PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

P.O. BOX 8699

PHILADELPHIA, PA 19101

(215) 841-5001

JOSEPH W. GALLAGHER
VICE PRESIDENT
NUCLEAR SERVICES

September 15, 1988

Docket Nos. 50-277
50-278
50-352

Mr. C. E. Rossi, Director
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: NRC Bulletin No. 88-07, dated June 15, 1988, "Power Oscillations in Boiling Water Reactor," Peach Bottom Atomic Power Station Units 2 & 3 and Limerick Generating Station Unit 1

Dear Mr. Rossi:

Philadelphia Electric Company's response to Bulletin 88-07, "Power Oscillations in Boiling Water Reactors" is provided in the Attachment. This response is for Peach Bottom Atomic Power Station, Units 2 and 3, and Limerick Generating Station Unit 1.

If you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,

JW Gallagher

Attachment

cc: Addressee
W. T. Russell, Administrator, Region I, USNRC
T. P. Johnson, USNRC Senior Resident Inspector
T. E. Magette, State of Maryland
T. J. Kenny, Limerick NRC Senior Resident Inspector
J. Urban, Delmarva Power
J. T. Boettger, Public Service Electric & Gas
H. C. Schwemm, Atlantic Electric

IE11
1/1

COMMONWEALTH OF PENNSYLVANIA :

: ss.

COUNTY OF PHILADELPHIA :

J. W. Gallagher, being first duly sworn, deposes and says:

That he is Vice President of Philadelphia Electric Company, the Licensee herein; that he has read the foregoing response to NRC Bulletin 88-07 relative to Peach Bottom Atomic Power Station Units 2 and 3, and Limerick Generating Station Unit 1, and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

J W Gallagher

Vice President

Subscribed and sworn to
before me this 15TH day
of September, 1988.

Judith Y. Franklin

Notary Public

JUDITH Y. FRANKLIN
Notary Public, Phila., Phila. Co.
My Commission Expires July 28, 1991

BULLETIN 88-07
POWER OSCILLATIONS IN BWRs

INTRODUCTION

Bulletin 88-07, "Power Oscillations in BWRs" describes an unanticipated event at LaSalle in which excessive neutron flux oscillations resulted while the plant was in natural circulation after a dual recirculation pump trip.

Three actions that must be taken by all BWRs Licenses to ensure that correct operator action can and will be taken in the event of uncontrolled power oscillations are described in this bulletin, and are restated prior to the response for each action.

Required actions have been addressed for both Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, and Limerick Generating Station (LGS) Unit 1. The details of compliance with the requested actions are presented in the following sections.

LICENSED REACTOR OPERATOR AND SHIFT TECHNICAL ADVISOR BRIEFING

Required Action:

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:

Peach Bottom and Limerick

All licensed Reactor Operators and Shift Technical Advisors (STAs) have been thoroughly briefed on the LaSalle event described in Bulletin 88-07. This action was completed at LGS by June 29, 1988, and at Peach Bottom by July 20, 1988.

ADEQUACY OF PROCEDURES AND OPERATOR TRAINING PROGRAMS

Required Action:

2) "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:

a. those plant conditions which may result in the initiation of uncontrolled power oscillations

b. actions which can be taken to avoid plant conditions which may result in the initiation of uncontrolled power oscillations

c. how to recognize the onset of uncontrolled power oscillations, and

d. 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:

Applicable procedures and operator training programs were reviewed to verify their adequacy by July 15, 1988 at LGS, and by Aug. 30, 1988, at PB. The three conditions that may result in uncontrolled power oscillations are: 1) as a result of a recirculation pump(s) trip, 2) during startup and shutdown, 3) rod sequence exchanges.

PEACH BOTTOM

Peach Bottom procedures relating to the three operating conditions of concern -- startup/shutdown, rod sequence exchanges, and recirculation pump trips have been reviewed to determine their adequacy in addressing the concerns of Bulletin 88-07.

Recirculation Pump Trip Condition

The most probable event that could result in a high power/low flow situation is a trip of one or two recirculation pumps, particularly from full power. The review of Peach Bottom procedures identified the need to revise the procedure dealing with Recirculation Pump Trips (OT-112) in order to ensure operator recognition of potential and actual power oscillation conditions, and take proper actions to avoid or deal with these oscillations.

The following changes were made to the Recirculation Pump Trip procedure.

- The bases for OT-112 have been revised to include explanations of power oscillations and the conditions that may result in the initiation of uncontrolled power oscillations.

- Procedure OT-112 has been revised to specify the immediate actions to be taken on the loss of one or more Recirculation Pumps. These actions are designed to avoid plant conditions that may result in the initiation of uncontrolled power oscillations.

