

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No: 50-454/455-98020(DRP)

Licensee: Commonwealth Edison Company

Facility: Byron Generating Station, Units 1 and 2

Location: 4450 N. German Church Road
Byron, IL 61010

Dates: October 6 - November 23, 1998

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EXECUTIVE SUMMARY

Byron Generating Station Units 1 and 2 Byron Inspection Report 50-454/98020(DRP); 50-455/98020(DRP)

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 7-week period of inspection activities by the resident staff and region based inspectors.

Operations

- The inspectors concluded that the conduct of operations in the control room were performed in a professional manner. Specifically, operators were attentive, properly used operating procedures, effectively controlled plant evolutions, responded appropriately to alarms, and were knowledgeable of plant conditions. (Section O1.1)
- While performing maintenance on the 345 kilovolt bus tie breakers, operators opened the wrong local breaker backup trip switches, which had the potential to place equipment and personnel at risk. The inspectors concluded the licensees corrective actions were acceptable to address identified problems with the pre-job briefing, inadequate work instructions, lack of adequate training, and a failure to resolve questions which the operators raised. No violations of regulatory requirements occurred since the deficiencies involved non-safety related equipment. (Section O4.1)
- The inspectors concluded that during the performance of Byron Operating Surveillance 3.2.1-853, "Unit Two ESFAS [Engineered Safety Feature Actuation Signal] Instrumentation Salve Relay Surveillance (Train B Containment Isolation Phase A - K612)," Revision 3, Temporary Procedure Change 98-2-295, a nuclear station operator failed to follow the procedural guidance for restoring letdown system flow, which resulted in the letdown system relief valve lifting. Contributing causes for the event included a failure to perform a pre-job brief, poor self-checking and peer-checking techniques, and a perceived time constraint to restore letdown system flow. A Non-Cited Violation was issued. (Section O4.2)

Maintenance/Surveillance

- The inspectors concluded that the observed maintenance activities were conducted well. Specifically, oversight of maintenance activities was evident; maintenance activities were completed in accordance with station procedures; and, maintenance personnel were knowledgeable of the associated activities and implemented good work practices. (Section M1.1)
- The inspectors concluded that the observed surveillance tests were performed well. Specifically, the surveillance tests satisfied the requirements of Technical Specifications; and each of the tested components met their respective acceptance criteria and remained operable. (Section M1.2)
- The inspectors concluded that Byron Engineering Surveillances 1BVS 7.1.2.1.b.1-1, "Unit 1 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test,"

Revision 8, and 2BVS 7.1.2.1.b.1-1, "Unit 2 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test," Revision 9, unacceptably preconditioned the stroke time testing of the auxiliary feedwater discharge valves, 1/2AF004A/B, by not measuring the stroke time until the sixth time the valves were opened during the test. An escalated enforcement action was issued to allow the licensee time to develop their corrective actions. (Section M1.3)

- The inspectors agreed with the licensee's conclusion that failure to provide appropriate work instructions for the configuration of the pressure manifold assembly used to inflate and maintain pressure on the temporary inflatable pipe plug, installed as an isolation boundary for maintenance on the 0A essential service water cooling tower to basin bypass valve, 0SX162D, resulted in the inadvertent over-pressurization and rupture of the inflatable pipe plug. The inspectors also agreed with the licensee that a lack of a continuous pressure watch contributed to the event. A Non-Cited Violation was issued (Section M3.1)
- The inspectors concurred with licensee's conclusion that the 1A diesel generator was rendered inoperable by inadequate maintenance practices on the main lube oil filter due to inappropriate procedural guidance in Byron Mechanical Maintenance Procedure 3208-2, "Emergency Stand-by Diesel Generator Engine Inspection 18-Month Surveillance," Revision 4. In addition, the inspectors noted that the licensee missed a prior opportunity to identify the degraded condition in the lube oil system, which resulted in the operation of the facility in a condition prohibited by Technical Specifications. A Non-Cited Violation was issued. (Section M3.2)
- The inspectors concluded that three maintenance department human performance errors occurred due to ineffective self-checking and peer-checking techniques. The inspectors also concluded that a lack of understanding of the independent verification process existed in the maintenance department. Three examples of Non-Cited Violations were issued for the failure to follow procedures. (Section M4.1)

Engineering

- The inspectors concluded that the selected operability assessments reflected sound engineering judgement and provided sufficient information to support the conclusions. (Section E1.1)

Plant Support

- The inspectors concluded that observed radiation work practices were effective and met applicable regulatory requirements. Specifically, radiologically controlled areas were properly posted; personal dosimetry was used correctly; radiation monitoring instruments functioned and were properly calibrated; and, decontamination centers were ready for use. (Section R1.1)

Report Details

Summary of Plant Status

The licensee operated both Units 1 and 2 at or near full power for the duration of the inspection period.

I. Operations

O1 Conduct of Operations

O1.1 Control Room Staff Observations

a. Inspection Scope (71707)

The inspectors interviewed shift managers, unit supervisors and nuclear station operators (NSOs); observed operations department shift turnovers; and observed the general conduct of control room activities.

b. Observations and Findings

The inspectors noted that the shift managers conducting shift turnover briefings were knowledgeable of topics covered; that licensed and non-licensed operators on-shift were in attendance; and that major work activities, limiting conditions for operation, and unit status were discussed. The inspectors observed frequent attendance by the Operations Manager and the Shift Operations Supervisor who stressed safety, procedure adherence, and configuration control.

The inspectors observed that unit supervisors demonstrated good command and control. The inspectors noted that NSOs were attentive, properly used operating procedures, utilized self-checks and peer-checks when manipulating equipment, and generally used three-way communications. Operators responded appropriately to expected and unexpected alarms by referring to annunciator response procedures for unexpected alarms and promptly informing supervisors of alarm conditions.

c. Conclusions

The inspectors concluded that the conduct of operations in the control room were performed in a professional manner. Specifically, operators were attentive, properly used operating procedures, effectively controlled plant evolutions, responded appropriately to alarms, and were knowledgeable of plant conditions.

