

May 25, 1989

Docket No. 50-322

Mr. John D. Leonard  
Vice President Nuclear Operations  
Long Island Lighting Company  
Shoreham Nuclear Power Station  
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Dear Mr. Leonard:

SUBJECT: DIRECTOR'S DECISION IN RESPONSE TO 2.206 PETITION REGARDING BWR STABILITY

RE: SHOREHAM NUCLEAR POWER STATION

Enclosed for your information are copies of a Director's Decision, letter of transmittal and Federal Register notice issued by the Director, Office of Nuclear Reactor Regulation (Director) in response to a Petition filed under 10 CFR 2.206 of the Commission's regulations. The Petition was filed by Ms. Susan Hiatt on behalf of the Ohio Citizens for Responsible Energy (OCRE). The Petitioner expressed concerns regarding the March 9, 1988 power oscillation event at LaSalle, Unit 2 and requested that the Director and Commission take specified action with respect to all boiling water reactors. As discussed in the enclosed Director's Decision, the Petitioner's request under 10 CFR 2.206 has been denied. However, the Petitioner's request to reopen rulemaking proceedings regarding Anticipated Transients Without Scram (ATWS) is being treated as a petition for rulemaking under 10 CFR 2.802 of the Commission's regulations.

Please contact me at (301) 492-1430 if you have any questions on this issue.

Sincerely,

/S/

Walter R. Butler, Director  
Project Directorate I-2  
Division of Reactor Projects I/II  
Office of Nuclear Reactor Regulation

Enclosures:

1. Letter dated April 27, 1989 to Ms. Susan L. Hiatt
2. Director's Decision dated April 27, 1989
3. Federal Register Notice dated April 27, 1989

cc w/enclosures:  
See next page

[LEONARD LETTER]

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Shoreham Nuclear Power Station

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

April 27, 1989

ES-89-03

Ms. Susan L. Hiatt  
Representative of Ohio Citizens for  
Responsible Energy, Inc.  
8275 Munson Road  
Mentor, Ohio 44060

Dear Ms. Hiatt:

This letter is in further response to your Petition of July 22, 1988, requesting that the Director, Office of Nuclear Reactor Regulation (NRR), take immediate action with respect to boiling water reactors (BWRs) to relieve what you allege to be undue risks to the public health and safety posed by the thermal-hydraulic instability of BWRs as revealed by an event at LaSalle County Station, Unit 2, on March 9, 1988.

On August 26, 1988, I informed you that your request for immediate relief was denied because the allegations that form the basis for your Petition did not reveal any new operational safety issue that posed an immediate safety concern for continued BWR operation. I also informed you that your Petition was being treated under 10 CFR 2.206 of the Commission's regulations and that appropriate action, that is, a formal decision, would be taken within a reasonable time.

For the reasons set forth in the enclosed Director's Decision under 10 CFR 2.206, your Petition has been denied. However, as discussed below, your request to reopen rulemaking proceedings regarding anticipated transients without scram (ATWS) is being treated as a Petition for rulemaking under 10 CFR 2.802 of the Commission's regulations. A copy of the Decision will be filed with the Secretary of the Commission for the Commission's review in accordance with 10 CFR 2.206. The Decision will constitute final action of the Commission 25 days after the date of issuance unless the Commission, on its own motion, institutes a review of the Decision within that time.

In the August 26, 1988 letter, I acknowledged your request to reopen rulemaking proceedings regarding ATWS as part of the relief requested. However, since that time, I have determined that this request is more properly treated as a petition for rulemaking under 10 CFR 2.802 of the Commission's regulations. As such, it has been referred to the NRC Office of Research for appropriate action. However, it is important to note that both the NRC and BWR Owners Group (BWROG) currently have programs in which analyses of ATWS conditions are being conducted. These analyses treat large amplitude power oscillations with state-of-the-art analytical methods. The results of these analyses to date confirm the technical bases for the current ATWS rule. Consequently, at this time, the NRC staff sees no basis for recommending that the Commission reopen rulemaking proceedings regarding ATWS. If, however, the staff finds evidence which contradicts the assumptions and results of previous ATWS analyses from either the information you provided in support of your Petition or new information from ongoing NRC and BWROG programs, it may then be appropriate for the Commission to reconsider the current ATWS rule.

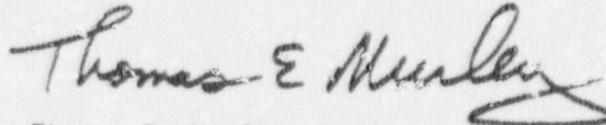
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Susan L. Hiatt

- 2 -

For your information, I am enclosing a copy of Supplement 1 to NRC Bulletin No. 88-07, "Lower Oscillations in Boiling Water Reactors", which is referenced in the Director's Decision. I am also enclosing a copy of the notice regarding this Decision that was filed with the Office of the Federal Register for publication.

Sincerely,



Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

Enclosures:

1. Director's Decision
2. Federal Register Notice
3. NRC Bulletin No. 88-07, Supplement 1

DD-89-03

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION  
Thomas E. Murley, Director

In the Matter of

BOSTON EDISON CO. (Pilgrim Nuclear Power Station, Docket No. 50-293)

CAROLINA POWER & LIGHT CO. (Brunswick Station, Units 1 and 2, Docket Nos. 50-324 and 50-325)

CLEVELAND ELECTRIC ILLUMINATING CO., ET AL. (Perry Nuclear Power Plant, Unit 1, Docket No. 50-440)

COMMONWEALTH EDISON CO. (Dresden Nuclear Power Plant, Units 2 and 3, Docket Nos. 50-237 and 50-249), (Quad Cities Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-254 and 50-265), (LaSalle County Station, Units 1 and 2, Docket Nos. 50-373 and 50-374)

CONSUMERS POWER CO. (Big Rock Point, Docket No. 50-155)

DETROIT EDISON CO. (Fermi Unit 2, Docket No. 50-341)

GENERAL PUBLIC UTILITIES (Oyster Creek Station, Docket No. 50-219)

