

Exelon Generation Company, LLC  
Byron Station  
4450 North German Church Road  
Byron, IL 61010-9794

www.exeloncorp.com

**September 29, 2003**

**LTR: BYRON 2003-0092**  
**File: 2.01.0700**

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

**Subject: Licensee Event Report (LER) 454-2003-003-00, "Licensed Maximum Power Level Exceeded Due to Inaccuracies in Feedwater Ultrasonic Flow Measurements Caused by Signal Noise Contamination"**

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

Enclosed is an LER involving an overpower condition on Byron Station Unit 1 and Unit 2 as a result of inaccuracies discovered in the measurement of feedwater flow using an ultrasonic flow measurement system. This event is reportable in accordance with Byron Station Unit 1 License Condition 2.F and Byron Station Unit 2 License condition 2.G due the violation of license condition 2.C(1) of each license, "Maximum Power Level."

Should you have any questions concerning this matter, please contact Mr. William Grundmann, Regulatory Assurance Manager, at (815) 234-5441, extension 2800.

Respectfully,



Stephen E. Kuczynski  
Site Vice President  
Byron Nuclear Generating Station

**Attachment LER 454-2003-003-00**

**cc: Regional Administrator, Region III, NRC**  
**NRC Senior Resident Inspector- Byron Station**

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Estimated burden per response to comply with this mandatory information 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 Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB 0202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose 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)

1 FACILITY NAME Byron Station, Unit 1						2 DOCKET NUMBER 05000454						3 PAGE 1 OF 5																	
4. TITLE Licensed Maximum Power Level Exceeded Due to Inaccuracies in Feedwater Ultrasonic Flow Measurements Caused by Signal Noise Contamination																													
5. EVENT DATE						6. LER NUMBER						7. REPORT DATE						8. OTHER FACILITIES INVOLVED											
MO		DAY		YEAR		YEAR		SEQUENTIAL NUMBER		REV NO		MO		DAY		YEAR		FACILITY NAME Byron, Unit 2				DOCKET NUMBER 0500455							
08		28		2003		2003		003		00		09		29		2003		FACILITY NAME				DOCKET NUMBER							
9. OPERATING MODE 1						11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check all that apply)																							
10. POWER LEVEL 100						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)																	
12. LICENSEE CONTACT FOR THIS LER																													
NAME William Grundmann, Regulatory Assurance Manager												TELEPHONE NUMBER (Include Area Code) (815) 406-2800																	
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT																													
CAUSE		SYSTEM		COMPONENT		MANUFACTURER		REPORTABLE TO EPIX		CAUSE		SYSTEM		COMPONENT		MANUFACTURER		REPORTABLE TO EPIX											
14. SUPPLEMENTAL REPORT EXPECTED												15. EXPECTED SUBMISSION DATE		MONTH		DAY		YEAR											
YES (If yes, complete EXPECTED SUBMISSION DATE)										X NO																			

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

Byron Station Unit 1 and Unit 2 exceeded their licensed maximum power level by 1.64% and 0.42%, respectively. In May of 2000 an Ultrasonic Flow Measurement System (UFMS) was installed on the feedwater lines to the steam generators in order to more accurately measure feedwater flow. This measured feedwater flow is then used in the reactor power calorimetric calculation. Feedwater flow pressure pulses occurred at frequencies which affected the UFMS signal and resulted in a bias in the determinations of the flow correction factors. This resulted in a non-conservatively low calorimetric calculation. When reactor power was adjusted to match the calorimetric power, an overpower condition was created. When this condition was discovered the UFMS was removed from service. If this UFMS technology is to be utilized in the future, then corrective actions will include installation of the UFMS in portions of the feedwater piping that are less susceptible to noise that could affect the UFMS signal, or installing noise filters on the UFMS installed on the four feedwater lines. In addition, the appropriate procedures will be revised to check for this noise when utilizing the UFMS to determine flow correction factors. An analysis performed indicated there was no adverse safety impact for the overpower condition on each unit. In accordance with Byron Station Unit 1 License Condition 2.F and Byron Station Unit 2 License condition 2.G, a notification was made to the NRC at 1355 CST on August 28, 2003, due to the violation of license condition 2.C(1) of each license, "Maximum Power Level."

<b>NRC FORM 366A</b> (7-2001)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		<b>APPROVED BY OMB NO. 31500104</b> <b>EXPIRES 07/31/2004</b>	
<b>LICENSEE EVENT REPORT (LER)</b> 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.	
<b>FACILITY NAME (1)</b>		<b>DOCKET NUMBER (2)</b>		<b>LER NUMBER (6)</b>	
Byron Station, Unit 1		STN 05000454		<b>YEAR</b>	<b>SEQUENTIAL NUMBER</b>
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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: August 28, 2003 / 1743 hours

Unit 1 - Mode 1 – Power Operations, Reactor Power 100%

Unit 2 - Mode 1 – Power Operations, Reactor Power 100%

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.

**Background**

An Ultrasonic Flow Measurement System (UFMS) is installed on each of the four feedwater [SJ] loops and is utilized as a calibration tool to correct feedwater venturi flow measurements through use of a correction factor (CF). The UFMS uses ultrasonic technology coupled with cross-correlation statistical techniques to measure feedwater flow by determining the displacement of time it takes for flow turbulences to travel a known distance in the feedwater piping. The UFMS vendor for Byron Station is Advanced Measurement and Analysis Group, Inc.

