

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No: 50-454/455-98017(DRP)

Licensee: Commonwealth Edison Company

Facility: Byron Generating Station, Units 1 and 2

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

Dates: July 14 - August 24, 1998

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## EXECUTIVE SUMMARY

### Byron Generating Station Units 1 and 2 NRC Inspection Report 50-454/98017(DRP); 50-455/98017(DRP)

This inspection included aspects of licensee operations, maintenance, and engineering. The report covers a 6-week period of inspection activities by the resident staff.

#### Operations

- The inspectors concluded that operator performance during the Unit 1 loss of offsite power event was excellent. The inspectors observed strong command and control oversight by the unit supervisor, with the operators focused on one task at any given time. Although material condition issues resulted in distractions to the operators, the shift appropriately prioritized their actions throughout the event. Adequate numbers of operators existed to perform operations as required, yet an excessive number of personnel did not exist in the main control room. Operators routinely used three-way communications and procedures as applicable. (Section O1.1)
- The inspectors concluded that the Unit 1 loose parts monitoring system was unnecessarily rendered inoperable by a system engineer's manipulation of the sensor alignment without authorization from the operations department. The inspectors also concluded that the licensee's response to this event was thorough and that the planned corrective actions appeared to be comprehensive. In addition, since January 1998, the licensee had identified numerous configuration control events. While the licensee identified each of these issues and implemented acceptable corrective actions for each event, the inspectors concluded that the licensee's actions had not yet been effective at arresting the adverse trend of configuration control events. (Section O2.1)
- The inspectors concluded that the main condenser tube leak and the failure of the bank overlap unit created some minor challenges and distractions for the main control room operators during the recovery from the Unit 1 loss of offsite power. These problems have occurred previously, however, the licensee properly documented them and has plans for correcting the bank overlap unit at the next available opportunity. No violations were identified. (Section O2.2)
- The inspectors concluded that a poor questioning attitude by a non-licensed operator and a lack of positive administrative controls combined to allow the main control room office ventilation system to be started while Technical Specifications required the system to be shut down to isolate the main control room ventilation (VC) system. A non-cited violation was issued. (Section O4.1)
- The inspectors identified an operability concern with the VC system while main control room doors were propped open as documented in NRC Inspection Report 50-454/98014(DRP); 50-455/98014(DRP). The licensee's subsequent investigation identified that during two periods of time, the VC system was not capable of maintaining the required positive pressure and therefore, the licensee was in a condition prohibited by Technical Specification. The procedural guidance contained in

Byron Administrative Procedure 1100-3, "Fire Protection Systems, Fire Rated Assemblies, Ventilation Seals, Flood Seals, and Water Tight Doors Impairments," Revision 11, allowed licensee personnel to incorrectly reach the conclusion that the safety-related VC envelope could be altered by simultaneously impairing three main control room doors without affecting the operability of the system. A violation was cited. (Section O8.1)

#### Maintenance/Surveillance

- The inspectors concluded that 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. However, the inspectors concluded that due to poor work planning and lack of knowledge of Technical Specification on one occasion personnel failed to recognize the entry conditions for a Technical Specification Limiting Condition for Operation (LCO) for the 1A residual heat removal pump. The actions required by the LCO were not exceeded. Furthermore, the inspectors concluded that insufficient planning for on-line maintenance activities resulted in additional unavailability of the containment spray system. No violations were identified. (Section M1.1).
- The inspectors concluded that observed surveillance tests were performed well. Specifically, the surveillance tests satisfied the surveillance requirements of Technical Specification and each of the tested components met their respective acceptance criteria. However, the inspectors concluded that the 1A component cooling water safety loop was made inoperable during performance of surveillance testing without the licensee entering the appropriate Technical Specification action requirement; however, no violation of Technical Specification LCO requirements occurred due to the short duration of the test. (Section M1.2)

#### Engineering

- The inspectors concluded that the licensee was aware of the industry concern regarding the orientation of Anderson Greenwood check valves. However, the licensee had not initiated action to identify those valves that were not oriented as specified by the vendor technical manual or correct those valves that were misoriented. (Section E2.1)

## 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 Unit 1 Loss of Off-Site Power**

###### **a. Inspection Scope (71707)**

On August 4, 1998, Unit 1 experienced a loss of offsite power (LOOP). As a result, the inspectors responded to the site and observed the licensee's activities throughout the recovery. The inspectors reviewed the circumstances surrounding the event, interviewed licensee personnel, and reviewed the facility's Technical Specifications (TS), Updated Final Safety Analysis Report (UFSAR) and the Individual Plant Examination (IPE) report.

###### **b. Observations and Findings**

At 2:47 a.m. on August 4, 1998, offsite Cherry Valley power line 0621 disconnected from the Unit 1 ring bus due to opening of two oil cooled breakers (OCB) caused by a lightning strike. The licensee completed a visual inspection of the protective devices associated with line 0621 and did not identify any abnormalities. Line 0621 was subsequently re-energized from Cherry Valley up to the open OCBs.

At 3:47 a.m., the operators attempted to restore the Unit 1 ring bus by shutting OCB 5-6. However, when the breaker was shut, it immediately tripped and the adjacent breakers opened on local breaker backup (LBB), a ring bus protective feature. Consequently, the Unit 1 system auxiliary transformer (SAT) lost power. As a result, both Unit 1 diesel generators (DGs) started and energized their respective engineered safety feature (ESF) busses, and the appropriate ESF equipment properly sequenced onto their respective busses. In addition, as designed, an automatic bus transfer switch shifted the reactor coolant pump power source from the SAT to the unit auxiliary transformer in time to prevent a reactor trip. The inspectors noted that all safety-related systems functioned as designed.