GEORGIA POWER CO. (Hatch Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-321 and 50-366)

GULF STATES UTILITIES CO. (River Bend Station, Docket No. 50-458)

ILLINOIS POWER CO. (Clinton Nuclear Power Plant, Docket No. 50-461)

IOWA ELECTRIC LIGHT & POWER CO. (Duane Arnold Nuclear Power Plant, Docket No. 50-331)

LONG ISLAND LIGHTING CO. (Shoreham Nuclear Power Plant, Docket No. 50-322)

MISSISSIPPI POWER & LIGHT CO. (Grand Gulf Nuclear Station, Docket No. 50-416)

NEBRASKA PUBLIC POWER DISTRICT (Cooper Station, Docket No. 50-298)

NIAGARA MOHAWK POWER CORP. (Nine Mile Point, Units 1 and 2, Docket Nos. 50-220 and 50-410)

NORTHEAST UTILITIES (Millstone Unit 1, Docket No. 50-245)

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NORTHERN STATES POWER CO. (Monticello Nuclear Power Plant, Docket No. 50-263)

PENNSYLVANIA POWER & LIGHT CO. (Susquehanna Steam Electric Station, Units 1 and 2, Docket Nos. 50-387 and 50-388)

PHILADELPHIA ELECTRIC CO. (Peach Bottom Nuclear Station, Units 2 and 3, Docket Nos. 50-277 and 50-278), (Limerick Nuclear Power Plant, Unit 1, Docket No. 50-352)

POWER AUTHORITY OF THE STATE OF NEW YORK (James A. Fitzpatrick Station, Docket No. 50-333)

PUBLIC SERVICE ELECTRIC & GAS CO. (Hope Creek Generating Station, Docket No. 50-354)

TENNESSEE VALLEY AUTHORITY (Browns Ferry Nuclear Station, Units 1, 2, and 3, Docket Nos. 50-259, 50-260, and 50-296)

VERMONT YANKEE NUCLEAR POWER CORP. (Vermont Yankee Nuclear Power Plant, Docket No. 50-271)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM (WNP Unit 2, Docket No. 50-397)

#### DIRECTOR'S DECISION UNDER 10 CFR 2.206

##### 1. INTRODUCTION

On July 22, 1988, Ms. Susan Hiatt, on behalf of Ohio Citizens for Responsible Energy, Inc., (Petitioner) filed a Petition in accordance with 10 CFR 2.206 with the Nuclear Regulatory Commission (NRC). The petition was referred to the Director, Office of Nuclear Reactor Regulation (NRR) for consideration.

The Petition asked the Director, NRR, to take immediate action to relieve alleged undue risks to the public health and safety posed by the thermal-hydraulic instability of boiling-water reactors (BWRs), as revealed by the power oscillation event at LaSalle Unit 2 on March, 9 1988 (LaSalle Event). The Petitioner specifically requested the NRC to order all BWR licensees to (1) place their reactors in cold shutdown, (2) develop and implement specified operating procedures relating to the thermal-hydraulic instability issues, (3) demonstrate

that certain specified training has been provided relating to these procedures, (4) demonstrate the capability of instrumentation related to power oscillations, (5) develop simulators capable of modeling power oscillations similar to those occurring at LaSalle as well as out-of-phase power oscillations, (6) report to the NRC all past and future incidents in which recirculation pumps have tripped off, (7) submit to the NRC justification for continued operation of BWRs, and (8) submit a report to the NRC within 1 year demonstrating compliance with Criterion 12 given in 10 CFR Part 50, Appendix A (GDC-12)<sup>1</sup>. In addition, the Petitioner requested the Commission to reopen Generic Issues B-19 and B-59, to reopen the Anticipated Transients Without Scram (ATWS) rulemaking proceeding, and to reconsider the use of the end-of-cycle recirculation pump trip on BWRs.

Ms. Hiatt alleged as grounds for the Petition that the LaSalle Event has serious safety implications for all BWRs and that the Nuclear Regulatory Commission (NRC) has failed to take appropriate regulatory action in response to the LaSalle Event. In the Petition, Ms. Hiatt cites the following postulated safety implications, some of which had been previously identified in several referenced documents attached to the Petition: (1) decay ratios determined by licensing calculations are not reliable indicators of core stability (Attachment 2 to Petition) and design analyses of the reactor cannot be relied upon to ensure that oscillations are not possible in BWRs; (2) The General Electric (GE) Company's guidance for operations provided in Service Information Letter (SIL) 380, Revision 1, is inadequate to ensure compliance with GDC-12 ( Attachment 4 to Petition); and (3) BWR plant instrumentation may

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<sup>1</sup> 10 CFR Part 50, Appendix A, Criterion 12, "Suppression of Reactor Power Oscillations," states that: "The reactor core and associated coolant, control, and protection systems shall be designed to assure that power oscillations which can result in conditions exceeding specified acceptable fuel design limits are not possible or can be reliably and readily detected and suppressed."

not detect power oscillations if they occur out of phase or too rapidly (Attachments 1 and 4 to Petition). Ms. Hiatt then asserts that (1) given the implications of the LaSalle Event, the actions requested of BWR licensees in NRC Bulletin No. 88-07 are insufficient, (2) most, if not all BWRs, are in a state of noncompliance with GDC-12, and (3) the NRC must take aggressive enforcement action to protect the health and safety of the public.

On August 26, 1988, I acknowledged receipt of the Petition. I informed Ms. Hiatt that (1) her request for immediate relief was denied because the allegations that formed the basis for the Petition did not reveal any new operational safety issues that posed an immediate safety concern for continued BWR operation, (2) the Petition would be treated under 10 CFR 2.206 of the Commission's regulations, and (3) appropriate action would be taken within a reasonable amount of time. For reasons discussed below, the Petition is denied. Ms. Hiatt's request to reopen rulemaking proceedings regarding ATWS is being treated separately as a petition for rulemaking under 10 CFR 2.802 of the Commission's regulations.

