U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No.:	50-255/97011(DRP)
Licensee:	Consumers Power Company 212 West Michigan Avenue Jackson, MI 49201
Facility:	Palisades Nuclear Generating Plant
Location:	27780 Blue Star Memorial Highway Covert, MI 49043-9530
Dates:	August 28 - October 17, 1997
Inspectors:	M. Parker, Senior Resident Inspector P. Prescott, Resident Inspector
Approved by:	Bruce L. Burgess, Chief Reactor Projects Branch 6

EXECUTIVE SUMMARY

Palisades Nuclear Generating Plant
NRC Inspection Report No. 50-255/97011(DRP)

This inspection reviewed aspects of licensee operations, maintenance, engineering and plant support. The report covers a 7-week period of resident inspection.

Operations

- The inspectors noted that operators were thoroughly prepared for a plant downpower and main turbine valve testing evolutions. Reactor engineering, system engineering and the procedure sponsor provided good support for these evolutions (Section O1.2).

- Operators failed to ensure that service water system valves were closed, which could have resulted in the potential draining of the component cooling water system in an Appendix R design bases fire. This resulted in the plant operating the facility outside the design bases for 10 days following discovery of the condition (Section O1.3).

- The licensee conservatively decided to shut down the plant due to a relatively minor increase in containment unidentified leakage. The inspectors noted that control room operators performed well in bringing the plant to hot shutdown.

- The inspectors concluded that the licensee provided good management oversight during the reactor startup, including the approach to critical with a reactivity manager and reactor engineering stationed onshift to augment shift coverage. Good conservative decision making took place on several occasions, specifically: to return the plant to a hot shutdown condition by inserting regulating rods during troubleshooting and repairs to CRDM 39, to insert all regulating rods when the ECP was not achieved with all control rods out, and to conduct a PRC meeting prior to continuation of a plant startup following the ECP discrepancy (Section O1.5).

Maintenance

- The inspectors noted the operators were challenged by a number of emergent equipment problems during the plant shutdown. This was indicative that the licensee continues to struggle with plant material condition issues (Section M1.1).

- The inspectors concluded that the maintenance procedure for repair of the waste gas surge tank was inadequate for the circumstances. The procedure allowed the waste gas surge tank to be vented to the auxiliary building atmosphere by allowing the gagging of relief valve, RV-1114, resulting in the contamination of five individuals during a routine VCT gas sample. The use of the procedure should have caused operators to question the potential for a breach of the waste gas surge tank discharge piping. Also, adequate equipment controls were not provided to prevent personnel contamination. The inspectors concluded that the use of a fluted tap by maintenance personnel when a 2 inch threaded bolt was specified in the work procedure was inappropriate and contributed to the contamination of personnel (Section M1.2).

Engineering

- The inspectors found the compensatory measures taken for the identified Appendix R issues to be adequate. The Appendix R enhancement review was found to be progressing slowly. However, the review appeared to be thorough (Section E1.1).

Plant Support

- The licensee's actions to improve the resin transfer process resulted in an error-free evolution for the spent fuel pool job (Section R1.1).

Report Details

Summary of Plant Status

The plant operated at essentially full power for the inspection period until September 19,1997. At 9:21 p.m., EST, a power reduction was commenced to 84 percent to perform turbine valve testing and repacking of a heater drain pump. Operations returned the plant to full power on September 21, 1997 at 8:00 a.m. On September 29, 1997, at 8:30 p.m., a plant shutdown was initiated to facilitate repairs on a small leak on a primary coolant pump leakoff line. The turbine was taken offline at 5:14 a.m. on September 30, 1997. The reactor was subcritical at 11:00 a.m. The forced maintenance outage was completed on October 15, 1997, when the reactor went critical at 1:00 p.m. The generator was synchronized and breaker closed at 11:39 p.m.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

Using Inspection Procedure 71707, the inspectors conducted frequent reviews of ongoing plant operations. The conduct of operations was considered by the inspectors to be good; specific events and noteworthy observations are detailed below.

O1.2 Reactor Downpower and Main Turbine Testing

a. Inspection Scope (71707)

The inspectors observed the conduct of control room operations for the downpower to repack heater drain pump P-10B and perform main turbine valve testing. Applicable procedures were reviewed.

b. Observation and Findings

On September 19, 1997, the inspectors observed control room operators commence a downpower to 85 percent reactor power. The purpose of the downpower was to allow operation with only one heater drain pump. Heater drain pump P-10B required repacking due to excessive leakage and testing of the main turbine governor and stop valves was to be performed. No operator performance weakness were noted. An extra nuclear control operator was added to support the shift and the inspectors noted good operator attentiveness to panels. A reactor engineering supervisor observed the downpower and issued appropriate guidance to maintain a proper axial shape index curve. The procedure sponsor was also present to monitor the downpower activity and verify the adequacy of the downpower procedure. System engineering monitored vibration due to concerns with the increased main turbine and generator vibrations caused by the missing piece of shroud on the low pressure turbine rotor stage. No problems with vibrations were noted.