O4 Operator Knowledge and Performance

O4.1 Wrong Local Breaker Backup (LBB) Trip Switches Opened During the Isolation of the 345 Kilovolt (KV) Bus Tie Breaker 6-7

a. Inspection Scope (71707)

The inspectors reviewed the circumstances surrounding the failure to properly isolate bus tie breaker 6-7 for maintenance. The inspectors interviewed operations department personnel and reviewed Root Cause Report 454-200-98-SCAQ00029, "Wrong Test Switches Opened to Disable 345 KV Bus Tie Breaker 6-7 LBB Trips."

b. Observations and Findings

On October 1, 1998, while isolating the 345 KV bus tie breaker 6-7 for maintenance, the operators mistakenly disabled the LBB feature for bus tie breaker 5-6 instead of breaker 6-7. The error was subsequently identified by operations analysis department (OAD) personnel during preparation for the maintenance activities. The shift manager was immediately notified, the system configuration was restored, and a prompt investigation was initiated into the cause of the error.

The licensee's investigation revealed that: (1) disabling the LBB feature of 345 KV bus tie breakers had previously been accomplished by OAD personnel and not by operating department personnel; (2) operators had not received training on disabling the LBB feature of 345 KV bus tie breakers; (3) work group responsibility for disabling the LBB feature was unclear; (4) the pre-job brief for the activity was inadequate; (5) the work instructions for the activity were insufficient; (6) labeling of the LBB trip switches was inadequate; and (7) the operators proceeded and attempted to accomplish the task without adequately resolving existing questions. The licensee's corrective actions for this issue included: (1) establishing a policy that disabling the LBB feature of 345 KV bus tie breakers is an operating department responsibility; (2) training the operators on disabling and restoring the LBB feature of 345 KV bus tie breakers; (3) developing procedural guidance for the activity; (4) enhancing the pre-job briefing checklist to include guidance on the need for support personnel who are familiar with the activity when assigned personnel have not previously performed the activity; and (5) improving the labeling of the equipment in the switchyard relay house. The inspectors concluded that the licensee's corrective actions were acceptable.

c. Conclusions

While performing maintenance on the 345 kilovolt bus tie breakers, operators opened the wrong local breaker backup trip switches, which had the potential to place equipment and personnel at risk. The inspectors concluded the licensee's corrective actions were acceptable to address identified problems with the pre-job briefing, inadequate work instructions, lack of adequate training, and a failure to resolve questions which the operators raised. No violations of regulatory requirements occurred since the deficiencies involved nonsafety-related equipment.

O4.2 Letdown Relief Valve Lifted Due to Operator Error During Surveillance Testing

a. Inspection Scope (71707)

The inspectors reviewed the circumstances surrounding the unexpected lifting of the letdown system relief valve, 2CV8117, during the performance of Byron Operating Surveillance (BOS) 3.2.1-853, "Unit Two ESFAS [Engineered Safety Feature Actuation Signal] Instrumentation Salve Relay Surveillance (Train B Containment Isolation Phase A - K612)," Revision 3, Temporary Procedure Change 98-2-295. The inspectors interviewed operations department personnel, reviewed the surveillance test procedure and evaluated the results of the licensee's prompt investigation.

b. Observations and Findings

On November 6, 1998, during the performance of BOS 3.2.1-853, Section F.1.11, the NSO performing the surveillance test restored letdown system flow incorrectly. Byron Operating Surveillance 3.2.1-853, Section F.1.11, specified that letdown system flow be restored by opening the 75 gallons per minute (gpm) letdown orifice 2B isolation valve, 2CV8149B, per Byron Operating Procedure (BOP) CV-17, "Establishing and Securing Normal and RH [Residual Heat Removal] Letdown Flow." Byron Operating Procedure CV-17, Section F.4, specified, in part, that prior to opening 2CV8149B the letdown line pressure control valve controller be in manual and open at 20 percent demand. In addition, BOP CV-17 specified that immediately following the opening of 2CV8149B the letdown line pressure control valve controller be adjusted to 370 pounds per square inch gauge (psig) and placed in automatic. However, the NSO failed to take the actions specified in BOP CV-17 and opened 2CV8149B, which resulted in the letdown system relief valve lifting. The NSO recognized the error when the letdown relief valve high temperature annunciator alarmed in the control room. The operating shift restored the system configuration, verified that the letdown system relief valve had reseated, and initiated a prompt investigation into the cause of the error.

The licensee's investigation revealed that the operator error occurred as a result of a failure to perform a pre-job brief and poor self-checking and peer-checking techniques. In addition, the licensee determined that the NSO perceived a time constraint to restore letdown system flow in order to prevent a pressurizer level deviation. The licensee's corrective actions for this event included disciplinary action against the involved operators, reviewing the event with operations department personnel emphasizing the importance of conducting thorough pre-job briefings and performing rigorous self-checks and peer-checks during all evolutions, and enhancing the procedural guidance in BOS 3.2.1-853. The inspectors concluded that the licensee's corrective actions were acceptable.

Technical Specifications (TS) 6.8.1.a, states that written procedures shall be established, implemented, and maintained for procedures recommended in Appendix A, of Regulatory Guide 1.33, Revision 2, February 1978. Appendix A of Regulatory Guide 1.33, Revision 2, February 1978, specifies that procedures are required for each surveillance test listed in TS. Byron Operating Surveillance 3.2.1-853 was the implementing procedure for the quarterly slave relay test of the train B containment isolation phase A slave relay K612 as required by TS 4.3.2.1. On November 6, 1998,

the letdown system relief valve lifted due to an NSO failure to restore letdown system flow in accordance with BOP CV-17 as required by BOS 3.2.1-853, Section F.1.11. This was an example of a violation of TS 6.8.1.a for failure to implement the procedure. This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-455/98020-01a(DRP)).

c. Conclusions

The inspectors concluded that during the performance of Byron Operating Surveillance 3.2.1-853, "Unit Two ESFAS [Engineered Safety Feature Actuation Signal] Instrumentation Salvage Relay Surveillance (Train B Containment Isolation Phase A - K612)," Revision 3, Temporary Procedure Change 98-2-295, a nuclear station operator failed to follow the procedural guidance for restoring letdown system flow, which resulted in the letdown system relief valve lifting. Contributing causes for the event included a failure to perform a pre-job brief, poor self-checking and peer-checking techniques, and a perceived time constraint to restore letdown system flow. A Non-Cited Violation was issued.

