RELEASED TO THE POR



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

DEC 1 9 1903

MEMORANDUM FOR: Edward L. Jordan, Chairman Committee to Review Generic Requirements

FROM: James H. Sniezek, Deputy Director Office of Nuclear Reactor Regulation

SUBJECT: DRAFT BULLETIN 88-07, SUPPLEMENT 1, REGARDING POWER OSCILLATIONS IN BOILING WATER REACTORS

NRR requests that the Committee to Review Generic Requirements (CRGR) review the enclosed draft bulletin supplement at the CRGR's earliest convenience. We would like to issue this bulletin prior to the end of the year. Should there not be a CRGR meeting for other items in the next two weeks, please consider having the draft bulletin discussed in a conference telephone call among CRGR members. This should be possible since the bulletin basically only asks for confirmation that GE recommendations have been implemented with some minor NRC modifications.

Draft Bulletin 88-07, Supplement 1, "Power Oscillations in Boiling Water Reactors (BWRs)," provides additional information concerning BWR power oscillations and requests that addressees take actions to ensure that the safety limit for the plant minimum critical power ratio is not violated. This bulletin is addressed to all holders of operating licenses or construction permits for BWRs and is sponsored by Lawrence C. Shao, Director, Division of Engineering and Systems Technology.

The proposed bulletin supplement and background information required by the CRGR Charter are enclosed.

James H Inezek

James H. Sniezek, Deputy Director Office of Nuclear Reactor Regulation

Enclosures:

- NRC Bulletin No. 88-07 Supplement 1, Power Oscillations in Boiling Water Reactors (BWRs)
- 2. CRGR Item IV.B. Contents of Packages Submitted to CRGR

CONTACT: Peter C. Wen, NRR 492-1172

12290039 XA.

DEC 1 9 1988

OMB No.: 3150-0011 NRCB 88-07, Supplement 1

UNITED STATES NUCLEAR REGULATORY COMMISSION OFFICE OF NUCLEAR REACTOR REGULATION WASHINGTON, D.C. 20555

December xx, 1988

NRC BULLETIN NO. 88-07, SUPPLEMENT 1: POWER OSCILLATIONS IN BOILING WATER REACTORS (BWRs)

Addressees:

All holders of operating licenses (OLs) or construction permits (CPs) for boiling water reactors (BWRs).

Purpose:

The purpose of this supplement is (1) to provide additional information concerning power oscillations in BWRs and (2) to request that addressees take action to ensure that the safety limit for the plant minimum critical power ratio (MCPR) is not violated.

Description of Circumstances:

Licensees were requested in NRC Bulletin No. 88-07 to take actions to prevent the occurrence of uncontrolled power oscillations during all modes of BWR operation. In addition, as mentioned in the bulletin, the NRC, as a separate action, requested that the BWR Owners Group (BWROG) perform generic evaluations of the BWR plant response to core thermal hydraulic instabilities. The preliminary results of these evaluations and the NRC's ongoing independent study indicate that when regional power oscillations become detectable on the average power range monitors (APRMs), 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. In addition, design features of many reactor protection systems (e.g., filtered APRM signals to provide a Simulated Thermal Power Monitor in the power/flow scram circuit) render them ineffective for automatic scram protection during regional thermal hydraulic instabilities.

In November 1988, General Electric Company (GE) issued a letter entitled "Interim Recommendations for Stability Actions" to the BWR licensees. The interim corrective actions recommended by GE were reviewed by the NRC and have been found acceptable for those plants which have effective automatic scram protection for regional oscillations. For plants which do not have effective automatic scram (such as flow biased scram) protection for regional oscillations, the staff believes that the procedures recommended by the BWROG may not provide sufficient, reliable protection. Therefore, the staff is requesting that plants without effective automatic scram protection

NRCB 88-07, Supplement 1 December xx, 1988 Page 2 of

for regional oscillations manually trip the reactor in response to every situation in which two recirculation pumps are tripped with the reactor in the RUN mode. In addition, the BWROG recommendations were addressed to GE-fueled reactors. The staff is addressing the applicability of these recommendations to reactors with fuel supplied by other vendors and for new fuel designs which have not been previously approved.