At 4:13 a.m., the licensee declared a Generating Station Emergency Plan (GSEP) Unusual Event due to a loss of offsite power for greater than 15 minutes. The licensee's immediate investigation identified that the LOOP was caused by a failed relay in one of the protection circuits on line 0621 and actuation of the LBB feature on OCB 5-6. The failure was internal to the relay, therefore, when the licensee inspected

the system after the lightning strike, the failure was not identified. The relay's purpose was to open breakers OCB 5-6 and OCB 4-5 when a fault was detected on line 0621, isolating the line from the Unit 1 ring bus. Since the relay only opened Byron switchyard breakers and there was not an actual fault on line 0621, the line was able to be re-energized from Cherry Valley. When operators attempted to shut OCB 5-6, the failed relay caused the breaker to trip open. When the breaker opened, all three poles did not open as fast as required by the breaker protective system design. Additionally, the timer that delayed actuation of the LBB circuit actuated faster than anticipated. Consequently, the LBB actuated and opened air cooled breaker (ACB) 6-7, causing the LOOP.

Following the identification of the causes of the LOOP, the licensee restored off-site power to the SAT and the ESF busses, secured the DGs and the ESF equipment that automatically started, and terminated the Unusual Event at 1:13 p.m. At the end of the inspection period, the licensee's root cause investigation and corrective action development for the relay failure, fast actuation of the LBB circuit, and early actuation of the OCB 5-6 LBB was in progress.

The inspectors observed main control room operations during significant portions of the Unusual Event. The inspectors noted strong command and control, with the operators focused on one task at any given time. Although several issues created distractions (see Section O2.2), the operators focused on the appropriate priority. Adequate numbers of operators existed to perform operations as required, and an excessive number of personnel did not exist in the main control room. Operators routinely used three-way communications and procedures as applicable. The inspectors concluded that the shift's performance following the LOOP was excellent.

The inspectors review of the plant's IPE noted that the core damage frequency (CDF) for Byron was dominated by loss of offsite power initiated events with the most risk significant sequences involving failure of an ESF bus due to failing to reenergize the bus via the DG following the LOOP. Therefore, since all safety-related equipment functioned as designed, the inspectors determined that the instantaneous risk increase due to the LOOP was small.

c. Conclusions

The inspectors concluded that operator performance during the Unit 1 loss of offsite power event was excellent. The inspectors observed strong command and control oversight by the unit supervisor, with the operators focused on one task at any given time. Although material condition issues resulted in distractions to the operators, the shift appropriately prioritized their actions throughout the event. Adequate numbers of operators existed to perform operations as required, yet an excessive number of personnel did not exist in the main control room. Operators routinely used three-way communications and procedures as applicable.

## O2 Operational Status of Facilities and Equipment

### O2.1 Unit 1 Loose Parts Monitoring (LM) System Rendered Inoperable due to Loss of Configuration Control

#### a. Inspection Scope (71707)

The inspectors reviewed the circumstances surrounding the loss of control of the configuration of the Unit 1 LM system which rendered it inoperable. The inspectors interviewed operations and engineering department personnel and reviewed Apparent Cause Evaluation Report 454-201-98-CAQS02045, "Unexpected LCOAR [TS Limiting Condition for Operation Action Requirement] Entry, Loose Parts Monitor Made Inoperable by SED [System Engineering Department] Engineer."

#### b. Observations and Findings

On July 13, 1998, a licensed operator identified that the Unit 1 LM sensor alignment was not correct for the existing sensitivity settings. The operators declared the system inoperable, performed Byron Operating Procedure (BOP) LM-5A1, "Loose Parts Monitoring System Alignment," Revision 13, and initiated problem identification form (PIF) B1998-03272. The operators' investigation revealed that earlier in the day a system engineer had changed the alignment of the sensors and did not adjust the sensitivity settings while listening to a noise that had alarmed the LM system on July 12, 1998. The system engineer had requested permission from the Unit 1 Nuclear Station Operator to listen to the LM system; however, the engineer did not discuss altering the configuration of the LM sensors. The 30 day TS Limiting Condition for Operation was not exceeded because of the short duration that the system was inoperable.

The licensee subsequently determined that this event was caused by several factors including: (1) the engineer did not understand the impact of his actions on the operability of the LM system; (2) the pre-job briefing was inadequate, in that, activities were performed outside what was discussed with and authorized by the Unit 1 Nuclear Station Operator; (3) the Unit Supervisor was not informed of the engineer's activities which bypassed another barrier that could have prevented this event from occurring; and (4) the engineer was distracted by a page and phone call and did not return the system to the as found condition. The licensee's corrective actions for this event included: (1) discussing the event with the system engineering department to heighten their sensitivity to maintaining control of the configuration of all plant systems and equipment; (2) holding an event review board with senior station management and the involved individuals; and (3) performing a system by system review to identify and evaluate any other actions that the engineers perform without authorization of the operations department that affect the configuration of plant systems and equipment. At the end of the inspection period, engineering department personnel were not authorized to manipulate any equipment without the assistance of an operator pending completion of the above corrective actions.

