



March 14, 1983

SECY-83-98A

POLICY ISSUE
(Information)

For: The Commissioners

From: William J. Dircks
Executive Director for Operations

Subject: SALEM RESTART

Purpose: To provide the Commissioners with a report on the current status of the staff evaluation of the failure to automatically scram events of February 22 and 25, 1983 at the Salem Nuclear Generating Station and the staff action plan for authorizing restart of Units 1 and 2.

Discussion: During a briefing on March 2, 1983 concerning the Salem reactor trip system failure events, the Commissioners requested that the staff provide its plan of action to resolve the issues identified from the NRC evaluation of the Salem events.

Enclosed is the Salem Restart status report which identifies the issues related to the recent Salem events and the short- and long-term actions needed to resolve those issues. For the short-term actions, the staff has or intends to obtain specific commitments from the licensee to complete those actions and the staff will assure their satisfactory completion prior to permitting restart of either Salem unit. For satisfactory resolution of the long-term actions, the staff intends to develop with the licensee an acceptable schedule for completion of those actions, obtain necessary written commitments, and follow up their completion on the agreed upon schedule.

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In addition to the short- and long-term actions identified in the report, the staff has also concluded that a show cause order should be issued to the licensee (see enclosure 2). The staff believes that the particular circumstances at this facility, as further detailed in the start-up report, justify requiring that these three separate but interrelated sets of actions be implemented by the licensee in a timely fashion.

Subject to satisfactory implementation of these actions, the staff has concluded that the Salem facilities can be restarted and operated without undue risk to the health and safety of the public. Enforcement actions are under active consideration by the staff and will be discussed separately with the Commission at a later date.



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Executive Director for Operations

Enclosures:

1. Salem Restart Status Report
2. Dft Show Cause Order

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Salem Restart Status Report

I. Summary

This report briefly describes the NRC and licensee actions to address and resolve equipment, operator procedures, training and response, and management issues identified by the NRC evaluation of the two events at Unit 1 of the Salem Nuclear Generating Station that resulted in failure of the reactor to trip automatically upon a valid signal. The second event occurred on February 25, 1983 and led to the realization that a similar event had occurred on February 22, 1983. Based on NRC evaluation, a number of potential contributors to failure have been identified. However, our initial evaluation indicates that all of the potential contributors to the failure are age-related and that a new device should perform properly.

An NRC task force has been established to conduct a separate longer range study of the broader implications of the events. NRC long-term actions identified herein are applicable to Salem but may have generic implications. The NRC task force will determine generic actions needed for other facilities. For the Salem facility, longer term actions developed by this task force may complement the long-term actions identified herein. NRC short-term actions identified in this report must be satisfactorily completed before plant startup.

II. Background

On February 25, 1983 an event occurred at Unit 1 of the Salem Nuclear Generating Station when the reactor-trip circuit breakers failed to automatically open following receipt of a valid trip signal from the Reactor Protection System (RPS). The manual trip system was used to shut down the reactor. Subsequently, it was concluded by the licensee that the failure to trip was caused by a malfunction of the undervoltage (UV) trip attachments in both reactor-trip circuit breakers. These UV trip attachments translate the electrical signal from the RPS to a mechanical action that opens the circuit breaker.

On February 26, 1983, an NRC team was onsite to conduct initial followup and to collect preliminary information. As a result of NRC inquiries, the licensee determined that both reactor-trip circuit breakers had similarly failed to open upon receipt of a valid trip signal on February 22, 1983. The failure to automatically trip on February 22 was not recognized by the licensee until the computer printout of the sequence of events was reexamined in more detail on February 26. Further evaluation of these events and the circumstances leading up to them revealed a number of issues that require resolution by the licensee and/or the NRC. This report identifies those issues and the short-term actions proposed to resolve them prior to resumption of operation at Salem Unit 1* and

*Salem Unit 2 is presently shut down for refueling and is not presently scheduled to resume operation before Unit 1.

the long-term actions that are needed following restart. The short-term actions required for Unit 1 will also be implemented on Unit 2 prior to restart of Unit 2.

The licensee met with NRC staff on February 28, March 5, and March 10, 1983 to present the results of initial evaluations related to the events. Based on licensee submittals of March 1 and March 8, 1983 and on the findings of the NRC evaluation of the Salem events, issues were identified and categorized as equipment issues, operator procedure, training and response issues, and management issues. They are discussed in detail in Section III of this report.

III. Issues

A. Equipment Issues

Three of the issues relate to the affected equipment, that is, the reactor-trip circuit breakers (Westinghouse DB-50 circuit breakers). These issues are 1) safety classification of the circuit breakers, 2) identification of the cause of the failure, and 3) verification testing of the circuit breakers.

1. Safety Classification of Breakers

During the initial NRC evaluation of the February 25 event, it was determined that maintenance was conducted on the Salem Unit 1 reactor-trip circuit breakers in January 1983, following a failure of one reactor-trip circuit breaker to trip upon receipt of an RPS signal at Salem Unit 2 on January 6, 1983. The work orders authorizing the January 1983 maintenance identified the maintenance as not safety related and not requiring quality assurance review. As a result, it was not clear on February 26, 1983 what portion, if any, of the reactor-trip circuit breakers was considered safety related by the licensee. The reactor-trip circuit breakers contain both a UV trip attachment and a shunt trip attachment, but only the UV trip attachment is operated by an automatic RPS trip signal.

Action/Evaluation

This issue has been resolved. Section 7.2.1.1 of the Salem Updated Final Safety Analysis Report (UFSAR), Revision 0, indicates that the Reactor Trip System includes the reactor-trip circuit breakers and the UV trip attachment. The Westinghouse Solid State Logic Protection System Description (WCAP-7488L) also defines the scope of the system as including the reactor-trip circuit breakers and the UV trip attachments. The UV trip attachment and the reactor-trip circuit breaker are safety-related equipment in that they are essential features of the Reactor Trip System, which is necessary to prevent or mitigate the consequences of a design-basis event that could result in exceeding the offsite exposure guidelines set forth in 10 CFR Part 100. The shunt trip attachment of the reactor-trip circuit breakers in the Westinghouse design is not required by present NRC regulations to be safety grade and, although it is

provided to perform the manual trip function, no credit is taken for this design feature in the safety analysis (a manual reactor trip also actuates the UV trip attachment). The licensee in a March 1, 1983 letter to NRC concurred

in this understanding. Hence, the specific issue with regard to the safety classification of the reactor-trip circuit breakers is considered resolved. Other issues concerning the manner in which the reactor-trip circuit breakers were treated from a procurement and maintenance standpoint at Salem are addressed under Management issues (Section III C). The licensee has made a commitment to install new UV trip attachments on all four Unit 1 circuit breakers prior to restart and to verify that the new circuit breakers have been properly serviced and tested.

2. Identification of Cause of Failure

The licensee's initial determination of the cause of the failure of the reactor-trip circuit breakers (as documented in a March 1, 1983 letter) was that there was binding and excessive friction of the vertical latch lever of the UV trip attachment due to a lack of proper lubrication. This conclusion was concurred in by Westinghouse representatives and was based on visual inspection of the UV trip attachment, in-place testing performed after the failures, and previous Westinghouse experience.

