NUREG-0905

Closeout of IE Bulletin 79-12: Short-Period Scrams at Boiling-Water Reactors

Final Report

U.S. Nuclear Regulatory Commission

Office of Inspection and Enforcement

C. J. DeBevec, R. A. Holland

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ABSTRACT

IE Circular 77-07 was issued on April 14, 1977 because of the occurrence of short period scram events at Dresden Unit 2 on December 28, 1976 and at Monticello on February 23, 1977. The circular advised BWR plants to revise their control rod withdrawal sequences and operating procedures to reduce the likelihood of future short period scrams. However, similar events continued to occur. These included events at Oyster Creek on December 14, 1978; at Browns Ferry Unit 1 on January 18, 1979; and at Hatch Unit 1 on January 31, 1979. As a result of these events, IE Bulletin 79-12 was issued on May 31, 1979. This bulletin required a written response from licensees of GE-designed BWRs regarding specific actions listed in the bulletin. All of the licensees responded in a satisfactory manner. No similar events have been reported since IE Bulletin 79-12 was issued.

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CLOSEOUT OF IE BULLETIN 79-12: SHORT-PERIOD SCRAMS AT BOILING-WATER REACTORS

Introduction

This report presents the final staff evaluation and closeout of IE Bulletin 79-12 dealing with short-period scrams at BWRs. Bulletin 79-12 was issued on May 31, 1979 because short-period scrams were occurring at BWRs. Before that, IE Circular 77-07, issued on April 14, 1977, dealt with this same problem. Although scrams of this nature pose no immediate safety hazard, the frequency of events resulted in an unnecessary challenge to safety systems.

The identified cause for short-period scrams involved reactor operator unawareness of impending criticality coupled with high control rod notch worth. Thus, the bulletin requirement called for, among other things, an estimate of critical position (ECP), the proper monitoring of all source range monitors (SRM) and the consideration of special control rod withdrawal sequences designed to mitigate short-period events.

For background information, IE Bulletin (IEB) 79-12 and IE Circular (IEC) 77-07 are provided as Appendices A and B, respectively.

Summary and Conclusions

On the basis of licensee response, past performance, and current licensee practices, it is the conclusion of this report that licensees have effectively complied with the specified bulletin actions. Assuming continued licensee compliance, short-period scram events are not expected to occur with significant frequency in the future.

A summary of licensee actions and the staff's evaluation is presented in Appendix C for each affected plant for each of the bulletin action items.

Background

The following short period scram events were used as examples in IEC 77-07:

> At Dresden Unit 2 No. 2 on December 28, 1976 during a reactor startup following a scram from unrelated causes about 9 hours earlier, a rod withdrawal of one notch resulted in a rapid power rise associated with a reactor period of about one second and caused an Intermediate Range Monitor (IRM) Hi-Hi flux scram. The IRM was on its most sensitive scale. The moderator was essentially without voids and the reactor water temperature was 338°F. A similar event occurred at this facility on August 17, 1972.
>
> At Monticello on February 23, 1977, following a reactor scram about 10 hours earlier from unrelated causes, a reactor period of about one second was experienced during startup before the reactor tripped on IRM Hi-Hi flux. The IRM was on its most sensitive scale and the short period resulted from the withdrawal of a control rod one notch. The reactor moderator had few voids and the water temperature was 480°F.

From these events the conclusions derived in the circular were that high xenon concentration coupled with the same generic control rod pattern contributed to the event. The circular then advised BWR plants to revise control rod withdrawal sequences and operating procedures to reduce the likelihood of short-period scram events occurring in the future.

However, the following events taken from IEB 79-12 indicated that the short-period scram problem still was not resolved. The following is a brief account of each event:

1. Oyster Creek - On December 14, 1978, the reactor experienced a scram as control rods were being withdrawn for approach to critical, following a scram from full power which had occurred about 15 hours earlier. The moderator temperature was 380 degrees F and the reactor pressure was 190 psig. Because of the high xenon concentration the operators had not made an accurate estimate of the critical rod pattern. The operator at the controls was using the SRM count rate, which had changed only slightly (425 to 450 cps) to guide the approach. Control rod 10-43 (first rod in Group 9) was being withdrawn in "notch override" to notch position 10, when the reactor became critical on an estimated 2.8 second period. The operator was attempting to reinsert the rod when the scram occurred. Failure of the "emergency rod in" switch to maintain contact, due to bent switch stop, apparently contributed to the problem.