## II. BACKGROUND

The LaSalle nuclear power station, operated by the Commonwealth Edison Company (CECO), is a two-unit site located 11 miles southeast of Ottawa, Illinois. Both units utilize General Electric-designed BWR/5 reactors with containments of the Mark II design.

On March 9, 1988, LaSalle Unit 2 underwent a dual recirculation pump trip event that resulted in a loss of forced circulation cooling, a reduction in

reactor power, and a decrease in reactor inlet feedwater temperature. Approximately 5 minutes after the recirculation pump trip, with the reactor being cooled via natural circulation, operators observed that the average power range monitor (APRM) indications were oscillating between 25 and 50 percent power (25 percent peak to peak) every 2 to 3 seconds. At the same time, the local power range monitor (LPRM) downscale alarms began to annunciate and clear, indicating that power was oscillating about the downscale alarm setpoint. During this period, the operators recognized that they were operating in a region of core instability. They attempted to restart a recirculation pump in order to increase flow to prevent instability, but this action was unsuccessful as all of the pump start permissive conditions had not been satisfied. (Permissives are protective features designed to inhibit start-up of equipment when certain specified conditions critical to proper functioning of the equipment are not within specified limits). Approximately 7 minutes after the recirculation pump trip, as operators were preparing to perform a manual scram, the reactor scrammed automatically because of high neutron flux in the reactor. (A reactor scram involves rapid insertion of shutdown and control rods by either manual or automatic actuation of the reactor protection system). The scram shut the reactor down, and recovery from the scram proceeded normally.

On March 16, 1988, after receiving additional information from the licensee concerning the event, the NRC dispatched an augmented inspection team (AIT) to the site. The AIT completed its inspection on March 24, 1988, and issued its inspection report on May 6, 1988. The AIT concluded that (1) fuel design limits had not been exceeded during the transient, and fuel damage had not occurred; (2) plant equipment functioned as designed; and (3) operator actions during the event were within the bounds of their procedures and training,

but the procedures and training program themselves were inadequate. The AIT also identified a number of generic technical concerns and recommended that they be considered further by the staff.

On June 8, 1988, the NRC Office for Analysis and Evaluation of Operational Data (AEOD) issued a special report documenting its concerns regarding the power oscillation event at LaSalle 2 and its recommendations for follow-up action. A response to the recommendations was provided to AEOD by NRR on June 24, 1988.

On June 15, 1988, following completion of its evaluation of the March 9, 1988, event at LaSalle, the NRC issued Bulletin No. 88-07 to holders of operating licenses and construction permits for BWRs. The bulletin requested that recipients take action to ensure that adequate operating procedures and instrumentation are available and adequate operator training is provided to prevent the occurrence of power oscillations during all modes of BWR operation.

The bulletin required that recipients confirm by letter to the NRC that the requested actions were completed and implemented. All confirmation letters have been received and reviewed. They indicate that:

1. All BWR licensees have procedures in place to detect and suppress instability regardless of the value of previously calculated decay ratios;
2. All licensed reactor operators and shift technical advisors were briefed regarding the LaSalle Event within 15 days following receipt of the bulletin, or before resuming shift duties if they had been unavailable during the 15 day period;
3. All action to modify operating procedures and the operator training program with respect to detection and suppression of potential reactor instabilities had been completed or would be completed before

startup from the current outage and, in a few cases, no later than December 15, 1988; and,

4. All licensees have confirmed that instrumentation relied upon by plant operators to execute operating procedures is adequate based on an assessment by the equipment vendor (GE) and a review of any modifications made to equipment since installation.

The staff has begun to audit licensee responses to the bulletin in more detail. The audits will continue over the next year.

In November 1988, General Electric Company (GE), working with the BWR Owners' Group (BWROG), issued a letter entitled "Interim Recommendations for Stability Actions" to the BWR licensees. The interim recommendations are based on the results of a generic evaluation of power oscillations performed for the BWROG at the request of the NRC staff. This evaluation has indicated that when regional power oscillations<sup>2</sup> become detectable on the average power range monitors, the safety margin with respect to the plant minimum critical power ratio (MCPR) may be insufficient under some operating conditions to ensure that operator action in response to APRM signals would prevent violation of the MCPR safety limit. The interim recommendations include explicit restrictions and modified operator actions to ensure that operation in the vulnerable power/flow operating regime is avoided. The recommendations were reviewed by the NRC staff and have been found acceptable for those plants which have effective automatic scram protection for regional oscillations. For plants

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<sup>2</sup> Regional oscillations are ones in which power oscillates only in distinct regions of the reactor core, as opposed to a core-wide oscillation, in which power oscillates throughout the core as was the case in the LaSalle Event.

which do not have effective automatic scram protection for regional oscillations, the staff believes that the interim recommendations may not provide sufficient, reliable protection. Consequently, the staff has requested that licensees implement the interim recommendations, and if appropriate, implement additional actions which compensate for the lack of automatic scram protection for regional oscillations. The staff's request is contained in Supplement 1 to NRC Bulletin 88-07 which is discussed in the next paragraph.

On December 30, 1988, the NRC issued Supplement 1 to NRC Bulletin 88-07. The supplement provides addressees with new information concerning power oscillations in BWRs and requests that they take specified actions to ensure that the safety limit for the plant minimum critical power ratio (MCPR) is not violated as a result of regional power oscillations. The supplement is an outgrowth of generic evaluations of power oscillations performed by the BWRDG at the NRC staff's request and the staff's independent study of regional power oscillations. The preliminary results of these evaluations indicate that when regional power oscillations become detectable on the average power range monitors, the MCPR safety margin may be insufficient under some operating conditions to ensure that manual actions taken in response to APRM signals would prevent violation of the MCPR safety limit. Licensees<sup>3</sup> were requested to take the following actions:

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<sup>3</sup> The supplement is not applicable to Pig Rock Point (Docket No. 50-155) because of unique design features and because existing operating limitations enforced by technical specifications address the stability concerns which are the subject of the supplement.