O8 Miscellaneous Operations Issues (92901)

- O8.1 (Closed) Violation 50-454/455-97020-01: "Failure to Incorporate Technical Specification Amendments 84, 86, 87, 88, 89, 90, and 91." The licensee failed to incorporate these Technical Specification Amendments into the controlled copies of Technical Specifications within the 30-day time requirement, which resulted in the operators utilizing outdated Technical Specifications during plant operations. The inspectors reviewed the licensee's corrective actions to check for any notable weaknesses. No weaknesses were identified and the corrective actions were found to be acceptable. This violation is closed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Maintenance Observations

a. Inspection Scope (62707)

The inspectors interviewed operations, engineering and maintenance department personnel and observed the performance of all or portions of the work requests (WRs) listed below. When applicable, the inspectors also reviewed TS and the Updated Final Safety Analysis Report (UFSAR). Maintenance associated with the centrifugal charging pump, the essential service water pump, and the emergency diesel generators were selected for observation since they were identified as risk significant components in the Byron Station Individual Plant Examination.

- WR 970080998-01 2B Centrifugal Charging Pump High Speed Gear Drive Maintenance
- WR 980080537-01 Repair Oil Leaks on Supply Line Fittings for the 2B Centrifugal Charging Pump
- WR 970113786-01 Repair Body-to-Bonnet Leak on 2CV8524A, Letdown Demineralizer Inlet Isolation Valve
- WR 970113787-01 Repair Body-to-Bonnet Leak on 2CV8522B, Letdown Demineralizer Outlet Isolation Valve
- WR 970069882-01 Calibrate 1PR013, Residual Heat Removal and Containment Spray Pump Room Cubicle Cooler Radiation Monitor
- WR 980112293-01 Troubleshoot Delayed Breaker Closing for the 1A Containment Spray Pump and Replace Control Switch
- WR 980065494-01 Inspect and Repair the 2A Essential Service Water Pump Discharge Strainer
- WR 970091481-01 Install Flexible Fuel Oil Lines on the 2A Emergency Diesel Generator per DCP [Design Change Package] 9600260
- WR 970110246-01 Install Flexible Fuel Oil Lines on the 2A Emergency Diesel Generator per DCP 9600258
- WR 960077983-01 Calibrate 1TIC DG 247A, 1A Emergency Diesel Generator Service Water Temperature Control Switch
- WR 970102349-01 Calibrate 1TY VD 001, 1A Emergency Diesel Generator Room Ventilation Dampers
- WR 980091024-01 Calibrate 1PDS DG 086A, 1A Emergency Diesel Generator Fuel Filter Differential Pressure Switch and
- WR 970038696-01 Replace 1TIS FW 187A Thru E, 1B Main Feed Pump Temperature Switches

c. Conclusions

The inspectors concluded that the observed maintenance activities were conducted well. Specifically, oversight of maintenance activities was evident; maintenance activities were completed in accordance with station procedures; and, maintenance personnel were knowledgeable of the associated activities and implemented good work practices.

M1.2 Surveillance Test Observations

a. Inspection Scope (t . /26)

The inspectors interviewed operations and engineering personnel, reviewed the completed test documentation and applicable portions of the UFSAR and TS, and observed the performance of selected portions of the following surveillance test procedures.

- BOP IC-3 Movable Incore Detectors - Flux Mapping Procedure
- 1BOS 3.2.1-803 Unit One ESFAS Instrumentation Slave Relay Surveillance (Train A Automatic Safety Injection - K608)

- 1BOS 3.2.1-920 Unit One ESFAS Instrumentation Slave Relay Surveillance (Train A Feedwater Isolation, Hi-Hi Steam Generator Level - K638)
- 1BOS 8.1.1.2.a-2 1B Diesel Generator Operability Monthly (Staggered) and Semi-Annual (Staggered) Surveillance
- 2BOS 3.2.1-815 Unit Two ESFAS Instrumentation Slave Relay Surveillance (Train B Automatic Safety Injection - K610)
- 2BOS 3.2.1-854 Unit Two ESFAS Instrumentation Slave Relay Surveillance (Train B Containment Isolation Phase A - K613)
- 2BOS 3.2.1-855 Unit Two ESFAS Instrumentation Slave Relay Surveillance (Train B Containment Isolation Phase A - K614)
- 2BOS 7.1.2.1.b-1 Motor Driven Auxiliary Feedwater Pump Monthly Surveillance
- 1BVS 0.5-3.SX.1-2 Unit 1 Test of the 1B Essential Service Water Pump and Miscellaneous System Check Valves
- 2BVS 5.2.f.2-1 ASME Surveillance Requirements for Safety Injection Pump 2SI01PA
- 2BVS 5.2.f.3-1 ASME Surveillance Requirements for Residual Heat Removal Pump 2RH01PA and,
- 2BVS 6.2.1.B-2 ASME Surveillance Requirements for 2B Containment Spray Pump

c. Conclusions

The inspectors concluded that the observed surveillance tests were performed well. Specifically, the surveillance tests satisfied the requirements of Technical Specifications; and each of the tested components met their respective acceptance criteria and remained operable.

