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Nebraska Public Power District

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NLS8800450
September 15, 1988

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

Gentlemen:

Subject: Response to NRC Bulletin No. 88-07: Power Oscillations in Boiling Water Reactors (BWRs)

On June 15, 1988, the NRC issued Bulletin 88-07 to address concerns which arose from the March 9, 1988, LaSalle Unit 2 event. On that date, LaSalle Unit 2 underwent a dual recirculation pump trip, and subsequently experienced an excessive neutron flux oscillation while in natural circulation.

NRC Bulletin 88-07 requested licensees of operating reactors to: 1) brief licensed reactor operators and shift technical advisors (STAs) on the event, 2) review their training programs and procedures to assure that reactor operators and STAs can recognize the onset of, or conditions which could lead to the onset of uncontrolled power oscillations, 3) assure that reactor operators and STAs are cognizant of actions to be taken to avoid and respond to these events, and 4) verify the adequacy of the instrumentation which is relied upon by operators within their procedures. The District's response to these concerns is provided in the Attachment.

If you have any questions regarding this response, or require any additional information, please contact me.

Sincerely,

L. G. Kuncl
Nuclear Power Group Manager

LGK/mjb:dmr7/2(Y1)

cc: Regional Administrator
USNRC - Region IV

NRC Resident Inspector
Cooper Nuclear Station

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STATE OF NEBRASKA)
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PLATTE COUNTY)

L. G. Kuncl, being first duly sworn, deposes and says that he is an authorized representative of the Nebraska Public Power District, a public corporation and political subdivision of the State of Nebraska; that he is duly authorized to submit this response on behalf of Nebraska Public Power District; and that the statements contained herein are true to the best of his knowledge and belief.

L. G. Kuncl

Subscribed in my presence and sworn to before me this 15th day of September, 1988.

Colleen M. Kuta
NOTARY PUBLIC

GENERAL NOTARY-State of Nebraska
COLLEEN M. KUTA
My Comm. Exp. Aug. 4, 1989

RESPONSE TO NRC BULLETIN NO. 88-07

"POWER OSCILLATIONS IN BOILING WATER REACTORS (BWRs)"

The District's response to NRC Bulletin No. 88-07 corresponds with the format of the "Requested Actions" identified in that bulletin. For simplicity, resolution of the "Requested Actions" with respect to operator training programs is addressed separately following the response to Requested Action 2.d. The response concludes with a discussion of the adequacy of the instrumentation used at CNS to recognize and respond to power oscillations.

Item 1: Within 15 days of receipt of this bulletin, all BWR licensees should ensure that any licensed reactor operator or Shift Technical Advisor performing shift duties has been thoroughly briefed regarding the March 9, 1988, LaSalle Unit 2 event.

Response: NRC Bulletin No. 88-07 was received by the District on June 17, 1988. By July 1, 1988, all licensed reactor operators and Shift Technical Advisors performing shift duties had been thoroughly briefed regarding the March 9, 1988, LaSalle Unit 2 event with the exception of several licensed reactor operators who were on vacation during this time. Those licensed reactor operators who were on vacation were thoroughly briefed on the LaSalle Unit 2 event immediately upon their return to duty such that by July 8, 1988, the District was in full compliance with NRC Bulletin 88-07, Item 1.

Item 2.a: Within 60 days of receipt of this bulletin all BWR licensees should verify the adequacy of their procedures and operator training programs to ensure that all licensed operators and Shift Technical Advisors are cognizant of those plant conditions which may result in the initiation of uncontrolled power oscillations.

Response: General Operating Procedure (GOP) 2.1.10, "Station Power Changes," clearly identifies the region of power and flow which is restricted due to the potential for uncontrolled power oscillations. A copy of the Power to Flow Map, which highlights this "Instability Region" is maintained in a prominent location in the control room at all times.