- (1) Within 30 days of receipt of the supplement, all BWR licensees should implement the GE interim stability recommendations described in the GE letter entitled "Interim Recommendations for Stability Actions". However, for those plants that do not have effective automatic scram protection in the event of regional oscillations, a manual scram should be initiated under all operating conditions when two recirculation pumps trip (or "no pumps operating") with the reactor in the RUN mode.
- (2) The boundaries of Regions A, B, and C shown in Figure 1 of the GE recommendations were derived for those BWRs using NRC approved GE fuel. For BWRs using fuel supplied by other vendors, these regions should be adopted in principle, but the power/flow boundaries should be based on existing boundaries that have been previously approved by the NRC. For proposed new fuel designs, the stability boundaries should be reevaluated and justified based on any applicable operating experience, calculated changes in core decay ratio using NRC approved methodology, and/or core decay ratio measurements. There should be a high degree of assurance that instabilities will not occur under any circumstances of operation in Region C.
- (3) The GE interim recommendations are ambiguous with respect to permissible conditions for entry of Regions B and C. Although the recommendations state that intentional operation in Region B is not permitted and operation in Region C is permitted only for purpose of fuel conditioning during rod withdrawal startup operations, intentional entry into Region B or C is also allowable in situations where rod insertion or a flow increase is required by procedures to exit Regions A and B after unintentional entry. Licensees should ensure that the procedures and training employed for implementation of these recommendations avoid any similar ambiguity which could lead to operator confusion.

Pursuant to 10 CFR 50.54(f), licensees are required to advise the NRC by letter within 60 days of receipt of the supplement whether the requested actions have been completed and implemented. The staff will evaluate the responses and the results of studies which are continuing over the next several months to determine whether any additional action by the staff is necessary.

### III. DISCUSSION

My staff and I have considered the safety implications identified in the Petition and the specific relief requested and have done so in light of the most recent data available to the staff from the BWROG and staff consultants. Our evaluation follows.

#### A. Bases for Request

##### 1. Reliability of Decay Ratio for Predicting Stability

Decay ratio in a reactor is a measure of the response of the neutron flux to a change or perturbation. As such, it is a convenient measure of the relative stability of a reactor core. A decay ratio of less than 1.0 indicates inherent stability in that the response to a perturbation will decay to the steady state value. A decay ratio equal to 1.0 represents the special condition when the response to a perturbation will be continuing oscillations of constant magnitude termed limit cycles. A decay ratio greater than 1.0 indicates an unstable condition in that the response to the perturbation diverges in a linear system. In a BWR, which is a non-linear system, decay ratios greater than 1.0 are indicative of larger amplitude limit cycle oscillations. Predictive methods developed by General Electric for determining BWR decay ratios were approved by the NRC with the provision that a 20 percent uncertainty be applied conservatively to the result. Calculated core decay ratios of less than 0.80 (i.e., 1.0 minus an uncertainty of .2) by GE methods were approved as acceptable evidence of core stability and compliance with GDC-12.

The predicted decay ratio for the LaSalle Unit 2 reactor was 0.60. However, large oscillations were observed during the LaSalle Event that indicate that actual decay ratio was greater than 1.0. Consequently, the uncertainty in the predictive method was significantly larger than expected, that is at least 40 percent versus 20 percent.

The larger-than-expected calculational uncertainty has since been attributed to an inadequate representation of actual reactor operating conditions in the LaSalle calculational model. In light of this potential for error, the staff has concluded that it will no longer accept predictive calculations of core decay ratio as bases for demonstrating compliance with GDC-12.

In order for a licensee to satisfy GDC-12 with respect to core-wide power oscillations, the staff's position is that each BWR unit must have the necessary operating limitations, response procedures, and operator training program to readily and reliably detect and suppress core-wide power oscillations regardless of calculated decay ratio. The staff has communicated this position to licensees in NRC Bulletin No. 88-07. As discussed above, all licensees have now responded to Bulletin No. 88-07 and have indicated that they have the necessary procedures and operator training program to readily and reliably detect and suppress core-wide power oscillations regardless of calculated decay ratios.

2. Adequacy of Procedural Guidance from GE (Service Information Letter 380, Revision 1)

The General Electric company issued Service Information Letter (SIL) 380, Revision 1 to its customers on February 10, 1984. The letter reflected new technical information regarding BWR stability and provided new guidance to BWR

operators for detecting and suppressing neutron flux oscillations. The letter superseded the previously issued SIL 380.

The NRC staff reviewed SIL 380, Revision 1, as part of its action to resolve Generic Issue E-19, "BWR Thermal-Hydraulic Stability." On the basis of the staff's review and that of its contractor, Oak Ridge National Laboratory, the staff concluded that "operating limitations which provide for the detection and suppression of flux oscillations in operating regions of potential instability, consistent with the recommendations of General Electric SIL 380 (Rev. 1), are acceptable to demonstrate compliance with GDC-10 and GDC-12 for cores loaded with approved CE fuel designs." The basis for this conclusion was the result of a technical evaluation that indicated that if properly implemented, the recommendations contained in the SIL were sufficient to readily and reliably detect and suppress limit cycle oscillations.<sup>4</sup>

It is important to note that operating procedures consistent with GE SIL 380, Revision 1 were not in place at LaSalle Unit 2 at the time of the March 9, 1988 incident. Consequently, the response and performance of reactor operators during the LaSalle Event does not reflect on the adequacy of the SIL recommendations.

The NRC staff continues to endorse the general operational guidance given in GE SIL 380, Revision 1 and believes that if properly implemented, it is sufficient to identify and terminate core-wide limit cycle oscillations. However,

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<sup>4</sup> NRC Memorandum and attachments from Harold R. Denton to Victor Stello, dated May 21, 1985.

as discussed previously in section 11 of this document, supplementary procedural actions are necessary to ensure that the safety limit for the plant minimum critical power ratio is not violated as a result of regional power oscillations.

### 3. Adequacy of Plant Instrumentation

In BWRs designed by GE, the neutron monitoring system (NMS) is used to monitor the core for neutron flux oscillations. The NMS uses incore detectors to monitor neutron flux from startup through full-power operation and is a safety-related system. The NRC staff reviews the design of the NMS as part of its normal licensing review.