2. Browns Ferry Unit 1 - On January 18, 1979, the reactor experienced a scram during the initial approach to critical following refueling. The operator was continuously withdrawing in "notch override" the first control rod in Group 3 (a high worth rod) because the SRM count rate had led him to believe that the reactor was very subcritical. A short reactor period, estimated at 5 seconds, was experienced. The operator was attempting to reinsert control rods when the scram occurred.

3. Hatch Unit 1 - On January 31, 1979, the reactor experienced a scram during an approach to critical. Control rod 42-15 (fifth rod in Group 3) was being continuously withdrawn in "notch override" when the scram occurred, with a period of less than 5 seconds. The temperature was about 200 degrees F with effectively zero Xenon.

The conclusions presented in the bulletin were basically the same as those of the circular except for one additional point. In the bulletin it was noted that the operator had failed to realize he was approaching criticality and was thus pulling the control rods continuously (notch override). This inicated that an accurate estimate of critical rod position had not been made and all SRMs may not have been properly monitored.

Therefore, the bulletin included the following requirements to deal more directly with the events:

1. Review and revise, as necessary, your operating procedures to ensure that an estimate of the critical rod pattern may be made prior to each approach to critical. The method of estimating critical rod patterns should take into account all important reactivity variables (e.g., core xenon, moderator temperature, etc.).

2. Where inaccuracies in critical rod pattern estimates are anticipated due to unusual conditions, such as high xenon, procedures should require that notch-step withdrawal be used well before the estimated critical position is reached and all SRM channel indicators are monitored so as to permit selection of the most significant data.

3. Review and evaluate your control rod withdrawal sequences to assure that they minimize the notch worth of individual control rods, especially those withdrawn immediately at the point of criticality. Your review should ensure that the following related criteria are also satisfied:

   a. Special rod sequences should be considered for peak xenon conditions.

   b. Provide cautions to the operators on situations which can result in high notch worth (e.g., first rod in a new group will usually exhibit high worth).

4. Review and evaluate the operability of your "emergency rod in" switch to perform its function under prolonged severe use.

5. Provide a description of how your reactor operator training program covers the considerations above (i.e., items 1 thru 3).

The implementation of these requirements has proved successful to date and it has not been necessary for the NRC to take any further action.

Criteria for Evaluation of Licensee Response

The criteria used for determining acceptability of licensee response to the bulletin was developed by analyzing the problem, determining alternate solutions that would be effective, and reviewing the particular considerations set forth in the licensee's response. The goal was to alleviate the short-period scram problem in the most effective and feasible way. Compliance with the intent of the bulletin rather than strict adherence to all of the requirements was the criterion used.

Bulletin action items 1, 2, and 3 are interrelated. The item calling for an estimate of critical position, was not a strict requirement in case the licensee indicated a commitment to use the Reduced Notch Worth Procedure (RNWP) or another comparable conservative withdrawal sequence. Use of RNWP was consistent with the second and third bulletin action items calling for notch step

withdrawal and special withdrawal sequences. The Alternative Reduced Notch Worth Procedure is a special sequence of control rod withdrawal developed by GE to alleviate short-period scrams.

The RNWP is basically an extension of the Banked Position Withdrawal Sequence (BPWS) which had been developed by GE to minimize the effects of a rod drop accident. BPWS helps minimize control rod reactivity worth by calling for the banked withdrawal of rods in groups (typically banked positions are at 1, 2, and 3 feet). An exception to banking is made for peripheral rods. RNWP extends this system by calling for notch step withdrawal of rods in groups 3 and 4, since rods in these groups generally exhibit high notch worths. It further calls for the notch step withdrawal of all rods in the post checkerboard (less than 50% rod density) regime.