The station procedures which may result in initiation of uncontrolled power oscillations contain additional "limitations" and/or "precautions" concerning the possibility for uncontrolled power oscillations (GOP 2.1.1, "Cold Startup Procedure"; GOP 2.1.2, "Hot Startup Procedure"; GOP 2.1.4, "Normal Shutdown From Power"; System Operating Procedure (SOP) 2.2.68.1, "Reactor Recirculation System Operations"; Abnormal Condition Procedure (ACP) 2.4.2.2.1, "Trip of Reactor Recirculation Pumps"; ACP 2.4.2.2.2, "Reactor Recirculation Flow Control System Failure"; and Nuclear Performance Procedure (NPP) 10.13, "Control Rod Sequence and Movement Control").

Additionally, the restrictions incorporated into Technical Specifications Sections 3/4.3.F (Amendment 94) for reactor recirculation operation below 45% core flow further ensures the Licensed Operators and Shift Technical Advisors are aware of this potential.

Item 2.b: Within 60 days of receipt of this bulletin all BWR licensees should verify the adequacy of their procedures and operator training programs to ensure that all licensed operators and Shift Technical Advisors are cognizant of actions which can be taken to avoid plant conditions which may result in the initiation of uncontrolled power oscillations.

Response: Station procedures which implement and direct power changes include specific actions, where necessary, to avoid the "Instability Region" (GOP 2.1.1, "Cold Startup Procedure"; GOP 2.1.2, "Hot Startup Procedure"; GOP 2.1.4, "Normal Shutdown From Power"; GOP 2.1.10, "Station Power Changes"; SOP 2.2.68.1, "Reactor Recirculation System Operations"; and NPP 10.13, "Control Rod Sequence and Movement Control"). These procedures direct that power should not exceed the 80% rod line when core flow is less than 45%, or conversely, core flow should not be reduced below 45% unless power is less than or equal to the 80% rod line.

Operator sign-offs are incorporated into the startup and shutdown procedures to ensure appropriate attention is given to avoidance of the "Instability Region."

Item 2.c: Within 60 days of receipt of this bulletin all BWR licensees should verify the adequacy of their procedures and operator training programs to ensure that all licensed operators and Shift Technical Advisors are cognizant of how to recognize the onset of uncontrolled power oscillations.

Response: Station procedures require the monitoring of neutron flux indications for normal response during all power changes. The LPRM upscale alarms are also monitored; any that alarm are checked for the possibility of local neutron flux oscillations.

MIS Computer Program "NOISE" has been developed and incorporated into station procedures to monitor the peak-to-peak oscillations of the APRMs and a representative number of the LPRMs. A comparison with baseline data recorded in accordance with Technical Specifications Section 3/4.3.F provides a method for recognizing abnormal flux oscillations (reference GOP 2.1.10, "Station Power Changes").

By September 30, 1988, station procedures will be revised to include a precaution to perform an emergency shutdown if abnormal flux oscillations exceed 10% peak-to-peak (GOP 2.1.4, "Normal Shutdown From Power"; GOP 2.1.10, "Station Power Changes"; SOP 2.2.68.1, "Reactor Recirculation System Operations"; ACP 2.4.2.2.1, Trip of Reactor Recirculation Pumps"; and ACP 2.4.2.2.2, "Reactor Recirculation Flow Control System Failure"). This will clearly define "Uncontrolled Power Oscillations."

Item 2.d: Within 60 days of receipt of this bulletin all BWR licensees should verify the adequacy of their procedures and operator training programs to ensure that all licensed operators and Shift Technical Advisors are cognizant of actions which can be taken in response to uncontrolled power oscillations, including the need to scram the reactor if oscillations are not promptly terminated.

Response: Station procedures clearly identify the necessity of inserting control rods and/or increasing core flow to suppress any abnormal neutron flux oscillations (GOP 2.1.10, "Station Power Changes"; SOP 2.2.68.1, "Reactor Recirculation System Operations"; ACP 2.4.2.2.1, "Trip of Reactor Recirculation Pumps"; and ACP 2.4.2.2.2, "Reactor Recirculation Flow Control System Failure").

