U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No:	50-255/99012(DRP)
Licensee:	Consumers Energy Company 212 West Michigan Avenue Jackson, MI 49201
Facility:	Palisades Nuclear Generating Plant
Location:	27780 Blue Star Memorial Highway Covert, MI 49043-9530
Dates:	November 4, 1999, through December 16, 1999
Inspectors:	J. Lennartz, Senior Resident Inspector R. Krsek, Resident Inspector
Approved by:	Anton Vegel, Chief Reactor Projects Branch 6 Division of Reactor Projects

EXECUTIVE SUMMARY

Palisades Nuclear Generating Plant
NRC Inspection Report 50-255/99012(DRP)

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

Operations

- On November 6, 1999, the licensee failed to ensure that the ventilation system was aligned as required by Technical Specifications while moving fuel in the spent fuel pool. A lack of internal and external communications amongst the operating crew and a lack of attention to detail by the operating crew while completing routine checklists were contributing factors. No adverse safety consequences resulted from the failure. This licensee identified issue was a Non-Cited Technical Specification Violation. (Section O4.1)

- Operations personnel failed to ensure that the secondary and primary coolant system temperatures met Technical Specification requirements prior to starting the first primary coolant pump on December 4, 1999. The evolution was characterized by weaknesses in the conduct of operating crew turnovers, the unclear designation of individuals' roles and responsibilities, and a lack of plant parameter validation prior to performing an evolution. No adverse safety consequences resulted from the failure. This licensee identified issue was a Non-Cited Technical Specification Violation. (Section O4.2)

- A lack of rigor regarding responsibilities by the Control Room Supervisor and the Nuclear Control Operator contributed to a missed surveillance of daily plant parameters. No adverse safety consequences resulted from the failure to perform the daily surveillance, DWO-1, "Daily/Weekly Surveillance Data Sheet," as required by Technical Specifications, on November 23, 1999. The missed surveillance was identified by licensee personnel and resulted in a Non-Cited Violation. (Section O4.4)

- Licensee personnel conducted a thorough root cause evaluation regarding the failure to perform the daily surveillance, DWO-1, "Daily/Weekly Surveillance Data Sheet," of plant parameters, as required by Technical Specifications, on November 23, 1999. Also, corrective actions were considered reasonable. (Section O4.4)

- The operating crew quickly recognized and terminated the inadvertent transfer of borated water to the primary coolant system, which minimized the potential adverse consequences of this event. (Section M3.1)

- The inspectors concluded that the corrective actions initiated to address the weaknesses observed in the operational events were reasonable. (Section O4.5)

Maintenance

- The inadvertent loss of 6 gallons of primary coolant system inventory on November 10, 1999, due to an inadequate tagging order, did not result in significant adverse safety consequences. However, the potential significance of the incident was increased, in that, the incident occurred when the primary coolant system was in a reduced inventory condition. This self-revealing incident resulted in a Non-Cited Violation. (Section M1.2)

- Interim corrective actions were considered reasonable and the Incident Response Team's evaluation was thorough for the inadvertent loss of primary coolant while in a reduced inventory condition. Initiating a multi-discipline root cause evaluation to evaluate circumstances related to the event was considered appropriate. (Section M1.2)

- Auxiliary operators performed the primary coolant system leakage test in a thorough and comprehensive manner. This resulted in the identification of several issues, some of which required the repair of active system leaks. (Section M1.4)

- No significant adverse consequences resulted from the inadvertent transfer of approximately 6,000 gallons of water from the refueling water storage tank to the primary coolant system on November 2, 1999. The licensee's root cause evaluation was considered thorough and the corrective actions to prevent recurrence were reasonable. This self-revealing event resulted in a Non-Cited Violation. (Section M3.1)

Engineering

- Engineering personnel pro-actively supported the refueling outage activities through timely and thorough support for emergent issues. Engineering personnel resolved the issues in a methodical, deliberate, and conservative manner which demonstrated a positive focus on safety, consistent with past observations. (Section E1.1)

- Engineering personnel developed a detailed troubleshooting and repair plan in response to the one control rod that failed to drop into the core as designed, during the planned manual reactor trip on October 15, 1999. The repair scope was appropriately expanded when new information was learned. (Section M1.3)

- The root cause for an incident in which borated water was inadvertently transferred from the safety injection refueling water tank to the primary coolant system was an error in the surveillance procedure that was developed by engineering personnel. Also, the procedure deficiency demonstrated a lack of rigor regarding procedure development and technical review by both engineering and operations personnel. (Section M3.1)

- Engineering personnel demonstrated ownership for the degraded containment liner moisture barrier which was resolved in a timely and effective manner. Also, during the 1999 refueling outage, engineering personnel identified that the nonsafety-related control rod drive mechanism cooling system ventilation louvers were not open and that the containment sump screen was not installed as previously assumed in analyses. These issues demonstrated an effective questioning attitude by engineering personnel. (Section E1.2)

- Plant data indicated that the nonsafety-related control rod drive cooling system was incorrectly configured for several years which demonstrated a lack of configuration control. Also, the containment sump screen was not welded to the frame along 1/3 of the screens length as assumed in previous engineering calculations. This demonstrated a lack of system design knowledge by engineering personnel. (Section E1.2)

- Engineering personnel failed to recognize how the acceptance criteria's validity would be impacted during past revisions to low pressure safety injection system test Procedure QO-8B. Consequently, an issue emerged during the 1999 refueling outage that required extensive testing and detailed engineering analysis to prove that the low pressure safety injection system was operable. The resultant operability assessment was considered thorough. (Section E1.3)

- Engineering and operations personnel demonstrated an ineffective questioning attitude during past low pressure safety injection system testing. (Section E1.3)

- During the refueling outage, the licensee identified control rod drive seal housing assembly leaks and evidence of crack indications on 30 of the 45 seal housing assemblies. Appropriate corrective actions to repair the seal housing assemblies were initiated to ensure compliance with the applicable American Society of Mechanical Engineers Code requirements. (Section E8.2)

Plant Support

- Radiation protection personnel pro-actively supported ongoing activities in the 1999 refueling outage. Radiation protection technicians consistently challenged radiation workers and utilized several tools, such as remote monitoring, in an effort to maintain radiation dose as low as reasonably achievable during the refueling outage. (Section R1.1)

- Overall, accumulated radiation dose for the 1999 refueling outage was higher than the original dose goals established prior to the start of the refueling outage. Emergent equipment issues extended the outage which contributed to the increased dose. (Section R1.1)

Report Details

Summary of Plant Status

The plant was shut down for the majority of the inspection period for a 37-day scheduled refueling outage that started on October 15, 1999. In addition to the refueling activities, the major maintenance items that were scheduled and completed included: replacing the seal packages on Primary Coolant Pumps P-50A, P-50C, and P-50D; replacing the motor on Primary Coolant Pump P-50D; rebuilding Primary Coolant Pump P-50A; and, replacing both low pressure turbines on the main turbine generator. Several equipment problems also emerged during the outage that required repairs. Consequently, the outage duration was extended to approximately 59 days.

Appropriate repairs were completed for all the emergent issues and the plant was taken critical on December 10, 1999. The main generator was synchronized to the electrical grid on December 12, 1999; however, secondary side chemistry samples indicated the plant was not within the specified limits for power operations shortly after the plant was on-line. The chemistry results required a plant shutdown to hot standby, which occurred on December 13, 1999. Extensive turbine generator work during the outage contributed to the secondary side chemistry issues, which were anticipated based on industry experience. The plant was subsequently synchronized to the grid on December 14, 1999, after the secondary chemistry issues were addressed. Power escalation was in progress when the inspection period ended.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

The inspectors noted that outage planning personnel and site management consistently demonstrated a positive focus on safety during the outage. In general, the plant was operated in conservative manner and an appropriate heightened awareness was evident while the primary coolant system was in a reduced inventory condition. This demonstrated a positive focus on safety and was consistent with past outage observations.