The use of a conservative rod withdrawal procedure is deemed an acceptable alternative to the Estimate of Critical Position and is consistent with bulletin action item 3. Its continued use by the licensee is likely, since a conservative withdrawal procedure fits in with fuel management goals.

The requirement for monitoring all SRM channel indicators during critical approach, is considered to be essential by the NRC. The reason for this position is that much of the problem addressed by the bulletin was associated with operator failure to recognize impending criticality.

Bulletin actions 4 and 5, calling for review of the emergency rod in switch and description of reactor operator training, were considered of secondary importance. All of the licensees responded positively to these items.

Results of Evaluation of Licensee Responses

Appendix C summarizes each licensee's responses to IEB 79-12 and the staff's conclusions regarding each response. It is important to note that the licensees are not bound to the use of any particular procedure with regard to IEB 79-12 since actual hardware or technical specifications are not involved. Instead, the NRC must rely upon the licensee's quality assurance program to effectively alleviate short-period scrams. Thus, the licensee's response along with the resident inspector's evaluation is the only barometer with which to gauge the licensee's long-range commitment.

The staff concluded that each licensee's response to IEB 79-12 was satisfactory, and if properly implemented, should significantly reduce the frequency of short-period scrams in the future.

Appendix A

IE Bulletin 79-12

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

May 31, 1979

IE Bulletin No. 79-12

SHORT PERIOD SCRAMS AT BWR FACILITIES

Summary:

Reactor scrams, resulting from periods of less than 5 seconds, have occurred recently at three BWR facilities. In each case the scram was caused by high flux detected by the IRM neutron monitors during an approach to critical. These events are similar in most respects to events which were previously described by IE Circular 77-07 (copy enclosed). The recent recurrences of this event indicate an apparent loss of effectiveness of the earlier Circular. Issuance of this Bulletin is considered appropriate to further reduce the number of challenges to the reactor protective system high IRM flux scram.

Description of Circumstances:

The following is a brief account of each event.

1. Oyster Creek - On December 14, 1978, the reactor experienced a scram as control rods were being withdrawn for approach to critical, following a scram from full power which had occurred about 15 hours earlier. The moderator temperature was 380 degrees F and the reactor pressure was 190 psig. Because of the high xenon concentration the operators had not made an accurate estimate of the critical rod pattern. The operator at the controls was using the SRM count rate, which had changed only slightly, (425 to 450 cps) to guide the approach. Control rod 10-43 (first rod in Group 9) was being withdrawn in "notch override" to notch position 10, when the reactor became critical on an estimated 2.8 second period. The operator was attempting to reinsert the rod when the scram occurred. Failure of the "emergency rod in" switch to maintain contact, due to a bent switch stop, apparently contributed to the problem.

2. Browns Ferry Unit 1 - On January 18, 1979, the reactor experienced a scram during the initial approach to critical following refueling. The operator was continuously withdrawing in "notch override" the first control rod in Group 3 (a high worth rod) because the SRM count rate had led him to believe that the reactor was very subcritical. A short reactor period, estimated at 5 seconds, was experienced. The operator was attempting to reinsert control rods when the scram occurred.

3. Hatch Unit 1 - On January 31, 1979, the reactor experienced a scram during an approach to critical. Control rod 42-15 (fifth rod in Group 3) was being continuously withdrawn in "notch override" when the scram occurred, with a period of less then 5 seconds. The temperature was about 200 degrees F with effectively zero xenon.

As indicated above, these short period trips occurred under a wide variety of circumstances. They did have several things in common, however. In none of these cases was an accurate estimate of the critical position made prior to the approach to critical. In each case a rod was being pulled in a high worth region. Finally, in each case the operator, believing that the reactor was very subcritical, was pulling a rod on continuous withdrawal.