As indicated in the response to Item 2.c, the District will revise station procedures by September 30, 1988, to include a precaution to perform an emergency shutdown if abnormal flux oscillations exceed 10% peak-to-peak (GOP 2.1.4, "Normal Shutdown From Power"; GOP 2.1.10, "Station Power Changes"; SOP 2.2.68.1, "Reactor Recirculation System Operations"; ACP 2.4.2.2.1, "Trip of Reactor Recirculation Pumps"; and ACP 2.4.2.2.2, "Reactor Recirculation Flow Control System Failure").

Additionally, all Licensed Operators are well aware of their authority to SCRAM the reactor in the event of any abnormal conditions which might jeopardize station safety, as noted in Conduct of Operations Procedure 2.0.1, "Operations Department Policy."

Training Program Review

The Nuclear Training Department at Cooper Nuclear Station has taken the following actions to address power oscillations in Boiling Water Reactors:

- The event was presented as a lesson to the Licensed Operator Requalification Class subsequent to the issuance of General Electric Service Information Letter (SIL) 380, Revision 1 on February 10, 1984, and Amendment No. 94 to the CNS Technical Specifications, both of which addressed BWR thermal-hydraulic instability in the high power/low flow region of the power/flow map.
- The below text is quoted from the Reactor Recirculation System student text used by the Licensed Operators and Shift Technical Advisors for both initial and requalification training. This text was modified to include the power oscillation type event in the abnormal operations section.

"A. Abnormal Operations

1. Operation in the Instability Region

"The instability region of the power to flow map is the area above the 80% rod line and less than 45% core flow. At this high power, low flow condition core flow can become unstable leading to oscillations in reactor power, both locally and core wide. Several BWRs have experienced abnormal neutron flux level oscillations (APRMs and LPRMs) while operating in this region of the map.

"With two recirc pumps running, operation in the instability region is allowed but not recommended. While in this region, LPRM and APRM signals must be monitored for abnormal oscillations. If oscillations occur, they can be suppressed by inserting control rods and/or increasing recirc flow."

- The recent LaSalle event was presented to the Licensed Operator and STA Requalification Classes during Training Cycle 89-03 which concluded July 15, 1988.

Instrumentation Adequacy

NRC Bulletin 88-07 also requested addresses to "verify the adequacy of the instrumentation which is relied upon by operators within their procedures."

Response: There are 124 incore detectors which are radially and axially spaced throughout the core to provide local power indications. The individual local power indications can be monitored at the 9-14 Panel (control room back panel). Those surrounding a particular control rod can be selected at the 9-5 Panel (control room front panel). There are also six Average Power Range Monitor channels, each of the channels monitoring average core power by using 14 to 1 of the uniformly spaced incore detectors. The Average Power Range Monitor Channels can be monitored by chart recorder at the 9-5 Panel or by meter indication at the 9-14 Panel.

There are also several computer programs available to the operators which can be used to determine core stability:

- OD-8, Local Power Range Monitor (LPRM) console display, displays the console reading of each of the incore detectors in a core format.

- P1, Periodical NSSS Core Performance Log, provides 10 minute filtered calibrated Local Power Range Monitor readings every 8 hours in core format. P1 may also be demanded by the operators when needed.

- NOISE, provides a peak-to-peak reading of preselected incore detectors and Average Power Range Monitors.

- PLOTREAL, provides a real time plot of up to three process points.

Present instrumentation at CNS is considered satisfactory in determining the magnitude of any power oscillations and core instability based on the following reasons:

- A large number of incore detectors provide indication of local power by real time display or by a hard copy print out.

- There are no circuit delays other than the normal circuit time constant, which provides an instrumentation response time for the LPRM amplifier of 60 milliseconds or less, plus a 1.5 ± 0.5 millisecond trip circuit. The Average Power Range Monitor averaging amplifier has a 5 millisecond response time and the respective recorders on the 9-5 Panel are set to a pen response time of 1 second.

- The incore detector readings can be quickly analyzed to determine core stability using the NOISE program, the OD-8 program, or selecting control rods at the 9-5 Panel.