Several equipment issues emerged during the outage which included issues involving control rod drive mechanism bearings, control rod drive seal housings, containment liner moisture barrier, containment sump screen analyses, primary coolant system check valve leakage, and low pressure safety injection system testing. The inspectors noted that these issues were addressed and resolved in a methodical, deliberate, and conservative manner which demonstrated a positive focus on safety. However, some of the emergent issues revealed a lack of knowledge of system design and system configuration control. (See Section E1.2)

Finally, a number of operational events occurred which resulted in violations of Technical Specification requirements. The circumstances surrounding these events are addressed in Sections O4 and M1 of this report.

O4 Operator Knowledge and Performance

O4.1 Movement of Irradiated Fuel Assemblies in the Fuel Storage Building

a. Inspection Scope (37551, 71707)

The inspectors reviewed the circumstances surrounding a licensee identified event in which charcoal filters, required to be in service by the Technical Specifications for fuel movement, were not in service during the movement of irradiated fuel assemblies. The inspection activities included a review of control room logs, operating procedures and Technical Specifications. The inspectors also discussed the event with appropriate operations personnel and management.

b. Observations and Findings

At approximately 8:45 a.m. on November 6, 1999, control room operators were informed that fuel handling personnel were moving irradiated fuel assemblies in the spent fuel pool. Shortly thereafter, the operators discovered that the charcoal filters associated with the ventilation system in the spent fuel handling area were not in operation, as required. At the time of discovery, reactor engineering and fuel handling personnel were conducting the post-refueling fuel reconstitution moves in the spent fuel pool. The control room operators immediately directed that all fuel moves be stopped and appropriately aligned the charcoal filters in the ventilation system to restore compliance with the Technical Specifications.

All subsequent fuel moves were placed on hold pending management approval. Condition Report 9902402 was generated and assigned the highest significance level (Level 1) and an Incident Response Team was formed to develop the facts surrounding the incident. The Level 1 condition report also required a multi-disciplined team to conduct a root cause evaluation.

Follow-up by licensee personnel determined that at approximately 11:30 p.m. on November 5, 1999, the Control Room Supervisor authorized fuel handling activities in the spent fuel pool. However, the Control Room Supervisor did not inform other personnel on the crew of the authorization and did not document the authorization in the Control Room Supervisor log book. At approximately 1:30 a.m. on November 6, 1999, fuel moves commenced in the spent fuel pool without the charcoal filter in service. In addition, during the turnover between the operating crews on the morning of November 6, 1999, neither authorization nor actual movement of irradiated fuel in the spent fuel pool was mentioned.

A review of operating procedures revealed that two general operating procedure checklists were used to assure the ventilation equipment status met the requirements for fuel handling activities. Ventilation System Checklist 11.4 prescribed and verified

ventilation system alignments, not only for activities which involved fuel handling, but also for activities with no fuel handling. General fuel handling Checklist 11.2 was intended to ensure the proper ventilation system alignment for fuel moves, by confirming that Checklist 11.4 was completed for fuel handling activities.

Interviews with operators by the Incident Response Team revealed that Checklist 11.2 was completed prior to establishing the proper alignment of the ventilation system for fuel movement activities prescribed in Checklist 11.4. The control room operator had achieved literal compliance with the completion of Checklist 11.2 by only confirming that Checklist 11.4 had been performed. However, the intent of Checklist 11.2 to verify that the ventilation system was appropriately aligned for fuel handling activities was not met.

In addition to the corrective actions already discussed, the licensee conducted stand down meetings with on-shift and engineering personnel involved with fuel moves to address communications, attention to detail, and procedure expectations. Revisions to the operating procedure checklists were also made, and all the issues identified by the Incident Response Team were addressed. The inspectors considered the root cause evaluation and corrective actions as reasonable. Also, the incident was appropriately reported to the NRC in Licensee Event Report 99-005 in accordance with 10 CFR 50.73(a)(2)(i)(B), as a condition prohibited by Technical Specifications.

The safety significance of the event was mitigated by Off-Normal Procedure 11.2, "Fuel Handling Accident," which in the event of a fuel handling accident, directs an immediate action to place the required charcoal filter in service.

Technical Specification 3.8.4 states, in part, that the ventilation system and charcoal filter in the fuel storage building shall be operating whenever irradiated fuel which has decayed less than 30 days is being handled in the fuel storage building. The failure to ensure that the charcoal filter was in operation in the fuel storage building during the movement of irradiated fuel which had decayed less than 30 days in the spent fuel pool is a Violation of the Technical Specification requirements. This licensee identified Severity Level IV Violation is being treated as a Non-Cited Violation (NCV), consistent with Section VII.B.1.a of the NRC Enforcement Policy. This Violation is in the licensee's corrective action program as Condition Report 9902402. (NCV 50-255/99012-01)

O4.2 Startup of Primary Coolant System Forced Circulation

a. Inspection Scope (71707)

The inspectors reviewed the circumstances surrounding a licensee identified event in which the primary coolant pumps were started in violation of the Technical Specification requirements. Inspection activities included a review of control room logs, operating procedures, Technical Specifications, and plant process computer data. The incident was also discussed with appropriate operations personnel and management.

b. Observations and Findings

On December 4, 1999, after starting Primary Coolant Pumps P-50A and P-50D, the oncoming Control Room Supervisor noted that the T-cold primary coolant system

Temperature Instrument TT-0122CA indicated approximately 8 degrees Fahrenheit less than the other three T-cold temperature instruments. Further review of plant process computer data revealed that when the first primary coolant pump was started, Temperature Instrument TT-0122CA indicated 83 degrees Fahrenheit. Steam Generator A and B temperature indications were noted to be 85 and 90 degrees Fahrenheit, respectively. The remaining three T-cold temperature instruments had temperature indications of greater than 90 degrees Fahrenheit. As-found testing of temperature instrument TT-01122CA, conducted after the incident, indicated that the instrumentation was operating within the established acceptance criteria for instrument uncertainty.

Standard Operating Procedure 1, "Primary Coolant System," and Technical Specification Section 3.1.1.h.(2) required steam generator temperatures to be less than the T-cold temperatures, prior to starting the first primary coolant pump. The basis for the requirement was to prevent heat transfer from the steam generator into the primary coolant system when the primary coolant pumps were started. Plant process computer data indicated that after the primary coolant pumps were placed in service, the primary coolant system pressure lowered. This was characteristic of heat being transferred from the primary coolant system to the steam generators and indicated that the bulk steam generator temperatures were less than the bulk primary coolant system temperatures. Therefore, heat was not transferred from the steam generator to the primary coolant system which precluded any adverse consequences.

Condition Report 9902868 was generated and assigned a Significance Level 2. The licensee subsequently investigated the incident and performed a root cause investigation. A review of the circumstances surrounding the event revealed several contributory factors which are detailed below:

- The at-the-controls operators for the shift were not used to perform the evolution, as they did not have just-in-time training for starting the PCP. Rather, the decision was made to utilize available operators who had recently taken the just-in-time training. However, the operators were in different watch positions during the actual evolution than they were in for the just-in-time training on the simulator.

- The mid-shift informal turnover to some of the operators that performed the evolution did not highlight that a primary coolant system cooldown had been initiated a couple hours before the evolution. The primary coolant system cooldown was initiated, in accordance with procedural requirements, to ensure the primary coolant system temperature was 5 to 15 degrees greater than the steam generator temperatures.