Action to be Taken by Licensees:

For all GE BWR power reactor facilities with an operating license:

1. Review and revise, as necessary, your operating procedures to ensure that an estimate of the critical rod pattern be made prior to each approach to critical. The method of estimating critical rod patterns should take into account all important reactivity variables (e.g., core xenon, moderator temperature, etc.).

2. Where inaccuracies in critical rod pattern estimates are anticipated due to unusual conditions, such as high xenon, procedures should require that notch-step withdrawal be used well before the estimated critical position is reached and all SRM channel indicators are monitored so as to permit selection of the most significant data.

3. Review and evaluate your control rod withdrawal sequences to assure that they minimize the notch worth of individual control rods, especially those withdrawn immediately at the point of criticality. Your review should ensure that the following related criteria are also satisfied:

   a.. Special rod sequences should be considered for peak xenon conditions.

   b. Provide cautions to the operators on situations which can result in high notch worth (e.g. first rod in a new group will usually exhibit high rod worth).

4. Review and evaluate the operability of your "emergency rod in" switch to perform its function under prolonged severe use.

5. Provide a description of how your reactor operator training program covers the considerations above (i.e., items 1 thru 3).

6. Within 60 calendar days of the date of issue of this Bulletin, report in writing to the Director of the appropriate NRC Regional Office, describing your action(s) taken, or to be taken, in response to each of the above items. A copy of your report should be sent to the United States Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D.C. 20555.

For all BWR facilities with a construction permit and all other power reactor facilities with an operating license or construction permit, this Bulletin is for information only and no written response is required.

Approved by GAO B180225 (R0072); clearance expires 7/31/80. Approval was given under a blanket clearance specifically for identified generic problems.

Enclosures:
1. IE Circular No. 77-07
2. List of IE Bulletins Issued in Last Twelve Months

Appendix B

IE Circular 77-07

NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

IE Circular 77-07
Date: April 14, 1977

SHORT PERIOD DURING REACTOR STARTUP

DESCRIPTION OF CIRCUMSTANCES:

Recent events of concern to the NRC occurred at the Monticello and Dresden BWRs involving inadvertent high reactivity insertions causing short periods during reactor startup.

At Dresden Unit No. 2 on December 28, 1976 during a reactor startup following a scram from unrelated causes about 9 hours earlier, a rod withdrawal of one notch resulted in a rapid power rise associated with a reactor period of about one second and caused an Intermediate Range Monitor (IRM) Hi-Hi flux scram. The IRM was on its most sensitive scale. The moderator was essentially without voids and the reactor water temperature was 338°F. A similar event occurred at this facility on August 17, 1972.

At Monticello on February 23, 1977, following a reactor scram about 10 hours earlier from unrelated causes, a reactor period of about one second was experienced during startup before the reactor tripped on IRM Hi-Hi flux. The IRM was on its most sensitive scale and the short period resulted from the withdrawal of a control rod one notch. The reactor moderator had few voids and the water temperature was 480°F.

The two most recent events were similar in the following respects:

1. Prior to the earlier, unrelated scram, both plants had been operating at or near full power with axial flux peaking in the bottom portion of the core.

2. The time from the earlier scrams to the subsequent startups maximized the xenon concentrations in the core.

3. High worth rod locations were similar and both plants were using the same generic control rod pattern (identified as B1).

4. Prior to the IRM scram at both facilities, dramatic indications of high notch worth had been seen with rod withdrawals resulting in periods ranging from 10 to 30 seconds, which were terminated by reinsertion of the rod.

Review of the events showed that all of the systems including the Reactor Protections System functioned as required. Analyses indicate that the combination of essentially no voids in the moderator and high xenon concentration accounted for the conditions that resulted in the control rod notch acquiring an unusually high differential reactivity worth which approximated one-half percent delta K/K at Monticello. This excessive worth of rod notch was the result of essentially no voids in the moderator and peak xenon conditions which necessitated the withdrawal of significantly more control rods than is normally required to reach criticality. The resultant flux distribution at criticality magnified the normal axial peaking at the top of the core due to the heavy xenon concentrations at the bottom. Additionally, the radial contribution to flux peaking was enhanced due to the withdrawal of peripheral rods.