In addition, the inspectors noted that the licensee had identified at least 62 other configuration control events during the period of January through July 1998. The inspectors also noted that the majority of these events involved balance of plant equipment or were administrative in nature and none of the events resulted in safety consequences. While the licensee's actions for each of the events were acceptable, the licensee's actions were not effective at arresting the adverse trend of configuration control events. At the end of the inspection period, the licensee's task force for developing an action plan to address the adverse trend of configuration control events was in progress.

c. Conclusions

The inspectors concluded that the Unit 1 loose parts monitoring system was unexpectedly rendered inoperable by a system engineer's manipulation of the sensor alignment without authorization from the operations department. The inspectors also concluded that the licensee's response to this event was thorough and that the planned corrective actions appeared to be comprehensive. In addition, since January 1998, the licensee had identified numerous configuration control events. While the licensee identified each of these issues and implemented acceptable corrective actions for each event, the inspectors concluded that the licensee's actions had not yet been effective at arresting the adverse trend of configuration control events.

O2.2 Unit 1 Control Rod Sequencing Failure Due to the Bank Overlap Unit

a. Inspection Scope (71707)

The inspectors observed the operator's response to a failure of the Unit 1 rod control bank overlap unit (BOU), reviewed PIF B1998-03500 and the associated apparent cause evaluation, and discussed the issue with system engineering personnel.

b. Observations and Findings

On August 4, 1998, the licensee identified a main condenser circulating water tube leak in the Unit 1 condenser. The leak was initially small, but continued to increase slowly in size. About 3 hours after the condenser tube leak started, the licensee lost offsite power to Unit 1 in an unrelated event (see Section O1.1). The loss of offsite power placed the site in a GSEP Unusual Event. During the event, the licensee determined that secondary chemistry had degraded enough to require isolating the condenser leak. Isolating the leak required a power reduction to accommodate the resulting reduced main condenser capability. The licensee began the power reduction at approximately 9:45 a.m.

At 10:10 a.m., while the operators were moving control rods to support the power reduction, control bank 'C' started to step into the core out of sequence. Specifically, control bank 'C' started to step in with control bank 'D' at 213 steps vice 113 steps as programmed. The operator immediately stopped the rod motion and power reduction. Operators contacted system engineering personnel who reviewed the event. Troubleshooting by engineering personnel identified that the BOU had failed to count

properly, resulting in the improper rod motion sequence. Engineering personnel rotated the switch counter to clean the contacts and the BOU subsequently functioned properly. Control rods were manually restored to the proper overlap position. After restoration of the BOU and control rod overlap, the operators reduced power in order to isolate and repair the main condenser circulating water leak.

Both the licensee and the inspectors noted that the failure of the BOU to maintain proper control rod overlap was a repetitive occurrence. The licensee had submitted a LER (see Section O8.5) describing a control rod sequencing problem for which the licensee was not able to conclusively identify the root cause, but noted that the most probable cause was the BOU. Based on the LER and the issue described in this section, the licensee planned to replace the BOU in each unit during the next refueling outage, or the next forced outage if one occurs. Additionally, the licensee was working with Westinghouse to determine an appropriate replacement periodicity. The inspectors concluded that the licensee's corrective actions were appropriate.

c. Conclusions

The inspectors concluded that the main condenser tube leak and the failure of the bank overlap unit created some minor challenges and distractions for the main control room operators during the recovery from the Unit 1 loss of offsite power. These problems have occurred previously, however, the licensee properly documented them and have plans for correcting the bank overlap unit at the next available opportunity. No violations were identified.

**O4 Operator Knowledge and Performance**

**O4.1 Inadvertent Start of Main Control Room Offices Ventilation Supply Fan**

a. Inspection Scope (71707)

The inspectors reviewed the circumstances surrounding the operation of the main control room offices ventilation system contrary to the requirements of TS. The inspectors discussed the issue with operations management, and reviewed the UFSAR, TS, and the LER (see Section O8.3).

b. Observations and Findings

On June 17, 1998, due to a failed radiation monitor (OPR33J), the licensee entered TS Action Requirement 3/4.3.3.3.1-b, which required that the action specified in Table 3.3-6 be taken. Table 3.3-6, "Radiation Monitoring Instrumentation for Plant Operations," Action 27, required that, with the number of operable radiation monitors less than the minimum required, within one hour, isolate the control room ventilation system and initiate operation of the control room make-up system. Isolation of the control room ventilation system included the shut down of the main control room offices ventilation system fans. The licensee completed the actions required by the TS. Operators did not place these fans out-of-service; however, the fan's control switches were placed in pull-to-lock.



On June 18, 1998, at 6:15 a.m., a non-licensed operator (NLO) noted that the NLO briefing room and shift manager's office were extremely warm. The NLO started the main control room office ventilation system without contacting any other operator and left to perform his assigned duties. The NLO was aware that the fans had been secured for the failed radiation monitor, but believed that the radiation monitor had been repaired. The shift briefing had not occurred yet and the NLO had not received a turnover concerning the status of the main control room offices ventilation system.

At 10:00 a.m., the shift manager returned to his office and questioned the cooler temperature. The main control room offices ventilation system was found operating. He immediately had the main control room office ventilation system shut down. The inspectors noted that if a high radiation signal had occurred from the three remaining operable radiation monitors, the system would have tripped and therefore the safety function would have performed as designed, resulting in minimal safety significance for the event.

The licensee's investigation revealed that management's expectations for the operation of hand switches located on local panels that are in the pull-to-lock position had not been clearly communicated, monitored, and reinforced periodically. Additionally, adequate positive control was not maintained for equipment necessary to support a TS action requirement; specifically, the ventilation fans had not been placed out-of-service. The licensee also identified a contributing cause was the lack of a questioning attitude by the operator who started the main control room offices ventilation system.

