



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

June 21, 1993

TO: FOR ACTION - ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR WESTINGHOUSE (W)-DESIGNED NUCLEAR POWER REACTORS EXCEPT HADDAM NECK

FOR INFORMATION - ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR COMBUSTION ENGINEERING (CE)-DESIGNED AND BABCOCK AND WILCOX (B&W)-DESIGNED NUCLEAR POWER REACTORS AND HADDAM NECK

SUBJECT: ROD CONTROL SYSTEM FAILURE AND WITHDRAWAL OF ROD CONTROL CLUSTER ASSEMBLIES, 10 CFR 50.54(f) (GENERIC LETTER 93-04)

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter (1) to notify addressees about a single failure vulnerability within the Westinghouse solid state rod control system that could cause an inadvertent withdrawal of control rods in a sequence resulting in a power distribution not considered in the design basis analyses, and (2) to require, in accordance with Section 50.54(f) of Part 50 of Title 10 of the Code of Federal Regulations (10 CFR 50.54(f)), that all action addressees provide the NRC with information describing their plant-specific findings related to this issue and actions taken. The NRC will use this information to assess licensee compliance with the plant-specific licensing basis regarding single failures in the rod control system.

Background

The staff issued Information Notice 93-46, "Potential Problem With Westinghouse Rod Control System and Inadvertent Withdrawal of a Single Rod Control Cluster Assembly," dated June 10, 1993, to alert licensees to the potential for an inadvertent withdrawal of one or more rod control cluster assemblies in Westinghouse plants in response to an insert signal.

Description of Circumstances

On May 27, 1993, operators at the Salem Nuclear Generating Station, Unit 2, experienced problems with the rod control system. During an attempt to withdraw Shutdown Bank A, the operator observed that the analog rod position indicator (ARPI) did not indicate that the control rods were being withdrawn. The operator stopped attempting to withdraw rods at 20 steps as indicated on the group demand indicator. At this time the ARPI indicated that all of the rods in Shutdown Bank A were at the 0 step position. (The function of the group demand indicator is to provide the operator with information on the

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position to which the rods should have moved on the basis of the demand from the rod control system. The function of the ARPI is to show the actual position of each rod.) The operator then attempted to insert Shutdown Bank A. However, one control rod (ISA3) withdrew to 8 steps as indicated by the ARPI while the group demand indicator counted down from 20 steps to 6 steps. The operator continued to try to insert the Shutdown Bank A control rods until the group demand indicator showed a rod position of zero. The operator observed that the indicated position on the ARPI for control rod ISA3 was 15 steps. Public Service Electric & Gas (the licensee) removed power from the rod by pulling fuses, and rod ISA3 dropped to the 0 step position as indicated by the ARPI.

The licensee initiated troubleshooting activities on the rod control system at Salem, Unit 2. An NRC augmented inspection team (AIT) was sent to Salem Unit 2 to evaluate this issue and observe the investigation of this event by the licensee.

The licensee, in response to NRC questions, has postulated that, for the event that occurred on May 27, 1993, a single failure in the rod control system caused a single rod to withdraw from the core 15 steps while the operator was applying a rod insertion signal. The failure of an integrated circuit on a slave cyclor decoder card disrupted the normal sequence of pulses that the rod control system sends to the rods in the selected bank. Normally, on insert demand, the pulses are staggered in a sequence that leads to rod insertion. With the failure, the rod control system periodically sent simultaneous pulses to the movable gripper coil, lift coil, and stationary coil for each of the rods in the selected bank. Under these conditions each rod in the bank may either remain where it is or withdraw from the core when a rod movement demand occurs.

When the rod control system is in the automatic mode of operation, a rod movement demand is generated automatically in response to changes in turbine load and changes in the average reactor coolant temperature. Rod movement then occurs without any operator action until the demand is satisfied. When the rod control system is in the manual mode of operation, a rod movement demand is generated only in response to operator manipulation of the IN-HOLD-OUT switch, given no failures in the demand circuit.

