viii)(A)				
			<input type="checkbox"/>	20.2203(a)(2)(iv)		<input type="checkbox"/>	50.73(a)(2)(i)		<input type="checkbox"/>	50.73(a)(2)(viii)(B)				
			<input type="checkbox"/>	20.2203(a)(2)(v)		<input type="checkbox"/>	50.73(a)(2)(ii)		<input type="checkbox"/>	50.73(a)(2)(x)				

LICENSEE CONTACT FOR THIS LER (12)

NAME  
Penny Reister, Regulatory Assurance Manager

TELEPHONE NUMBER (Include Area Code)  
(815) 234-5441 X2280

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

X YES  
(If yes, complete EXPECTED SUBMISSION DATE)

NO

EXPECTED SUBMISSION DATE (15)

MONTH DAY YEAR  
06 29 2001

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

During the review of data used to calculate the feedwater (FW) flow calibration constants, two errors were discovered. Specifically, errors were found in the FW density correction and the thermal expansion factor. These errors resulted in a non-conservative calculation of reactor power by 0.12%. Further review determined the errors have been present since May 2000 and the errors were applicable to both Byron Station units. This event was determined to be reportable as violation of an operating license condition based on the average power level over an eight hour shift exceeding the full steady state licensed power level. An evaluation of the calorimetric instrument uncertainty calculation determined the density correction and thermal expansion coefficient errors did not result in exceeding the 2% Rated Thermal Power (RTP) uncertainty allowance in the safety analysis. Therefore, the assumptions in the safety analysis have remained bounded. The root cause investigation is still in progress. A supplemental report will be issued when the root cause investigation is completed. Immediately following discovery of the errors, an administrative reactor power limit was established on Unit 1 and a validation of the entire Byron Station process used to calculate the feedwater flow calibration coefficients was performed.

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the information and Records Management Branch (t-6 f33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office Of Management And Budget, Washington, DC 20503. If 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.

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

**A. Plant Conditions Prior to Event:**

Event Date/Time: May 15, 2001 / 0700 hours

Unit 1 - Mode 1 - Power Operations, Reactor Power - 98%  
Unit 2 - Mode 1 - Power operations, Reactor Power - 95%

Reactor Coolant System [AB] for both Units: Normal operating temperature and pressure

No structures, systems or components were inoperable at the start of the event that contributed to the event.

**B. Description of Event:**

On May 12, 2000, for Unit 2 and May 16, 2000, for Unit 1, Byron Station implemented an ultrasonic flow measurement system (UFMS) to more accurately determine main feedwater (FW) [SJ] mass flowrate. The UFMS directly measures the time the FW travels a known distance in the pipe and then, utilizing a computer program, calculates a reference FW mass flowrate by using manually inputted parameters such as the pipe inside area and a reference FW density. This more precise measurement of FW mass flowrate is then used to calculate FW correction factors (i.e., calibration constants) which are applied to the FW mass flowrate measurements from the installed venturi flow measurement system. This corrected FW mass flowrate is then used as an input into the process computer [ID] generated reactor power calorimetric calculation.

The FW calibration constants are determined in accordance with Byron Station Engineering Procedure, BVP 800-44, "Feedwater Venturi Calibration Unit 1 and 2." Following the UFMS FW measurement collection period, the calculated UFMS reference data is then inputted into a separate computer spreadsheet tool. This tool performs the final data reduction and determines an actual mass flowrate by correcting for actual FW conditions at the time of the measurement. An external FW density correction is part of this data reduction effort. This density correction is the ratio of the actual density of the FW during the data collection period, based on fluid temperature and pressure as recorded by plant instrumentation, and the reference density which UFMS uses in its computer program to calculate the reference mass flowrate.

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**B. Description of Event, cont.:**

On May 10, 2000, two days prior to the start of UFMS implementation at Byron Station, the UFMS vendor implemented a change to the UFMS computer program. Instead of manually determining the reference fluid density from the steam tables and inputting it into the UFMS, the reference FW temperature and pressure are entered as input parameters and the UFMS calculates the FW reference density. This change also modified the UFMS output data format to include the calculated reference density. The Byron Station engineer involved in the UFMS implementation was trained on this change by the UFMS vendor.