Corrective actions by the licensee included: (1) a review of the event with all operators; (2) training sessions to address the use of human performance improvement tools; (3) monitoring and coaching the use of the human performance tools by management in the field; (4) a procedure revision to require the use of administrative controls such as out-of-service or caution cards when equipment is placed in a shutdown condition required by TS; and (5) inappropriate actions and individual accountability and responsibilities were clearly communicated to operators directly involved with the event. The inspectors concluded that the licensee's corrective actions were acceptable.

The inspectors concluded that with OPR33J inoperable, the licensee did not maintain the main control room ventilation (VC) system isolated as required by TS 3.3.3.1 and Table 3.3-6, Action 27. 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 (50-454/98017-01(DRP)).

c. Conclusions

The inspectors concluded that a poor questioning attitude by a non-licensed operator and a lack of positive administrative controls combined to allow the main control room offices ventilation system to be started while TS required the system to be shut down to isolate the VC system. A Non-Cited Violation was issued.

**O8 Miscellaneous Operations Issues (92700 and 92901)**

- O8.1 (Closed) URI 50-454/455-98014-01 and LER 50-454/98016: Main Control Room Pressure Non-Compliance Due to Inadequate Procedure. This issue was discussed in NRC Inspection Report 50-454/98014(DRP); 50-455/98014(DRP), Section O2.1. The inspectors had identified an operability concern with the VC system while three main control room doors were simultaneously propped open. Technical Specification Surveillance Requirement 4.7.6.e.3 required that at least once per 18 months, a positive pressure greater than or equal to 0.125 inch water gauge relative to ambient pressure in areas adjacent to the control room be demonstrated with the VC system operating in makeup mode. The licensee's subsequent investigation determined, and the LER documented, that during two periods of time, from 9:00 a.m. until 4:45 p.m. on June 16, 1998, and from 1:35 p.m. on June 17, 1998, until 8:02 a.m. on June 18, 1998, the VC system was not capable of maintaining the required positive pressure. Consequently, with both trains of the VC system inoperable, the licensee was in a condition prohibited by TS. However, while the doors were open the Emergency Operating Procedures would have prompted the operators to close the doors during an accident if the control envelope was required to be established. The manual action would have compensated for inability of control room envelope to automatically establish the required differential pressure.

The licensee's investigation identified that station personnel followed Byron Administrative Procedure (BAP) 1100-3, "Fire Protection Systems, Fire Rated Assemblies, Ventilation Seals, Flood Seals, and Water Tight Doors Impairments," Revision 11, but due to insufficient procedural guidance, failed to adequately evaluate the effects of multiple impairments of the VC envelope. The procedural guidance contained in BAP 1100-3 allowed licensee personnel to reach the conclusion that the VC envelope could be altered by simultaneously opening three main control room doors without affecting the operability of the VC system. The failure of BAP 1100-3 to provide appropriate guidance to ensure that the implementation of the ventilation barrier impairment process did not render the safety-related VC system inoperable is considered a violation of 10 CFR Part 50, Appendix B, Criterion V (50-454/455-98017-02(DRP)).

The inspectors reviewed the licensee's corrective actions documented in LER 50-454/98016 and concluded that they were reasonable. This URI and LER are closed.

- O8.2 (Closed) URI 50-455/98011-02: "Failure to Hang an Out-of-Service on the 2B Reactor Coolant Pump Prior to Performing Balancing Activities." The inspectors discussed an example of a potential violation of TS 6.8.1.a in NRC Inspection Report 50-454/98011(DRP); 50-455/98011(DRP); specifically, a failure to ensure that an out-of-service (OOS) was in place prior to positioning balancing weights on the 2B reactor coolant pump. The same inspection report cited an example of an inadequate OOS, violation 50-454/455-98011-01, partially caused by an inadequate walkdown by maintenance personnel. The licensee's violation response included corrective actions that would reasonably prevent the recurrence of the failure to ensure an OOS was in place prior to performing work. Therefore, this violation constitutes an additional

example of violation 50-454/455-98011-01 and is not being cited individually. No additional response to violation 50-454/455-98011-01 is required. Further corrective actions for this additional example are expected to be taken in conjunction with corrective actions for the previously cited violation. This item is closed.

- O8.3 (Closed) LER 50-454/98015: "Operator Started Fan While in LCOAR [Limiting Condition for Operation Action Requirement] Due to Poor Work Practices." This LER is discussed in Section O4.1 of this report. A non-cited violation was issued. This LER is closed.
- O8.4 (Closed) LER 50-454/98008: "Manual Reactor Trip due to Loss of Communication During Rod Drop Testing Caused by Procedure Deficiency." On March 5, 1998, during the performance of Byron Engineering Surveillance 1BVS 1.3.4-1b, "Manual Rod Drop Time," Revision 12, the Unit 1 Nuclear Station Operator manually tripped the unit as a result of losing communications with in-plant test personnel. The Unit 1 Nuclear Station Operator's actions were in accordance with licensee management's expectations for the loss of communications with in-plant test personnel as disseminated during the heightened level of awareness briefing for the evolution. The licensee was unable to determine the cause of the loss of communications; however, the licensee concluded that had the test procedure required the use of a voice amplifier by the main control room test participant the loss of communications would not have occurred. The inspectors reviewed the licensee's corrective actions and found them to have been acceptable. This LER is closed.
- O8.5 (Closed) LER 50-454/98005: "Manual Reactor Trip due to Indeterminate Rod Sequencing Problem." This event was discussed in NRC Inspection Report 50-454/98009(DRP); 50-455/98009(DRP). The licensee was unable to conclusively determine the cause of the improper rod sequencing; however, the licensee concluded that the most probable cause was a failure of the bank overlap thumb wheel switch. Since the licensee was unable to conclusively determine the cause, the long term corrective actions included monitoring the operation of the bank overlap unit. The inspectors reviewed the licensee's corrective actions and found them to be acceptable. This LER 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 following work requests (WR). When applicable, the inspectors also reviewed TS and the UFSAR. Maintenance observations associated with the residual heat removal pump and direct