- The Senior Reactor Operators leading this evolution did not validate that the primary coolant system T-cold temperatures were warmer than the steam generators just prior to the start of the primary coolant pumps. The Nuclear Control Operator who started the primary coolant pump also did not validate that the correct system conditions were established.

Operations management initiated several immediate corrective actions which included new policies on the expectations for the conduct of just-in-time training and for non-routine watch station turnovers. Stand down meetings were conducted with operations crews to address the need to ensure all prerequisites were met just prior to performing an activity and to clarify the individual responsibilities of an operating crew. Several long-term actions to prevent recurrence were also initiated to address the roles and responsibilities of crew members, improve internal and external crew communication, and enhance the current operating procedure.

The inspectors considered the root cause evaluation and corrective actions as reasonable. Also, the incident was appropriately reported to the NRC in Licensee Event Report 99-007 in accordance with 10 CFR 50.73(a)(2)(i)(B), as a condition prohibited by Technical Specifications.

Technical Specification 3.1.1.h(2) requires, in part, that the steam generator secondary temperatures be less than or equal to the T-cold primary coolant system temperatures prior to the initiation of primary coolant system forced circulation (starting the first primary coolant pump). The failure to ensure that the steam generator secondary temperatures were less than or equal to the T-cold primary coolant system temperatures prior to starting the first primary coolant pump is a Violation of the Technical Specification requirements. This licensee identified Severity Level IV Violation is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy. This Violation is in the licensee's corrective action program as Condition Report 9902868. (NCV 50-255/99012-02)

O4.3 Plant Startup

a. Inspection Scope (37551, 71707)

The inspectors observed portions of the plant startup, including the approach to criticality, synchronization of the main generator to the electrical grid and the subsequent shutdown to hot standby for secondary chemistry issues. The inspectors also reviewed the applicable procedures and Technical Specifications.

b. Observations and Findings

The inspectors noted that the approach to criticality on December 10, 1999, the synchronization of the main generator to the electrical grid on December 12, 1999, and the subsequent plant shutdown to hot standby on December 13, 1999, were deliberate and executed in accordance with plant procedures. The operating crews actively utilized the appropriate procedure for the ongoing evolution.

The inspectors also noted more formal mid-shift turnovers, and the increased use and oversight of the just-in-time training process in the reactor simulator. Operating crew roles and responsibilities were generally well defined for the evolutions. Control room operators' performance during these evolutions was characterized by procedure adherence and the effective use of self and peer-checking. Also, reactor engineering personnel actively supported the control room operators during the evolutions observed.

Anomalies which did arise during these evolutions were handled methodically by the operating crews and demonstrated effective monitoring of plant parameters. For example, when the turbine generator was synchronized to the grid, the operations crew expected an initial power load of approximately 40 Megawatts, based on past experience. However, only 17 Megawatts was observed and the subsequent power escalation rate was also considerably lower than expected. The operating crew responded by attentively monitoring the control panels for any abnormal indications and methodically operating the reactor to account for the decreased power escalation rate.

O4.4 Failure to Take Control Room Logs

a. Inspection Scope (61726, 71707)

The inspectors reviewed the circumstances surrounding a licensee identified event in which control room operators failed to complete a daily surveillances. Inspection activities included a review of applicable condition reports, control room logs, surveillance and administrative procedures, Technical Specifications, root cause evaluation, and the licensee event report. Also, the inspectors discussed the event with control room operators, and operations and plant management.

b. Observations and Findings

Operations personnel identified on November 23, 1999, that the daily readings on surveillance DWO-1, "Daily/Weekly Surveillance Data Sheet," had not been completed. The daily surveillance was required to monitor and document Technical Specification related plant parameters. Plant parameters that were not documented in DWO-1 included:

- Boric acid heat trace temperatures (Technical Specification Standing Order 54);
- Primary coolant system leakage; (Technical Specification Table 4.2.2) and,
- Process radiation monitor readings (Offsite Dose Calculation Manual); and
- Fuel Oil Storage Tank T-10A level (Technical Specification 4.7.3.1).

The missed surveillance was identified by the oncoming Shift Engineer while reviewing control room logs. The surveillance was promptly completed by operations personnel with satisfactory results to verify compliance with Technical Specification requirements.

Further investigation by operations personnel identified that the required surveillance had not been completed within the specified interval plus allowable extension. Consequently, an operability assessment was required for the items that were not documented as required by Surveillance DWO-1. Operations personnel concluded that the following equipment remained operable but was degraded:

- Boric acid heat tracing was needed to support the designated boric acid flow path to the primary coolant system that was required by the procedure in effect during the missed surveillance, General Operating Procedure 14. However, a second flow path was available that did not require heat tracing. Therefore, the operability requirements were fortuitously met.

- The primary coolant system was visually checked for leakage, as required, during a containment tour conducted by an Auxiliary Operator. The completed containment tour and resultant satisfactory results were documented in the Radwaste Log Book. However, the completed visual check for primary coolant system leakage was not documented in DWO-1.

- The process radiation monitors were not required per Technical Specifications and were included on DWO-1 as a convenience. Also, operations personnel reviewed historical data on the plant computer and the daily readings that were taken by radiological protection personnel regarding the radiation monitor readings during the time period that the surveillance was missed. The monitors were reading as expected.

However, during the time of the missed surveillance, one emergency diesel generator was required to be operable and, therefore, Fuel Oil Storage Tank T-10A was required to be operable. Consequently, Tank T-10A was considered inoperable from the time that the missed surveillance was identified until it was completed satisfactorily (about 20 minutes).

Operations personnel subsequently concluded, based on a review of past data sheets and plant activities, that the level in Tank T-10A was maintained above the required limit for the duration of the missed surveillance. Consequently, no actual adverse safety consequences resulted.

However, the inspectors noted that a lack of rigor regarding responsibilities by the Control Room Supervisor and the Nuclear Control Operator involved contributed to the missed surveillance. The Control Room Supervisor incorrectly assumed that the Shift Engineer had reviewed the required surveillance to ensure the surveillance was completed. Consequently, the Control Room Supervisor signed the "Shift Turnover Items" check list to indicate that the surveillance had been completed without verifying that the surveillance had been completed.

Also, the Nuclear Control Operator failed to perform the surveillance during the shift as expected. The inspectors noted that there was no administrative tool in place to remind the Nuclear Control Operator to perform the surveillance which contributed to this incident.

A Significance Level 2 Condition Report, CPAL9902747, was generated for root cause determination. The evaluation conducted by licensee personnel was considered thorough and identified the following root causes:

- The Nuclear Control Operator, who would normally perform the surveillance, failed to remember to perform the surveillance because of on-going activities he was involved with. Also, there was no additional administrative tool to remind the operator to perform the surveillance.

- The Control Room Supervisor, based on past practice of having another on-shift person review the DWO-1 data sheets, assumed that the surveillance was completed and signed the turnover sheet without validating his assumption.

The remedial and corrective actions to prevent recurrence included the following:

- the Control Room Supervisor involved in the incident presented a lessons learned training session the operating crews;
- a single on-shift position, Nuclear Control Operator - Turbine, was designated responsibility for completing the daily required surveillances; and,
- Administrative Procedure 4.0, "Operations Organization, Responsibilities and Conduct," was revised to add a review of DWO-1 to the Nuclear Control Operator's turnover section on the Control Room Reactor Log.

The inspectors considered the corrective actions as reasonable. Also, the incident was appropriately reported to the NRC in Licensee Event Report 99-006 in accordance with 10 CFR 50.73(a)(2)(i)(B), as a condition prohibited by Technical Specifications.