### Discussion

The rod control system installed at Salem Unit 2 is used at all Westinghouse-designed pressurized-water reactors (PWRs) except Haddam Neck. Initial assessments by Westinghouse showed that a single failure in the rod control system could result in unintended rod withdrawal movements in multiple control rods. Although the reactor protection system is independent of the rod control system logic and, therefore, the scram function is not compromised, there remains a concern that a previously unanticipated single-failure mechanism may exist in the control system that can initiate or aggravate reactivity excursions and result in fuel failure. This is of particular importance since the frequency of demand on the rod control system for power adjustments is very high (daily in many plants).

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General Design Criterion (GDC) 25, "Protection system requirements for reactivity control malfunctions," of Appendix A to 10 CFR 50 specifies that acceptable fuel design limits not be exceeded for any single malfunction of the reactivity control systems. The Standard Review Plan (NUREG-0800) Sections 15.4.1, 15.4.2 and 15.4.3, discuss the specified acceptable fuel design limits for single failures in the reactivity control system (in this case the rod control system). One of these fuel design limits is that fuel rods do not violate the minimum departure from nucleate boiling ratio (DNBR) criterion.

The staff requested activation of the Westinghouse Owners Group Regulatory Response Group (RRG) on June 8, 1993. The Westinghouse Owners Group RRG met with the staff on June 14, 1993, to discuss the RRG generic safety assessment of the Salem event. The RRG concluded that the failure can produce a withdrawal signal if either a manual or automatic insert command is given to any rod control cluster assembly (RCCA) bank or overlapping banks. The RRG also discussed analysis results showing that asymmetric RCCA withdrawal at power and from a subcritical condition are the limiting cases. For both of these cases conservative bounding evaluations indicate that a small percentage (less than 5 percent) of the fuel rods experience a calculated DNBR below the limit value.

The staff believes that the safety significance of this issue is not high based on the following information:

- All automatic safety functions will perform as designed.
- For the worst cases of single failures in the rod control system only a small number (or none) of the fuel rods will be below the DNBR limit.
- Not all events will lead to fuel rods below the DNBR limit.

Furthermore these events do not provide a challenge to the reactor coolant system or the containment boundary. Although the staff believes that the safety significance of this issue is not high, it believes that compliance with plant-specific licensing bases is in question for all action addressees. GDC 25 specifies that acceptable fuel design limits not be exceeded for any single malfunction of the reactivity control systems. The analyses discussed by the Westinghouse Owners Group indicated that fuel failures could result from single failures identified as a result of the Salem event.

Westinghouse issued a Nuclear Safety Advisory Letter (NSAL) 93-007, dated June 11, 1993, recommending the following actions:

1. Licensed operators should continue the normal process of verifying that rod motion is proper for required movement.
2. Licensees should confirm the functionality of rod deviation alarms.
3. Operators should review the advisory letter to ensure their understanding of the event.

4. The Westinghouse Owners Group (WOG) survey its members regarding rod misalignment events and provide a summary.

Implementation of the recommendations in the Westinghouse NSAL is judged by the NRC staff to be a prudent action.

The licensee for Salem is implementing several compensatory actions prior to the startup of either unit. These actions include:

- Enhanced rod control system surveillances prior to startup and during operation
- More frequent periodic surveillances of the rod control system
- Modification of the startup procedure to preclude an asymmetric rod withdrawal from the subcritical condition by
  - first pulling control rods while still highly borated to the estimated critical position, then,
  - deborating to criticality
- Classroom and simulator training addressing the effects of potential single failures in the rod control system
- Issuance of standing orders to heighten operator awareness of potential rod control system malfunctions
- Review of event response procedures to assure adequate guidance to operators in the event of a rod control system malfunction

#### Required Response

Pursuant to Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), each action addressee is required to submit written information as follows:

1. Within 45 days from the date of this generic letter:
  - (a) Provide an assessment of whether or not the licensing basis for each facility is still satisfied with regard to the requirements for system response to a single failure in the rod control system and provide a supporting discussion for this assessment in light of the information generated as a result of the Salem event.
  - (b) If the assessment in 1(a) indicates that the licensing basis is not satisfied
    - provide an assessment of the impact of potential single failures in the rod control system on the licensing basis of the facility

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- describe any compensatory short-term actions taken or that will be taken to address any actual or potential degraded or nonconforming conditions (see Generic Letter 91-18, Reference 1) such as
    - additional cautions or modifications to surveillance and preventive maintenance procedures
    - additional administrative controls for plant startup and power operation
    - additional instructions and training to heighten operator awareness of potential rod control system failures and to guide operator response in the event of a rod control system malfunction
2. If the assessment in 1(a) indicates that the licensing basis is not satisfied, within 90 days from the date of this generic letter provide a plan and schedule for the long-term resolution of this issue.