M1.3 Preconditioning of Auxiliary Feedwater (AF) Valves During Surveillance Testing

a. Inspection Scope (61726)

The inspectors interviewed operations and engineering department personnel and reviewed Byron Engineering Surveillances (BVSs) 1BVS 7.1.2.1.b.1-1, "Unit 1 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test," Revision 8, 2BVS 7.1.2.1.b.1-1, "Unit 2 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test," Revision 9, 1BVS 7.1.2.1.b.2-1, "Unit 1 Auxiliary Feedwater Pump Emergency Actuation Signal Verification Test," Revision 4, and 2BVS 7.1.2.1.b.2-1, "Unit 2 Auxiliary Feedwater Pump Emergency Actuation Signal Verification Test," Revision 3. The inspectors also reviewed Byron Site Policy Memo 600.12, "Preconditioning," and the applicable portions of the UFSAR and TS.

b. Observations and Findings

During the review of 1/2BVS 7.1.2.1.b.1-1, the inspectors identified that the stroke time testing of the AF pump discharge valves, 1/2AF004A/B, were not performed until the sixth time the valves were stroked open during the performance of the test. The inspectors questioned the validity of the test methodology due to the preconditioning of

the valves prior to performance of the stroke time testing. In response to the inspectors questions, the licensee evaluated the test methodology and concluded that the valves had been preconditioned prior to the stroke time testing. The licensee also identified that during the performance of 1/2BVS 7.1.2.1.b.2-1, the AF pump start time response testing had been preconditioned since the time response of the AF pumps was not performed on the first start of the pumps.

10 CFR Part 50, Appendix B, Criteria XI, "Test Control," requires, in part, that a test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. Test procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions.

Technical Specification Surveillance Requirement 4.7.1.2.1.c.(1), requires that each AF pump be demonstrated operable at least once per 18 months during shutdown by verifying that each automatic valve in the flowpath actuates to its correct position upon receipt of an AF actuation test signal. Auxiliary feedwater pump discharge valves, 1/2AF004A/B, are normally open valves that receive an open signal upon receipt of an AF actuation signal. In addition, UFSAR, Section 10.4.9.3.1, specifies, in part, that an AF pump can deliver at least 160 gpm to each of three unfaulted steam generators within 1 minute without operator action necessary for 30 minutes following an accident. The licensee performs 1/2BVS 7.1.2.1.b.1-1 to satisfy TS Surveillance Requirement 4.7.1.2.1.c.(1) and demonstrate that the stroke time for 1/2AF004A/B supports the flow requirements described in UFSAR, Section 10.4.9.3.1.

Byron Site Policy Memo 600.12, "Preconditioning," defines preconditioning as the unacceptable practice of "grooming" a component prior to a surveillance in such a way that the results of the surveillance test are invalidated. The unacceptable preconditioning of the AF pump discharge valves, 1/2AF004A/B, is considered an apparent violation of 10 CFR Part 50, Appendix B, Criteria XI, (Escalated Enforcement Item 50-454/455-98020-02(DRP)). This issue, which may represent a violation of NRC requirements, will remain open for a reasonable time to allow the licensee to develop its corrective actions.

c. Conclusions

The inspectors concluded that Byron Engineering Surveillances 1BVS 7.1.2.1.b.1-1, "Unit 1 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test," Revision 8, and 2BVS 7.1.2.1.b.1-1, "Unit 2 Auxiliary Feedwater Valve Emergency Actuation Signal Verification Test," Revision 9, unacceptably preconditioned the stroke time testing of the auxiliary feedwater discharge valves, 1/2AF004A/B, by not measuring the stroke time until the sixth time the valves were opened during the test. An escalated enforcement item was issued to allow the licensee time to develop their corrective actions.

M3 Maintenance Procedures and Documentation

M3.1 Inadvertent Inflatable Pipe Plug Rupture

a. Inspection Scope (62707)

The inspectors reviewed the circumstances surrounding the inadvertent over-pressurization and rupture of a temporary inflatable pipe plug that had been installed as an isolation boundary for maintenance on the 0A essential service water (SX) cooling tower to basin bypass valve, 0SX162D. The inspectors interviewed operations and maintenance department personnel and reviewed WR 960112838, "Install/Remove Pipe Plug to Support Valve Work," Temporary Alteration 98-0-044, "Installation of Inflatable Pipe Plugs in Lines 0SX98AB and 0SX98AD at the Cooling Tower Basin," and Root Cause Report 454-200-98-CAQ00023, "0SX162D Inflatable Balloon Isolation Plug Ruptures due to Over-pressurization."

b. Observations and Findings

On September 16, 1998, shortly following the pressurization of the temporary inflatable pipe plug for maintenance on 0SX162D, the pipe plug ruptured due to over-pressurization. Since maintenance work had not commenced on 0SX162D, the SX basin level was unaffected. The inspectors noted that if 0SX162D had been removed for maintenance, as planned, water level in the SX basin would have been inadvertently lowered which would have reduced the water inventory in the ultimate heat sink and placed maintenance personnel at risk. Due to the basin configuration at the time the minimum basin level required by TS would have been maintained. In response to the pipe plug rupture, the shift manager suspended work on the SX system and initiated an investigation into the cause of the event.

The licensee's investigation revealed that the pipe plug had been over-pressurized due to an incorrectly configured pressure manifold assembly. The pressure manifold was incorrectly configured due to insufficient work instructions. Specifically, WR 960112838 stated, install the inflatable pipe plug and inflate per Temporary Alteration 98-0-044; however, Temporary Alteration 98-0-044 did not contain assembly instructions for the pressure manifold. Consequently, the mechanics assembled the manifold with a single high pressure regulator (0-4000 psig) between the manifold isolation stop valves and the pressure source, which resulted in sufficient pressure fluctuations to over-pressurize the low pressure pipe plug.

10 CFR Part 50, Appendix B, Criteria V, "Instructions, Procedures, and Drawings," requires that activities affecting quality be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and be accomplished in accordance with these instructions, procedures, or drawings. The failure to provide appropriate work instructions for the configuration of the pressure manifold assembly, which resulted in the inadvertent over-pressurization and rupture of an inflatable pipe plug, is an example of a violation of 10 CFR Part 50, Appendix B, Criteria V. This non-repetitive, licensee-identified and corrected violation is being

treated as a Non-Cited Violation, consistent with Section VII.B.1, of the NRC Enforcement Policy (50-454/455-98020-03a(DRP)).

The licensee's immediate corrective actions for this event included correcting the configuration of the pressure manifold assembly; installing a new inflatable pipe plug; demonstrating reliable pressure control with the pressure manifold; and establishing a dedicated pressure watch. The inspectors concluded that the licensee's immediate corrective actions were acceptable. However, the inspectors were concerned that the lack of work instructions for assembly of the pressure manifold had been identified by the licensee but was not addressed.