The failure to perform the daily surveillance of Fuel Oil Storage Tank T-10A within the required frequency and allowable extension is a Violation of Technical Specification 4.7.3.1. This Severity Level IV Violation was identified by licensee personnel and is being treated as a Non-Cited Violation (NCV), consistent with Section VII.B.1.a of the NRC Enforcement Policy. This Violation is in the licensee's corrective action program as Condition Report 9902747. (NCV 50-255/99012-03)

c. Conclusions

The inspectors concluded that no adverse safety consequences resulted from the failure to perform the daily surveillance, DWO-1, "Daily/Weekly Surveillance Data Sheet," of plant parameters, as required by Technical Specifications, on November 23, 1999. Fortuitously, historical plant data and documentation was available to prove that operability requirements were met for the required plant parameters with the exception of Fuel Oil Storage Tank T-10A level.

The missed surveillance was identified by licensee personnel and resulted in a Non-Cited Violation. Licensee personnel conducted a thorough root cause evaluation and the corrective actions were considered reasonable. A lack of rigor regarding responsibilities by the Control Room Supervisor and the Nuclear Control Operator contributed to missing a Technical Specification required surveillance.

O4.5 Conclusions on Operator Knowledge and Performance

The inspectors noted that, in general, the plant was operated in a deliberate and conservative manner during the refueling outage and subsequent plant startup. Control room operators demonstrated effective monitoring of the plant status and active use of plant procedures during the initial plant startup and return to hot standby.

However, a number of operational events occurred which resulted in two Technical Specification Violations. Individually, the events did not result in any significant adverse safety consequences. The events demonstrated a lack of rigor by the operations staff during the completion of normal operational duties during the refueling outage. In all

instances, a leading contributory factor was a lack of fundamental internal and external communications amongst the operating crews. Weaknesses were also identified in the conduct of non-routine turnovers, the clarity of operational procedures, the designation of individual roles and responsibilities for evolutions, and the validation of plant parameters prior to beginning an evolution.

Operations management initiated immediate corrective actions to address the weaknesses observed in the operational events which occurred. A thorough evaluation to determine the root causes, and a heightened management attention to address the causes for the events were warranted and were being conducted.

O8 Miscellaneous Operations Issues (92700)

O8.1 (Closed) Licensee Event Report 50-255/99-005: Charcoal filter not in service during movement of irradiated fuel assemblies as required by Technical Specifications. This licensee identified and corrected event is addressed in Section O4.1 of this report. No new issues were revealed in the Licensee Event Report. This item is closed.

O8.3. (Closed) Licensee Event Report (LER) 50-255/99-006: "Failure to Perform Technical Specification Surveillance of Fuel Oil Storage Tank Level." This licensee identified and corrected event was addressed in detail in Sections O4.2 and M1.2 of this report and was a Non-Cited Violation. No new issues were revealed by the Licensee Event Report. This item is closed.

O8.2 (Closed) Licensee Event Report 50-255/99-007: Failure to ensure that the steam generator secondary temperature indications were less than the primary coolant system cold leg temperature indications prior to starting the first primary coolant pump, as required by the Technical Specifications. This licensee identified and corrected event was addressed in detail in Section O4.2 of this report. No new issues were revealed in the Licensee Event Report. This item is closed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Maintenance and Surveillance Testing Observations

a. Inspection Scope (61726, 62707, 71707)

The inspectors observed or reviewed portions of the following maintenance work orders and surveillance activities. Also, the inspectors interviewed operations, engineering, and maintenance department personnel and, when applicable, reviewed Technical Specifications, the Final Safety Analysis Report and vendor manuals.

Work Order Number.:

- 24912968 High Pressure Safety Injection Check Valve ES-3116 (Loop 1B)
- 24913083 Control Rod Drive Mechanism Clutch Rebuilds
- 24911739 Main Steam Isolation Valve CV-0510 Modification Installation
- 24913574 Safety Injection Tank T-82D Level Switch Boric Acid Leak
- 24910261 Primary Coolant Pump P-50A

Surveillance No.:

- QO-8B Engineered Safeguards System Check Valve Operability Test and Low Pressure Safety Injection Motor Operated Valve Operability Test
- RO-12 Containment High Pressure and Spray System Tests
- RT-71A Primary Coolant System, Class 1 System Leakage Test
- T-340 Low Pressure Safety Injection Full Flow Verification (Cold Shutdown)
- T-387 Low Pressure Safety Injection System Flow Rate Troubleshooting (Cold Shutdown)
- T-191 Low Power Physics Testing
- RO-22 Control Rod Drop Timing
- RO-65 High Pressure Safety Injection Trains 1 and 2, and Hot Leg Injection Check Valve Test and Cold Leg/Hot Leg Flow Balance Test
- SOP-23 Plant Heating System, Attachment 8, Cold Weather Checklist CL CWCL-1

b. Observations and Findings

In general, work activities were well coordinated and completed in a manner to preclude adverse safety consequences. Also, the inspectors noted that when conflicts between scheduled work activities and required plant conditions surfaced, operations and outage planning personnel, in general, identified the deficiency prior to any resultant adverse safety consequences.

The inspectors observed that work performed on High Pressure Safety Injection Check Valve CK-ES-3116 utilized the appropriate measuring and test equipment and had an

appropriate post maintenance test. The initial identification of the issue and the subsequent maintenance activities were well documented in work requests and work orders appropriate for the task.

The inspectors also reviewed the initial implementation of the Cold Weather Checklist CL-CWCL-1 contained in SOP-23. The inspectors noted the preparatory activities contained in the checklist for the onset of cold weather were completed satisfactorily.

However, some incidents did occur during this inspection report period that demonstrated a lack of rigor regarding the control and performance of work activities. The specific discussions of these maintenance and surveillance activities are addressed in Sections M1.2, M1.4, and M3.1 of this report.

M1.2 Inadvertent Breach of Primary Coolant System

a. Inspection Scope (62707)

The inspectors reviewed the circumstances surrounding a self-revealing event in which a maintenance activity resulted in the primary coolant system being inadvertently breached while in a reduced inventory condition. The inspectors reviewed applicable condition reports, administrative procedures, work orders, tagging orders and the licensee's Incident Response Team findings.

b. Observations and Findings

On November 10, 1999, with the primary coolant system in a reduced inventory condition, Work Order 24912943 was initiated to repair a body to bonnet leak on a 1 inch manual isolation valve, MV-ES-3106, for a pressure transmitter on Safety Injection Tank T-82A. When workers loosened and lifted the valve bonnet, water flowed unexpectedly from the valve. Consequently, approximately 6 gallons of water was lost from the primary coolant system. The maintenance worker immediately reinstalled the valve bonnet to stop the leak. A catch basin rigged at the job site by radiation protection technicians effectively caught most of the water and directed it to a drain.

As an immediate corrective action, all work activities that breached the primary coolant system were stopped and an Incident Response Team was formed, as requested by the site vice president, to investigate the event. During the investigation, licensee personnel identified that the associated tagging order was inadequate. Work Order 24912943 was released to be executed on October 27, 1999, and initially written to clean boric acid from the valve and tighten the packing. Subsequently, the work order was revised on November 3, 1999, to disassemble and repair a body to bonnet leak. The work order was subsequently added to an existing tagging order to perform the repairs.

However, the tagging order that was used did not isolate MV-ES-3106 from the discharge of the low pressure safety injection pump that was in-service for shutdown cooling. Consequently, primary coolant system water was pumped out of MV-ES-3106 by the low pressure safety injection pump when the valve bonnet was removed.