current (DC) bus were selected since they were risk significant components for core damage frequency determination.

- WR 980041210-01 Remove and Replace Support for Removal of Floor Plug
- WR 980026773-03 Pump Stuffing Box Extension Gasket Leak
- WR 980077426 Look for Ground on the 125 Volt Direct Current Distribution Center Bus 212

b. Observations and Findings

Improper TS Limiting Conditions for Operation (LCO) Entries During the 1A Residual Heat Removal (RH) Pump Maintenance Period

The inspectors observed that one of the support struts for the Unit 1 containment recirculation sump containment isolation valve, 1SI8811A, was removed to accommodate removal of a floor plug above the 1A RH pump. The inspectors noted that the licensee had entered the action requirements of TS 3.4.10 while the strut was removed and questioned the Unit Supervisor (US) about the appropriateness of the LCO action requirement entry. The action required by TS 3.4.10 was to restore the structural integrity of the affected component(s) to within its limits or isolate the affected component(s) prior to increasing reactor coolant system temperature above 200°F. The US concluded that the TS 3.4.10 action requirement should not have been entered and also agreed with the inspectors that the required action could not be completed with the unit operating at full power. The US concluded that the correct action was to enter TS action requirement 3.7.8, which stated that with one or more snubbers inoperable, within 72 hours replace or restore the inoperable snubber to operable status and perform an engineering evaluation per TS 4.7.8.g on the attached component or declare the attached system inoperable and follow the appropriate action statement for that system.

The US then requested the engineering evaluation required by TS 4.7.8.g. The inspectors reviewed the engineering evaluation for removal of the strut on 1SI8811A and discussed expectations with engineering and operations management. Management's expectation was that the LCO entry and the need for an engineering evaluation should have been identified during the planning stages for the maintenance activity so that the evaluation could have been completed prior to commencing the work.

Additionally, the 1A containment spray (CS) pump suction valve, 1CS009A, and containment recirculation sump containment isolation valve, 1SI8811A, were closed and out-of-service (OOS) to support work on the RH system. The inspectors noted that the 1A CS train was inoperable due to the fact that 1CS009A and 1SI8811A were shut and OOS. However, the inspectors noted that the licensee had not entered the action requirements of TS 3.6.2.1, which required, in part, that with one inoperable CS system, restore the inoperable system to operable within 7 days, or be in at least Hot Standby within the next 6 hours.

The inspectors also questioned the US regarding the failure to enter the action requirements of TS 3.6.2.1. Originally, the operating shift believed that no TS required actions would be missed by not entering TS 3.6.2.1 action requirements. The operators noted that TS Action Requirement 3.5.2.a was entered due to making the 1A RH train inoperable and they believed that the required actions of TS 3.6.2.1 would be met by entering the TS 3.5.2.a action requirements. Upon further review, the licensee concluded that the two TS required actions were not cascading and the US subsequently entered TS Action 3.6.2.1. The 1A CS train was inoperable from 8:00 p.m. on July 19 through 5:43 p.m. on July 21, 1998.

Planned maintenance on 1A CS train components caused the 1A CS train to be inoperable the following week from July 26 until July 30, 1998. The inspectors concluded that the previously unplanned and unrecognized entry into the action requirements of TS 3.6.2.1, followed by the planned entry into the same TS action requirement the next week resulted in unnecessary unavailability of the CS system.

The licensee performed a post maintenance critique and apparent cause evaluation. The inspectors concurred with the licensee's assessment that the operating shift was not provided with adequate support from the work planning group. Operations department management further stated that the lack of planning support did not meet management's expectations. The licensee also identified training inadequacies regarding TS knowledge and the licensee's TS interpretations. Corrective actions included the following: (1) the Shift Operations Superintendent issued a daily order discussing the TS discrepancies, emphasizing the responsibility that correct TS application has been and will remain with the operations shift personnel; (2) operations department work planners and unit planning supervisors were to identify applicable TS action requirements for maintenance periods on a Project Manager's Checklist and provide this information to the operating shifts; and (3) formal training to emphasize the TS discrepancies and cover current TS interpretations.

c. Conclusions

The inspectors concluded that 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. However, the inspectors concluded that several errors were made with TS action requirement entries for the 1A residual heat removal pump maintenance period due to poor work planning support of operations and poor knowledge of TS requirements. Furthermore, the inspectors concluded that insufficient planning for on-line maintenance activities resulted in additional unavailability of the containment spray system. No violations were identified.

## M1.2 Surveillance Test Observations

### a. Inspection Scope (61726)

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.