In addition, the inspectors were concerned that on October 13, 1998, the licensee performed a similar maintenance activity on the 0B SX cooling tower without addressing all of the identified causes for the inadvertent over-pressurization and rupture of the inflatable pipe plug on September 16, 1998. The licensee had incorporated corrective actions for each of the identified causes with the exception of the lack of work instructions for the configuration of the pressure manifold assembly. However, since the licensee used the same pressure manifold configuration which had previously been demonstrated reliable, with a dedicated pressure watch, the maintenance activity was completed without error.

The licensee's root cause evaluation determined that the work instructions were inadequate, in that, insufficient information was provided to ensure the proper assembly of the pressure manifold. The licensee also determined that a lack of a continuous pressure watch contributed to the event. The licensee's corrective actions for this event included: (1) implementing controls on the use of inflatable pipe plugs comparable to those used for freeze seals which require a mandatory system pressure watch; (2) using separate work packages for the installation of inflatable pipe plugs; and (3) requiring these work packages contain detailed assembly drawings and engineering hold points. The inspectors concurred with the conclusions of the licensee's root cause evaluation and determined that the licensee's corrective actions were acceptable.

c. Conclusions

The inspectors agreed with the licensee's conclusion that failure to provide appropriate work instructions for the configuration of the pressure manifold assembly used to inflate and maintain pressure on the temporary inflatable pipe plug, installed as an isolation boundary for maintenance on the 0A essential service water cooling tower to basin bypass valve, 0SX162D, resulted in the inadvertent over-pressurization and rupture of the inflatable pipe plug. The inspectors also agreed with the licensee that a lack of a continuous pressure watch contributed to the event. A Non-Cited Violation was issued.

M3.2 1A Diesel Generator (DG) Tripped on Low Lube Oil Pressure Due to an Inadequate Maintenance Procedure

a. Inspection Scope (62707)

The inspectors reviewed the circumstances surrounding the low lube oil pressure trip of the 1A DG during the performance of BOS 8.1.1.2.a-1, "Unit One 1A Diesel Generator Operability Monthly (Staggered) and Semi-Annual (Staggered) Surveillance," Revision 14. The inspectors interviewed operations, maintenance, and engineering department personnel, and reviewed vendor technical information, Licensee Event Report 50-454/98018, "Inoperable Unit 1 Diesel Generator Due to Low Lube Oil Pressure Condition," Operability Assessment 98-052, "Diesel Generator 1A Prelube Pump Relief Valve," and Operability Determination Self-Assessment 98-0037.

b. Observations and Findings

On September 12, 1998, during the performance of BOS 8.1.1.2.a-1, the 1A DG tripped during the first minute of operation due to a low lube oil pressure condition. The DG is designed to trip on a low lube oil pressure condition when manually started or when operated in the test mode. In the emergency mode of operation the low lube oil pressure trip is bypassed; consequently, the DG would operate until failure due to inadequate lubrication. The licensee declared the 1A DG inoperable and initiated an investigation into the cause of the low lube oil pressure condition.

The licensee's investigation revealed that the low lube oil pressure condition was caused by inadequate maintenance practices and inadequate procedural guidance in Byron Mechanical Maintenance Procedure (BMP) 3208-2, "Emergency Stand-by Diesel Generator Engine Inspection 18 Month Surveillance," Revision 4, which resulted in 1 of 146 filter elements missing its cartridge guide and many of the elements being slightly crushed. Consequently, filter media bypassed the filter elements and clogged the two parallel lube oil strainers, which resulted in the 1A DG tripping on low lube oil pressure. The licensee's corrective actions for this event included: (1) revising BMP 3208-2 to provide specific instructions and inspection requirements for maintenance on the main lube oil filters; (2) developing a pre-defined work instruction to inspect the strainers following lube oil recirculation after every filter element replacement; (3) initiating a design modification to install pressure indication on the lube oil strainers; and (4) evaluating the use of one of two parallel lube oil strainers at a time to preclude the simultaneous clogging of both lube oil strainers. The inspectors concluded that the licensee's corrective actions were acceptable.

10 CFR Part 50, Appendix B, Criteria V, "Instructions, Procedures, and Drawings," requires, in part, that activities affecting quality shall be prescribed by documented procedures of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Procedure BMP 3208-2, "Emergency Stand-by Diesel Generator Engine Inspection 18-Month Surveillance," Revision 4, failed to provide appropriate guidance to ensure that the maintenance activities performed on the main lube oil filter did not render the 1A DG inoperable. This was an example of a violation of 10 CFR Part 50, Appendix B, Criteria V. This non-repetitive, licensee identified and corrected violation is being treated as a

Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-454/455-98020-03b).

On September 3, 1998, the licensee missed an opportunity to identify the clogging of the lube oil strainers when a lifting relief valve was identified in the lube oil system upstream of the lube oil strainers. The licensee's initial troubleshooting incorrectly determined that the relief valve was lifting below its setpoint due to a failure of the valve. As a result, the licensee incorrectly concluded that the 1A DG remained operable with the lifting relief valve, which was subsequently documented in Operability Assessment 98-052. In response to this missed opportunity to identify that the 1A DG was inoperable, the licensee performed a self-assessment of the operability determination process. The inspectors concluded that this self-assessment was very good.

c. Conclusions

The inspectors concurred with licensee's conclusion that the 1A diesel generator was rendered inoperable by inadequate maintenance practices on the main lube oil filter due to inappropriate procedural guidance in Byron Mechanical Maintenance Procedure 3208-2, "Emergency Stand-by Diesel Generator Engine Inspection 18-Month Surveillance," Revision 4. In addition, the inspectors noted that the licensee missed a prior opportunity to identify the degraded condition in the lube oil system, which resulted in the operation of the facility in a condition prohibited by Technical Specifications. A Non-Cited Violation was issued.