A review of NRC records showed that after the earlier event at Dresden Unit No. 2 on August 17, 1972, corrective measures were taken for the subsequent startup consisting of notchwise withdrawal of the group of rods. This corrective action was taken only for that operating cycle.

Evaluation of these events indicates that essentially trouble-free startups can be accomplished by avoiding the peak xenon with no moderator voids condition or possibly by the use of a rod pattern developed for these particular conditions.

These events indicate a need for all licensees of operating BWRs to review their startup procedures and practices to assure that their operating staff has adequate information to perform reactor startups avoiding such short periods in the event that the above-described conditions of peak xenon with no moderator voids exist at the time of startup. Operators should be made aware that extremely high rod notch worths can

be encountered under these conditions. The procedures should include requirements for a thorough assessment following the occurrence of a short period before any further rod withdrawals are made. These considerations should be included in the operator training and requalification training programs.

No written response to this Circular is required. If you need additional information regarding this matter contact the Director of the cognizant NRC Regional Office.

Appendix C

Summary and Evaluation of Licensee's Response and Current Action

TABLE C-1

BIG ROCK POINT: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will perform an ECP before startup.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	All SRMs are monitored. Uses the GE RNWP for all startups which ensures hot startup notch step withdrawal.	Current practice acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP; no other special sequence is required. Operators cautioned to expect criticality after all notch pulls.	Current practice acceptable Response acceptable
4. Review operability of "emergency rod in" switch.	Does not have an "emergency rod in" switch.	Response acceptable
5. Describe how operator training covers short periods.	Training covers reactor periods, control rod worths, and notch worths.	Response acceptable

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-2

BROWNS FERRY 1/2/3: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP. Licensee uses a rod sequence which is acceptable and sufficient to replace an ECP.	Current practice acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	All SRMs are monitored. Uses a procedure of rod withdrawal that requires notch step withdrawal for high-notch-worth rods. Notch step withdrawal is enforced by the hardwire rod sequence control system in the post-checkerboard regime.	Current practice acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Sequence covers hot startups. Cautions are provided in the control room.	Response and current practice acceptable Response and current practice acceptable
4. Review operability of "emergency rod in" switch.	Check of ronor* switch is performed before startup.	Response acceptable
5. Describe how operator training covers short periods.	Instruction and training is provided to cover short periods.	Response acceptable

*Ronor = rod out notch overrode, or emergency rod in.

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-3

BRUNSWICK 1/2: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	A program for an ECP is being developed.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP for all startups. RNWP is a special sequence which includes notch step withdrawal. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP for all startups. Will caution operators in the classroom during training.	Response acceptable
4. Review operability of "emergency rod in" switch.	Review of switch concluded, operability verified.	Response acceptable
5. Describe how operator training covers short periods.	Training covers contributing factors and prevention of short-period scram.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-4

COOPER STATION: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP before startup; however, RNWP is used. RNWP is an acceptable alternative to an ECP.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP for all startups. RNWP includes notch step withdrawal. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP for all startups; no other special sequences are required because RNWP is a special sequence designed specifically for short-period prevention. Cautions are provided to operators on high-notch-worth situations.	Response acceptable
4. Review operability of "emergency rod in" switch.	Ronor* switch inspected and in good shape. It is tested before each startup.	Response acceptable
5. Describe how operator training covers short periods.	Training covers high-rod-worth situations and withdrawal procedures.	Response acceptable

*Ronor = rod out notch override, or emergency rod in.