Address the required written reports 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 of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). In addition, submit a copy to the appropriate regional administrator. This generic letter requires information that will enable the NRC to verify that the licensee is complying with its current licensing basis regarding single failure vulnerability within the rod control system. Accordingly, an evaluation justifying this information requirement is not necessary in accordance with 10 CFR 50.54(f).

#### Backfit Discussion

This generic letter does not involve any backfitting. It only requires (under the provisions of 10 CFR 50.54(f)) the submittal of information needed by the NRC staff to assess the compliance by the action addressees with existing NRC rules and regulations.

Although the staff believes that the safety significance of the issue addressed by this generic letter is not high, there is an urgency to the information requirement involved based on the consideration that plants may be currently operating outside of their licensing bases and the information is needed promptly to allow the staff to assess this situation. Therefore, a notice of opportunity for public comment on this generic letter was not published in the Federal Register.

Paperwork Reduction Act Statement

This generic letter contains information collection requirements that are subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.). These requirements were approved by the Office of Management and Budget, Approval Number 3150-0011, which expires June 30, 1994.

The public reporting burden for this collection of information is estimated to average 40 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for further reducing reporting burden, to the Information and Records Management Branch (MNBB-7714), U.S. Nuclear Regulatory Commission, Washington, D.C. 20555; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-3019, (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

Compliance with the request for the following information is purely voluntary. The information would assist the NRC in evaluating the cost of complying with this generic letter.

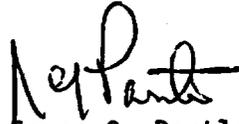
- (1) the licensee staff time and costs to perform requested inspections, corrective actions, and associated testing
- (2) the licensee staff time and costs to prepare the requested reports and documentation
- (3) the additional short-term costs incurred as a result of the inspection findings such as the costs of the corrective actions or the costs of down time
- (4) an estimate of the additional long-term costs that will be incurred in the future as a result of implementing commitments such as the estimated costs of conducting future inspections or increased maintenance

The NRC is issuing this generic letter to the information addressees to alert them to a problem with the Westinghouse rod control system and inadvertent withdrawal of a control rod. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, the requested actions and reporting requirements applicable to the action addressees are not applicable to the information addressees; therefore, no specific action or written response is required from them.

June 21, 1993

If you have any questions about this matter, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,



James G. Partlow  
Associate Director for Projects  
Office of Nuclear Reactor Regulation

Enclosure:

List of Recently Issued NRC Generic Letters

Technical contacts: Margaret Chatterton, NRR  
(301) 504-2889

Timothy Collins, NRR  
(301) 504-2897

Lead project manager: Thomas Alexion, NRR  
(301) 504-1326

Reference:

Generic Letter 91-18, "Information to Licensees  
Regarding Two NRC Inspection Manual Sections  
on Resolution of Degraded and Nonconforming  
Conditions and on Operability," issued  
November 7, 1993

LIST OF RECENTLY ISSUED GENERIC LETTERS

<u>Generic Letter</u>	<u>Subject</u>	<u>Date of Issuance</u>	<u>Issued To</u>
93-03		NOT AS YET ISSUED	
93-02	NRC PUBLIC WORKSHOP ON COMMERCIAL GRADE PROCUREMENT AND DEDICATION	03/23/93	ALL HOLDERS OF OLs OR CPs FOR NPRs AND ALL RECIPIENTS OF NUREG-0040, "LICENSEE CONTRACTOR AND VENDOR INSPECTION STATUS REPORT" (WHITE BOOK)
93-01	EMERGENCY RESPONSE DATA SYSTEM TEST PROGRAM	03/03/93	ALL HOLDERS OF OLs OR CPs FOR NPRs, EXCEPT FOR BIG ROCK POINT AND FACILITIES PERMANENTLY OR INDEFINITELY SHUT DOWN
92-09	LIMITED PARTICIPATION BY NRC IN THE IAEA INTERNATIONAL NUCLEAR EVENT SCALE	12/31/92	ALL HOLDERS OF OLs OR CPs FOR NPRs
92-08	THERMO-LAG 330-1 FIRE BARRIERS	12/17/92	ALL HOLDERS OF OLs OR CPs FOR NPRs
92-07	OFFICE OF NUCLEAR REACTOR REGULATION REORGANIZATION	10/10/92	ALL HOLDERS OF OLs OR CPs FOR NPRs
83-28 SUPPLEMENT 1	REQUIRED ACTIONS BASED ON GENERIC IMPLICATIONS OF SALEM ATWS EVENTS	10/07/92	ALL LIGHT-WATER REACTOR LICENSEES AND APPLICANTS
92-06	OPERATOR LICENSING NATIONAL EXAMINATION SCHEDULE	09/06/92	ALL POWER REACTOR LICENSEES AND APPLICANTS FOR AN OL
92-05	NRC WORKSHOP ON THE SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE (SALP) PROGRAM	09/04/92	ALL HOLDERS OF OLs OR CPs FOR NPRs