M4 Maintenance Staff Knowledge and Performance

M4.1 Maintenance Human Performance Errors

a. Inspection Scope (62707)

The inspectors reviewed the circumstances surrounding three maintenance department human performance errors. The inspectors interviewed operations and maintenance department personnel, reviewed Byron Electrical Maintenance Surveillance (BHS) 3.3.7.1-14, "Semi-Annual Surveillance of Fire Detection Instrument Trip Actuating Device and Supervised Circuits UCSR [Upper Cable Spreading Room] Detection Zones 45 and 46," Revision 2; 1BHS 7.11.1.b-1, "Air Duct Detectors and Associated Ventilation Dampers 18 Month Surveillance, Revision 2; and Byron Instrument Surveillance (BIS) 3.1.1-204, "Surveillance Calibration of Steam Generator Narrow Range Level Protection Loop 519, 529, 539, 549," Revision 12; and evaluated the results of the licensee's prompt investigations.

b. Observations and Findings

Wrong Unit Error During Fire Protection Surveillance

On October 12, 1998, during the performance of 2BHS 3.3.7.1-14, Section F.18, the electrical maintenance technicians performing the surveillance test procedure lifted the Unit 1 lead "TH SIG" for thermal fire zone 1D-46 instead of lifting the Unit 2 lead "TH SIG" for thermal fire zone 2D-46. This action resulted in the receipt of fire protection trouble alarm for zone 1D-46 instead of 2D-46. The operating shift recognized the wrong unit error, restored the system configuration, and initiated a prompt investigation into the cause of the error.

The licensee's investigation revealed that following authorization to perform the surveillance activity, two maintenance technicians proceeded to the wrong unit's auxiliary electric equipment room and failed to recognize their error due to ineffective self-checking and peer-checking techniques. The licensee also identified that the same key unlocked both unit's fire protection cabinets and the surveillance procedure had not been printed on unit specific color coded paper as practiced in the past. The licensee's corrective actions for this event included disciplinary action against the involved maintenance technicians; reviewing the event with maintenance department personnel emphasizing the importance of rigorous self-checking and peer-checking techniques during all evolutions; modifying the locks on all auxiliary electric equipment room cabinets to be unit specific; and re-instituting the practice of printing surveillance procedures on unit specific color coded paper. The inspectors concluded that the licensee's corrective actions were acceptable.

Byron Station Operating License for Unit 2, NPF-66, states, in part, that the licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the licensee's Fire Protection Report. Byron Fire Protection Report, Section 3.4, "Quality Assurance Program," states, in part, that activities involving fire protection systems are covered by the Commonwealth Edison Company Quality Assurance Program, which requires that activities be performed as described by documented instructions, procedures, and drawings appropriate for the activity. The maintenance technician's lifting of the Unit 1 lead "TH SIG" for thermal fire zone 1D-46 instead of lifting the Unit 2 lead "TH SIG" for thermal fire zone 2D-46 during the performance of 2BHS 3.3.7.1-14, Section F.18, was an example of a violation of the Byron Station Operating License for failure to implement the procedure. This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1, of the NRC Enforcement Policy (50-454/455-98020-04a(DRP)).

Wrong Bistable Test Switch Manipulation During Instrument Calibration

On October 13, 1998, during calibration of the steam generator narrow range level protection loop 519 in accordance with BIS 3.1.1-204, the instrument maintenance technicians manipulated a bistable test switch on the wrong instrument. Specifically, during the performance of BIS 3.1.1-204, Section F.8, the instrument maintenance technicians actuated bistable test switch 2 on pressurizer level loop 460 instead of on steam generator narrow range level protection loop 519, which resulted in an

unexpected isolation of letdown system flow. The maintenance technicians immediately recognized their error and notified the operating shift. The operating shift directed the restoration of the pressurizer level channel, restored the letdown system configuration and initiated a prompt investigation into the cause of the error.

The licensee's investigation revealed that the error occurred due to on the job distractions and ineffective self-checking techniques. The licensee also identified that the failure to clearly define the roles and responsibilities of the assigned technicians and discuss human error prevention techniques and potential human error traps during the pre-job briefing contributed to the event. The licensee's corrective actions for this event included disciplinary action against the involved maintenance personnel; reenforcement of management's expectations regarding the conduct of pre-job briefings and human error reduction techniques; and conducting additional human error prevention training. The inspectors concluded that the licensee's corrective actions were acceptable.

Technical Specifications 6.8.1.a, states that written procedures shall be established, implemented, and maintained for procedures recommended in Appendix A, of Regulatory Guide 1.33, Revision 2, February 1978. Appendix A of Regulatory Guide 1.33, Revision 2, February 1978, specifies that procedures are required for each surveillance test listed in TS. Byron Instrument Surveillance 3.1.1-204, is the implementing procedure for the calibration of steam generator narrow range protection loops 519, 529, 539, and 549 as required by TS 4.3.1.1, TS 4.3.2.1, and TS 4.3.3.6. The maintenance technician's manipulation of a bistable test switch associated with pressurizer level loop 460 instead of steam generator narrow range level loop 519 during the performance of BIS 3.1.1-204, Section F.8, which resulted in an unexpected isolation of letdown system flow, was an example of a violation of TS 6.8.1.a for failure to implement the procedure. This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-455/98020-01b(DRP)).

Wrong Lead Lifted During Fire Protection Surveillance

On October 21, 1998, during the performance of 1BHS 7.11.1.b-1, Section F.13, the electrical maintenance technicians performing the surveillance test procedure lifted lead 3 on the diesel generator ventilation system induct combustion detector 1XY-VD003 instead of lead 3 on the AR440AR auxiliary relay for the fire damper being tested, AR-VDX3. Lead 3 for 1XY-VD003 was located in the ventilation ducting in the diesel fuel oil storage tank room whereas AR-VDX3 was located in the 1A diesel generator room. The purpose of lifting lead 3 on the relay was to provide personnel protection for the maintenance technicians while replacing the electro-thermal links for the fire dampers. The lifted lead on 1XY-VD003 resulted in the 1A diesel fuel oil storage tank room exhaust fan being rendered inoperable. However, the fan was already inoperable since its control switch was in the pull-to-lock position with a caution card attached in accordance with the surveillance test procedure. The error was subsequently identified by the oncoming electrical maintenance crew during their preparations to complete the surveillance testing. The shift manager was immediately notified, the system configuration was restored, the surveillance test was completed, and a prompt investigation was initiated into the cause of the error.