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-5

DRESDEN 2/3: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP is being used. RNWP is an acceptable alternative to an ECP.	Current practice acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP for all startups. RNWP was specifically developed to mitigate short-period events. All SRMs are monitored.	Current practice acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP for all startups; no other special sequence is required because RNWP was specifically developed to mitigate short-period events. Cautions are provided in control room.	Current practice acceptable
4. Review operability of "emergency rod in" switch.	Operability of switch was determined adequate upon review.	Response acceptable
5. Describe how operator training covers short periods.	Special training covers short-period events.	Response acceptable

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-6

DUANE ARNOLD: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP, an acceptable alternative to an ECP, being used.	Current practice acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP which is specifically designed to help mitigate short periods. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP; no other special sequence is required. Operators are cautioned in the plant startup procedures.	Response acceptable
4. Review operability of "emergency rod in" switch.	Review has determined that switch would respond adequately after prolonged use.	Response acceptable
5. Describe how operator training covers short periods.	Training includes a review of startup procedures and approaches to criticality in the training program.	Response acceptable

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-7

J. A. FITZPATRICK: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will perform an ECP.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Notch step withdrawal is used for Groups 3 & 4. Administrative controls are being written to cover operating procedures. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Sequences in use are felt to be acceptable for all conditions. Cautions are made to operators.	Response acceptable
4. Review operability of "emergency rod in" switch.	Operability of switch will be determined before each startup.	Response acceptable
5. Describe how operator training covers short periods.	Bulletin provisions are reviewed in training.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-8

HATCH 1/2: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP is being used. Use of RNWP alleviates need to use an ECP.	Current practice acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP especially designed to mitigate short-period events, for all startups. All SRMs are monitored.	Current practice acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP especially designed to mitigate short-period events, for all startups; no other special sequence is required. Cautions are provided covering notch withdrawal, high-rod-worth situations, and SRM monitoring.	Current practice acceptable Response acceptable
4. Review operability of "emergency rod in" switch.	Has not experienced problems with that type of switch to date.	Response acceptable
5. Describe how operator training covers short periods.	Will incorporate events in training program and reemphasize problems associated with high notch worths during critical approach.	Response acceptable

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-9

MILLSTONE 1: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP which alleviates need for ECP, is used.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	RNWP is used. Notch step withdrawal in the post-checkerboard regime covers items. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	RNWP is used; no other special sequence is required. Cautions are provided in operating procedures.	Response acceptable Response acceptable
4. Review operability of "emergency rod in" switch.	Review conducted; switch expected to perform its function over a long period.	Response acceptable
5. Describe how operator training covers short periods.	Bulletin provisions are covered during training.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-10

MONTICELLO: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	An ECP is performed.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP specifically designed to mitigate short-period events. All SRMs are monitored.	Current practice acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP; no other special sequence is required. Cautions are provided during training.	Current practice acceptable Current practice acceptable
4. Review operability of "emergency rod in" switch.	Expect ronor* switch to function under prolonged use upon review.	Response acceptable
5. Describe how operator training covers short periods.	Training covers bulletin items, operating events, and a detailed review of plant startup procedures.	Response acceptable

*Ronor = rod out notch override, or emergency rod in.

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-11

NINE MILE POINT 1: SUMMARY AND EVALUATION OF LICENSEE"S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	An ECP is not performed; however, an acceptable alternative to an ECP, is used.	Current practice acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	An "approach to critical" procedure has been added to the operators' startup procedure and the reactor analyst operator instructions. The procedure describes neutron monitoring and single notch withdrawal.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP which includes notch step withdrawal in the peak Xe condition. Cautions are provided in operating procedures.	Response acceptable Response acceptable
4. Review operability of "emergency rod in" switch.	"Emergency rod in" switch is tested after refueling outage.	Response acceptable
5. Describe how operator training covers short periods.	Training will include operating procedures for these conditions.	Response acceptable

NOTES: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

"Current practice acceptable" refers to the licensee's current procedures, as verified by the Resident Inspector, which may be slightly different from that of the initial response.