The NRC is currently working with the BWROG to develop a generic approach to long-term corrective actions. The BWROG is planning to evaluate hardware modifications and/or additions and complementary procedure revisions needed to facilitate stability monitoring and to improve the manual and/or automatic protective actions as needed to avoid neutron flux oscillations and to suppress them if they occur. The BWROG study is expected to be completed within 6 months of the issuance of this supplement and to result in generic recommendations. The BWROG has indicated that these recommendations will be transmitted to addressees in parallel with the NRC review in order to facilitate development of plant-specific solutions within 12 months. The staff expects to issue another generic communication that will provide guidance for long-term resolution of the stability issue.

Actions Requested:

.

Operating Reactors:

- (1) Within 30 days of receipt of this supplement, all BWR licensees should implement the GE interim stability recommendations described in Attachment 1. 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 (Attachment 1) 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 or 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.

Construction Permit Holders:

All construction permit holders should complete the requested actions above before the date scheduled for fuel loading.

NRCB 88-07, Supplement 1 December xx, 1988 Page 3 of

Reporting Requirements:

Within 60 days of receipt of this supplement, all holders of OLs shall confirm by letter to the NRC that the requested actions have been completed and implemented. Prior to fuel loading, CP holders shall confirm by letter to the NRC that the requested actions have been completed and implemented.

The required written reports shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C., 20555, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended. In addition, a copy of the report shall be submitted to the appropriate Regional Administrator.

This request is covered by Office of Management and Budget Clearance Number 3150-0011 which expires December 31, 1989. The estimated average burden hours is approximately 100 to 200 person-hours per response, including assessment of the new recommendations, searching data sources, gathering and analyzing the data, and preparing the required reports. These estimated average burden hours pertain only to these identified response-related matters. Comments on the accuracy of this estimate and suggestions to reduce the burden may be directed to the Office of Management and Budget, Room 3208, New Executive Office Building, Washington, D.C. 20503, and to the U.S. Nuclear Regulatory Commission, Records and Reports Management Branch, Office of Administration and Resource Management, Washington, D.C. 2055.

If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi, Director Division of Operational Events Assessment Office of Nuclear Reactor Regulation

Technical Contacts: L. Phillips, NRR (301) 492-3235

P. C. Wen, NRR (301) 492-1172

Attachments: 1. "Interim Recommendations for Stability Actions," GE, November 1988. 2. List of Recently Issued NRC Bulletins

To: BWR Utilities

Subject: INTERIM RECOMMENDATIONS FOR STABILITY ACTIONS

GE, working with the BWR Owners' Group, is performing a generic evaluation of plant response to stability related oscillations. The objective is to determine the degree of mitigation provided by the existing reactor protection system and to determine the margin to safety limits associated with possible automatic or manual actions. Preliminary results indicate that for certain plants and operating conditions, interim operating procedures supplementing those previously provided in SIL-380 are appropriate to assure adequate margin to the Minimum Critical Power Ratio (MCPR) safety limit should regional oscillations occur. While these results are preliminary, they indicate a condition which should receive immediate attention.

Accordingly, the recommended "Interim Stability Corrective Actions for BWRs Using GE Fuel" contained in the enclosure are provided for implementation on your plant(s). Ongoing analysis will better define the degree of conservatism in this approach. However, given today's understanding of the situation, it is prudent to immediately implement these recommenda-tions on an interim basis.

We believe that the attached recommendations will help to prevent instability and provide clear and concise guidelines for operator action to keep plant operation within acceptable bounds in the unlikely event of regional oscillations. Furthermore, by taking decisive action to avoid the region in which low stability margins exist, post event speculation regarding possible safety limit violations can be avoided.

(Original signed by) P. W. Marriott, Manager Licensing and Consulting Services

INTERIM CORRECTIVE ACTIONS

- 1. Intentional operation shall not be allowed in Region A or Region B of Figure 1.
- 2. If Region A is unintentionally entered: '

Group 1 plant operators shall take immediate actions to exit the region. Immediate action consists of either:

Insertion of a predefined set of control rods which will most effectively reduce core thermal power.

or

Increasing recirculation pump speed if one or more pumps are in operation. Starting a recirculation pump to exit this region is NOT an appropriate action.