The NRC has conducted an initial determination of the cause of the failure based on inspection of the failed UV trip attachments and interviews with cognizant maintenance personnel on how the devices were maintained. The inspection indicates that there were possibly multiple contributing causes of failure. Possible contributors are (1) dust and dirt; (2) lack of lubrication; (3) wear; (4) more frequent operation than intended by design; (5) corrosion from improper lubrication in January 1983; and (6) nicking of latch surfaces caused by vibration from repeated operation of the breaker. The contributors appear to be cumulative, with no one main cause. The initial investigation also indicates that all of the potential contributors to the failure of the UV trip attachments are age related and that a new device would likely perform properly. Many surfaces of the latch mechanism are worn and the additional friction tended to prevent proper operation. Proper lubrication throughout the life of the device might have prevented the wear that can be seen on the sample.

These initial findings indicate that the UV trip attachment failed from binding and excessive friction. However, in addition to the potential contributors cited above, there remains the possibility that other UV trip attachment or breaker problems may have caused the Salem failures. Because of the importance to safety of the reactor-trip circuit breakers and UV trip attachments, the NRC staff has prepared a more structured approach to resolving this issue. Therefore, a laboratory testing and examination program funded by NRC will attempt to determine the precise cause of failure. Appendix A describes the initial NRC inspection effort and extent of additional examination and testing to be done by NRC.

NRC Action - Short Term

NRC conducted an initial evaluation of the cause of the UV trip attachment failures which included visual examination of the devices by qualified personnel and determining how the devices were maintained (See Appendix A for details). Based on this, we conclude that operation with new devices, in conjunction with preoperational testing and periodic surveillance, is acceptable.

NRC Action - Long Term

NRC will conduct laboratory testing and examination of the failed attachments to determine the precise cause of failure, if possible. We anticipate that this work will be complete within one month and the results will be available for consideration by the generic task force.

3. Verification Testing

On August 20, 1982, one reactor-trip circuit breaker on Unit 2 failed to operate during surveillance testing. A UV trip attachment was reinstalled on this circuit breaker after replacing the coil, the circuit breaker was reinstalled, and subsequent post maintenance testing was performed to establish operability. Similarly, on January 6, 1983, a reactor trip occurred at Salem Unit 2 due to a low-low steam generator level, but one reactor-trip circuit breaker failed to open. The licensee concluded that the circuit breaker failure was due to binding from dirt and corrosion in the UV trip attachment. The UV trip attachment on the Unit 2 circuit breaker, as well as the UV trip attachment on all Unit 1 reactor-trip circuit breakers, was cleaned, lubricated and readjusted under supervision of a Westinghouse representative. On February 20, both breakers performed satisfactorily during reactor trip events. Since the circuit breakers again failed on February 22 and 25, adequacy of the testing to ensure circuit breaker operability is an issue. Testing following reactor-trip circuit breaker maintenance or initial installation should be sufficiently comprehensive to provide reasonable assurance that the circuit breaker will function as needed.

Licensee Action - Short Term

The licensee has proposed a program to verify proper operation of the reactor-trip circuit breakers prior to returning them to service. The program will involve preinstallation testing of UV trip attachments 25 times by the vendor. After installation on the trip breakers, the UV trip attachment and trip breaker will be tested ten more times. Once initial adjustments have been performed, any failure in the 25 cycle or 10 cycle tests will constitute a failure of the trip assembly and investigation of the cause of failure and NRC notification will be required. Following this testing, a time response test of the breaker actuated through the RPS will be performed. The NRC staff considers this issue to be sufficiently resolved to permit restart of the plant pending a commitment by the licensee to develop and implement a program comparable to that described below under Long Term.

Licensee Action - Long Term

Although the licensee has not yet proposed a long-term program, the NRC staff has concluded that an extensive bench test of the reliability of a reactor-trip circuit breaker and UV and shunt trip attachments as an integrated unit is indicated. The test would involve cycling (a total of 2000 cycles: 1000 trips by UV trip attachment and 1000 trips by shunt trip attachment) under simulated environmental service conditions to determine if a properly maintained circuit breaker and its attachments can operate for an extended number of cycles. The purpose of this test will be to determine if there are accumulated effects which will affect proper breaker operation. If these tests

point to specific deficiencies in components or in the integral assembly, further testing or design modifications may be indicated. The testing would be performed by the licensee or appropriate industry owners group or vendor. We anticipate that this program could be completed within six months.

NRC Action - Short Term

NRC will verify satisfactory completion of the licensee's short-term preoperational testing program.

NRC Action - Long Term

NRC will require the licensee to establish a long-term reliability test program for the reactor-trip circuit breakers and will assure that the following points are included:

1. a sufficient number of cycles is included to provide statistically meaningful results.
2. the test exercises both UV and shunt trip attachments (not simultaneously), as well as the circuit breakers.
3. the test is conducted under environmental conditions similar to those seen by the circuit breakers.
4. sufficient delay time is included between cycles to allow return to steady-state conditions.
5. test procedures and acceptance criteria which will give reasonable assurance of uncovering possible deficiencies in the integral breaker assembly and individual components.

4. Maintenance and Surveillance Procedures

During the review, it was determined that no specific maintenance procedure existed at the Salem facility to conduct preventive or corrective maintenance on the reactor-trip circuit breakers. The maintenance conducted in January 1983 was not performed in accordance with the latest Westinghouse recommendations, which were contained in Westinghouse Technical Bulletin NSD-74-1, as amended by technical data letter NSD-74-2. Additionally, no program of

preventive maintenance had been conducted on these circuit breakers since original installation.

With respect to surveillance testing, the licensee conducted a functional test of one of the two reactor-trip circuit breakers every month, so each circuit breaker was tested once every two months. The surveillance tests involved tripping a circuit breaker by use of the UV trip attachment. The licensee also operated the circuit breakers weekly by exercising the shunt trip attachment. In view of the number of reactor-trip circuit breaker failures at Salem, it appears that the periodic surveillance testing was ineffective in detecting

reactor-trip circuit breaker failures of the type experienced on February 22 and 25, 1983.

The licensee has now developed a maintenance procedure and preoperational verification program. The NRC staff initial review of the procedures and program identified certain deficiencies (see Appendix B).

Licensee Action - Short Term

The licensee has now developed a specific preventive maintenance procedure for use on the reactor-trip circuit breakers (including the UV trip attachment), which is based on all applicable vendor maintenance recommendations, appropriate quality assurance (QA) requirements, and post maintenance testing.

The licensee has proposed monthly testing of the main reactor-trip circuit breakers by use of the UV trip attachment and weekly testing of the reactor-trip circuit breakers by use of the shunt trip attachment. We do not agree with the weekly testing interval of the shunt trip attachment, as further discussed in Appendix B, and will also require that the associated bypass breakers be tested prior to plant restart and at each refueling outage.

Licensee Action - Long Term

The NRC will require that the licensee incorporate results of a long-term verification testing of the reactor-trip circuit breaker into maintenance and surveillance programs. This action should be completed within two months of completion of long-term testing.

