Commonwealth Edison
Byron Nuclear Station
4450 North German Church Road
Byron, Illinois 61010

June 28, 1994

LTR: BYRON 94-0238
FILE: 3.03.0800 (1.10.0101)

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The Enclosed Supplemental Licensee Event Report from Byron Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(v).

This report is number 92-004; Docket No. 50-454.

Sincerely,

G.K. Schwartz for
Station Manager
Byron Nuclear Power Station

GKS/DSK/ng

Enclosure: Licensee Event Report No. 92-004 Supplement

cc: J. Martin, NRC Region III Administrator
NRC Senior Resident Inspector
INPO Record Center
CECo Distribution List

(4347z/VS/100593)

IE22
1/1

SIGNATURE PAGE FOR LICENSE EVENT REPORT

LER Number
454: 92-004

Title of Event: Operability Determination of Source Range Nuclear Instrumentation

Occurred: 07-01-92 / 1505
Date Time

OSR DISCIPLINES REQUIRED: ABCG

KSE / 6/21/94
SES DATE

Acceptance by Station Review:

G Franklin / 6-22-94
OE Date

Kevin Elam ACG / 6/21/94
SES Date

RAS / 6/21/94
RAS Date

_____ / _____
OTHER Date

Approved by: _____ / 6/28/94
Station Manager Date

(9941R\WPF\061694-1)

LICENSEE EVENT REPORT (LER)

FACILITY NAME	DOCKET NUMBER	PAGE
BYRON NUCLEAR POWER STATION	0 5 0 0 0 4 5 4	1 OF 0 7

TITLE

OPERABILITY DETERMINATION OF SOURCE RANGE NUCLEAR INSTRUMENTATION

EVENT DATE			LER NUMBER			REPORT DATE			OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQ. NUMBER	REVISION	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 7	0 1	9 2	9 2	- 0 0 4	- 0 1	0 8	2 9	9 4	Byron, Unit 2	0 5 0 0 0 4 5 5
										0 5 0 0 0

OPERATING MODE		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (CHECK ONE OR MORE OF THE FOLLOWING)							
	1		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
POWER LEVEL	1 0 0		20.405(a)(1)(i)		50.36(c)(1)	X	50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER
K. ELAM, LEAD NUCLEAR ENGINEER, EXT. 2247	8 1 5 2 3 4 - 5 4 4 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B				N							

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

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

At 1505 on 07/01/92, Byron Station received an operability assessment, ENC-QE-40.1, regarding the Boron Dilution Protection System (BDPS) (NR) [IG]. The operability assessment was precipatated by the discovery of two non-conservative assumptions in the safety analysis for the system. On-Site Review 92-089 was immediately convened that concurred with the determination that BDPS is to be considered operable under a certain set of conditions. However, when the plant is outside of these conditions, the BDPS subsystem may not be capable of performing its intended safety function. Special Operating Order SO-U1/U2-19 was revised to implement the findings and recommendations of the operability assessment by detailing the conditions necessary for BDPS operability. This Special Operating Order remained in effect until further safety analysis was performed that provided permanent resolution of this issue.

This event is reportable pursuant to 10CFR50.73(a)(2)(v), any event or condition that alone could have prevented the fulfillment of the safety function to structures or systems that are needed to mitigate the consequences of an accident.

A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 07/01/92 / 1505

Unit 1 MODE 1 - Operations Rx Power 100% RCS [AB] Temperature/Pressure 580°F/2235 psig

Unit 2 MODE 1 - Operations Rx Power 100% RCS [AB] Temperature/Pressure 579°F/2238 psig

B. DESCRIPTION OF EVENT:

At 1505 on 07/01/92, Byron Station received an operability assessment, ENC-QE-40.1, regarding the Boron Dilution Protection System (BDPS) (NR) [IG]. On-Site Review 92-089 was immediately convened that concurred with the determination that BDPS is to be considered operable under a certain set of conditions. However, when the plant is outside of these conditions, the BDPS subsystem may not be capable of performing its intended safety function. Special Operating Order SO-U1/U2-19 was revised to implement the findings and recommendations of the operability assessment by detailing the conditions necessary for BDPS operability. This Special Operating Order remained in effect until further safety analysis was performed that provided permanent resolution of this issue.

On March 4, 1992, Westinghouse issued a Potential Issue (PI) on the operability of the Boron Dilution Protection System. This PI was issued because two potential non-conservatisms were identified in the original Safety Analysis for this system:

1. The assumed Inverse Countrate Ratio (ICRR) curve in the analysis was found to be non-conservative at another Westinghouse plant.