TABLE C-12

OYSTER CREEK: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	An ECP is performed, including important variables such as Xe.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses notch withdrawal after reaching the checkerboard pattern (except for peripheral rods). Also commences notch withdrawal of rods with three doublings of initial SRM count.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Rod worth curves for the first six groups of rods were developed using 3D simulator code. Sequence is altered for high notch worth rods. Notch step withdrawal is provided for high Xe. Operators are cautioned about use of ECP.	Response acceptable
4. Review operability of "emergency rod in" switch.	"Emergency rod in" switch is tested before each startup.	Response acceptable
5. Describe how operator training covers short periods.	Outline of training procedure includes SRM response, control rod worth, subcritical multiplication, ECP, and a review of the Oyster Creek short-period incident.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-13

PEACH BOTTOM: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform ECP; however, RNWP is performed. Current practice of using RNWP alleviates need of an ECP.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	RNWP includes notch step withdrawal for hot startup condition (criticality achieved post-checkerboard) monitoring of all SRMs covered in training.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	RNWP can be considered a special sequence for all short-period circumstances. Cautions are provided in procedures.	Response acceptable
4. Review operability of "emergency rod in" switch.	Operability is tested before startup.	Response acceptable
5. Describe how operator training covers short periods.	Training covers physics, parameters, monitoring of SRMs, IRMs, precautions when approaching critical, and the theory of differential rod worths.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-14

PILGRIM: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP, which alleviates the need for an ECP, is used.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	RNWP includes notch step withdrawal. All SRMs are continuously monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Uses RNWP; special sequence design for this problem. Cautions are provided to operators.	Response acceptable
4. Review operability of "emergency rod in" switch.	The review of ronor* switch concluded its functionability over long periods did not necessitate testing.	Response acceptable
5. Describe how operator training covers short periods.	Training emphasizes high notch worths.	Response acceptable

*Ronor = rod out notch override, or emergency rod in.

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-15

QUAD CITIES 1/2: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, licensee's method of rod withdrawal is similar to that of RNWP as verified by the RI and alleviates the need for an ECP.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses banked withdrawal coupled with the notching of rods in Groups 3 & 4. Rods are notch step withdrawn in the post-checkerboard regime. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	Sequence has been developed as described above and covers peak Xe condition. Cautions are provided in startup procedure and training.	Response acceptable
4. Review operability of "emergency rod in" switch.	"Emergency rod in" switch will perform adequately.	Response acceptable
5. Describe how operator training covers short periods.	Training includes discussion of notch worth, excess Xe, and short-period events.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

TABLE C-16

VERMONT YANKEE: SUMMARY AND EVALUATION OF LICENSEE'S RESPONSE AND CURRENT ACTION

BULLETIN ITEM	LICENSEE'S RESPONSE	STAFF EVALUATION
1. Ensure an accurate estimate of critical position prior to startup.	Will not perform an ECP; however, RNWP is used.	Response acceptable
2. Consider notch step withdrawal for hot startups and monitor all SRMs.	Uses RNWP for startups. It includes notch step withdrawal. All SRMs are monitored.	Response acceptable
3. Consider special sequences for peak Xe conditions and Provide cautions to operators on high notch worth situations.	RNWP minimizes notch worths; no other special sequence is required. Cautions are provided in procedures.	Response acceptable
4. Review operability of "emergency rod in" switch.	The switch will be checked in the startup sequence.	Response acceptable
5. Describe how operator training covers short periods.	Training includes a review of short-period transients.	Response acceptable

NOTE: "Response acceptable" refers to the licensee's formal response to IE Bulletin 79-12.

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13. ABSTRACT (200 words or less)

IE Circular 77-07 was issued on April 14, 1977 because of the occurrence of short period scram events at Dresden Unit 2 on December 28, 1976 and at Monticello on February 23, 1977. The circular advised BWR plants to revise their control rod withdrawal sequences and operating procedures to reduce the likelihood of future short period scrams. However, similar events continued to occur. These included events at Oyster Creek on December 14, 1978; at Browns Ferry Unit 1 on January 18, 1979; and at Hatch Unit 1 on January 31, 1979. As a result of these events, IE Bulletin 79-12 was issued on May 31, 1979. This bulletin required a written response from licensees of GE-designed BWRs regarding specific actions listed in the bulletin. All of the licensees responded in a satisfactory manner. No similar events have been reported since IE Bulletin 79-12 was issued.

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