Prior to testing of the main turbine governor and stop valves the operations shift had "just in time" training on the simulator. A question was asked by operators regarding how to

back out of the surveillance should a problem occur requiring a rapid downpower. The question was resolved prior to commencing the test by assigning an extra nuclear control operator to enhance control room panel monitoring. System engineering monitored main turbine and generator vibrations during the testing. No testing problems were identified.

c. Conclusions

The inspectors noted thorough preparedness by operations for the downpower and main turbine valve testing evolutions. Reactor engineering, system engineering and the procedures sponsor provided good support for these evolutions.

O1.3 Inadequate Appendix R Compensatory Measures

a. Inspection Scope (71707)

The inspectors reviewed the licensee's corrective actions taken in response to a reportable 50.72 involving a condition outside the design basis. This condition is the result of an Appendix R fire involving the component cooling water (CCW) and service water (SW) seal cooling valves for the essential safety systems (ESS) pumps. The licensee identified that during a control room fire a hot short may fail open interfacing CCW/SW systems valves resulting in the loss of all CCW water to the SW system. The most limiting scenario could lead to draining of the CCW system in approximately 25 seconds.

b. Observations and Findings

On September 12, 1997, as an interim compensatory measure for the potential Appendix R component cooling water loss of inventory scenario, an auxiliary operator was directed to place caution tags on the air supply valves to CV-0951, CV-0880 and CV-0879. Caution tags were also placed on the respective control switches in the control room. This compensatory measure was proposed as corrective action for condition report C-PAL-97-1270, which had detailed the Appendix R scenario. The air supply valves were required to be in the closed position to ensure the valves would not inadvertently open.

The onshift shift supervisor and auxiliary operator located the three valves to be caution tagged in the plant. The auxiliary operator manipulated the air isolation valve to ensure they were open. This was observed by the shift supervisor. At this point, the shift supervisor was uncertain how much the auxiliary operator comprehended about the required task. Also, the auxiliary operator did not realize that to immediately resolve the issue the desired position for the air isolation valves was closed. The onshift senior reactor operator guidance to the auxiliary operator was to hang the tags. The auxiliary operator was not specifically directed by the shift supervisor to place the valves in the closed position. There is no procedural requirement that when caution tags are used, plant equipment is verified to ensure it is left in the required position.

A nuclear control operator was tasked to hang the caution tags. The nuclear control operator directed the auxiliary operator to hang the caution tags on the control valve air isolation valves. At this point, the nuclear control operator was uncertain if he directed the auxiliary operator to close and tag, or just tag the valves. The nuclear control

operator assumed the auxiliary operator understood the issue and knew what actions were required to properly implement the caution tag requirements. The assumption was based on the fact the auxiliary operator had earlier walked down the valves with the shift supervisor.

The auxiliary operator proceeded to hang the caution tags on the air isolation valves. The auxiliary operator did not close the air isolation valves because he understood that they needed to remain open to maintain the control valves closed. This was reinforced by the fact that during the walk down the auxiliary operator manipulated the valves in front of the shift supervisor to show the valves were in the open position. The auxiliary operator does not recall ever being told by either the shift supervisor or nuclear control operator that the valves needed to be closed.

Guidance under the "Special Instructions "portion of the caution tags read, "Do not open without SS permission." There was no specific direction to suggest to the operator that the air supply valves were to be shut at the time the tags were hung.

On September 24, 1997, permanent placards were placed in the control room to indicate that the air supply valves were permanently closed. The system checklist procedure was revised with the normal position of the valves indicated as "closed." A different auxiliary operator removed the temporary caution tags and attached permanent caution tags. The auxiliary operator found the air supply valves were open and not closed.

The failure to ensure adequate compensatory measures were taken to address the Appendix R concern is considered a Violation of 10 CFR 50 Appendix B, Criterion XVI, "Corrective Action." However, the inspectors reviewed this licensee's actions for this self-identified item and determined this was a Non-Cited Violation consistent with Section VII.B.1 of the Enforcement Policy (NCV No. 50-255/97011-02).

c. Conclusions

The onshift operations personnel failed to take adequate measures to ensure the air supply valves to three SW valves were left in the proper valve configuration. Failure to ensure the air supply valves were closed could have resulted in the potential draining of the CCW system in the event of an Appendix R fire. This resulted in the plant operating the facility outside the design bases for 10 days following discovery of the condition. This was considered a non-cited Violation.