2. The setpoint for the flux doubling did not include an uncertainty analysis.

At the time the PI was received from Westinghouse, insufficient information was available to determine operability of the system. Pursuant to the PI issued by Westinghouse, Byron Station, in concert with Nuclear Fuel Services (NFS), Nuclear Licensing (NLA), and Braidwood Station agreed on the conservative compensatory actions included in OSR 92-032. These actions mitigated the probability and consequences of a dilution accident by maintaining a high shutdown margin and administratively controlling the valves capable of contributing to an inadvertent dilution. These actions were:

Whenever either unit was in Modes 3, 4, or 5:

1. The required shutdown margin was increased to a minimum of 1.65% (from 1.0%) when in Mode 5.

B. DESCRIPTION OF EVENT: (continued)

2. Normal shutdown operating practice was to maintain charging flow less than 130 gpm. If charging flow was to be maintained at greater than 130 gpm, the shutdown margin was increased to:

   Mode 4: 1.45%
   Mode 5: 1.84%

3. Manual valve _BR7004 to the primary water system was locked closed.

4. Administrative controls were implemented that required the possible dilution paths be isolated (valves _CV8428, _CV8435, _CV8441, _CV8439 locked closed and verified closed and air or electrical power removed from _CV111B) before draining the pressurizer level below the bottom of the indicated range while in Mode 5.

5. Administrative controls were implemented that required the Boron Thermal Regeneration System (BTRS) be isolated prior to draining the pressurizer level below the bottom of the indicated range while in Mode 5, and that the demineralizer water supply valve for the demineralizer flush be locked closed. Also that demineralizer flush operations performed while in Mode 5 only be performed under strict administrative procedure, such that additional valves be closed and written verification and independent check be obtained that the valves to the primary water system or demineralized water supply were reshut and locked after flushing operations. (_BR7052, _BR7053, _BR7054, _CV8542)

6. Flushing the emergency boration line with primary water was strictly controlled and only when the charging rate was monitored and controlled to less than 130 gpm.

7. The outlet valves from the Boric Acid Storage Tanks were verified open after any maintenance activities. (_AB8461)

Since that time, Nuclear Fuel Services (NFS) and Engineering and Nuclear Construction (ENC) have pursued evaluating the operability of the system, and concluded that the generic concerns for the BDPS system are applicable to Byron:

1. The assumed ICRR curve does not bound the Byron and Braidwood sites. It was found that the curve from Braidwood Unit 1 Cycle 3 has been the most bounding thus far, and that it will likely remain bounding.

2. A sensitivity analysis had not been performed for the Byron and Braidwood sites. Although it has not been possible to provide a quantitative uncertainty for the circuitry at this time, a best estimate of the uncertainty for the doubling setpoint is 30%, thus making the analysis setpoint 2.6.

TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

B. DESCRIPTION OF EVENT: (continued)

Through the performance of specialized safety analysis cases, Nuclear Fuel Services (NFS) concluded that BDPS remains OPERABLE in certain conditions. However, the analysis failed to demonstrate operability for all conditions. If all of these conditions are not met, the system is to be considered INOPERABLE. The conditions are:

1. The Shutdown Margin must be at least 1300 pcm in Modes 3, 4, and 5.

2. All Loop Stop Isolation Valves must be open.

3. At least 1 Reactor Coolant Pump must be operating.

4. The Source Range Nuclear Instrumentation Count Rate must be at least 10 counts per second.

With the preceding conditions not being met, both trains of BDPS shall be declared inoperable and the appropriate Technical Specification actions taken.

This issue is reportable under Title 10, Code of Federal Regulations, Part 50, Section 73, (a)(2)(v), any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

C. CAUSE OF EVENT:

The cause for this event was inadequate safety analysis and subsequent review for the Boron Dilution Protection System.

At the time of the original analysis, Westinghouse used the most limiting ICRR available from the industry in the input assumptions to the postulated accidents. However, development of new low leakage loading patterns and neutron source positions have rendered that ICRR non-bounding.

It is not known exactly why an instrument uncertainty analysis was not included in the design of the BDPS setpoint. However, it is believed that the fact that BDPS was not a part of the original design of the plant and that BDPS does not have its own Limiting Condition for Operability in the Byron/Braidwood Technical Specifications contributed to this oversight.

D. SAFETY ANALYSIS:

It has been concluded that BDPS may be incapable of performing its intended safety function in the event of a boron dilution accident under certain plant conditions. However, the safety analysis performed merely failed to demonstrate acceptable performance for all conditions using the present analysis method. After implementing possible improvements to the method of analysis, a wider spectrum of conditions may be acceptable for BDPS operability.