NRC Action - Short Term

The NRC staff has completed an initial review of the surveillance and maintenance program and its procedures. Certain deficiencies have been identified (see Appendix B). The licensee will be required to complete action necessary to resolve the identified deficiencies prior to restart and to reduce the frequency of testing the shunt trip attachment unless compelling reasons to the contrary are developed.

NRC Action - Long Term

NRC will evaluate the licensee's proposed lubrication requirements for the UV trip attachments (i.e., type of lubricant, frequency of lubrication, points of application, etc.). NRC will also assure that results of long-term verifica

tion testing of the reactor-trip circuit breakers are adequately incorporated into maintenance and surveillance programs to determine testing frequency, inspection requirements, and lifetimes.

The evaluations will be conducted with the assistance of the Franklin Research Center (FRC) and the Brookhaven National Laboratory (BNL).

B. Operating Procedures, Operator Training, and Operator Response Issues

Based on examination of the circumstances associated with the events involving reactor-trip circuit breakers, certain issues have been identified relative to procedures, training, and operator response. They are

1. Operating procedures for reactor trip and ATWS
2. Operator training effectiveness relative to the RPS and associated indicators
3. Operator response

These issues are discussed in the sections below.

1. Operating Procedure for Reactor Trip and Anticipated Transients Without Scram (ATWS)

Interviews with control room operators were conducted by NRC staff, and a review of the operating procedure for ATWS and reactor trip (EI-4.3) have revealed that a) the operators do not take immediate action to initiate a manual trip based on reactor-trip "first-out" annunciators, b) they were not directed to do so by the procedure; however, the procedure did require a manual trip if an automatic reactor trip did not occur. The procedure required only evaluation of reactor power level remaining high and/or multiple control rods failing to insert, and c) at least one operator questioned the appropriateness of the ATWS procedure's step to trip the turbine, without first verifying that the reactor had tripped, since that results in a loss of heat sink. Based on these discussions with operators, the staff believes that the revised procedure dated March 2, 1983, would not have substantially changed the operators' response due to a perceived need to evaluate plant status from control room indications.

Licensee Action - Short Term

1. The NRC will require the licensee to identify the indications in the control room that provide positive indication, without operator analysis or verification, that an automatic reactor trip demand is present.
2. The NRC will require the licensee to revise procedures to direct the operators to insert a manual trip whenever positive indication of an automatic trip demand is present without delaying to evaluate the overall plant status.
3. The NRC will require the licensee to review the basis for the ATWS procedure steps and order of priority in light of the operators' concern, revise the procedure as necessary, and train the operators on the basis for the procedural steps and importance of procedural compliance.
4. The NRC will require that all operators be trained on the revised procedures prior to restart of Unit 1.

Licensee Action - Long Term

The NRC will require the licensee to incorporate any procedural changes for Unit 1 into Unit 2 procedures and retrain Unit 2 operators on revised procedures prior to Unit 2 restart.

NRC Action - Short Term

NRC will review the adequacy of licensee's revised procedures and basis for the procedural steps and order of priority.

NRC will also review the adequacy of the Westinghouse Owners Group, Emergency Operating Procedure Guidelines.

2. Operator Training

Interviews conducted by NRC with the licensed operators who were onshift during the two events indicate a lack of familiarity with the functions of the annunciators and indicators associated with RPS. The interviews also revealed that the operators who were onshift during the February 25 event did not recognize that a failure of the RPS had occurred until approximately 30 minutes after the event. Specifically, the operators interviewed were not able to describe whether the reactor-trip-indicator light (red) on the RPS mimic status panel indicated a demand for or confirmation of a breaker trip. Interviews also indicated that at least some operators questioned the validity of annunciators until they could be confirmed by independent indication. This need to verify caused the operators not to take immediate action to trip the reactor based on annunciator indication and verification of reactor power level remaining high and/or multiple control rods failing to insert on February 25, 1983 as discussed in operator response issue B.3.

In any event, it is apparent that training in the areas of the RPS and associated indications and alarms is warranted.

Licensee Action - Short Term

The NRC will require the licensee to conduct the additional training required in issue B.1 and additional training on the RPS and associated indications and alarms (specifically whether these are demand or confirmatory and the use of this information), and to review the February 22 and 25 events with all operators.

Licensee Action - Long Term

The NRC will require the licensee to assure that RPS training and associated subjects in the operator qualification and requalification program address the areas of (1) logic function of the RPS and (2) operation of the RPS and associated indications. This training shall be incorporated in the ongoing regular training programs.

NRC Action - Short Term

NRC will evaluate the adequacy and completion of remedial training prior to Unit 1 and Unit 2 restart.

NRC Action-Long Term

NRC staff will audit the licensee's requalification program.

3. Operator Response

Interviews with operators on shift for the February 22 and 25, 1983 events and with I&C and maintenance personnel disclosed the following:

- a. In both events, the operators took 20 to 30 seconds to determine the overall plant status and initiate a manual reactor trip. For the first event, this evaluation began with the electrical bus transfer failure.

This evaluation was necessary because of the resulting large number of alarms and lost equipment controls and status indicators. This evaluation time was nearly identical to the time it took for the plant conditions to degrade causing the RPS to provide an automatic reactor trip signal. For the second event, the evaluation of the plant status began when the reactor trip annunciator actuated and the evaluation determined that a reactor trip was in fact necessary based on plant parameters and control room indicators. This time could have been shortened had the operators recognized that an earlier valid trip was called for by the RPS.

- b. During the first event, after an operator was directed to manually trip (scram) the reactor, the switch handle was not operated correctly. When the SRO called for a manual trip, the control handle was inadvertently pulled off the board and had to be reinserted to perform the manual trip. Because of the near coincident automatic trip signal, this may have contributed to the operator's failure to recognize that the automatic trip system had called for a trip and had failed to trip the reactor prior to the manual trip.
- c. In spite of the positive indication of the reactor protection system failure during the second event, the operators neither understood nor trusted the indications. Because of this the operators unnecessarily reevaluated plant status. The operators manually tripped the reactor in response to their evaluation of the plant status and control room indicators and not due to recognition of the failure of the reactor protection system.
- d. NRC was initially informed by licensee I&C and maintenance personnel that the first out panel and RPS logic systems are highly reliable. Based on this information and the NRC's general understanding of the logic of these systems, the NRC concluded that the information provided in the Salem control room (i.e., first out panel alarms, illuminated RPS displays, and safety grade instruments) was adequate to enable operators to immediately identify an ATWS event. Subsequent to this initial

conclusion and based on NRC questioning of the licensee on March 3 and 4, the licensee conducted tests which indicated that short-duration signals (less than 10 milliseconds) could produce a reactor trip annunciation on the first out panel and a computer printout indicating a reactor trip without initiating the reactor protection system. However, after reviewing test results, the licensee concluded that the testing indicated the system was functioning as designed and that it required trip signals of more than 10 to 12 milliseconds duration to actuate the reactor-trip circuit breakers and seal in the reactor protection system. Accordingly, the current design of the first out panel can result in operators questioning the reliability of the information provided on this panel.

Based on the above, the NRC concluded that for the event on February 22, the operators' response was prompt and fully satisfactory. For the event on February 25, taking into account the deficiency in the reactor trip procedure and deficiencies in training that resulted in (1) operators failing to recognize an RPS reactor trip demand and (2) the operators failing to understand the control room indications, the operators' response time was reasonable.