In general, the staff considers the NMS to be adequate for implementation of the guidelines provided in GE SIL 380, Revision 1. However, during follow-up review of the LaSalle Event the NRC augmented inspection team identified some time response and filtering characteristics of the NMS instruments in LaSalle Unit 2 that they were concerned about. The AIT also expressed concern about the ability of the APRMs to properly detect regional oscillations which cause APRM signals to oscillate out-of-phase. Because of these concerns, the staff requested, in NRC Bulletin No. 88-07 and in meetings with the BWROG, that licensees verify the adequacy of the instrumentation that is relied upon by operators within their procedures.

In response to Bulletin 88-07, all licensees have evaluated their instrumentation with regard to time response and filtering characteristics and

have indicated that instrumentation relied upon by plant operators to execute operating procedures is adequate. The BWROG and the NRC staff have independently evaluated the ability of NMS instrumentation to properly detect regional oscillations which occur as asymmetric out-of-phase oscillations. The results of these evaluations are discussed below.

Power oscillations with an amplitude and phase that vary spatially in the reactor are termed regional oscillations, and usually occur as asymmetric out-of-phase oscillations. These oscillations are difficult to monitor accurately with average power range instruments in the NMS but can be detected with local power range instruments. The results of generic evaluations of power oscillations performed by GE for the BWR owners group (BWROG) at the request of the NRC staff and the staff's independent evaluation have indicated that when regional power oscillations become detectable on the APRMs, the safety margin with respect to the plant minimum critical power ratio (MCPR) may be insufficient under some operating conditions to ensure that operator action in response to APRM signals would prevent violation of the MCPR safety limit. In light of this GE issued interim recommendations to BWR licensees which include explicit restrictions on reactor power level and coolant flowrate, and actions for plant operators to take if unacceptable power/flow operating regimes are entered unintentionally. The interim recommendations were reviewed by the NRC staff and found acceptable for those plants which have effective automatic scram protection for regional oscillations. For plants which do not have effective automatic scram protection for regional oscillations, the staff believes that the interim recommendations may not provide sufficient, reliable protection. Consequently, the staff has requested that licensees implement the interim recommendations, and if appropriate, implement additional actions which

compensate for the lack of automatic scram protection for regional oscillations. The staff's request is contained in Supplement 1 to NRC Bulletin 88-07 which was discussed previously in the section II. of this document. The staff believes that implementation of the requests in NRC Bulletin 88-07 and Supplement 1 to the bulletin will ensure continued safe plant operation in the interim until long-term corrective actions are developed and put in place. The NRC staff will continue to work with the BWROG to develop long-term corrective actions. The staff expects to issue another generic communication within 12 to 24 months that will provide guidance for long-term resolution of this stability issue.

#### 4. Safety Significance of Power Oscillations

Power oscillations in BWRs are not considered to be a serious generic safety concern because oscillations can be detected and suppressed. Tests and operating experience (LaSalle Event) indicate that core-wide power oscillations can be terminated manually in a timely fashion by control room operators or ultimately by automatic action of the high-power level trip function in the reactor protection system.

Asymmetric out-of-phase oscillations are unlikely because of restrictions on reactor operating conditions. Moreover, procedures specified in Supplement 1 to NRC Bulletin 88-07 ensure that such oscillations would be suppressed quickly with an anticipatory reactor scram initiated manually by a reactor operator.

E. Petitioner's Request

1. Order All BWR Licensees To Place Their Reactors in Cold Shutdown

As described above, the NRC issued Bulletin No. 88-07 in response to the LaSalle event. As indicated by their responses to Bulletin No. 88-07, all BWR licensees have developed and implemented procedures to detect and suppress core-wide power oscillations. Consequently, no BWR licensee now relies on a calculated decay ratio to demonstrate compliance with GDC-12.

As already explained, Supplement 1 to Bulletin No. 88-07 specified additional procedures to deal with regional power oscillations. The recommendations of Supplement 1 are currently being implemented. In light of the relatively short period for implementation (60 days), and existing restrictions on reactor operating conditions that minimize the probability of regional oscillations, the staff has concluded that continued operation of all BWRs while licensees are implementing the recommendations of Supplement 1 is acceptable.

In summary, based on our review of the generic implications of the LaSalle Event to date, we have not identified any operational safety concerns nor instances of regulatory non-compliance which warrant a shutdown of boiling water reactors. Consequently, your request is denied.

2. Order All BWR Licensees to Develop and Implement Specified Procedures.<sup>5</sup>

This request is denied for the following reasons:

- (a) The NRC staff currently believes that procedural guidance provided to licensees in SIL 380, Revision 1 for detecting and suppressing power oscillations is adequate for mitigating core-wide oscillations.
- (b) The NRC staff has determined that explicit procedures different from those specified by the Petitioner are necessary to control regional power oscillations and ensure continued plant operation in accordance with GDC 12. The staff has specified the necessary procedures in Supplement 1 to NRC Bulletin 88-07 and requested that licensees implement the specified procedures within 30 days of receipt of the supplement.

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<sup>5</sup> Petitioner requests implementation of the following specific procedures: (a) Immediately insert control rods to below the 80% rod line following reduction or loss of recirculation flow or other transients which result in entry into potentially unstable regions of the power/flow map; (b) Increase recirculation flow during routine reactor startups and insert some control rods prior to reducing recirculation flow below 50% during shutdowns to avoid operation in potentially unstable areas of the power/flow map; (c) immediately scram the reactor if (a) or (b) above are not successful in preventing and suppressing oscillations. The licensees shall submit these procedures to the NRC for review and approval.

The contents of Supplement 1 to NRC Bulletin 88-07, including the specified procedures, are discussed in section II of this document. The staff has judged that continued plant operation during the 30 day implementation period is acceptable based on the low likelihood of a regional oscillation in the relatively short period of 30 days.