**B. Description of Event:**

Byron Station Units 1 and 2 installed the UFMS in May 1999. During testing, measurements of the CFs indicated an unexpected difference between the Braidwood Station Unit 1 and Byron Station Unit 1 feedwater venturi flowrates and venturi CFs. This resulted in different megawatt electric recoveries between the two Units with Byron Station Unit 1 generating more megawatts electric (approximately 15 mw) than Braidwood Station Unit 1.

An evaluation was conducted to determine and understand the difference between Byron Station Unit 1 and Braidwood Station Unit 1 and was inconclusive. However, the evaluation did verify the UFMS was installed correctly and it was operating within design criteria established for the UFMS. Consequently, a decision was made to implement feedwater venturi correction factors using the UFMS at Byron in May 2000.

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Over the next several months, additional internal and external evaluations were conducted in an attempt to understand the discrepancy between the two units. The results of these investigations concluded that the UFMS was operating in accordance with the criteria required by the UFMS vendor.

A broader test plan was developed in early 2003 to continue the investigation. In May 2003, a flow comparison test with the common feedwater header flow to the sum of the four branch lines was conducted on Braidwood Station Unit 1. The results of this test were within the expected criteria. In August 2003, this test was re-performed at Byron Station Unit 1. The difference between the sum of the UFMS measurements in the four feedwater loops and the common header was outside the acceptance criteria (1.572% compared to a maximum allowable statistical limit of 0.70%). With this test outside of its acceptance criteria, Byron Station reduced power and returned the CFs to 1.0 on both units, pending resolution of the issue.

Upon investigation by site and vendor personnel, it was determined that signal noise affected the flow velocity calculations, which in turn affected the determination of the CFs. With the noise contaminated CFs inputted into the calorimetric calculation, a non-conservative or lower power measurement resulted. When reactor power was adjusted to match the calorimetric calculation, an overpower condition was created. An overpower condition potentially existed since initial implementation in May 2000.

The CFs utilized from the UFMS installed on the four individual feedwater lines indicate a historical worst case reactor power correction of 2.62% for Unit 1 and 1.88% for Unit 2. The UFMS installed on the common feedwater header, which is believed to be accurate since there is no noise contamination in this location, indicate a reactor power correction of 0.98% for Unit 1 and 1.46% for Unit 2. Consequently, the difference between the two power corrections is considered to be the percentage of overpower. Therefore, the worst case power condition for Unit 1 was 101.64% reactor power and for Unit 2 was 100.42% reactor power.

In accordance with Byron Station Unit 1 License Condition 2.F and Byron Station Unit 2 License condition 2.G notification was made to the NRC at 1355 CST on August 28, 2003, due to the violation of License Condition 2.C(1) of each license, "Maximum Power Level."

### C. Cause of Event:

The root cause of this event was noise contamination of the UFMS ultrasonic signal. Feedwater flow pressure pulses occurred at frequencies which affected the UFMS signal and resulted in a bias in the determinations of the flow correction factors. This noise caused the UFMS to indicate a lower than actual feedwater flowrate which resulted in a non-conservative calorimetric result.

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Contributing causes are a lack of questioning attitude during the implementation and subsequent evaluations and the failure to use the diagnostic tool which could identify the noise.

**D. Safety Analysis:**

The safety significance of the overpower issue for Byron Station Units 1 and 2 has been evaluated by Westinghouse and Exelon Nuclear Fuels. The evaluation considered a conservatively bounding overpower value of 102.62% plus a 2% of the Byron uprated power limit (i.e., 3586.6 Mwt) calorimetric uncertainty. Byron station implemented a 5% power uprate in May 2001. The impact of the overpower condition was evaluated for pre and post power operations. The following areas were reviewed:

Design Transients  
 Operating Margin to Reactor Trip  
 Neutron Fluence Projections, Reactor Vessel Integrity, and Low Temperature Overpressure Protection  
 Loss of Coolant Containment (LOCA) Integrity  
 Steamline Break Containment Integrity  
 All Updated Final Safety Analysis Chapter 15 accidents  
 Fuel Evaluation

The acceptance criteria were met for all the evaluated events.

**E. Corrective Actions:**

Byron Station Units 1 and 2 reduced reactor power to ensure the licensed thermal power limit was not being exceeded. Additionally, the CFs for the feedwater flow venturis were reset to 1.0.

The UFMS will remain out of service pending completion of an independent technical review. If the UFMS technology is utilized, then the installation of the UFMS on the common feedwater header or the installation of noise filters on the UFMS installed on the four feedwater lines will be implemented.

Also, appropriate Station procedures that are used to obtain UFMS CFs will be revised to include a step to check the UFMS for signal noise and if noise exists that contaminates the signal then the UFMS will not be used to establish new CFs.

A communication protocol will be established amongst the Exelon engineering organizations and the UFMS vendor to improve the working relationship through effective sharing of relevant information.

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Revisions to the UFMS diagnostic tool will be pursued to ensure station personnel can use it to diagnose noise.

An evaluation will be conducted to determine if additional training is needed for Exelon personnel involved in the UFMS.

**F. Previous Occurrences:**

There were no previous occurrences of a violation of licensed maximum power level due to the AMAG system ultrasonic noise. Byron reported an overpower of 0.12% on Unit 1 and 2 due to personnel error while using the AMAG system (LER 2001-001-01 dated June 14, 2001.)

**G. Component Failure Data:**

N/A