Licensee Action - Short Term

1. The NRC will require that in addition to the training required in issue 2, operators must be cautioned on the use of the manual trip "J" handle control.

Licensee Action - Long Term

1. The NRC will require the licensee to evaluate alternative means to permanently secure the "J" handle as part of the Detailed Control Room Design Review.
2. The NRC will require the licensee to reevaluate the design of the first out panel system with regard to the reliability of information presented to operators, as a part of its detailed control room design review.

NRC Action - Long Term

1. The NRC staff will evaluate the licensee's findings and corrective actions related to these long-term actions as part of the NRC review of the licensee's detailed control room design review. The licensee's schedule for completion of the detailed control room review will be submitted for staff review on April 15, 1983.

C. Management Capability and Performance

The deficiencies identified during the review of circumstances surrounding these events raises the question of the responsiveness, practices, and capability of licensee management at the corporate and station level. Additionally, a number of specific management issues directly related to the failure of the reactor trip breaker events were also identified. The issues discussed in this section are:

1. Overall Management Capability and Performance
2. Master Equipment List
3. Procurement Procedures
4. Work Order Procedures
5. Post Trip Review
6. Timeliness of Event Notification
7. Updating Vendor Supplied Information
8. Involvement of QA Personnel with other Station Departments
9. Post Maintenance Operability Testing
1. Overall Management Capability and Performance

Historically, PSE&G management has not displayed the expected aggressive effort to self evaluate and redirect efforts to correct internally identified problems. However, the licensee has responded the specific evaluations conducted by external organizations such as INPO, NRC and consultants. Each of these are discussed below.

The 1981 INPO evaluation identified opportunities for improvement in numerous areas including: staffing, personnel safety practices, adherence to procedures, control of documents and design changes, availability of technical support, operating practices with respect to inoperable alarms and tagouts, shift turnover procedures; and goals and objectives.

Based on continuing observation, the licensee responded positively to selected findings by various actions although the effectiveness of these actions has been less than expected.

The area of preventive maintenance, beyond that required by technical specifications, was also raised as an issue by INPO in 1981. The licensee instituted a program to be responsive to this INPO concern, but the recent 1982 INPO report still contains Findings and Recommendations and identifies a target date for completion of this effort in February 1983. It should be noted that the reactor trip breakers were identified by the licensee for inclusion in this program.

Based on the 1982 INPO report additional findings were identified in the areas of industrial safety, use of the computer tagging system, backlog of work orders, drawing revisions and plant modifications, adherence to established radiation protection procedures and policies, and material and housekeeping conditions in the auxiliary building and intake structures.

Four SALP assessments were conducted by the NRC during the period October 1980 - October 1982. The earlier assessments identified weaknesses in the areas of: design change documentation, engineering support responsiveness, health physics, physical security and overall management followup to numerous areas. The later SALP assessments acknowledge licensee management attention to, and improvements in the areas of, design change tracking and documentation and health physics. Physical security, despite several initiatives on the part of the licensee to improve the area, continued to be weak. Very recently, the licensee has dedicated considerable resources to physical security which, if properly implemented, should facilitate a number of hardware improvements and add several managers to the organization to more effectively monitor security activities on a day-to-day basis.

The most visible commitment made by the licensee are organizational. During the licensing process for Salem Unit 2 in 1981, the licensee made a decision to place all activities, including engineering under a single vice president. Commitments were made to recall these activities from the corporate offices in Newark, New Jersey to the site located in Southern New Jersey. While the licensee was hopeful that such relocation of the engineering staff, including QA personnel, to the site would prove more effective, the process has moved much more slowly than hoped and has even resulted in the loss of certain personnel. As late as January 1983, the QA department was placed in the Nuclear Department, and began moving to the site. The organizational and location changes have now been in transition for almost 18 months. Station organizational changes were also made to focus effort appropriately and a number of new data management systems were installed to track issues for management followup.

With respect to safety review committees, NRC inspection experience has shown that the onsite and offsite review committees are properly constituted, meet frequently, and ask cogent questions. Since licensing of Unit 2, the licensee has maintained a separate independent Safety Review Group (SRG) with a general charter to identify and evaluate safety issues. In response to an NRC request, the licensee has agreed to evaluate the effectiveness of the SRG in terms of types of issues addressed and more importantly, the approach to and timeliness of the licensee's response to such recommendations.

PSE&G management is generally capable and has been willing to make changes to improve safety. While the licensee has demonstrated his ability to react to external direction, and strong self-assessment program has not been effectively carried out that would identify the specific deficiencies identified by the several external review efforts discussed previously, or of equal importance, to identify and rectify their root causes.

Licensee Action-Short Term

NRC will require the licensee to determine whether the currently identified problems with the reactor trip breakers are indicative of broader based problems with the administrative and managerial control system.

Licensee has committed to evaluate the effectiveness of the independent SRG in terms of issues addressed and resolutions. In particular, the evaluation should address the role of SRG with respect to the August 1982 and January 1983 reactor trip breaker problems.

NRC Action - Short Term

NRC will review the licensee's evaluations and will require the licensee to address any broader based problems identified as a result of that evaluation.

Licensee Action - Long Term

Continue management initiatives aimed at improving organizational responsiveness to identifying and resolving problems, particularly in the areas of procedure adequacy and adherence.

NRC Action - Long Term

Continue to review the adequacy of management control and timely resolution of problems through an augmented inspection program.

2. Master Equipment List

The licensee maintains a Q list that identifies activities, structures, and systems to which the Operational Quality Assurance (QA) Program applies. A Master Equipment List (MEL) is used by the licensee as the reference document for determining the safety classification of individual equipment. The MEL is intended to be a comprehensive list of all station equipment and identifies each item as nonsafety related or safety related. When preparing maintenance work orders, the MEL is consulted to determine if QA coverage of the work is necessary. Licensee and NRC review identified three problems associated with the MEL. These problems are, 1) the accuracy and completeness of the document, 2) issuance as a noncontrolled document, and 3) lack of understanding by plant personnel of its proper use.

The MEL was derived from engineering source documents and a construction program document called Project Directive 7 (PD-7) and was provided to station personnel by the Engineering Department as a reference document in July 1981. Prior to issuance of the MEL, the PD-7 was used as the reference document. The MEL, however, was not issued as a controlled document, therefore verification of its accuracy and completeness on issuance was not assured, and it was not updated in the plant as necessary. The reactor-trip circuit breakers were not included in the MEL. In addition, some personnel were not familiar with how to use the MEL for determining the classification of a particular piece of equipment. Maintenance personnel acknowledged that reference was made to PD-7 on occasion during the January - February 1983 period.

Licensee Action - Short Term

The NRC will require that the licensee:

1. Verify the MEL is complete and accurate with respect to emergency core cooling (ECCS) including actuation systems, RPS, auxiliary feedwater, and containment isolation systems.
2. Instruct appropriate personnel in the purpose and use of the MEL.

Licensee Action - Long Term

NRC will require that the licensee verify the completeness and accuracy of the MEL and reissue it as a controlled document.