Based on the initial findings of the Incident Response Team, the associated Condition Report 9902482 was assigned the highest significance level (Level 1) which would require a root cause evaluation by a multi-discipline team. Also, the licensee's Incident Response Team identified several barriers that failed and several procedure non-compliance issues which included:

- a complete off shift tagging authority review was not always conducted when work orders were added to an existing tagging orders;
- the need for a tagging order, after Work Order 24912943 was revised, was not added to the schedule, which precluded the off shift tagging personnel from using a new tagging order;
- the off shift tagging authority did not review the existing primary coolant system tagging order to ensure the scope was adequate for Work Order 24912943;
- the work order cover sheet descriptions of "Effect on Plant Conditions," and "Problem Description," were not revised after the work order was re-planned.

The licensee's root cause evaluation was in progress at the end of the inspection period. However, the licensee's Incident Response Team identified the following apparent causes:

- the work control scheduling process failed to ensure that the appropriate tagging order was connected to the work order after the work order was revised; and,
- the reviews performed by the off shift tagging authority personnel and person-in-charge of the work did not effectively challenge the tagging boundary adequacy, prior to releasing revised Work Order 24912943.

The inspectors noted that several interim actions were implemented to address the apparent causes which included the following:

- a new daily report was created for off shift tagging authority personnel that identified changes made to the work order tagging field in the electronic database for tracking maintenance activities;
- a documented review was required for all changes to tagging orders, including tagging orders that had work orders added to them; and,
- each work order was reviewed jointly by off shift tagging authority personnel and the person-in-charge of the work to verify tagging boundary adequacy.

The inspectors considered the interim actions as reasonable and noted that no similar incidents occurred after the interim actions were implemented. Also, the inspectors noted that the licensee's Incident Response Team findings were thorough and that the pending multi-discipline root cause evaluation was appropriate.

The inspectors noted that the loss of 6 gallons from the primary coolant system did not result in significant adverse safety consequences. However, the potential significance of the event was increased, in that, the inadvertent breach occurred while the primary coolant system was in a reduced inventory condition.

Administrative Procedure 4.10, "Personnel Protective Tagging," Revision 9, Section 5.2, required, in part, that the off shift tagging authority ensure the adequacy of tagging orders. However, the tagging order used for Work Order 24912943 was inadequate, in that, MV-ES-3106 was not isolated from the discharge of the low pressure safety injection pump. Consequently, approximately six gallons of primary coolant system inventory was inadvertently lost.

The inadequate tagging order is a violation of Administrative Procedure 4.10. This Severity Level IV Violation was self-revealing and is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy. This Violation is in the licensee's corrective action program as Condition Report 9902482. (NCV 50-255/99012-04)

c. Conclusions

The inspectors concluded that the inadvertent loss of 6 gallons of primary coolant system inventory on November 10, 1999, due to an inadequate tagging order, did not result in any significant adverse safety consequences. However, the potential significance of the incident was increased, in that, the event occurred when the primary coolant system was in a reduced inventory condition. Interim corrective actions were considered reasonable. This self-revealing incident resulted in a Non-Cited Violation.

Also, the inspectors concluded that the licensee's Incident Response Team's evaluation was thorough and that the pending multi-discipline root cause evaluation demonstrated an appropriate significance determination by the licensee's corrective action program.

M1.3 Control Rod Drive Mechanism Bearing Repairs

a. Inspection Scope (37551, 62707)

The inspectors observed portions of the repair activities that were conducted to replace the bearings in the control rod drive mechanism dual clutch assemblies. The repairs were part of the corrective actions for the one control rod that failed to fall into the core when the plant was shutdown for the refueling outage. The inspectors also reviewed applicable work orders, work instructions, and condition reports. In addition, the inspectors discussed the repair activities with engineering and maintenance personnel.

b. Observations and Findings

Control Rod 14 failed to fall into the core when the reactor was manually tripped, as planned, to start a refueling outage on October 15, 1999. Engineering personnel subsequently concluded that the rod failed to fall into the core because of hardened grease in a bearing located in the rod drive clutch assembly. (This issue was addressed in detail in NRC Inspection Report 50-255/99011(DRP)).

Engineering personnel developed a detailed troubleshooting and repair plan. During the troubleshooting inspections, engineering personnel appropriately expanded the plan's scope as more information was learned. A total of 37 control rod drive clutch assemblies, in addition to the clutch assembly for Control Rod 14, were subsequently disassembled and all the bearings were inspected.

Each control rod drive clutch assembly contained four sets of bearings which provided different functions. Following disassembly of the 37 clutch assemblies, engineering personnel identified an additional 8 bearings that were degraded and another 17 bearings that exhibited slight resistance to rotation. Of the eight degraded bearings, four served the same function as the seized bearing that prevented Control Rod 14 from falling into the core.

Maintenance personnel subsequently rebuilt 38 out of a total 45 control rod drive clutch assemblies by replacing the four sets of bearings with new bearings. One of the clutch assemblies that was disassembled was recently rebuilt in 1996. Engineering personnel did not identify any degradation of the bearings in that clutch assembly. Therefore, engineering personnel concluded that the seven clutch assemblies that had been rebuilt in 1998 did not need to be inspected or rebuilt this outage. Subsequent rod drop testing demonstrated that all the control rods were operable.

Licensee personnel have not completed the root cause evaluation for the bearing failure which is being tracked by Inspection Followup Item 50-255/99011-02.

c. Conclusions

The inspectors concluded that appropriate repairs were completed in response to the one control rod that failed to drop into the core as designed during the planned manual reactor trip on October 15, 1999. Engineering personnel developed a detailed troubleshooting and repair plan that was appropriately expanded when new information was learned.

M1.4 Class 1 Primary Coolant System Leakage Test

a. Inspection Scope (37551, 61726)

The inspectors observed the performance of RT-71A, "Primary Coolant System, Class 1 System Leakage Test." This included review of the test procedure, observations of portions of the pre-job brief and test performance, and discussions with engineering and operations personnel.

b. Observations and Findings

The purpose of this test was to verify leak tightness of the primary coolant system lines through the performance of a Class 1 System Leakage Test. The test required personnel who were qualified to perform VT-2 examinations to walkdown primary coolant system lines while the plant was at normal operating temperature and pressure.

The inspectors noted that the required plant and system conditions were met for the entire duration of the test. The inspectors accompanied and observed several of the auxiliary operators performing the test. The auxiliary operators were observed to be thorough during the walkdowns, and exhibiting a positive questioning attitude during the performance of the test. Several issues, including active leaks which required repair, were identified.

After the completion of the test, the inspectors identified that one of the five individuals performing the walkdowns was not on the approved list of VT-2 qualified examiners. A records review performed by engineering personnel revealed that the individual was previously qualified and therefore fortuitously met the qualification requirements of a VT-2 qualified examiner.

Subsequent conversations with the shift supervisor, nuclear control operator and engineer overseeing the test, revealed that no one had verified or questioned the qualifications of the individuals performing the test during either the job planning, or pre-job brief for the test. This weakness was documented by licensee personnel in Condition Report 9902914 and corrective actions were implemented to preclude recurrence.

c. Conclusions

The inspectors concluded that the primary coolant leakage test was performed by auxiliary operators in a thorough and comprehensive manner. This resulted in the identification of several issues, some of which required the repair of active system leaks. A weakness was identified, in that, during the job planning and pre-job brief neither operations nor engineering personnel responsible for the test verified that the individuals performing the test had the proper qualification. Fortuitously, one individual, who was not on the approved examiners list, did meet the required qualifications.