- 1BVS 0.5-3.CC.1-2 ASME Surveillance Requirements for Component Cooling (CC) Pump 1CC01PB
- 2BOS 8.1.1.2.a-2 2B Diesel Generator Operability Monthly Surveillance
- 1BOS 7.4.a-1 Essential Service Water (SX) System Valve Position Monthly Surveillance

### b. Observations and Findings

#### 1B CC Pump ASME Surveillance Test

On July 14, 1998, the inspectors attended the pre-job briefing and observed the performance of the 1B CC pump ASME surveillance test. During performance of the procedure, CC flow was throttled through the 1A RH heat exchanger in order to establish the necessary flowrate for the test. Following the pre-job briefing, the inspectors questioned the US regarding a note in Byron System Engineering Surveillance 1BVS 0.5-3.CC.1-2, "ASME Surveillance Requirements for Component Cooling Pump 1CC01PB," Revision 17. The note stated that no TS action requirement entry was required with the 1A RH heat exchanger outlet throttle valve, 1CC9507A, closed while opening 1A RH heat exchanger outlet motor operated valve, 1CC9412A. The inspectors questioned the operability of the 1A CC safety loop with 1CC9507A closed.

The inspectors discussed the 1A CC safety loop operability with licensee management. The licensee was unable to provide justification for not declaring the train inoperable and entering the applicable TS action requirement. As a result, the licensee initiated a temporary change to the procedure which required the operators to declare the applicable CC safety loop inoperable when the manual throttle valves for the RH heat exchangers were out of their normal positions.

The inspectors concluded that although the 1A CC safety loop was briefly inoperable during performance of 1BVS 0.5-3.CC.1-2, the 1B CC safety loop was operable. Technical Specification 3.7.3.a required, in part, that with only one safety loop operable, restore at least two loops to operable status within 7 days or be in at least hot standby within the next 6 hours. Therefore, the inspectors concluded that a violation of TS requirements had not occurred.

c. Conclusions

The inspectors concluded that the observed surveillance tests were performed well. Specifically, the surveillance tests satisfied the surveillance requirements of TS and each of the tested components met their respective acceptance criteria. Additionally, the inspectors concluded that the 1A component cooling water safety loop was made inoperable during performance of surveillance testing without the licensee entering the appropriate TS action requirement; however, no violation of TS requirements occurred due to the short duration of the test.

**M8 Miscellaneous Maintenance Issues (92700 and 92902)**

- M8.1 (Closed) Violation 50-454/455-97002-07b(DRP): "Failure to Enter a Limiting Condition for Operation (LCO) Action Requirement for Essential Service Water (SX) Flushing Operation Surveillance." The licensee failed to implement the requirements of the safety evaluation contained in modification M6-1-88-060 to incorporate an LCO action requirement into Byron Operating Surveillance (BOS) SX-M1 "1A AF [Auxiliary Feedwater] Pump SX Suction Line Monthly Flushing Surveillance," Revision 1. The overall impact of the modification was that both the SX and auxiliary feedwater systems were affected by performance of the surveillance and that an evaluation was required in accordance with 10 CFR 50.59 for the surveillance procedure to address LCO applicability.

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.

- M8.2 (Closed) Violation 50-454/455-97002-06a(DRP): "Inadequate Foreign Materials Exclusion (FME) Procedure." Foreign material was found in the thrust bearing housing of the 1B CS pump and between the mechanical seal seating surfaces of the 1A CS pump as a result of inadequate FME procedural controls.

The inspectors reviewed the licensee's initial corrective actions and determined that the corrective actions for this specific event were acceptable. However, in response to a subsequent similar violation, 50-454/455-98005-02(DRP), the licensee has initiated more comprehensive corrective actions to correct a programmatic problem with FME controls. The effectiveness of these corrective actions have yet to be determined. Therefore, violation 50-454/455-97002-06a(DRP) is closed and violation 50-454/455-98005-02(DRP) remains open pending further review of the licensee's corrective actions.

- M8.3 (Closed) Violation 50-454/455-97015-03a(DRP): "Failure to Follow BFP [Byron Fuel Handling Procedure] FH-31 for Foreign Materials Exclusion (FME) Controls." The inspectors identified that procedural requirements regarding FME controls were not being followed by contractors performing work on the spent fuel pool fuel transfer canal modification. This was due to inadequate FME training for the contractors and the failure to include FME procedural requirements in the work package.

The inspectors reviewed the licensee's initial corrective actions and found them to be acceptable. The licensee has initiated a broad corrective action program to correct a programmatic problem with FME controls at Byron Station. The effectiveness of this corrective action program will take time to determine. The inspectors considered this violation closed with the long term corrective actions to be followed with violation 50-454/455-98005-02(DRP).

- M8.4 (Closed) Violation 50-454/455-97022-02(DRP): "Failure to Follow Procedure NSWP-A-03." The inspectors identified two holes not protected with FME covers in the floor drain sump cover on the Unit 1 containment floor drain sump. This was due to a lack of appropriate covers which could accommodate drain hoses.

The inspectors reviewed the licensee's initial corrective actions and found them to be acceptable. The licensee has initiated a broad corrective action program to correct a programmatic problem with FME controls at Byron Station. The effectiveness of this corrective action program will take time to determine. The inspectors considered this violation closed with the long term corrective actions to be followed with violation 50-454/455-98005-02(DRP).

- M8.5 (Closed) Violation 50-454/455-97002-06b(DRP): "Inadequate Procedure Results in Unexpected Plant Transient Due to Unit 2 Pressurizer Power Operated Relief Valve (PORV) Lift." A station work request prepared to troubleshoot pressurizer spray valve oscillations failed to identify that work on the spray valve switch circuit could affect the operation of the PORV. The potential for the PORV to lift could have been identified during the work review and authorization process because the station drawings showed that the control signal for the PORV could be affected by work on the spray valve switch circuit.