Group 2 plant operators shall manually scram the reactor to exit the region.

3. If Region B is unintentionally entered:

Group 1 and Group 2 plant operators shall take immediate action to exit the region. Immediate action consists of:

Insertion of a predefined set of control rods which will most effectively reduce core thermal power.

or

Increasing recirculation pump speed or recirculation flow (FCV plants) if one or more pumps are in operation. Starting a recirculation pump or shifting from low to high speed (FCV plants) to exit this region is NOT an appropriate action.

4. Intentional operation in Region C shall be allowed only for control rod withdrawals during startup requiring PCIOMR. This region should be avoided for control rod sequence exchanges, surveillance testing and reactor shutdowns.

During control rod withdrawal, flux monitoring should be conducted in accordance with SIL 380, Revision 1.

5. If at any time during operation in Region A, B or C, core thermal hydraulic instability occurs, the plant operator shall manually scram the reactor.

Evidence of thermal hydraulic instability consists of APRM peak to peak oscillations of greater than 10% or periodic LPRM upscale or downscale alarms in addition to the guidance provided in SIL 380, Revision 1.



FIGURE 1 DEFINED OPERATING REGIONS

REACTOR POWER GREATER THAN THE 100% ROD LINE CORE FLOW LESS THAN 40% OF RATED CORE FLOW REGION A REACTOR POWER BETWEEN THE SO& AND 100% ROD LINES

CORE FLOW LESS THAN 40% OF RATED CORE RATED REGION B

REACTOR POWER GREATER THAN THE SO& ROD LINE CORE FLOW BETWEEN 40% AND 45% OF RATED CORE FLOW REGION C

CORE THERMAL POWER (% OF RATED)

.

TABLE 1 US OPERATING REACTOR GROUPS

GROUP 1

.

• •

. .

OYSTER CREEK NINE MILE 1 DRESDEN 2,3 MILLSTONE 1 QUAD CITIES 1,2 PILGRIM MONTECELLO DUANE ARNOLD

COOPER VERMONT YANKEE PEACH BOTTOM 3,3 LIMERICK

GROUP 2

BRUNSWICK 1,2 HATCH 1,2 BROWNS FERRY 1,2,3 FERMI 2 FITZPATRICK HOPE CREEK SUSQUEHANNA 1,2 LASALLE 1,2 HANFORD 2 SHOREHAM NINE MILE PT 2 CLINTON PERRY RIVER BEND GRAND GULF 1

* Based on information available to GE. Excludes Big Rock

DEC 1 9 1988

CRGR Item IV.B Contents of Packages Submitted to CRGR (Rev. 4, Stello to List 042387, dcs 41860 342 ff)

Question:

 The proposed generic requirement or staff position as it is proposed to be sent out to licensees.

Response:

The proposed requirements are set forth in the bulletin (Enclosure 1).

Question:

 Draft staff papers or other underlying staff documents supporting the requirements or staff positions.

Response:

- NRC Information Notice No. 88-39, "LaSalle Unit 2 Loss of Recirculation Pumps With Power Oscillation Event," dated June 15, 1988.
- NRC Bulletin No. 88-07, "Power Oscillations In Boiling Water Reactors (BWRs)," dated June 15, 1988.
- Memorandum from Victor Stello, Jr. to The Commissioners, "Progress Report on Staff Review of Regulatory Implications Related to Power Oscillations Event at LaSalle 2." (DRAFT)

Question:

III. Each proposed requirement or staff position shall contain the sponsoring office's position as to whether the proposal would increase staff requirements or staff positions, would implement existing staff requirements or positions, or would relax or reduce existing requirements or staff positions.

Response:

General Design Criterion (GDC) 12 "Suppression of Reactor Power Oscillations" of Appendix A to 10 CFR Part 50 requires that the reactor core and associated coolant, control, and protection systems 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. Technical Specifications specify a safety limit (minimum critical power ratio) for BWR operations. The action items in the proposed bulletin implement these existing regulatory requirements.

Question:

IV. The proposed method of implementation along with the concurrence (and any comments) of OGC on the method proposed.

Response:

The method of implementation will be the proposed bulletin (Enclosure 1). A copy of this bulletin has been forward to OGC. Any comments received will be incorporated prior to issuance.