3. Order all BWR Licensees To Demonstrate That Certain Training Related to the Specified Procedures Has Been Provided

This request is denied for the following reasons:

- (a) The responses to NRC Bulletin No. 88-07 indicate that all licensed reactor operators and shift technical advisors performing shift duties at BWRs were briefed thoroughly regarding the LaSalle Event within 15 days of receipt of NRC Bulletin No. 88-07 or soon thereafter.
- (b) The responses to NRC Bulletin No. 88-07 indicate that all BWR licensees have confirmed the adequacy of their existing operator training program regarding detection and suppression of power oscillations or have made the program modifications necessary to properly address this subject and accommodate changes in procedures in response to Supplement 1 to the bulletin.

4. Order All BWR Licensees To Demonstrate the Capability of Instrumentation Related to Power Oscillations

This request is denied for the following reasons:

- (a) The NRC staff considers the neutron monitoring system designed for BWRs by GE to be adequate for detecting core-wide power oscillations in BWRs.
  - (b) On the basis of responses to NRC Bulletin No. 88-07, the NRC staff believes that all licensees have confirmed that the response and filtering characteristics of instrumentation relied upon by operators to execute operating procedures are acceptable.
  - (c) Implementation of operating procedures specified in Supplement 1 to NRC Bulletin 88-07 will compensate for inability of APRMs to properly detect regional oscillations.
5. Order All BWR Licensees To Develop Simulators Capable of Modeling Power Oscillations Similar to Those Occurring at LaSalle and Out-of-Phase Oscillations

This request is denied for the following reason:

- (a) Current NRC regulations, that is, 10 CFR §55.45(b), in conjunction with NRC Regulatory Guide 1.149 and NUREG-1258, already require utilities to have a simulation facility capable of modeling the effects of loss of forced reactor coolant flow and to certify the simulation facility for use in operator licensing examination after May 26, 1991. However, although simulator training for control of power oscillations will improve an operator's ability to detect and suppress oscillations in a timely fashion, non-simulation based training can be fashioned which is sufficient to address stability concerns. Consequently, the staff concludes that training programs now in place, including improvements made in response to NRC Bulletin 88-07, are adequate in the interim until the enhancements of 10 CFR §55.45(b) take full effect in 1991.
6. Order All BWR Licensees To Report to the NRC Regarding all Future and Past Incidents in which Recirculation Pumps have Tripped Off or that Involved Power Oscillations.

This request is denied for the following reasons:

- (a) Existing NRC regulations, that is, 10 CFR §50.72 and 10 CFR §50.73, already require that significant events involving recirculation pump trips or power oscillations be reported to the Commission. Such events are those in which the pump trips or oscillations lead to (a) completion of any nuclear plant shutdown required by the plant's technical specifications; or, (b) any operation or condition prohibited by the plant's technical specifications; or, (c) the plant being in a condition not covered by the plant's operating and emergency procedures, or (d) any event or condition that resulted in an unplanned manual or automatic actuation of any engineered safety feature, including the reactor protection system. Petitioner demonstrates no basis for requiring repetition of reports already required by §50.72 and §50.73.
- (b) Since the accident at Three Mile Island, Unit 2 in 1979, programs have been developed and implemented in several NRC offices to systematically review and evaluate operating reactor event reports. Such programs include Analysis and Evaluation of Operational Data (AEOD), Operating Reactors Assessment and Events Analysis (NRR) and the Resident Inspector program (NRC Regional Offices). These reviews have been performed to ensure prompt response to accidents, to identify significant precursor events and

to identify adverse trends and patterns in operating experience, including any associated with BWR instability. The staff considers these past reviews of licensee event reports to have been adequate. The Petition gives no basis to re-examine these reports and the staff concludes that action to collect and review past event reports is unnecessary.

7. Reopen Generic Issue B-19, "BWR Thermal-Hydraulic Stability"

This request is denied because a generic reassessment of BWR stability is not necessary in order for the staff to specify criteria licensees must meet to be in compliance with existing regulations.

NRC staff action on Generic Issue B-19 culminated in the identification of two acceptable methods by which licensees could show compliance with GDC-10 and GDC-12. Licensees could either (1) show that thermal-hydraulic instabilities are not possible by design by calculating acceptably low decay ratios with analytical methods approved by the staff, or (2) show that proper capabilities for detection and suppression of oscillations are embodied in plant operating procedures and operating limits. As discussed in section A.1. of this Decision, the staff has concluded that in light of the LaSalle Event, use of a calculated decay ratio to demonstrate compliance with general design criteria is no longer acceptable and that all BWR licensees must show that proper detection and suppression capabilities exist at their plants, that is, method 2 listed previously. Because the staff concludes that the implementation of method 2 listed above continues to be a valid means for complying with GDC-12, method 2 remains a valid resolution of Generic Issue B-19. Consequently, repetition of the generic issue resolution process for Issue B-19 is unnecessary.

8. Reopen Generic Issue B-59, "Part Loop Operation in PWRs and BWRs"

This request is denied because the LaSalle Event has not revealed any deficiency in the technical resolution of Generic Issue B-59.

In resolving Generic Issue B-59 for BWRs, the staff evaluated the acceptability of operating the reactor for electricity production at reduced power with only one of two recirculation loops in operation (i.e. at a reduced coolant flowrate). The results of the evaluation were that stable single loop operation is achievable and acceptable with specified operating limits and procedures for avoiding as well as detecting and suppressing power oscillations that may arise (e.g., if perhaps the operating recirculation pump tripped). In the LaSalle Event, instability arose following inadvertent trip of both recirculation pumps when the reactor operated with no recirculation loops in operation. Power operation with both recirculation loops inoperable is prohibited by each license for operation of a BWR. The LaSalle Event reaffirms the necessity for prohibiting operation with no recirculation loops in operation. However, the LaSalle Event does not invalidate the technical findings from the review of Generic Issue B-59.