Had certain plant conditions existed where the BDPS system was inoperable and a dilution accident was initiated, two other sources for indication of the decrease in shutdown margin were available to alert the operator. During shutdown conditions, the Source Range indication is broadcast audibly in the control room and containment. Also, the High Flux at shutdown annunciator, which is intended to notify personnel of an inadvertent criticality during fuel load and is set to actuate at an instantaneous indication of 5 times the background countrate, is available in Modes 3 through 6.

Furthermore, the consequences of an unmitigated dilution accident do not pose a substantial safety hazard. Analysis performed by Los Alamos National Laboratory (LANL) for the NRC has concluded that an unmitigated dilution of a PWR in a shutdown Mode would result in a return to power and may result in an increase in reactor coolant system pressure and some fuel damage. LANL further concluded that the return to power transient would be self limiting by virtue of the inherent negative feedback of the reactor. The self limiting return to power would also limit fuel damage and repressurization.

E. CORRECTIVE ACTIONS:

Upon the notification of this concern to Byron, the compensatory actions documented und OSR 92-032 were promptly implemented.

Upon the receipt of the Operability Assessment from NFS specifying the conditions necessary for BDPS operability, Byron Station immediately implemented the following actions:

1. The Special Operating Order (SO Unit 1/Unit 2 92-019) was revised to implement the four conditions for operability.

2. The station's Nuclear Regulatory Commission Resident Inspector was notified of this condition.

3. The station made the required Emergency Notification System phone call within the required 4 hours.

E. CORRECTIVE ACTIONS: (continued)

Future actions were necessary to resolve this issue for the long-term. A synopsis of these actions included the following:

1. The 30% uncertainty of the doubling setpoint was confirmed by ENC. Westinghouse performed an analysis that supported the 30% conclusion and the NRC accepted that value when approving the new BDPS Tech Spec. (NTS # 454-200-92-03200-01)

2. Byron Station determined the maximum primary flow rate through flow orifice _CV17M by measurement. The highest measured flow rate was 92 gpm on Unit 1. The analysis assumed 150 gpm, therefore, future analysis may benefit from using a lower flow rate. (NTS # 454-200-92-03200-02)

3. NFS investigated the possibility of demonstrating a wider array of operable conditions for BDPS. A partnership was formed with Comanche Peak, Wolf Creek, Callaway, Braidwood and Byron, with Comanche Peak being the lead plant in any licensing changes. Comanche Peak was successful in licensing the Volume Control Tank high level alarm to render the Boron Dilution Protection System moot in analysis space. Since Byron and Braidwood had already obtained approval on the new BDPS Tech Spec, Byron will follow Comanche Peak's lead should that avenue pay economic dividends. (NTS # 454-200-92-03200-03)

4. Amendment 51 to the Byron and Braidwood Technical Specifications was approved by the NRC that includes a new LCO for BDPS. Tech Spec 3/4.1.2.7 reflects the conditions for operability and includes appropriate action statements and surveillance requirements. (NTS # 454-200-92-03200-04)

F. RECURRING EVENTS SEARCH AND ANALYSIS:

a) EVENT SEARCH (DIR, LER)

There have been no previous occurrences of a DVR caused by improper analysis of the BDPS system, although non-conservatisms in the analysis of this system have occurred in the past.

b) INDUSTRY SEARCH (OPEX's NPRDS)

NPRDS is not applicable for this event, however, this event was initiated by a discovery at Comanche Peak. The other stations directly affected by the BDPS analysis are Braidwood, Callaway, and Wolf Creek.

OPEX: Plant Status Report (PS)#2607.

TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

F. RECURRING EVENTS SEARCH AND ANALYSIS: (continued)

c) NWR

Not applicable.

d) ANALYSIS

No trend identified.

G. COMPONENT FAILURE DATA:

MANUFACTURER	NOMENCLATURE	MODEL NUMBER	MFG PART NUMBER

No equipment failed during this event.

H. OTHER RELATED DOCUMENTS:

ENC-QE-40.1, Operability Determination Checklist
OSR 92-032, Precautionary Measures Taken for BDPS Potential Issue
OSR 92-089, Review of ENC-QE-40.1 for BDPS Operability

I. EFFECTIVENESS REVIEW:

Not applicable.

J. ADDITIONAL DATA:

a) Affected Technical Specification: 3/4.3.1.1, Functional Unit 6

b) Procedures: Not applicable

c) Cause Code: BD2.6

d) Equipment Involved: Boron Dilution Protection System of the Source Range Instrumentation

e) Other: BDPS, Source Range, Westinghouse Analysis