The licensee's initial corrective actions were discussed in NRC Inspection Report 50-454/97002(DRP); 50-455/97002(DRP) and found to be acceptable by the inspectors. In NRC Inspection Report 50-454-97015(DRP); 50-455-97015(DRP), the inspectors noted a similar event where the OB SX make-up pump inadvertently started as a result of poor documentation of precautions for potential system response in the work package. The lack of broad-based corrective actions to address the inadvertent PORV lift was the basis for citing a violation for the inadvertent SX make-up pump start. Violation 50-454/455-97002-06b(DRP) is closed and Violation 50-454/455-97015-02(DRP) remains open pending review of the licensee's corrective actions.

- M8.6 (Closed) LER 50-454/96001-01: "Unrecognized Change in System Flow Results in Operation Outside TSs." This event was originally discussed in detail in NRC Inspection Report 50-454/96003(DRP); 50-455/96003(DRP) and resulted in one violation. The violation was subsequently closed in NRC Inspection Report 50-454/98005(DRP); 50-455/98005(DRP). The licensee's evaluation of the event resulted in the LER and did not change the nature of the event nor did it affect the previously issued violation. This LER is closed.



- M8.7 (Closed) LER 50-454/97004: "Thrust Bearings Installed Backward on the Residual Heat Removal (RH) and Containment Spray (CS) Pumps Due to Lack of Specific System/Component Knowledge." This event was originally discussed in detail in NRC Inspection Report 50-454/97002(DRP); 50-455/97002(DRP) and resulted in two violations. The violations were subsequently closed in NRC Inspection Report 50-454/98014(DRP); 50-455/98014(DRP). The licensee's evaluation of the event resulted in the LER and did not change the nature of the event nor did it affect the previously issued violations. This LER is closed.

### III. Engineering

#### **E2 Engineering Support of Facilities and Equipment**

##### **E2.1 Orientation of Anderson Greenwood Check Valves**

###### **a. Inspection Scope (37551)**

The inspectors interviewed engineering department personnel, observed the installed orientation of selected Anderson Greenwood check valves, and reviewed applicable procedures and documentation including the vendor technical manual and Byron Maintenance Procedure (BMP) 3100-35, "Anderson-Greenwood Type CV1B Wafer Check Valve Repair," Revision 4.

###### **b. Observations and Findings**

The inspectors determined that engineering department personnel were aware of an industry concern regarding the orientation of Anderson Greenwood check valves. Specifically, the licensee had received notification of at least two safety-related check valve failures that had been directly attributable to misorientation, one of which occurred at Braidwood Station. The vendor technical manual specified that the valves be oriented in either the vertical position with flow upward or in a horizontal position with the hinge pin mounted vertically. Failure to properly orient the check valves could result in excessive wear and an increased failure rate.

Based on discussions with engineering department personnel, the inspectors concluded that the licensee had not initiated action to identify those valves that were not oriented as specified by the vendor technical manual or correct those valves that were misoriented. Specifically, while the licensee had previously identified that the primary water makeup to Unit 1 component cooling water surge tank inlet check valve, 1CC070B, and the demineralized makeup water to Unit 2 component cooling water surge tank inlet check valve, 2CC070A, were misoriented, the licensee had not initiated action to correct their orientation. In addition, the inspectors identified that at least three other safety-related check valves were misoriented including the 0A essential service water makeup pump discharge check valve, 0SX028A; the 0B essential service water makeup pump discharge check valve, 0SX028B; and the 0A essential service water cooling tower circulating water makeup check valve, 0SX0143A. At the end of

the inspection period, the licensee was re-evaluating their actions regarding Anderson Greenwood check valves. This issue is considered an Inspector Follow-up Item (50-454/455-98017-03(DRP)) pending additional NRC review of the licensee's inspection and testing programs and the maintenance work history for these check valves.

c. Conclusions

The inspectors concluded that the licensee was aware of the industry concern regarding the orientation of Anderson Greenwood check valves. However, the licensee had not initiated action to identify those valves that were not oriented as specified by the vendor technical manual or correct those valves that were misoriented.

**E8 Miscellaneous Engineering Issues (92903)**

- E8.1 (Closed) Violation 50-454/94003-01(DRS); 50-455/94003-01(DRS): "Inadequate Corrective Actions on Auxiliary Feedwater (AF) system." This violation addressed the failure of the licensee to identify, for a number of years, that there was the potential for the AF system to not automatically transfer the AF suction to the emergency service water. The design problem was licensee identified and corrected; the violation was to address programmatic issues. The licensee performed training on the issue, and enhanced its operability manual and design basis program. This item is closed.
- E8.2 (Closed) VIO 50-454/455-96005-03 and EEI 50-455/97005-03: Inadequate safety evaluation and failure to perform a safety evaluation respectively. The first item described a safety evaluation that did not adequately justify that no unreviewed safety question existed, primarily due to a failure to include the necessary basis or reference calculations appropriately. The second item was a failure to perform a safety evaluation for a modification to the Unit 2 containment floor drain system that most likely existed since original construction. The inspectors reviewed the licensee's corrective actions and determined that the corrective actions were appropriate to correct each specific problem. However, a violation, 50-454/455-98005-04, was also issued recently for failure to perform a safety evaluation prior to venting the volume control tank into the gaseous waste processing system. The licensee's response to the recent violation, as well as indicators from the off site review committee, was to conduct a root cause investigation, Report Number 454-200-98-CAQS00001. The root cause report identified several causes of the safety evaluation process failures, including: weaknesses in the safety evaluation procedure sequencing, format, and clarity; training weaknesses in certification control and refresher training frequency; and poor response to off site review committee comments. The inspectors concluded that the corrective actions planned for violation 50-454/455-98005-04 were broad actions that would also preclude repetition of the two subject violations. Therefore, violations 50-454/455-96005-03 and 50-455/97005-03 are closed. Violation 50-454/455-98005-04 remains open pending completion of the licensee's corrective actions identified in the root cause report.