9. Reopen Rulemaking Proceedings Regarding Anticipated Transients Without Scram

In the acknowledgement letter sent to Petitioner on August 26, 1988, I included this request among those to be considered pursuant to 10 CFR 2.206. I have subsequently determined, however, that this request is more properly treated as a petition for rulemaking under 10 CFR 2.802. As such, it has been referred to the NRC Office of Research for appropriate action. However, it is important to

note that both the NRC and BWR Owners Group (BWROG) currently have programs in which analyses of ATWS conditions are being conducted. These analyses treat large amplitude power oscillations with state-of-the-art analytical methods. The results of these analyses to date confirm the technical bases for the current ATWS rule. Consequently, at this time, the NRC staff sees no basis for recommending that the Commission reopen rulemaking proceedings regarding ATWS. If, however, the staff finds evidence which contradicts the assumptions and results of previous ATWS analyses from either the information you provided in support of the request or new information from ongoing NRC and BWROG programs, it may then be appropriate for the Commission to reconsider the current ATWS rule.

10. Reconsider Use of the End-of-Cycle Recirculation Pump Trip on BWRs

The end-of-cycle recirculation pump trip (EOC-RPT) is part of the reactor protection system and is an essential safety supplement to the reactor trip. The EOC-RPT reduces reactor coolant flowrate to provide additional negative reactivity for mitigation of events in which the reactor coolant system is pressurized rapidly. The additional negative reactivity from the EOC-RPT is needed primarily at the end of the cycle to compensate for (1) changes in reactor power distribution over the cycle that have reduced thermal margin and (2) a decrease in the rate of negative reactivity insertion during reactor scram. The two events for which the EOC-RPT protective feature will function are closure of the turbine stop valves and fast closure of the turbine control valves. In both cases, the EOC-RPT is accompanied by an anticipatory scram of the reactor that is initiated by the same signals that initiate the EOC-RPT.

11. Require Licensees To Submit Justification For Continued Operation in Light of the Issues Raised in the Petition

In NRC Bulletin 87-07 and Supplement 1 to that bulletin, the NRC Staff specified actions licensees should take to ensure continued safe operation and compliance with the Commission's regulations. All licensees have confirmed, under oath and affirmation, that (1) all necessary actions requested in NRC Bulletin 87-07 have been completed and, (2) that full documentation of the action taken is available for inspection by the NRC. Licensees are also required to advise the NRC by letter, within 60 days of receipt of Supplement 1 to the bulletin, whether actions requested in the supplement have been completed and implemented. The staff considers responses to both the bulletin and the supplement, which are acceptable to the staff, to be adequate justification on the part of licensees for continued operation. Consequently, your request is denied.

12. Order All BWR Licensees to Submit a Report to the NRC Within One Year Demonstrating Compliance with Criterion 12 Given in 10 CFR Part 50, Appendix A (GDC 12)

As indicated previously in paragraph A.1., the NRC staff's position regarding compliance with GDC-12 is that, regardless of the magnitude of the calculated decay ratio, each BWR licensee should have in place the necessary

operating limitations, response procedures, and operator training program that permit plant operators to identify and terminate limit cycle oscillations.

The staff's position was communicated to licensees in NRC Bulletin No. 88-07, through meetings with the BWROG and in Supplement 1 to NRC Bulletin 88-07. The staff believes that actions licensees are expected to take in response to NRC Bulletin 88-07 are sufficient to ensure compliance with GDC-12 for core-wide oscillations. However, if plant inspections reveal that actions taken by licensees are inadequate, plant-specific actions would be pursued at that time. With respect to regional oscillations, procedures specified in Supplement 1 to NRC Bulletin 88-07 ensure that such oscillations would be suppressed quickly with an anticipatory reactor scram initiated manually by a reactor operator. As discussed previously, the staff believes that implementation of these procedures will ensure continued safe plant operation in the interim until long-term corrective actions are developed and put in place.

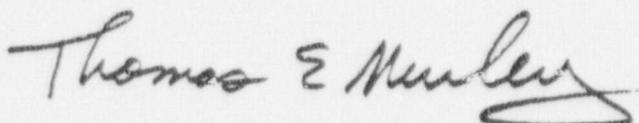
#### IV. CONCLUSION

The Petitioner seeks the institution of a show-cause proceeding pursuant to 10 CFR 2.202 to modify or revoke the operating license of all BWR facilities. The institution of proceedings pursuant to 10 CFR 2.202 is appropriate only where substantial health and safety issues have been raised. See Consolidated Edison Company of New York (Indian Point, Units 1, 2, and 3), CLI-75-8, 2 NRC 173 (1975) and Washington Public Power System (WPPS Nuclear Project No. 2), DD-84-7,

19 NRC 899, 923 (1984). This is the standard that I have applied to the concerns raised by the Petitioner in this decision to determine whether enforcement action is warranted.

For the reasons discussed above, I conclude that no substantial health and safety issues have been raised by the Petitioner. Accordingly, the Petitioner's request for action pursuant to 10 CFR 2.206 is denied. As provided in 10 CFR 2.206(c), a copy of this Decision will be filed with the Secretary of the Commission for the Commission's review.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script that reads "Thomas E. Murley". The signature is written in dark ink and is positioned above the typed name and title.

Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland,  
this 27th day of April 1989.

## NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-293, et al.\*

BOSTON EDISON COMPANY, et al.\*

(Pilgrim Nuclear Power Station, et al.)\*

## ISSUANCE OF DIRECTOR'S DECISION UNDER 10 CFR 2.206

Notice is hereby given that the Director, Office of Nuclear Reactor Regulation (NRR), has issued a Director's Decision concerning a Petition dated July 22, 1988, filed by Ms. Susan Hiatt, on behalf of Ohio Citizens for Responsible Energy Inc. The Petition asked the Director, NRR, to take immediate action to relieve what the Petitioner alleged to be undue risks to the public health and safety posed by the thermal-hydraulic instability of boiling-water reactors (BWRs), as revealed by the power oscillation event at LaSalle Unit 2 on March 9, 1988 (LaSalle Event). The specific relief requested was to order all BWR licensees to (1) place their reactors in cold shutdown, (2) develop and implement specified procedures relating to the thermal-hydraulic instability issues, (3) demonstrate that certain specified training has been provided relating to these procedures, (4) demonstrate the capability of instrumentation related to power oscillations, (5) develop simulators capable of modeling power oscillations similar to those occurring at LaSalle and out-of-phase power oscillations, (6) report to the NRC regarding all past and future incidents in which recirculation pumps have tripped off, (7) submit to the NRC justification for continued operation of BWRs, and (8) submit a report to the NRC within one year demonstrating compliance with Criterion 12 given in 10 CFR Part 50, Appendix A (GDC-12). In addition, the Commission was requested to reopen Generic Issues B-19 and B-59, reopen the ATWS rulemaking proceeding, and