NRC Action - Short Term

NRC will perform sampling review of the MEL on the above systems.

NRC Action - Long Term

NRC will confirm completion of the licensee's long-term action.

3. Procurement Procedures

A review of safety and quality classifications for the reactor trip breakers indicates that the licensee's established management and administrative controls allowed the procurement of replacement components for a safety system with a quality less than that of the original design. This is evidenced by procurement activities concerning the purchase of reactor trip breakers and replacement components conducted during the period from June 1, 1981 to March 1, 1983. One example involved the issuance of a purchase order for a spare reactor trip breaker on June 1, 1981. Contrary to the established administrative controls; the breaker was classified incorrectly; the proper review and approval was not conducted; and no QA requirements were imposed as required for the original equipment. Subsequently, on September 15, 1982, the classification for the same order was changed to an even more inappropriate classification without the required review and approval process. As a result of these activities, the purchased breaker was received and placed into storage, without further use, without appropriate documentation that would demonstrate suitability for its use had it been required.

All subsequent purchases for reactor trip breaker components consistently utilized the initial incorrect classification. A spare coil for a UV trip attachment purchased in this manner may have been utilized on August 20, 1982. Though the procurement review focused on the reactor trip breaker, the licensee's activities in the area for other safety related components could have resulted in similar circumstances existing for plant safety systems.

Licensee Action - Short Term

NRC will require and the licensee has made a commitment to have the procurement procedures evaluated and modified as required to ensure that the appro-

priate classification is being applied to items and/or services important to safety. Pending satisfactory resolution of this item and a commitment by the licensee to develop and implement a program comparable to that described under Long Term, the staff considers this issue sufficiently resolved to permit restart.

Licensee Action - Long Term

The licensee will review the organization relationships involved in the procurement process and assess the current management controls to provide and ensure that departure from expected performance of personnel involved in the procurement process will be appropriately flagged for management attention. Additionally, the licensee will formulate a plan to review and assess on a

sampling basis the procurement process as it relates to all prior procurement activity on systems important to safety. The plan will address the schedule, and criteria to be applied for an accelerated sampling based upon initial finding.

4. Work Order Procedures

The review identified that the personnel preparing maintenance work orders were not complying with instructions contained in the station administrative procedure. Specifically, for the work performed on the reactor-trip circuit breaker in January 1983, the engineering department was not consulted to verify safety classification, and an erroneous nonsafety determination was made. Such consultation is required if equipment is not listed in the MEL. There was, therefore, no independent review within the maintenance organization, and the Quality Assurance Department was not involved in the work. Historically, there was no requirement for QA personnel to be involved in the review of work orders as they were processed to assure that appropriate steps were taken to assign classification. It should be noted, however, that all other work orders for maintenance or services on the reactor trip breakers were found to be properly designated safety-related.

Licensee Action - Short Term

The licensee has made a commitment to have the QA Department review all non-safety related work orders prior to starting work, and to implement a program and training to ensure that work orders are properly classified.

NRC will require the licensee to review work orders written since issuance of the MEL for proper classification and will evaluate safety consequences of those found improperly classified.

NRC Action - Short Term

NRC will review licensee's work order classification program.

5. Post-Trip Review

The licensee did not determine that there had been a failure to trip on February 22 until the computer printout of the sequence of events was re-

evaluated on February 26, as a result of NRC inquiries. Although the licensee conducted a review of each trip, there was no formal procedure for conducting a systematic review. By letter dated March 1, 1983, the licensee made a commitment to develop a post-trip and post-safety injection review procedure. The procedure will specify the review and documentation necessary to determine the cause of the event and whether equipment functioned as designed. Other key elements of a post-trip review procedure are 1) necessary management authorization for restart, 2) debriefing of affected operators, 3) verification that reporting requirements were completed, and 4) followup review by safety committees. Furthermore, the affected individuals who will be required by procedure to review the sequence of events computer printout and other event records will need to receive necessary training in the proper interpretation, understanding and evaluation of these records.

Licensee Action - Short Term

NRC will require and the licensee has committed to develop and issue a post-trip and post-safety-injection review procedure and train appropriate Operations Department personnel on the requirements prior to Unit 1 restart.

NRC Action - Short Term

NRC will review the licensee's post-trip and post-safety injection review procedure to ensure the key elements noted above are adequately addressed.

6. Timeliness of Event Notification

On three occasions between January 30 and February 25, 1983, the licensee notified NRC of significant events belatedly. In each case, the notification was approximately 30 minutes late. Two of these reports were for the February 22 and 25 events. Furthermore, in the February 22 event, the first notification did not contain known significant information regarding actuation of engineered safety features and opening of the power operated relief valves. This additional information was provided approximately 40 minutes later. The notification procedures used by the licensee warrants further evaluation as to the priority assigned for NRC notification.

Licensee Action - Short Term

NRC will require the licensee to reemphasize reporting requirements with all shift and on-call management personnel and will reevaluate notification priorities.

NRC Action

NRC will confirm that licensee's short term action is completed.

7. Updating Vendor Supplied Information

As a result of the February 25, 1983 event and NRC IE Bulletin 83-01, the licensee indicated not being aware of the existence of two Westinghouse technical service bulletins that provided preventive maintenance recommendations for the reactor-trip circuit breakers. The two documents in question

were published by Westinghouse in 1974. The licensee has requested documentation for all Westinghouse equipment and will incorporate this information into station documents. While we are not aware of any problems with other vendor documentation, an NRC staff concern is whether a similar situation exists with respect to documentation for other vendor-supplied information.

Licensee Action - Short Term

The licensee has made a commitment to a program to update existing documentation on safety equipment and to ensure that vendor documentation is under a controlled system.

Licensee Action - Long Term

The licensee will complete the above program in a timely manner.

NRC action - Long Term

NRC will perform inspections to verify the implementation of licensee's program.

8. Involvement of QA Personnel with Other Station Departments

The Quality Assurance Department did not review maintenance work orders associated with repair of the reactor-trip circuit breakers in January 1983 because the work was not designated safety related. Further examination determined that the QA Department does not review for proper determination of classification the work orders designated nonsafety related by other departments. Discussions with the licensee indicate that the QA Department has been somewhat isolated from the activities of other departments.

As a result of prior decisions, the licensee had initiated steps in January 1983 to relocate the QA Department from the corporate offices in Newark, N.J. to the site and is taking steps to increase QA Department involvement in other station activities. Completion of this program of increased QA involvement with other station activities need not be completed prior to restart, because completion of short-term actions in management issues 5 and 6 is sufficient to correct QA deficiencies in the short term.

Licensee Action - Short Term

The licensee has made a commitment to institute a program to more fully integrate QA activities into the overall activities.

Licensee Action - Long Term

The licensee will complete the above QA integration program.

NRC Action - Long Term

Monitor licensee's implementation of the above QA integration program.

9. Post-Maintenance Operability Testing

Past practice at Salem for post maintenance operability testing has varied. Such testing may be specified by the preparer of the maintenance work order or left to the discretion of maintenance personnel. For safety-related equipment, post-maintenance surveillance testing is done before returning the equipment to service. Additional functional post-maintenance and repair testing of equipment, such as surveillance testing, may need to be performed to demonstrate operability as an integral part of the larger component or system in which it must function.