M3 Maintenance Procedures and Documentation

M3.1 High Pressure Safety Injection System Testing

a. Inspection Scope (37551, 71707)

The inspectors reviewed the events and circumstances surrounding a self-revealing event that occurred during the restoration from surveillance testing. The event resulted in the inadvertent transfer of approximately 6,000 gallons of water from the safety injection refueling water storage tank to the primary coolant system. The inspection activities included a review of the applicable condition report, the root cause evaluation, and the surveillance procedure.

b. Observations and Findings

On November 2, 1999, the control room operators restored the system lineup after Surveillance Test Procedure RO-65, "High Pressure Safety Injection Trains 1 and 2, and Hot Leg Injection Check Valve Test and Cold Leg/Hot Leg Flow Balance Test,"

Revision 18, was completed. The operator repositioned the system valves to the "as found" position in the order listed in the procedure.

The safety injection refueling water storage tank outlet valve, CV-3031, was opened before closing the suction valve to the shutdown cooling pump, MO-3189. The prescribed actions inappropriately aligned a flow path from the refueling water storage tank to the primary coolant system. Consequently, approximately 6,000 gallons of water was inadvertently transferred from the storage tank to the primary coolant system when the plant was in the refueling mode.

The inadvertent transfer was recognized by the Nuclear Control Operators in less than a minute and was terminated approximately two minutes after the transfer was initiated. Therefore, no significant adverse consequences resulted from the inadvertent transfer.

Licensee personnel generated Condition Report 992307 to document the incident. The condition report was appropriately assigned the next to the highest significance level (Level 2) which required a root cause evaluation. Also, Procedure RO-65 was appropriately revised.

The inspectors considered the root cause evaluation that was conducted by licensee personnel as thorough and self-critical. Licensee personnel concluded that the root cause was an error in the surveillance procedure. The error was introduced when engineering personnel who developed the procedure failed to recognize the inherent flaw associated with using the same checklist for the initial test setup and the restoration alignment.

Several factors that contributed to the incident were identified which included the following:

- the operating crew performing the test failed to recognize the potential for the inadvertent transfer to occur;
- all the operating crew members were not aware that the test was going to be performed due to a lack of communication;
- the operating crew was not made aware of a similar problem that was identified the previous day during preparation for a different test which involved the same equipment; and,
- the operating crew which was originally scheduled and had prepared for the test did not actually perform the test because of a change in the outage schedule.

Also, engineering and operations personnel demonstrated a lack of rigor regarding attention to detail during the procedure development and technical review which contributed to the deficient procedure.

Selected tests were reviewed by the work control center or the on-shift personnel within 48 hours of the work being performed, as an interim corrective action that was implemented during the outage. The reviews were completed to identify key interface

points, and to ensure that the combination of existing system and test alignments would not result in unintended flow paths. In addition, the key interface points were verified acceptable within 12 hours of performing the test. The inspectors noted that the interim corrective actions effectively precluded any additional similar events during the outage.

The corrective actions to prevent recurrence were documented in the evaluation of Condition Report 992307 and included the following:

- transfer ownership of writing technical specification surveillance procedures to the operations technical support group; and,

- review and clarify, as necessary, the expectations for the roles and responsibilities of operations department personnel during a refueling outage.

The inspectors considered the corrective actions to prevent recurrence as reasonable.

10 CFR Part 50, Appendix B, Criterion 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. Surveillance Procedure RO-65, an activity affecting quality, was not appropriate to the circumstances, in that, the procedure prescribed a flow path alignment that resulted in an inadvertent transfer of water from the safety injection refueling water storage tank to the primary coolant system. This Severity Level IV Violation was self revealing and is being treated as a Non-Cited Violation, consistent with Section VII.B.1.a of the NRC Enforcement Policy. This Violation is in the licensee's corrective action program as Condition Report 992307. (NCV 50-255/99012-05)

c. Conclusions

The inspectors concluded that no significant adverse consequences resulted from the inadvertent transfer of approximately 6,000 gallons of water from the refueling water storage tank to the primary coolant system on November 2, 1999. The root cause was determined to be an error in the surveillance procedure that was developed by engineering personnel. Also, the procedure deficiency demonstrated a lack of rigor regarding procedure development and technical review by engineering and operations personnel. This self-revealing event resulted in a Non-Cited Violation.

The licensee's root cause evaluation was considered thorough and the corrective actions to prevent recurrence were reasonable. The operating crew quickly recognized and terminated the inadvertent transfer which minimized the potential adverse consequences.

ENGINEERING

E1 Conduct of Engineering

E1.1 General Comments (37551)

The inspectors noted that engineering personnel pro-actively supported the refueling outage activities through timely and thorough support for emergent issues. In general, engineering personnel resolved the issues in a methodical, deliberate, and conservative manner which demonstrated a positive focus on safety. The inspectors' observations were consistent with past outages.

E1.2 Emergent Equipment Issues

a. Inspection Scope (37551)

The inspectors reviewed applicable condition reports, engineering evaluations, Updated Final Safety Analysis sections, and associated operability recommendations for several emergent equipment problems during the outage. In addition, the inspectors observed several status meetings and conducted inspections of ongoing work activities related to the emergent equipment issues.

b. Observations and Findings

Several equipment problems emerged during the outage which challenged the engineering organization. One equipment problem identified by engineering personnel pertained to a degraded moisture barrier between the containment floor and the containment liner. In addition, corrosion on the containment liner plate was identified in several locations. Engineering personnel generated Condition Report 9902035 to document the issue in the licensee's corrective action program.

Engineering personnel developed a detailed plan to analyze the scope of the problem and to repair the degraded moisture barrier. The moisture barrier was subsequently restored and, based on non-destructive examination testing, engineering personnel determined that the containment liner plate was not degraded. Therefore, engineering personnel concluded that the containment liner was operable. The inspectors reviewed the operability assessment and did not identify any concerns. Engineering personnel assigned to the issue demonstrated ownership for the problem that contributed to timely and effective resolution.

However, some emergent issues revealed a lack of knowledge regarding system design or a lack of system configuration control by engineering personnel. For example:

- The containment sump screen, as found, was not welded to the frame along 1/3 of the screens length as assumed in previous engineering calculations. Engineering personnel conducted extensive testing and subsequently concluded that the as-found configuration was acceptable. The inspectors reviewed the

operablility assessment, conducted an inspection of the containment sump, and did not identify any concerns.

- The nonsafety-related control rod drive mechanism cooling system ventilation louvers were found closed during the 1996 refueling outage. Therefore, cooling to the control rod drive mechanisms and seal housings was significantly reduced. Consequently, the potentially increased temperatures may have contributed to the failed bearing on the control rod drive mechanism (see Section M1.3) and the cracks that were identified on the control rod drive seal housings (see Section E8.2). The impact that the decreased cooling flow had on the control rod drive mechanisms and seal housings was being evaluated by engineering personnel during the root cause analysis which has not been completed.

  Engineering personnel identified this issue while investigating the control rod drive mechanism bearing failure and seal housing cracks which demonstrated a positive questioning attitude. However, available temperature profile data indicated that the system had been incorrectly configured for several years. Also, the inspectors noted that the system's design configuration was not well understood by engineering personnel. The ventilation louvers were subsequently pinned open and satisfactorily tested.

c. Conclusions

The inspectors concluded that engineering personnel demonstrated ownership for the degraded containment liner moisture barrier which was resolved in a timely and effective manner. Also, engineering personnel identified that the nonsafety-related control rod drive mechanism cooling system's ventilation louvers were not open which demonstrated an effective questioning attitude.

However, plant data indicated that the nonsafety-related control rod drive cooling system was incorrectly configured for several years which demonstrated a lack of configuration control. Also, the containment sump screen was not welded to the frame along 1/3 of the screens length as assumed in previous engineering calculations which demonstrated a lack of system design knowledge by engineering personnel.