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reconsider the use of the end-of-cycle circulation pump trip on BWRs. Ms. Hiatt gave as grounds for the Petition that the LaSalle Event has serious safety implications for all BWRs and that the Nuclear Regulatory Commission (NRC) had failed to take appropriate regulatory action in response to the LaSalle Event.

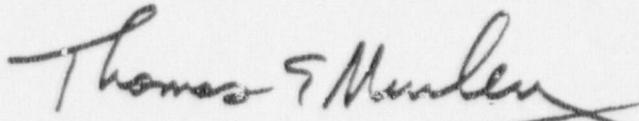
On August 26, 1988, the Director, Office of Nuclear Reactor Regulation (NRR), acknowledged receipt of the Petition. He informed Ms. Hiatt that (1) her request for immediate relief was denied because the allegations that formed the basis for the Petition did not reveal any new operational safety issues which posed an immediate safety concern for continued BWR operation, (2) the Petition would be treated under 10 CFR 2.206 of the Commission's regulations, and (3) appropriate action would be taken within a reasonable time.

In the August 26, 1988 letter, the Director, NRR, acknowledged Ms. Hiatt's request to reopen the ATWS rulemaking proceedings as a request which would be treated pursuant to 10 CFR 2.206. This request, however, will not be treated pursuant to 10 CFR 2.206 but is being treated separately as a petition for rulemaking under 10 CFR 2.802 of the Commission's regulations.

The Director has now determined that all of Ms. Hiatt's requests, except for her request to reopen the ATWS rulemaking, should be denied for the reasons set forth in the "Director's Decision Pursuant to 10 CFR 2.206" (DD-89-03). The Decision is available for inspection and copying in the Commission's Public Document Room, 2120 L Street N.W., Washington, D.C. 20555 and at the Local Public Document Rooms near the facilities listed below. The addresses and hours of operations for the local public document rooms may be obtained by calling the following toll-free number: 1-800-638-8061.

A copy of the Decision will be filed with the Secretary of the Commission for the Commission's review in accordance with 10 CFR 2.206(c). As provided in 10 CFR 2.206(c), the Decision will become the final action of the Commission twenty-five (25) days after issuance unless the Commission on its own motion institutes review of the Decision within that time.

FOR THE NUCLEAR REGULATORY COMMISSION



Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland,  
this 27th of April 1989.

\* CAROLINA POWER & LIGHT CO. (Brunswick Station, Units 1 and 2, Docket Nos. 50-324 and 50-325)  
CLEVELAND ELECTRIC ILLUMINATING CO., ET AL. (Perry Nuclear Power Plant, Unit 1, Docket No. 50-440)  
COMMONWEALTH EDISON CO. (Dresden Nuclear Power Plant, Units 2 and 3, Docket Nos. 50-237 and 50-249), (Quad Cities Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-254 and 50-265), (LaSalle County Station, Units 1 and 2, Docket Nos. 50-373 and 50-374)  
CONSUMERS POWER CO. (Big Rock Point, Docket No. 50-155)  
DETROIT EDISON CO. (Fermi Unit 2, Docket No. 50-341)  
GENERAL PUBLIC UTILITIES (Oyster Creek Station, Docket No. 50-219)  
GEORGIA POWER CO. (Hatch Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-321 and 50-366)  
GULF STATES UTILITIES CO. (River Bend Station, Docket No. 50-458)  
ILLINOIS POWER CO. (Clinton Nuclear Power Plant, Docket No. 50-461)  
IOWA ELECTRIC LIGHT & POWER CO. (Duane Arnold Nuclear Power Plant, Docket No. 50-331)  
LONG ISLAND LIGHTING CO. (Shoreham Nuclear Power Plant, Docket No. 50-322)  
MISSISSIPPI POWER & LIGHT CO. (Grand Gulf Nuclear Station, Docket No. 50-416)  
NEBRASKA PUBLIC POWER DISTRICT (Cooper Station, Docket No. 50-298)  
NIAGARA MOHAWK POWER CORP. (Nine Mile Point, Units 1 and 2, Docket Nos. 50-220 and 50-410)  
NORTHEAST UTILITIES (Millstone Unit 1, Docket No. 50-245)  
NORTHERN STATES POWER CO. (Monticello Nuclear Power Plant, Docket No. 50-263)  
PENNSYLVANIA POWER & LIGHT CO. (Susquehanna Steam Electric Station, Units 1 and 2, Docket Nos. 50-387 and 50-388)  
PHILADELPHIA ELECTRIC CO. (Peach Bottom Nuclear Station, Units 2 and 3, Docket Nos. 50-277 and 50-278), (Limerick Nuclear Power Plant, Unit 1, Docket No. 50-352)  
POWER AUTHORITY OF THE STATE OF NEW YORK (James A. Fitzpatrick Station, Docket No. 50-333)  
PUBLIC SERVICE ELECTRIC & GAS CO. (Hope Creek Generating Station, Docket No. 50-354)  
TENNESSEE VALLEY AUTHORITY (Browns Ferry Nuclear Station, Units 1, 2, and 3, Docket Nos. 50-259, 50-260, and 50-296)  
VERMONT YANKEE NUCLEAR POWER CORP. (Vermont Yankee Nuclear Power Plant, Docket No. 50-271)  
WASHINGTON PUBLIC POWER SUPPLY SYSTEM (WNP Unit 2, Docket No. 50-397)