Licensee Action - Long Term

The licensee will review and revise procedures and practices as necessary to ensure that functional testing of the overall components or system is performed to demonstrate operability prior to returning the equipment to service following maintenance and repair. Procedures will be revised, as necessary, to assure that operations department personnel review the testing prior to returning such equipment to service.

NRC Action - Long Term

NRC will review licensee's revised procedures and their implementation to assure that appropriate post maintenance operability testing is being accomplished before equipment is returned to service.

Appendix A

RESULTS OF NRC STAFF EVALUATION OF EVENTS AT SALEM NUCLEAR GENERATING STATION

I. IDENTIFICATION OF CAUSE OF FAILURE

Summary and Initial Findings

Initial inspection of the UV trip attachment indicates a possibility of multiple contributing causes of failure. Possible contributors are (1) dust and dirt; (2) lack of lubrication; (3) wear; (4) more frequent operation than intended by design; (5) corrosion from improper lubrication in January 1983; and (6) nicking of latch surfaces caused by vibration from repeated operation of the breaker. The contributors appear to be cumulative, with no one main cause. The initial investigation indicates that the failure was age related and that a new device would perform properly. Many surfaces of the latch mechanism are worn and the additional friction tended to prevent proper operation. Proper lubrication throughout the life of the device might have prevented the wear that can be seen on the sample.

The tests and examinations proposed by the staff and its contractor will attempt to determine the cause of failure and if possible reproduce it. The following summarizes the initial findings and lists the proposed tests.

Discussion and Circumstances

A site visit was conducted on March 3, 1983 by NRC and Franklin Research Center personnel to inspect the type DB-50 circuit breaker undervoltage trip attachment in an effort to determine the most probable cause of failure. The reactor trip circuit breaker rooms for Units 1 and 2, each of which contain four DB-50 circuit breakers, were visually inspected and the following observations were made:

1. All four DB-50 Unit 1 circuit breakers and UV trip attachments were removed from the circuit breaker cabinets. The enclosures were generally clean and free of dust. The ambient temperature was between 85 and 95°F, with warm exhaust air from inverter cabinets being directed at the DB-50 circuit breaker cabinets. The spacing between cabinets is approximately 3 feet.
2. All four DB-50 Unit 2 circuit breakers were also inspected. The UV trip attachments were removed, however. The circuit breaker cabinets contained a layer of loose dust approximately 1/16 inch thick. The ambient temperature was in the 70°F range. UV trip attachments are mounted on the top of the circuit-breaker platform, to the right of the shunt trip attachment, which is several inches from the bottom of the circuit breaker cabinet.

Interviews were conducted with an electrical maintenance supervisor who discussed the circumstances of the removal of the circuit breakers that were involved with the incident on Unit 1, and an electrical supervisor who had

also worked on the circuit breakers in question in August 1982. The information received was that the circuit breakers and their UV trip attachments had been operated frequently and had operated during surveillance testing within a few days prior to the incident.

A request was made to Salem management to provide one of the UV trip attachments and a shunt trip attachment for testing at Franklin Research Center (FRC). This request was complied with, and an investigation of these devices is now under way at FRC.

Results of Initial Examination

Initial evaluations indicated roughness in the operation of the trip latch. There is some dragging of the mechanism, and portions of the latch mechanism have obvious signs of wear. Possible contributing factors to the failure to operate are a lack of lubrication, wear, jarring of the UV attachment as a result of circuit breaker operation and more frequent operation of the UV trip attachment than was intended during design. It is postulated that under most industrial applications, the UV attachment would be used very infrequently and probably would be operated only during test sequences at perhaps yearly or longer intervals. Therefore, in industrial applications, it would operate only a few times, perhaps 20 or 30 cycles during its lifetime, and would not be a normal tripping mechanism for the breaker. However, in its use at Salem and other nuclear power plants, it is the prime tripping device for the circuit breaker, and is therefore called upon to operate on the order of 50 times per year. This would mean that at its current age, in 1983, there would have been possibly 400 to 500 trip operations of this device.

During the initial evaluation it was noted that the shunt trip attachment has been operated once every seven days since August 1982, rather than at longer intervals. This means that the circuit breaker is tripped and closed every seven days. This causes jarring of the entire mechanism of the circuit breaker and its attached relays and coils due to the normal operation of the breaker. This may or may not be significant, but it should be noted that the UV attachment stayed energized during these trips, and its latch mechanism was jarred somewhat by operation of the circuit breaker. This possibly added to the friction built up in the latch mechanism from normal operation by causing the latch mechanism to just slightly nick the surface that it rides on and thereby tend to prevent operation. Further investigation will try to determine whether this is indeed a problem. It appears from initial inspection of the device that wear and roughness of mating surfaces in the trip latch are present. Proper lubrication might have prevented the current situation or could have reduced the roughness to the point where proper operation could occur.

Further investigation will attempt to determine whether the CRC-2-26 lubricating and cleaning spray added to the operating problem by either causing corrosion or removing all residual lubrication from initial construction and

possible caking of dust and dirt. It appears that from the time of initial construction of the UV trip attachments up until January of 1983, no lubrication procedures had been performed, and then, in January of 1983, lubrication procedures were undertaken by the maintenance personnel and a Westinghouse

technician. At this time, the CRC-2-26 lubricant cleaner was sprayed on all four UV trip attachments associated with the Unit 1 circuit breaker. This lubricant is being procured by FRC for testing purposes.

List of Investigations To Be Performed by NRC Contractor (FRC)

1. The first test will be to perform various deenergizations and energizations of the UV trip attachment and monitor the device under various conditions.
2. The second test will be to disassemble the latch mechanism to observe the surfaces of the various parts of the latch and to photograph these surfaces through a microscope to determine the various levels of wear on these surfaces.
3. The third test is to determine the effects of CRC-2-26 spray on the various types of metals used in this devices. An attempt will be made to use metals other than those in the actual attachment. If possible, the chemical consistency of this spray will be determined from the manufacturer.

To prove that the sample UV trip attachment is identical to all such Salem devices, a visual inspection of all existing Salem Unit 1 and 2 UV trip attachments will be performed. This can take place at Salem, with no disassembly needed. The inspection can be made with the devices mounted on the circuit breakers or loose. These inspections should be done as soon as possible, and Tuesday, March 8, 1983 is recommended.

If further tests are required they will be based on the results of these initial tests. All tests will be nondestructive such that the device can be used for further testing and returned to the utility.

Additional Test To Be Conducted by the Licensee, as Revised by NRC Staff

This test will require the use of a spare circuit breaker. The UV trip and shunt trip attachments will be mounted on the breaker, and the breaker will be operated repeatedly to determine the effect on the shunt and UV trip attachments. It is surmised that while the attachments are energized and the breaker trips and closes a number of times, additional friction of the trip latch may occur from the vibration. This test is described in detail in the following section.