- A table of LPRMs has been incorporated in OT-112 to give operators specific instruments to monitor and criteria for recognizing uncontrolled power oscillations.

- Based on criteria specified in OT-112, operators will scram the reactor if oscillations are not promptly terminated.

Procedure OT-112 is included in Cycle 88-03 of Licensed Operator Requalification training on the Simulator between August 8 - September 30, 1988. All Licensed Control Room Operators, Staff SROs, and Certified Instructors will complete this training cycle. Training on OT-112 will be administered to the current SRO license class during the appropriate module scheduled within that program.

Startup and Shutdown Conditions

It was not necessary to make changes to procedures concerning startup/shutdown since current procedures adequately address the concerns of the Bulletin. GP-2, Normal Plant Startup, requires that the reactor not be operated in regions of high power/low flow, where power oscillations are likely to occur. If the reactor must be operated in these regions, special surveillances are required to be conducted to keep the operators aware of potential power oscillation conditions.

During shutdown, operators are required to insert rods to below the limits of Technical Specification Figure 3.6.5, "Thermal power and Core Flow Limits of Specification 3.6.F.3, 3.6.F.4 and 3.6.F.5." Below the limit in Technical Specification Figure 3.6.5, the reactor will not be in the high power/low flow condition that is of concern. This action is taken to ensure that the regions of instability are exited as quickly as possible.

During startup, Reactor Engineering personnel must be present in the control room to monitor core stability when power may be in unstable regions specified by Technical Specifications, or when both power is greater than 15% and core flow is less than 50%. Procedure RE-31, Reactor Engineering Startup/Load Drop Instructions, details core stability monitoring practices during startup and shutdown. ST 3.10 "Core Thermal Hydraulic Stability Monitoring" will be implemented whenever reactor power is in regions I or II of Technical Specification Figure 3.6.5. Training on appropriate actions, and procedures to use during these conditions are included in Cycle 88-03 of Licensed Operator Requalification training on the Simulator between August 8 - September 30, 1988. All Licensed Control Room Operators, Staff SROs and Certified Instructors will complete this training cycle.

Rod Sequence Exchange Conditions

Rod Sequence Exchanges are only performed at 50% core flow so that conditions of high power/low flow are not reached. In addition, scram margins are closely monitored. Procedure RE-31 will be revised and in use by October 1, 1988, and will state that deep control rods (notches 08-26) should be inserted as needed to increase the scram margin. If core flow falls below 50%, then ST 3.10 or RE-31 must be implemented. These procedures require core monitoring by Reactor Engineering personnel. Therefore, conditions favorable to uncontrolled power

oscillations are not likely to exist during rod sequence exchanges.

Adequacy of Peach Bottom Procedures - Conclusion

As a result of the procedures review, the procedure addressing Recirculation Pump Trip condition has been revised to be adequate. Procedures covering the other two conditions were found to be adequate. Training on appropriate actions, and procedures to use during these conditions are included in Cycle 88-03 of Licensed Operator Requalification training on the Simulator between August 8 - September 30, 1988. All Licensed Control Room Operators, Staff SROs and Certified Instructors will complete this training cycle.

LIMERICK

Each of the three areas of potential instability delineated above are avoided by procedure or Reactor Engineering practice at Limerick Generating Station.

Recirculation Pump Trip Condition

The most probable event that could result in a high power/low flow situation is a trip of one or both recirculation pumps. Procedure OT-112, Recirculation Pump Trip, specifically provides an immediate operator action to fully insert deep rods (notches 08-26) fully to prevent a scram. The follow-up action is to insert control rods as required to reduce reactor power to below the limit specified in Tech Spec Figure 3.4.1.1-1. By inserting control rods, the high power/low flow condition susceptible to power oscillations is avoided after a recirculation pump(s) trip. The Bases for OT-112 specifically addresses the need for inserting control rods to eliminate the possibility of sustained power oscillations. OT-112 is addressed in the classroom in Licensed Operator Training, course LOT-1540, and is practiced in the Simulator by Simulator Training Scenario, "STS-13".

Startup and Shutdown Conditions

During startup, Recirculation Pump speed is increased to 28% (20% feedwater runback limit) to ensure that core flow is greater than 45% as power is increased. GP-2, Normal Plant Startup, not only

raises Recirculation Pump speed to 28%, but at approximately 10% rated thermal power, total core flow is verified to be greater than 45%. If core flow is less than 45% and power is greater than Technical Specification Figure 3.4.1.1-1, ST-6-107-880-*, APRM and LPRM Noise Level Determination, is performed to determine APRM and LPRM noise levels. These baseline noise levels can then be used to monitor core stability as power is increased by 5% increments. GP-2, Normal Plant Startup, is addressed in Licensed Operator Training, course LOT-1530 and is practiced in the simulator by Simulator Training Scenarios STS-29, 29A and 30. Technical Specification 3.4.1.1-1 is specifically addressed in Licensed Operator Training, course LOT-1840, Technical Specification Selected LCO's.