E1.3 Low Pressure Safety Injection System Testing

a. Inspection Scope (37551, 71707)

The inspectors observed portions of the testing and troubleshooting activities that were conducted to investigate an emergent equipment problem associated with the low pressure safety injection system. In addition, the inspectors reviewed applicable test procedures, Technical Specifications, sections of the Updated Final Safety Analysis Report, historical test data, engineering analyses, and condition reports. Also, the inspectors observed the associated Plant Review Committee Meeting.

b. Observations and Findings

The low pressure safety injection system failed Surveillance Test QO-8B, "Engineered Safeguards System Check Valve Operability Test and Low Pressure Safety Injection Motor Operated Valve Position Verification Test," on November 28, 1999. Inadequate flow was indicated in injection loops 2A and 2B, with loop 2B exhibiting the lowest indicated flow. Operations personnel declared the low pressure safety injection system inoperable and generated Condition Report 9902812. The condition report was assigned the next to highest significance level (Level 2) and required a root cause evaluation. In addition, this non-emergency event was appropriately reported to the NRC in accordance with 10 CFR 50.72(b)(2)(i).

Engineering personnel conducted extensive troubleshooting activities which analyzed individual system components by aligning the system in various configurations. System testing was conducted over several days and operations personnel collected data that was subsequently analyzed by engineering personnel. Engineering personnel did not identify any failed components or obstructions within the system during testing. Also, system flow data obtained during testing this outage replicated the flow data that was documented during system testing in 1993. Therefore, engineering personnel concluded that the low pressure safety injection system had not degraded.

Subsequently, engineering personnel determined that the test acceptance criteria specified in QO-8B was not valid based on the following:

- The acceptance criteria was increased in 1996 to address instrument uncertainty which was subsequently determined to be conservative. The acceptance criteria was again increased in 1999 to incorporate a future Improved Technical Specification requirement to verify that the low pressure safety injection motor operated valves were in the proper position. Collectively, the two revisions increased the acceptance criteria beyond system capabilities.

- Engineering personnel consulted with the fuel vendor to determine if the assumed minimum required low pressure safety injection flow that was specified in the accident analysis could be decreased. Engineering personnel determined, as documented in EA-GEJ-99-01, "Palisades Cycle 15 Safety Analysis Report Review," that the minimum assumed low pressure safety injection flowrate could be decreased and still meet emergency core cooling system acceptance criteria. Therefore, the acceptance criteria specified in QO-8B was considered overly conservative by licensee personnel.

- Procedure QO-8B aligned the low pressure safety injection system differently than during an accident condition. Engineering analysis, EA-LPSI-99-01, "Low Pressure Safety Injection Testing Correction Factor Determination," was performed to determine and quantify the effects on the low pressure safety injection system from the different lineups.

  Specifically, during test QO-8B, the low pressure safety injection pump suction was aligned to the primary coolant system. However, during an accident the pump suction would be aligned to the safety injection refueling water storage

tank which was located at a higher elevation than the primary coolant system piping. The resultant available suction head to the low pressure safety injection pumps would be greater when aligned for an accident. The acceptance criteria specified in QO-8B did not account for the difference in available suction head to the low pressure safety injection pumps when aligned for an accident. Therefore, the acceptance criteria specified in QO-8B was considered overly conservative by licensee personnel.

Engineering personnel failed to recognize how the test acceptance criteria validity was impacted during individual past revisions to test procedure QO-8B. Consequently, the resolution of this issue required extensive testing and detailed engineering analysis to prove that the low pressure safety injection system was operable.

Subsequently, the acceptance criteria specified in QO-8B was revised by licensee personnel to incorporate the new accident analysis flow rates, appropriate correction factors, and instrument uncertainties. Subsequent low pressure safety injection system testing was completed satisfactorily. Therefore, engineering personnel concluded that the low pressure safety injection system was operable and that the previous test acceptance criteria was inappropriate. In addition, the issue was discussed with plant management at a Plant Review Committee meeting. The Plant Review Committee concluded that there were no nuclear safety issues. Subsequently, licensee personnel retracted the non-emergency event report that was made to the NRC on November 28, 1999.

During a review of historical test data, the inspectors noted that 1996 QO-8B test data indicated that the flow in one loop was less than the specified acceptance criteria with a single pump running. However, the scope of the test, at that time, was to ensure that the system check valves would go full open. Therefore, the procedure allowed a second pump to be started if adequate flow was not obtained with a single pump running. After a second pump was started, per the procedure, adequate flow was exhibited which demonstrated check valve operability.

The inspectors noted that during the 1996 test, the low pressure safety injection system was aligned with the single pump running as would be expected for the analyzed large break loss of coolant accident. Also, test data documented that the low pressure safety injection system flow to the one loop was less than the required amount of injection flow that was established, at that time, for accident conditions. Consequently, the low pressure safety injection system design capability for analyzed accidents was suspect.

However, engineering and operations personnel failed to recognize that the system's ability to satisfy design criteria was suspect in 1996. Therefore, licensee personnel failed to question the operability of the low pressure safety injection system following the test.

Fortuitously, calculations performed during this outage concluded that the low pressure safety injection system would have provided the required amount of cooling flow to the reactor core during a design basis accident. Therefore, the low pressure safety injection system was considered operable in 1996. The inspectors reviewed the operability assessment and did not identify any concerns.

c. Conclusions

The inspectors concluded that engineering personnel failed to recognize how the test acceptance criteria validity would be impacted during past revisions to low pressure safety injection system test Procedure QO-8B. Consequently, an issue emerged during the outage that required extensive testing and detailed engineering analysis to prove that the low pressure safety injection system was operable. The resultant operability assessment was considered thorough.

Also, the inspectors concluded that engineering and operations personnel demonstrated an ineffective questioning attitude during past low pressure safety injection system testing. Documented data from testing conducted in 1996 indicated that the low pressure safety injection system's design capability was suspect which was not recognized by engineering or operations personnel. Fortuitously, calculations performed during this outage concluded that low pressure safety injection system was operable in 1996.

E8 Miscellaneous Engineering Issues (92700)

E8.1 (Open) Licensee Event Report 50-255/99-003: Reduction in Service Water Flow Through Containment Air Coolers VHX-1 and VHX-2.

On October 29, 1999, non-intrusive check valve testing was performed on Containment Air Coolers VHX-1 and VHX-2. Indicated flow in the test alignment was observed at approximately 1,450 gallons per minute for VHX-1 and 700 gallons per minute for VHX-2. The safety function of the containment air cooler discharge check valves was to remain open in order to pass a minimum of 1,600 gallons per minute service water flow to limit post accident containment pressure and temperature.

On October 31, 1999, visual examinations of the containment air cooler discharge check valves was performed. The discs on check valves CK-SW407 and CK-SW408, for containment air coolers VHX-1 and VHX-2 respectively, were found detached and wedged in the respective check valve outlet ports. The configuration of the discs in the outlet ports obstructed the valve outlets in the service water flow path for VHX-1 and VHX-2.

A review of recent service water history prior to the start of the refueling outage was conducted. On September 15, 1999, a sudden unexplained drop of approximately 400 gallons per minute of containment service water was observed. At that time, licensee personnel believed the reduction in flow was due to a variance in the flow indication, not an actual reduction in service water flow. Licensee personnel speculated that this may have been the time when one of the check valves failed. Further licensee analysis concluded that the other check valve had failed prior to September 15, 1999.