II. REVISED SURVEILLANCE OF REACTOR-TRIP CIRCUIT BREAKER OPERATION AND VERIFICATION TESTING

The licensee proposed the following increased surveillance of reactor-trip circuit breaker operation:

1. Main and bypass breakers will be shunt-tripped weekly.
2. Main breakers will be UV-tripped monthly.

The acceptability of this revised surveillance of reactor-trip circuit breaker operation has been evaluated by NRC staff. Based on an analysis conducted by NRC staff, which considered reactor-trip system unavailability, reactor-trip circuit breaker failure rates, and test intervals, the following conclusions were drawn. First, the proposed test of each reactor-trip circuit breaker UV trip attachment once every 30 days is acceptable. Second, the proposed test of the shunt trip attachment once every seven days is considered to be excessive and may impact on the reliability of the reactor trip system by increasing the potential for a single failure. During testing, a single failure in the logic portion of the reactor trip system could prevent an automatic SCRAM. Thus, it is recommended that the shunt trip attachment be tested on the same schedule as the UV trip attachment; that is, once every 30 days. It is also recommended that the UV trip of the bypass breakers be tested prior to restart and every refueling thereafter.

Discussion

The acceptability of the proposed test intervals for the reactor-trip circuit breakers was based on NRC staff review of reactor-trip circuit breaker failure rate data obtained from Licensee Event Reports (LERs). The generic RPS unavailability of 3×10^{-5} (used in both NUREG-0460, "Anticipated Transients Without Scram for Light Water Reactors," and by the ATWS Task Force and Steering Group in the development of the proposed ATWS Rule) was used in evaluating the licensee's proposed test intervals. In addition, the following considerations were incorporated into the NRC staff recommendation:

1. The shunt trip attachment provides a diverse means of tripping the reactor-trip circuit breaker, which is electrically independent of the UV trip attachment. The UV trip attachment is supplied by a 48-V dc source and is deenergized to trip. The shunt trip attachment is supplied by a 125-V dc source and is energized to trip.
2. The shunt trip attachment is an energize-to-actuate device and is not "fail safe" in that a loss of power will not cause a trip. However, the shunt trip is powered from a reliable Class 1E battery-backed source.
3. Since the shunt trip attachment is an energize-to-actuate device, it is not subject to the constant heating effects that the continuously energized UV trip attachment experiences. The heating effects may contribute to the higher failure rate of the UV trip attachment.
4. The mechanical construction of the shunt trip attachment is less complex than that of the UV trip attachment. The shunt trip attachment does not rely on the successful operation of the complex latching mechanism that has been determined to be the source of the majority of the failures of the UV trip attachment.
5. The majority of the electrical circuit breakers used in the high-voltage electrical distribution system have dc-powered energize-to-actuate shunt trip attachments. These circuit breakers are used for manual, as well as automatic, trip functions for load shedding and power switching. Reliability of energize-to-actuate shunt trips in similar applications through-

out the nuclear power industry has been shown to be significantly higher than for devices that are constantly energized.

6. Over 70% of the known reactor-trip circuit breaker failures were caused by UV trip attachment failures.
7. Most of the concerns relating to the events at Salem on February, 22 and 25, 1983 are related to the operation of the UV trip attachment. During the events at Salem, the shunt trip attachment functioned properly.
8. The bypass breakers are required to trip in response to a UV trip demand signal should this occur when the main breakers are being tested. Since the test frequency of the main breakers has been increased, the bypass breakers should be tested to verify the capability to perform their backup safety function.

Verification Testing

It is recommended that a bench test be performed on one DB-50 reactor-trip circuit breaker. The purpose of the test will be to cycle the DB-50 with the UV trip and shunt trip attachments in place for a total of 2000 cycles to determine if any adverse effects can be identified and, if there are no adverse effects, show that a properly maintained breaker and its subcomponents can operate for an extended number of cycles. The breaker will be tripped, with each cycle being alternated with the UV and shunt trips. The ambient temperature should be 100°F to simulate the expected service environment, and the circuit breaker should be cycled no more often than once every 30 minutes to allow for return to steady-state conditions. The results of each circuit breaker operation will be documented and a visual check made. Additional details for this type of test will be provided at a later time.

Appendix B

INITIAL NRC STAFF REVIEW OF LICENSEE'S MAINTENANCE PROCEDURE AND PREOPERATIONAL VERIFICATION PROGRAM

NRC staff reviewed the licensee's maintenance procedure, Salem Generating Station Maintenance Department Manual Maintenance Procedure M3Q-2, Revision 1. This document includes a procedure for verifying proper operation of the UV trip attachment and testing of the UV trip attachment coil following replacement. NRC staff also reviewed the licensee's proposed reactor-trip circuit breaker operational verification program, which references Procedure M3Q-2. The following comments and recommendations were made concerning these documents:

1. The maintenance procedure does not specify whether the maintenance and testing described are applicable to both the main and bypass breakers. It should specify that it does.
2. The maintenance procedure should specify required actions to be taken in the event any acceptable tolerances, as identified in Enclosure 7 of M3Q-2, are not met.
3. The frequency of all maintenance and testing specified in the procedure, with the exception of the verification testing identified following UV trip attachment replacement, should be specified.
4. The procedure should be modified to require cleaning of the entire circuit breaker room, the removal of all four circuit breakers and cleaning of the cabinets by vacuuming, and cleaning of the breakers during every refueling outage.
5. Section 9.7.2.1 of Procedure M3Q-2 specifies that the UV trip attachment is to be cleaned with a standard solvent. The procedure should specify the exact solvent to be used. NRC will request FRC and BNL to determine the adequacy of the proposed solvent and any potential adverse effects from its use. (This evaluation need not be completed prior to plant startup).
6. Section 9.7.2.2 specifies the composition of the lubricant to be applied to specific points of the UV trip attachment. This specification should state whether the mechanism is to be lubricated each time maintenance is performed. NRC will request FRC and BNL to determine the adequacy of the lubricant and the points of application specified, as well as the frequency of lubrication.
7. Any UV trip attachment that does not successfully complete the 25 consecutive cycles of testing to be performed by Westinghouse should not be accepted or installed by the licensee.
8. Section 9.7.4.15 specifies the testing to be performed on the UV trip attachment coil following its replacement. The maintenance procedure should be revised to require that all replacement UV trip attachment successfully complete 25 consecutive cycles of testing prior to instal-

lation in the plant and start of the ten test cycle specified in the maintenance procedure. The time between each of the ten tests should be specified. NRC recommends 30 minutes for the reasons specified in Appendix A. NRC staff believe the increase in test cycles, and the acceptance criteria specified if any failures occur during this testing, are reasonable and should be incorporated into maintenance procedure M3Q-2.

9. Technical Department Procedures Nos. IIC-18.1.011 and IIC-18.1.010, referenced by the licensee, should be reviewed and their acceptability determined by NRC staff.

Following revision of the maintenance procedure and the associated proposed reactor-trip circuit breaker operational verification program to incorporate the above comments and recommendations, the NRC staff will reevaluate the documents and provide another report that will include the results of the NRC contractor's evaluations and will document the final NRC evaluation and conclusions concerning the adequacy of the maintenance procedure and preoperational verification program.