Question:

V. Regulatory analyses generally conforming to the directives and guidance of NUREG/BR-0058 and NUREG/CR-3568.

Response:

It is estimated that the average cost to the industry for implementation of the proposed bulletin supplement is \$10,000 to \$20,000 per response. This is based on our best estimate of the cost for assessment of the new recommendations, the incremental cost of modifying the plant procedures and operator training to accommodate the modifications to BWROG recommendations addressed in the proposed bulletin supplement and the cost of preparing the letter to notify NRC that the requested actions are complete. It is our understanding that the BWROG/GE recommendations have been implemented by the industry as requested in the correspondence from General Electric Company to the BWR utilities.

It is estimated that there will be no significant incremental cost to the NRC for review of the actions requested in the proposed bulletin supplement. Review of the licensee response will consist only of recording by the project managers that the requested actions have been completed and implemented. Temporary Instructions for review by regional inspection of licensee implementation of Bulletin 88-07 actions will be amended to include the actions requested by the proposed bulletin supplement. Since these inspections have not started, the additional cost for the inspection will be insignificant.

There are no new trips anticipated because of the proposed bulletin. However, it is anticipated that the modifications to BWROG recommendations requested by the proposed bulletin might result in one additional reactor scram by the industry with one day of down time. This is based on industry provided information concerning the frequency of "two recirculation pump trip without scram" events. The estimated associated cost to the industry is \$500,000. It is assumed that the interim recommendations will be in effect for one to two years.

There are no actions requested in the proposed bulletin which would result in radiation exposure of the general public or plant personnel.

Question:

VI. Identification of the category of reactor plants to which the generic requirements or staff position is to apply.

Response:

The proposed bulletin would apply to all holders of operating licenses or construction permits for boiling water reactors.

Question:

VII. For each such category of reactor plants, an evaluation which demonstrates how the action should be prioritized and scheduled in light of other on going regulatory activities. The evaluation shall document for consideration information available concerning any of the following factors as may be appropriate and any other information relevant and material to the proposed action:

Response:

Response to this item is not required pursuant to Revision 4 of the CRGR Charter, Section III.D., since the requested actions of the proposed bulletin are considered necessary to bring facilities into compliance with the existing regulatory requirements.

Question:

- VIII. For each evaluation conducted pursuant to 10 CFR 50.109, the proposing office director's determination together with the rationale for the determination based on the consideration of paragraphs (I) through (VII) above that:
 - A. there is a substantial increase in the overall protection of public health and safety or the common defense and security to be derived from the proposal; and
 - B. the direct and indirect costs of implementation, for the facilities affected, are justified in view of this increased protection.

Response:

Response to this item is not required because the required actions of the proposed bulletin contain no backfitting issues.

Question:

IX. For each evaluation conducted for proposed relaxations or decreases in current requirements or staff positions, the proposing office director's determination, together with the rationale for the determination based on the considerations of paragraphs (I) through (VII) above, that:

- A. the public health and safety and the common defense and security would be adequately protected if the proposed reduction in requirements or positions were implemented, and
- B. the cost saving attributed to the action would be substantial enough to justify taking the action.

Response:

This item is not applicable to the proposed bulletin because no relaxation or decrease in current requirements is being proposed.

ROUTING AND TRANSMITTAL SLIP

The state of the second s

. .

and the second states

		-	

87

Date

IO: (Name. office symbol, room number, building, Agency/Post)					Initiels	Date
1.	BCS					
2.	PDR					
8						
6.						
B.			/			
Ac	tion	V	File	Note and Return		m
Ap	proval		For Clearance	Per Conversation		noi
As	Requested		For Correction	Prepare Repty		1
Cir	rculate		For Your Information	See Me		
Co	mment		Investigate	Signature		
port	the second state of the se	and the second second	And the state of t			

This previous Central File material can now be made publicly available.

CAPER Nity 153 material

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room NoBidg. 3701
Confinado	Phone No.
5041-102	OPTIONAL FORM 41 (Rev. 7-76)

AL - 100 1078 01-201-0047 3351

FPMR (41 CFR) 101-11.206