During performance of GP-4, Rapid Plant Shutdown to Hot Shutdown, recirculation flow is reduced to minimum, and the plant is quickly scrammed so that any high power/low flow situation is quickly exited. GP-3, Normal Plant Shutdown, instructs the operator to utilize Reactor Maneuvering Shutdown Instructions provided by Reactor Engineering in accordance with RE-201, Reactor Maneuvering Plan Approval. These instructions provide for the insertion of sufficient control rods prior to reducing both recirculation pumps' speeds to minimum so that reactor power is below the limit in Technical Specifications Figure 3.4.1.1-1, thus preventing entry into a high power/low flow condition. According to GP-3 Operations personnel verify that reactor power is less than Tech Spec Figure 3.4.1.1-1 when core flow is less than 45% and perform ST-6-107-880-*, APRM and LPRM Noise Level Determination, if reactor power is above the limit. Therefore, if a high power/low flow condition is entered, APRM/LPRM noise levels will be monitored. GP-3 and GP-4 are addressed in License Operator Training (LOT-1530) and plant shutdown is practiced in the simulator by Simulator Training Scenario STS-17.

Rod Sequence Exchange Conditions

Since Limerick is a control cell core, total sequence A and B exchanges are not performed. Deep/shallow rod exchanges are performed between RSCS Groups 9 and 10 but do not occur in areas susceptible to instability. Power and flow are reduced to conduct this reactor maneuver. However, recirculation flow is not reduced to minimum, maintaining core flow greater than 45%. The rod sequence exchange between RSCS Group 9 and 10 is performed and recirculation flow increased. Therefore, conditions favorable to uncontrolled power oscillations are not likely to exist during rod sequence exchanges.

Adequacy of Limerick Procedures - Conclusion

Specific details of how to recognize uncontrolled power oscillations and the actions required in response to power oscillations were not previously included in the procedures. The applicable procedures have been revised to include specific actions, such as instituting a scram and other actions, needed to identify and mitigate excessive power oscillations after control rods are inserted to reduce reactor power to less than the Technical Specification limit. In addition to the initial briefing, Licensed Operator Requalification training will be given to address Bulletin 88-07, "Power Oscillations in BWRs", and the procedural changes noted above, and will include a simulator demonstration incorporating power oscillations.

The current procedures, therefore, address those plant conditions (recirculation pump trips, startup/shutdown and rod sequence exchanges) that can lead to power oscillations. Specific actions (inserting control rods after a recirculation pump trip, maintaining core flow greater than 45% on startup/shutdown and deep/shallow exchanges) are in the procedures to prevent plant conditions that could result in uncontrolled power oscillations.

ADEQUACY OF INSTRUMENTATION

An additional requested action presented in the Bulletin is restated below:

"Addressees should also verify the adequacy of the instrumentation which is relied upon by operators within their procedures."

Response:

Peach Bottom and Limerick

The existing power range neutron monitoring instrumentation has been evaluated and determined to be adequate for monitoring neutron flux oscillations. The evaluation and determination were completed by August 8, 1988, for both LGS Unit 1 and PBAPS Units 2 and 3. The Local Power Range Monitors (LPRMs) installed at both Peach Bottom and Limerick are designed to supply an ionization current proportional to the core neutron flux without suffering from a loss of saturation plateau. The detector output will remain linear (plus or minus 1%) over a range of neutron

flux that is sufficient to accommodate local flux peaks of a magnitude on the order of those experienced at LaSalle.

The applicable drawings for Peach Bottom and Limerick have been reviewed, and it has been determined that the installed instrumentation has not been modified in such a way as to prevent the detection of oscillations (as had occurred at LaSalle). Both Peach Bottom and Limerick have GE power range neutron monitoring instrumentation installed. The adequacy of GE supplied power range neutron monitoring instrumentation to detect flux oscillations is discussed in GE Service Information Letter (SIL) 380, Rev. 1, the methodology of which was endorsed by the NRC as documented in NRC Generic Letter 86-02, "Technical Resolution of Generic Issue B-19: Thermal-Hydraulic Stability". Both Peach Bottom and Limerick have implemented SIL 380, Rev. 1.

CONCLUSION

As presented in the analyses above, procedures, training, and instrumentation at Peach Bottom Atomic Power Station, and Limerick Generating Station adequately fulfill the requirements in the actions requested of the licensee in Bulletin 88-07, Power Oscillations in Boiling Water Reactors.