ENCLOSURE 2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)	
PUBLIC SERVICE ELECTRIC)	Docket Nos. 50-272 and 50-311
AND GAS COMPANY)	
(Salem Nuclear Generating)	License Nos. DPR-70 and DPR-75
Station, Units 1 & 2))	

ORDER TO SHOW CAUSE

I.

Public Service Electric and Gas Company (the licensee) holds License Nos. DPR-70 and DPR-75 which authorize operation of Units 1 and 2 of the Salem Nuclear Generating Station. The facilities are Westinghouse pressurized water reactors (PWRs) located at the licensee's site at Hancock's Bridge, Salem County, New Jersey.

II.

On February 25, 1983, an event occurred at Unit 1 of the Salem Nuclear Generating Station when the control rods failed to insert since the reactor-trip circuit breakers failed to automatically open following receipt of a valid trip signal from the Reactor Protection System (RPS). The manual trip system was used to shut down the reactor. Subsequently, it was concluded by the licensee that the failure to trip was caused by a malfunction of the undervoltage (UV) trip attachments in both reactor-trip circuit breakers. Evaluation of the event of February 25, 1983 revealed that a similar failure had occurred on February 22, 1983, at Salem 1. There had also been a previous event at Salem 2 involving a failure of one reactor trip circuit breaker to trip on January 6, 1983.

The malfunction of the undervoltage device on February 25 was determined by the licensee and the vendor (Westinghouse) to be excessive friction on the mechanical latch lever in the UV trip mechanism. It appears that no preventative maintenance was conducted on the Salem 1 DB-50 circuit breakers until January 1983. Additionally, the recommendations of a Westinghouse 1974 Technical Bulletin and Data Letter (NSD DATA LETTER 74-2) were not implemented during the January maintenance since the personnel who performed the maintenance were not aware of the bulletin recommendations. The specific details of the event and the licensee's response are contained in the NRC Restart Status Report of March 1983.

The NRC review of the event revealed a number of management inadequacies, such as the management supervision and control of the procedures governing the classification of equipment as safety-related equipment, management supervision of maintenance techniques, and management attention to the safety implications of system malfunctions.

If there were a potentially severe transient, from a worst case set of initial conditions, and the reactor shutdown system did not function, an extremely severe accident could occur in the absence of timely operator action. Therefore, the technical significance of the aforementioned failures is readily apparent, and when coupled with the cause of the challenge to the reactor protection system, i.e., a feedwater system transient, and the frequency of past feedwater system transients,^{1/} the event raises serious safety questions regarding the safe operation of the Salem facility.

^{1/} Of primary concern to the NRC is the ATWS (anticipated transient without scram) event initiated by a loss of feedwater transient. In 1981 and 1982, Salem 1 experienced about 11 and 5 feed transients, respectively, while Salem 2 experienced about 14 in 1981 and about 11 in 1982. This results in a total average of about 10 transients per unit year of

III

The analysis of the event, therefore, raised equipment issues, operational issues and management issues which must be addressed to ensure safe future operation.

The licensee has agreed to take certain remedial actions prior to resumption of operation from the current outage, as well as certain longer-term actions following restart. These remedial actions involve equipment issues, operational issues, and management issues. The equipment issues involve (1) safety classification of breakers, (2) identification of cause of failure, (3) verification testing and (4) maintenance and surveillance procedures. The operational issues involve (1) operating procedure for reactor trips and anticipated transients without scram (ATWS), (2) operator training and (3) operator response. The management issues involve (1) overall management capability and performance, (2) master equipment list, (3) procurement procedures, (4) work-order procedures, (5) post-trip review, (6) timeliness of event notification, (7) updating vendor-supplied information, (8) involvement of QA personnel with other station departments, and (9) post maintenance operability testing. The NRC staff has reviewed these proposed corrective actions and determined that, after implementation, they will ensure the safe operation of the facility. However, to ensure that permanent corrective actions are in place, and to increase the reliability of the mitigation features of this particular facility due to its history, certain other long-term actions are required in the interest of the public health and safety.

IV.

Accordingly, pursuant to Sections 103, 161(i), and 182 of the Atomic Energy Act of 1954, as amended, and the Commission's regulations in 10 CFR Parts 2 and 50, IT IS HEREBY ORDERED THAT the licensee should show cause why it should not be required to:

A. Within 60 days of the effective date of this Order, submit to the Director, Office of Nuclear Reactor Regulation, a detailed schedule for accomplishing the following actions as soon as possible:

- (1) Implementing at the Salem facility (Units 1 and 2) the following feature of the proposal by the Industry Group on ATWS submitted on April 23, 1982, on Docket PRM-50-29 (page 10 of Appendix C): provision of automatic initiation of turbine trip and auxiliary feedwater independent of the reactor protection system;
- (2) Providing at the Salem facility diversity in activating (tripping) the reactor from breakers, for example, by incorporating the breaker shunt trip function into the automatic trip circuits of the reactor protection system;
- (3) Developing and implementing procedures consistent with the applicable emergency response guidelines (letters from Jurgensen to Eisenhut dated November 30, 1981, from Kingsley to Eisenhut dated July 21, 1982, from Kingsley to Eisenhut dated January 4, 1983) for ATWS-type transients; and

- (4) Training operators and advisory personnel on the procedures developed under section IV.A(3) prior to implementation.

The schedule shall be subject to approval by the Director and shall be implemented following such approval. The Director may modify the approved schedule in writing for good cause.

- B. Within 60 days of the date of this Order, submit to the Director their plan and schedule to conduct an evaluation into the background, causes, and circumstances leading up to the events of February 22 and 25, 1983. The purpose of the evaluation shall be to develop a plan to further improve the management's role in identifying and directing resolution of problems associated with safety-related equipment procurement, maintenance, surveillance and operations. The scope of the evaluation will cover all safety-related equipment. The evaluation shall include a review of the methods used by managers to identify inter-departmental problems that may affect safety-related activities. The evaluation shall also include an analysis of the effectiveness of existing independent safety review groups with specific examination of their roles in the identification of issues and recommendations related to problems associated with the reactor trip breakers. The plan shall include the method for reporting the results of the evaluation to the Director, and the licensee's method for implementation of any recommendations resulting from the evaluation and/or the NRC review of the evaluation report. Upon approval by the Director, the plan and schedule shall be implemented. The Director may modify the approved plan and schedule in writing for good cause.

V.

Within 25 days of the date of this order, the licensee may show cause why the actions described in Section IV should not be ordered by filing a written answer under oath or affirmation that sets forth the matters of fact and law on which the licensee relies. As provided in 10 CFR 2.202(d), the licensee may answer by consenting to the order proposed in Section IV of this order to show cause. Upon the licensee's consent, or upon failure of the licensee to answer this order within the allotted time, the terms of Section IV of this order will become effective. Alternatively, the licensee may request a hearing on this order within 25 days after the issuance of this order. Any request for a hearing or answer to this order shall be submitted to the Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, D. C. 20555. A copy of the request or answer shall also be sent to the Executive Legal Director at the same address.

If a hearing is held on this order, the Commission will issue an order designating the time and place of hearing. If a hearing is held, the issue to be considered at such a hearing shall be whether the licensee shall perform the actions specified in Section IV of this order.

FOR THE NUCLEAR REGULATORY COMMISSION

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland,
this day of March 1983.