The licensee's investigation revealed that even though the location of the relay was specifically discussed during the pre-job briefing for the surveillance test procedure, the wrong lead was lifted due to ineffective self-checking techniques; and the independent verification of the lifted lead did not identify that the wrong lead had been lifted due to a lack of understanding of the independent verification process. The licensee's corrective actions for this event included reviewing the independent verification process with the maintenance department; developing and implementing surveillance test pre-execution walkdown requirements for first line supervisors; and enhancing the procedural guidance in fire protection damper surveillance tests to include equipment locations. The inspectors concluded that the licensee's corrective actions were acceptable.

Byron Station Operating Licenses for Unit 1, NPF-37, states, in part, that the licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the licensee's Fire Protection Report. Byron Fire Protection Report, Section 3.4, "Quality Assurance Program," states, in part, that activities involving fire protection systems are covered by the Commonwealth Edison Company Quality Assurance Program, which requires that activities be performed as described by documented instructions, procedures, and drawings appropriate for the activity. The maintenance technician's lifting of lead 3 on the induct combustion detector 1XY-VD003 instead of lead 3 on the AR440AR auxiliary relay for the fire damper being tested, AR-VDX3, during the performance of 1BHS 7.11.1.b-1, Section F.13, was an example of a violation of the Byron Station Operating License for failure to implement the procedure. This non-repetitive, licensee identified and corrected violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy (50-454/455-98020-04b(DRP)).

c. Conclusions

The inspectors concluded that three maintenance department human performance errors occurred due to ineffective self-checking and peer-checking techniques. The inspectors also concluded that a lack of understanding of the independent verification process existed in the maintenance department. Three examples of Non-Cited Violations were issued for the failure to follow procedures.

M8 Miscellaneous Maintenance Issues (92700, 92902)

- M8.1 (Closed) LER 50-454/98018: "Inoperable Unit 1 Diesel Generator Due to Low Lube Oil Pressure Condition." This LER is discussed in Section M3.2 of this report. A Non-Cited Violation was issued. This LER is closed.
- M8.2 (Closed) Violation 50-454/455-97015-02 (DRP): "Corrective Actions were inadequate for an Inadvertent Lift of a Unit 2 Pressurizer Power Operated Relief Valve (PORV) and were inadequate to Prevent the Inadvertent Start of the 0B Essential Service Water (SX) Make-up Pump." While replacing the 0B SX cooling tower basin level switch, the 0B SX make-up pump inadvertently started due to insufficient precautions in the work package. This occurrence was similar to violation 50-454/455-97002-06b, which was cited for inadequate work instructions that resulted in the inadvertent lifting of a Unit 2

pressurizer PORV. The licensee's failure to implement broad-based corrective actions was considered to be a violation of 10 CFR Part 50, Appendix B, Criteria XVI.

The inspectors reviewed the licensee's recent corrective actions to check for any notable weaknesses. No weaknesses were identified and the corrective actions were found to be acceptable. This violation is closed.

- M8.3 (Closed) Violation 50-454/455-97015-03b(DRP): "Failure to Follow Procedure for Fuel Handling Cleanliness Zones and Requirements." The inspectors identified that a person had logged into but had not logged out of a cleanliness control zone, established to perform modifications in the fuel transfer canal. The person's failure to log out of the cleanliness zone was considered to be an example of a failure to follow Byron Fuel Handling Procedure FH-31, "Fuel Handling Cleanliness Zones and Requirements," and a violation of TS 6.8.1.a.

The inspectors reviewed the licensee's corrective actions to check for any notable weaknesses. No weaknesses were identified and the corrective actions were found to be acceptable. This violation is closed.

III. Engineering

E1 Conduct of Engineering

E1.1 Operability Assessments

a. Inspection Scope (37551)

The inspectors interviewed operations and engineering department personnel; reviewed applicable portions of the UFSAR and TS; and evaluated the following Operability Assessments.

- 98-015 3 KW Heaters Instead of 2.5 KW Heaters on the Diesel Driven Auxiliary Feedwater Pumps and Essential Service Water Make-up Pumps
- 98-022 Relief Valves Installed on Unit 1 AF004 Valve Accumulators Greater than Maximum Allowable Working Pressure
- 98-023 Less Than Full Thread Engagement on 1B, 2A, 2B Diesel Generator Prelube Pump Relief Valve Flanges
- 98-043 Less Than Full Thread Engagement on 4 of 8 Studs on the Essential Service Water Pump Suction Flange
- 98-045 AF018 Valves Ultimate Heat Sink Impact
- 98-046 Missing Insulation on 1B Auxiliary Feedwater Diesel Exhaust Line
- 98-049 1A Diesel Generator Oil Sample Contained Greater Than 20 ppm Copper and,
- 98-054 Broken Bracket on the 1B Diesel Generator Fuel Oil Return Line

c. Conclusions

The inspectors concluded that the selected operability assessments reflected sound engineering judgement and provided sufficient information to support the conclusions.

E8 Miscellaneous Engineering Issues (92700)

- E8.1 (Closed) LER 50-454/96014-02: "Failure to Comply with Design Basis Due to Degradation of Boraflex in Spent Fuel Racks." On October 1, 1996, the licensee identified in LER 50-454/96014-00 that spent fuel racks had boraflex shrinkage and gaps which exceeded the largest gap assumed in the licensee's criticality analysis for the spent fuel pit. On April 23, 1997, the licensee also identified in supplemental LER 50-454/96014-01 a modeling deficiency in the original spent fuel pit criticality analysis. The original analysis assumed boral poison plates were located on all four faces of a particular storage cell within the spent fuel pit which was not correct. Some peripheral fuel storage cells do not have boral poison in the exterior plates. The licensee determined that with the fuel separation design of the fuel pool and administratively maintaining the fuel pool water at greater than or equal to 2,000 parts per million (ppm) boron the $k_{\text{effective}}$ of the pool will be less than 0.95. The licensee requested and received a license amendment changing the Technical Specification to allow for soluble boron to be credited in maintaining the spent fuel pit $k_{\text{effective}}$ less than or equal to 0.95. This license amendment has been incorporated into the current Technical Specifications and implemented procedurally by the licensee. Licensee Event Report 50-454/96014-02 was issued by the licensee to document completion of the corrective actions listed in LERs 454/96014-00 and 454/96014-01. This LER is closed.