The licensee initiated immediate corrective actions including refurbishment and enhancements to the check valves. The enhancements made to the check valves were expected to ensure the check valves would remain intact for the upcoming fuel cycle. In addition, the licensee was exploring ways to operate the containment air coolers with

increased service water flow to minimize the opportunity for excess check valve wear. The licensee was still addressing the Technical Specification issues and safety significance of this event at the end of the inspection period. Analyses of the event considering the impact of reduced flow through the two containment air coolers was also in progress. This item will remain open pending completion of the licensee's analysis of the event.

E8.2 (Open) Licensee Event Report 50-255/99-004: Control Rod Drive Seal Housing Leaks and Crack Indications.

Following the reactor shutdown for the refueling outage, licensee personnel inspected reactor head components identified moisture and boric acid deposits on the exterior surfaces of three control rod drive seal housings. The control rod drive seal housing assemblies make up a portion of the American Society of Mechanical Engineers Class 1 Primary Coolant System Pressure Boundary. The three control rod drive seal housings were removed from the reactor head and subjected to nondestructive visual and dye penetrant examinations. The examinations determined that all three housings had crack indications in the vicinity of the "J" welds which attached the seal housing tube to the autoclave flange. In addition, the two housings with circumferential crack indications (locations CRD-10 and CRD-44) appeared to have through-wall cracks.

Based on the initial examination results, the scope of the licensee's investigation was expanded. Eventually, all 45 control rod drive seal housings were removed from the reactor head. The licensee performed examinations of all the seal housings using a combination of visual, dye penetrant, eddy current, and ultrasonic inspection techniques. The nondestructive examinations revealed that 30 of the 45 seal housing assemblies contained circumferential cracks in the vicinity of the "J" welds. In addition, three of the housings contained small axial cracks in the seal housing assembly tube walls. In addition, the two seal housings which exhibited potential through-wall cracks (CRD-10 and CRD-44) were sent to the vendor for destructive metallurgical examination.

The licensee initiated corrective actions to return the control rod drive seal housings to full compliance with the American Society of Mechanical Engineers Code requirements. The repair activities included the use of flap wheel polishing to remove all the known defects in the control rod drive seal housing assemblies. After repair, the seal housings were verified to be in a defect-free condition through the satisfactory performance of visual, dye penetrant, and eddy current testing. In addition, all installed control rod drive seal housings, with the exception of three new housings purchased by the licensee prior to the outage, were given a polished surface. The polished surface provided significantly fewer corrosion initiation sites in the seal housing which would result in the mitigation of potential crack propagation.

The licensee had initially concluded that the cause for the seal housing cracks was transgranular stress corrosion cracking, combined with an inadequate post weld heat treatment of the seal housing assemblies during the manufacturing process. At the end of the inspection period, the licensee had not received the final report on the destructive metallurgical examination of the two seal housing assemblies. This item will remain open pending inspector review of the licensee's final analysis of the root causes and

review of the destructive metallurgical examinations conducted on two of the control rod drive seal housings.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 General Comments (71750)

The inspectors observed worker radiation protection work practices during routine plant tours and observations of maintenance activities during the outage. Radiation protection technicians were noted to be pro-active during involvement with ongoing activities as part of a comprehensive effort to maintain dose as low as reasonably achievable during the entire outage.

Radiation dose awareness was heightened among all work groups during the outage. The inspectors noted the consistent and increased use of the following tools by radiation protection and plant personnel during the refueling outage:

- strategically positioned remote monitoring cameras installed inside of the reactor containment to observe work activities by radiation protection and plant personnel;
- remote electronic dosimetry was utilized which provided continuous monitoring of radiation dose of workers;
- temporary lead shielding was installed on the reactor head to reduce the general area radiation dose rates on the 649 foot elevation of reactor containment; and,
- communication headsets were utilized in the reactor containment which provided timely communications between radiation protection and plant personnel.

Radiation protection coverage was also evident for all work activities observed in containment during the refueling outage. In particular, the inspectors noted that radiation protection coverage for the removal of the Primary Coolant Pump P-50A impeller, a potentially high dose activity, was comprehensive and thorough.

Overall accumulated radiation dose for the outage based on the available electronic dosimetry data, was approximately 249.9 person-rem. This was significantly higher than the original dose projection goal of 187.5 person-rem, prior to the start of the refueling outage. Emergent equipment problems that required additional repairs, and the extended duration of the outage contributed significantly to the higher radiation dose. The electronic dosimetry data revealed that approximately 28 person-rem was incurred due to these emergent issues.

Condition Report 9902764 was generated when the original dose goal was exceeded, which demonstrated an appropriate sensitivity to maintaining radiation worker dose as

low as reasonably achievable. An evaluation of the causes for the higher than expected radiation dose was in progress at the end of the inspection. In addition, the licensee was still analyzing the personnel dosimeters, which were used to document the dose of record.

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 December 16, 1999. 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

G. R. Boss, Operations Manager
T. J. Brown, Chemical and Radiological Services
D. E. Cooper, General Manager, Plant Operations
P. D. Fitton, System Engineering Manager
J. K. Ford, Engineering Programs Manager
N. L. Haskell, Director, Licensing
K. M. Haas, Director, Engineering
P. A. Harden, Design Engineering Manager
D. G. Malone, Licensing
R. L. Massa, Shift Operations Supervisor
T. J. Palmisano, Site Vice President
L. J. Ross, Acting Manager, Maintenance and Construction
S. T. Wawro, Director, Maintenance and Planning

NRC

R. G. Schaaf, Project Manager, NRR

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 Followup of Written Reports of Nonroutine Events at Power Reactor Facilities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-255/99-003	LER	Reduction in service water flow through containment air coolers VHX-1 and VHX-2.
50-255/99-004	LER	Control rod drive seal housing leaks and crack indications.
50-255/99012-01	NCV	Technical Specification requirement not met for the operation of charcoal filter during irradiated fuel moves in the fuel storage building.
50-255/99012-02	NCV	Technical Specification requirement not met for ensuring that the steam generator secondary temperatures were less than or equal to the T-cold primary coolant system temperatures prior to starting the first primary coolant pump.
50-255/99012-03	NCV	Technical Specification requirement not met for the surveillance of fuel oil storage tank level.
50-255/99012-04	NCV	Inadequate tagging order which resulted in the inadvertent breach of the primary coolant system while in reduced inventory.
50-255/99012-05	NCV	Inadequate test procedure which resulted in the inadvertent transfer of solution to the reactor cavity.

Closed

50-255/99-005	LER	Technical Specification requirement not met for the operation of charcoal filter during irradiated fuel moves in the fuel storage building.
50-255/99-006	LER	Technical Specification requirement not met for the surveillance of fuel oil storage tank level.
50-255/99-007	LER	Technical Specification requirement not met for ensuring that the steam generator secondary temperatures were less than or equal to the T-cold primary coolant system temperatures prior to starting the first primary coolant pump.
50-255/99012-01	NCV	Technical Specification requirement not met for the operation of charcoal filter during irradiated fuel moves in the fuel storage building.

50-255/99012-02	NCV	Technical Specification requirement not met for ensuring that the steam generator secondary temperatures were less than or equal to the T-cold primary coolant system temperatures prior to starting the first primary coolant pump.
50-255/99012-03	NCV	Technical Specification requirement not met for the surveillance of fuel oil storage tank level.
50-255/99012-04	NCV	Inadequate tagging order which resulted in the inadvertent breach of the primary coolant system while in reduced inventory.
50-255/99012-05	NCV	Inadequate test procedure which resulted in the inadvertent transfer of solution to the reactor cavity.

Discussed

50-255/99011-02	IFI	Root cause evaluation associated with the failure of Control Rod Drive Mechanism No. 14.