As a result of this change, the Byron Station engineer recognized that in addition to the UFMS input changes, the computer spreadsheet tool would need to be adjusted to accept the new output of UFMS. He decided the new UFMS output data files could be made to conform to the current spreadsheet tool by simply moving data columns.

The changes were made and the UFMS implementation occurred as scheduled. The procedure yielded FW calibration constants of 1.69% for Unit 1 and 1.68% for Unit 2. BVP 800-44 was performed several times since this initial implementation in May 2000. The results of these tests were FW calibration constants ranging from 1.35% to 1.8%.

On May 10, 2001, UFMS testing was performed on Byron Station Unit 1 as part of the reactor power uprate implementation. The FW calibration constant calculated (i.e., 2.31%) was larger than expected. Due to the larger than previously calculated constant, the data was sent to corporate engineering and the vendor for review. On May 14, 2001, the vendor noticed a potential discrepancy in the external density correction and contacted the Byron Station engineer. On May 15, 2001, the Byron Station engineer determined the discrepancy with the external density correction was due to an error with the reference density used in the data reduction computer spreadsheet.

An evaluation revealed that when the UFMS changes were performed on May 10, 2000, the reference temperature and pressure inputs into the UFMS were incorrectly verified by the engineer to yield the same reference density previously entered. Consequently, the reference density entered as a constant in the data reduction spreadsheet tool now differed from the reference density calculated by the UFMS. This resulted in the external density correction to be in error.

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**B. Description of Event, cont.:**

The reference FW temperature and pressure inputs were 438.5°F and 1000 psia, respectively. This correlated to a UFMS calculated density of 52.23 lb/cu ft. To obtain the same reference density as the data reduction computer spreadsheet (i.e., 52.3 lb/cu ft), a FW temperature of 437.5°F should have been used. This one-degree difference in FW temperature resulted in incorrect FW calibration constants and a 0.12% non-conservative calculation of reactor power.

Although Unit 1 was at 98.2% reactor power at the time of discovery, this error was present since the original Byron Station implementation of the UFMS in May 2000. Though not specifically verified, there appear to have been numerous instances when both Units operated above 99.88% reactor power for an 8 hour period. This exceeded NRC guidance for determining the operating license maximum power level and consequently is reportable to the NRC in accordance with license requirement 2.F for Unit 1 and license condition 2.G for Unit 2.

Following discovery of this error, a complete validation of the entire FW venturi calibration process was performed. This validation discovered one additional error in an input parameter used in the UFMS. An instantaneous thermal expansion factor should have been used instead of an average thermal expansion factor. This error was minor and had an insignificant effect on the FW calibration constant calculation. This error had also been in place since the UFMS implementation in May 2000.

**C. Cause of Event:**

The root cause investigation was not complete as of the report date. This report will be supplemented upon completion of the root cause. The expected submittal date is June 29, 2001.

**D. Safety Analysis:**

The safety analyses contained in the Update Final Safety Analysis Report for Byron Station contains an allowance of two percent rated thermal power to account for calorimetric program uncertainty. This allowance is provided to bound the periods of time when actual reactor power is greater than indicated calorimetric power. An evaluation of the calorimetric instrument uncertainty calculation determined that the error induced by the density and thermal expansion factor errors did not result in exceeding the 2% RTP allowance contained in the safety analysis. Therefore, the assumptions assumed in the safety analysis remained bounded. The overall risk significance of the 0.12% error is minimal.

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**E. Corrective Actions:**

An immediate administrative reactor power limit was established on Unit 1 to preclude operation above 100% with the current error in the feedwater flow calibration coefficients. There was no administrative reactor power limit required for Unit 2 because, as a result of the power uprate plan, the current feedwater calibration factors were conservatively reset to 1.00. Following the validation and correction of the errors, feedwater flow calibration coefficient testing was performed on both Byron Station units and the administrative reactor power limit on Unit 1 was removed.

The root cause investigation was not complete as of the report date. This report will be supplemented upon completion of the root cause. The expected submittal date is June 29, 2001.

**F. Previous Occurrence:**

LER 455-98-001-00, Exceed License Power Level Due to Calorimetric Instrument Discrepancy, dated February 27, 1998.

Corrective actions in this LER would not have been expected to prevent the occurrence of this current event.