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 Radiological Protection Practices

a. Inspection Scope (71750)

The inspectors routinely reviewed the status and posting of radiologically controlled areas (e.g., radiation areas, high radiation areas, locked high radiation areas, and contamination areas). The inspectors also conducted independent surveys of established boundaries to verify that radiation measurements were in compliance with regulatory requirements for posting of radiologically controlled areas. Additionally, the inspectors reviewed general radiation worker practices including use of proper dosimetry, monitors, and instruments.

b. Observations and Findings

The inspectors noted that radiologically controlled areas were properly posted and verified that radiation levels at the posted boundaries were appropriate for the postings.

The inspectors observed that personnel working within the controlled areas properly wore dosimetry. When personnel exited the controlled areas, they properly used personal contamination monitors; hand carried items such as tools were properly monitored; and, electronic doses were properly recorded. The inspectors also checked several survey instruments, area radiation monitors and air samplers for proper operation and calibration. Where portable survey instruments were available for personal contamination surveys, backgrounds were found sufficiently low for meaningful surveys. The inspectors also verified that the electronic radiation work permit sign in and sign out process was functioning properly. The inspectors noted that the personnel decontamination centers in the auxiliary building and technical support center were ready for use, that appropriate decontamination equipment was available, and that the survey instruments available were operable and had timely calibrations.

c. Conclusions

The inspectors concluded that observed radiation work practices were effective and met applicable regulatory requirements. Specifically, radiologically controlled areas were properly posted; personal dosimetry was used correctly; radiation monitoring instruments functioned and were properly calibrated; and, decontamination centers were ready for use.

V. Management Meetings

X1 **Exit Meeting Summary**

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on November 23, 1998. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

FARTIAL LIST OF PERSONS CONTACTED

Licensee

K. Graesser, Site Vice President
W. Levis, Station Manager
B. Adams, Regulatory Assurance Manager
J. Bauer, Radiation Protection Manager
T. Gierich, Operations Manager
B. Kouba, Engineering Manager
T. Schuster, Work Control Manager
M. Snow, Maintenance Manager
J. Stone, Nuclear Oversight Manager

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observations
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities
IP 92700:	Onsite Follow-up of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92901:	Follow-up Plant Operations
IP 92902:	Follow-up Maintenance

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-455/98020-01a	NCV	Failure to follow BOS 3.2.1-853 which resulted in lifting the letdown system relief valve
50-455/98020-01b	NCV	Failure to follow BIS 3.1.1-204 which resulted in the unexpected isolation of letdown system flow
50-454/455-98020-02	EEI	Unacceptable preconditioning of the AF pump discharge valves, 1/2AF004A/B
50-454/455-98020-03a	NCV	Inappropriate maintenance instructions resulted in inflatable pipe plug rupture
50-454/455-98020-03b	NCV	Inappropriate maintenance procedure resulted in the 1A DG being inoperable
50-454/455-98020-04a	NCV	Failure to follow fire protection surveillance 2BHS 3.3.7.1-14
50-454/455-98020-04b	NCV	Failure to follow fire protection surveillance 1BHS 7.11.1.b-1

Closed

50-455/98020-01a	NCV	Failure to follow BOS 3.2.1-853 which resulted in lifting the letdown system relief valve
50-455/98020-01b	NCV	Failure to follow BIS 3.1.1-204 which resulted in the unexpected isolation of letdown system flow
50-454/455-98020-03a	NCV	Inappropriate maintenance instructions resulted in inflatable pipe plug rupture
50-454/455-98020-03b	NCV	Inappropriate maintenance procedure resulted in the 1A DG being inoperable
50-454/455-98020-04a	NCV	Failure to follow fire protection surveillance 2BHS 3.3.7.1-14
50-454/455-98020-04b	NCV	Failure to follow fire protection surveillance 1BHS 7.11.1.b-1
50-454/455-97020-01	VIO	Failure to incorporate Technical Specification Amendments 84, 86, 87, 88, 89, 90, and 91

50-454/98018	LER	Inoperable Unit 1 diesel generator due to low lube oil pressure condition."
50-454/455-97015-02	VIO	Inadequate corrective actions for an inadvertent lift of a Unit 2 pressurizer PORV and for prevention of an inadvertent start of an essential service water make up pump
50-454/455-97015-03b	VIO	Failure to follow procedure for fuel handling cleanliness zones
50-454/96014-02	LER	Failure to comply with design basis due to degradation of boraflex in spent fuel racks

LIST OF ACRONYMS USED

AF	Auxiliary Feedwater
BAP	Byron Administrative Procedure
BAR	Byron Annunciator Response
BHS	Byron Electrical Maintenance Surveillance
BIS	Byron Instrument Surveillance
BMP	Byron Mechanical Maintenance Procedure
BOP	Byron Operating Procedure
BOS	Byron Operating Surveillance
BRP	Byron Radiological Protection Procedure
BVS	Byron Engineering Surveillance
DG	Diesel Generator
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
ESFAS	Engineered Safety Feature Actuation Signal
FME	Foreign Material Exclusion
GPM	Gallons per Minute
HVAC	Heating, Ventilating, and Air Conditioning
IFI	Inspector Follow-up Item
KV	Kilovolt
LBB	Local Breaker Backup
LCOAR	Limiting Condition for Operation Action Requirement
LER	Licensee Event Report
NCV	Non-cited Violation
NRC	Nuclear Regulatory Commission
NSO	Nuclear Station Operator
OAD	Operations Analysis Department
OOS	Out-of-Service
PDR	Public Document Room
PIF	Problem Identification Form
PORV	Power Operated Relief Valve
PSIG	Pounds per Square Inch
PPM	Parts Per Million
RH	Residual Heat Removal
RP	Radiological Protection
RP&C	Radiological Protection and Chemistry
SI	Safety Injection
SX	Essential Service Water
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
VIO	Violation
WR	Work Request