OL = OPERATING LICENSE  
 CP = CONSTRUCTION PERMIT

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Original signed by

James G. Partlow

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\*SEE PREVIOUS CONCURRENCE

ADPR:NRR	*ADT:NRR	*D/DORS:NRR	*C/OGCB:DORS:NRR
JGPartlow	WTRussell	BKGrimes	GHMarcus
06/21/93	06/21/93	06/18/93	06/18/93
*C/HICB:DRCH:NRR	*D/DRCH:NRR	*D/SRXB:NRR	*OGC
JSWermiel	BABoger	ACThadani	SHLewis
06/17/93	06/17/93	06/18/93	06/18/93
*OGCB:DORS:NRR	*ADM:RPB	*SRXB:DSSA:NRR	*SRXB:DSSA:NRR
NECampbell	TechEd	MSChatterton	TECollins
06/17/93	06/16/93	06/18/93	06/18/93
			*C/SRXB:DSSA:NRR
			RCJones
			06/18/93

DOCUMENT NAME: 93-04.GL

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ADPR:NRR JGPartlow 06/ /93	ADT:NRR E.P. Passari 06/2/93	C/DORS:NRR 3K... 05/18/93	C/OGCB:DORS:NRR GHMarcus 06/18/93
*C/HICB:DRCH:NRR JSWermiel 06/17/93	*D/DRCH:NRR BABoger 06/17/93	*D/SRXB:NRR ACThadani 06/18/93	*OGC SHLewis 06/18/93
*OGCB:DORS:NRR NECampbell 06/17/93	*ADM:RPB TechEd 06/16/93	*SRXB:DSSA:NRR MSCatterton 06/18/93	*SRXB:DSSA:NRR TECollins 06/18/93
			*C/SRXB:DSSA:NRR RCJones 06/18/93

DOCUMENT NAME: SALEM.GL

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06/17/93	06/17/93	06/ /93	06/ /93
*OGCB:DORS:NRR	*ADM:RPB	SRXB:DSSA:NRR	SRXB:DSSA:NRR
NECampbell	TechEd	<i>MS</i> MSchatterton	TECollins <i>sted</i>
06/17/93	06/16/93	<i>MS</i> 06/16/93	C/SRXB:DSSA:NRR RCJones 06/ /93

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JGPartlow	WTRussell	BKGrimes	GHMarcus	
06/ /93	06/ /93	06/ /93	06/ /93	
*C/HICB:DRCH:NRR	*D/DRCH:NRR	D/SRXB:NRR	OGC <i>2/2 No legal objection</i>	
JSWermiel	BABoger	ACThadani	SHLewis	
06/17/93	06/17/93	06/ /93	06/18/93	
*OGCB:DORS:NRR	*ADM:RPB	SRXB:DSSA:NRR	SRXB:DSSA:NRR	C/SRXB:DSSA:NRR
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OGC  
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SRXB:DSSA:NRR  
TECollins  
06/ /93

C/SRXB:DSSA:NRR  
RCJones  
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*J.P. Campbell*

*SEE COMMENT  
ON GH 91-18*

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Lead project manager: James Stone, NRR  
(301) 504-1419

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NECampbell	TechEd <i>MMESAe</i>	MSchatterton	TECollins	RCJones
06/ /93	06/ 17/93	06/ /93	06/ /93	06/ /93