## 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 August 24, 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.

## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

K. Graesser, Site Vice-President  
D. Wozniak, Acting Station Manager  
B. Adams, Regulatory Assurance Supervisor  
J. Bauer, Radiation Protection Manager  
E. Campbell, Support Services Manager  
T. Gierich, Operations Manager  
B. Kouba, Engineering Manager  
T. Schuster, Nuclear Oversight Manager  
M. Snow, Maintenance Manager

## INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observations
IP 71707:	Plant Operations
IP 92700:	Onsite Follow-up of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92901:	Follow-up Operations
IP 92902:	Follow-up Maintenance
IP 92903:	Follow-up Engineering

## ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

50-454/98017-01	NCV	Operator Started VV Fan While in LCOAR Due to Poor Work Practices
50-454/455-98017-02	VIO	Failure to Meet TS 3.0.3 Action Requirements for Two Trains of VC Inoperable
50-454/455-98017-03	IFI	Orientation of Anderson Greenwood Check Valves

### Closed

50-454/98017-01	NCV	Operator Started VV Fan While in LCOAR Due to Poor Work Practices
50-454/455-98014-01	URI	Main Control Room Ventilation Envelope Operability
50-454/98-016	LER	Main Control Room Pressure Non-Compliance Due to Inadequate Procedure
50-455/98011-02	URI	Failure to Hang an OOS on the 2B RCP Prior to Performing Balancing Activities
50-454/98015	LER	Operator Started Fan While in LCOAR Due to Poor Work Practices
50-454/98008	LER	Manual Reactor Trip Due to Loss of Communication During Rod Drop Testing Caused by Procedure Deficiency
50-454/98005	LER	Manual Reactor Trip Due to Indeterminate Rod Sequencing Problem
50-454/455-97002-07b	VIO	Failure to Transfer Design Requirements from Modification to Surveillance
50-454/455-97002-06a	VIO	Inadequate FME Procedure
50-454/455-97015-03a	VIO	Failure to Follow BFP FH-31 for FME Controls
50-454/455-97022-02	VIO	Failure to Follow Procedure NSWP-A-03
50-454/455-97002-06b	VIO	Inadequate Procedure Results in Unexpected Plant Transient Due to Unit 2 Pressurizer Power Operated Relief Valve (PORV) Lift

50-454/96001-01	LER	Unrecognized Change in System Flow Results in Operation Outside Technical Specifications
50-454/97004	LER	Thrust Bearings Installed Backward on the Residual Heat Removal (RH) and Containment Spray (CS) Pumps
50-454/455-94003-01	VIO	Inadequate Corrective Actions on Auxiliary Feedwater (AF) System
50-454/455-96005-03	VIO	Safety Evaluation Did Not Have the Necessary Basis or Calculations Adequately Referenced in the Evaluation to Justify That No Unreviewed Safety Questions Existed
50-455/97005-03	EEL	Failure to Perform a Safety Evaluation for Various Types of Grates in Containment Floor Drain System

Discussed

50-454/455-98005-02	VIO	NSWP-A-03 Inadequate to Prevent Material Intrusion Into CS System
50-454/455-98005-04	VIO	Failure to Perform Safety Evaluation for Venting CV System

## LIST OF ACRONYMS USED

ACB	Air Circuit Breaker
AF	Auxiliary FeedWater System
BAP	Byron Administrative Procedure
BMP	Byron Mechanical Maintenance Procedure
BOP	Byron Operating Procedure
BOS	Byron Operating Surveillance
BOU	Bank Overlap Unit
BRP	Byron Radiological Protection Procedure
BVS	Byron Engineering Surveillance
CC	Component Cooling Water System
CDF	Core Damage Frequency
CS	Containment Spray System
DC	Direct Current
DG	Diesel Generator
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
ECCS	Emergency Core Cooling System
ESF	Engineered Safety Feature
FME	Foreign Material Exclusion
IFI	Inspector Follow-up Item
IPE	Individual Plant Examination
LBB	Local Breaker Backup
LCO	Limiting Condition for Operation
LCOAR	Limiting Condition for Operation Action Requirement
LER	Licensee Event Report
LM	Loose Parts Monitoring System
LOOP	Loss of Offsite Power
NCV	Non-cited Violation
NLO	Non-licensed Operator
NRC	Nuclear Regulatory Commission
OCB	Oil Circuit Breaker
OOS	Out-of-Service
PDR	Public Document Room
PIF	Problem Identification Form
PORV	Power Operated Relief Valve
RH	Residual Heat Removal
SAT	System Auxiliary Transformer
SX	Essential Service Water System
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved Item
US	Unit Supervisor
VC	Main Control Room Ventilation System
VIO	Violation
WR	Work Request