O1.4 Reactor shutdown for Forced Maintenance Outage

a. Inspection Scope (71707)

The inspectors observed the pre-job brief, simulator "just in time" training and the plant shutdown for a maintenance forced outage.

b. Observations and Findings

The control room operators commenced an orderly shutdown of the reactor on September 29, 1997. The shutdown was initiated due to increased unidentified primary coolant system leakage. Primary coolant system leakage had risen from an average of

0.05 gpm to 0.199 gpm over the last four days. Inspection of the containment identified the source of the leak as a cracked weld on a seal package controlled bleedoff line for the P-50A primary coolant pump.

Operators held a pre-job brief and simulator "just in time" training prior to commencing the shutdown. The pre-job brief was thorough. Roles and responsibilities were discussed between the members of the operations shift. The operations superintendent provided management oversight of these activities and subsequent shutdown. The inspectors noted that the nuclear control operator (NCO) responsible for control rods and reactor power and the other NCO responsible for turbine load reduction had not previously performed a reactor shutdown. An extra NCO was assigned to the shift. This NCO was assigned responsibility for maintaining proper feedwater flow and monitoring other balance of plant equipment.

The simulator instructor discussed in detail a December 2, 1995, event following a turbine trip. A high startup rate was observed while withdrawing control rods to maintain primary coolant system temperature. The instructor stressed that review of the event noted the NCO attempted to control T_{ave} with control rods. However, at that point in time reactor power was at approximately 10^{-1} percent power and the control rods had little or no effect on T_{ave}. The instructor indicated that T_{ave} should be controlled by decay heat removal through the turbine bypass valve.

During the first simulator practice at taking the turbine and generator offline, simulator parameters were difficult to control for the operators. Initial simulator conditions caused feedwater oscillations and a 4°F difference in temperature between T_{ref} and T_{ave}. The inspectors noted a weakness in three-way communication with the shift. A subsequent rerun on the simulator with more normal shutdown conditions noted improved shift performance.

The off-going shift supervisor conducted a brief with the on-coming crew prior to the conduct of the normal shift turnover. The oncoming crew assumed the shift with the plant at approximately 85 percent reactor power. The crew commenced a turbine load reduction at 24 percent an hour. The downpower proceeded in an orderly manner. However, at approximately 23 percent reactor power, a problem arose during the transfer of electrical loads from the station power to startup transformer. The G bus breaker 252-402 would not close. The G bus supplies power to one of the two cooling tower pumps, P-39B. The inspectors noted a momentary loss of command and control because the shift supervisor and control room supervisor were focused in the effort to reclose the breaker. The impact of the loss of one of the cooling tower pumps would be relatively minor on condenser vacuum at this power level. At this time, the operators were also contending with xenon buildup and its impact on reactor power. Further attempts to close the breaker were unsuccessful. The shift supervisor and control room supervisor re-focused on the plant shutdown. At approximately 18 percent power, operators noted that the condensate pump recirc valve CV-0730 was not opening as expected. The control room supervisor quickly anticipated plant conditions and the actions required to address the problem. At approximately 7 percent power the turbine was taken offline, the main feedwater pump was taken offline and auxiliary feedwater lined up. The failure of CV-0730 required the condensate pumps to be shut off to prevent damage to the pump due to low flow conditions. The main steam isolation valves were closed, which meant loss of the bypass valve to control primary coolant system

temperature. The automatic dump valves opened to control primary coolant system temperature. The inspectors noted one other discrepancy. During the control room supervisor's discussion of the sequence of events that would occur due to the failure of CV-0730, the NCO controlling reactivity believed he would control temperature with control rod movements. In actuality, the NCO's function was to control reactor power. This had been reviewed during the simulator training.

c. Conclusions

The licensee conservatively decided to shut down the plant due to a relatively minor increase in containment sump level. The inspectors noted that control room operators performed well in bringing the plant to hot shutdown. A momentary weakness in command and control was noted when the shift supervisor and control room supervisor were overly involved in attempts to close breaker 252-402 to maintain cooling tower pump P-39B online.

O1.5 Startup From Forced Outage

a. Inspection Scope

The inspectors observed the initial and subsequent successful attempts for plant startup after completing a forced maintenance outage. The main reason for the outage was to repair a cracked weld of the pump seal package controlled bleedoff line for P-50A primary coolant pump. "Just in time" simulator training and pre-job brief for the initial startup were also observed.

b. Observations and Findings

On October 8, 1997, operators commenced heatup of the primary coolant system. On October 9, 1997, at 9:05 EST, the plant exited cold shutdown. On October 10, 1997, the oncoming crew received "just in time" training and conducted a pre-job brief in preparation for the approach to critical. The inspectors noted both the simulator training and pre-job brief were well conducted.

However, the off-going shift received the primary coolant pump high/low alarm. Operations determined the alarm was caused by the purification demineralizer inlet relief valve RV-2013 lifting. The relief valve lifted when the third letdown orifice stop valve opened, which caused an excessive differential pressure across the demineralizer. Radiation protection subsequently notified operations of water leakage in the auxiliary building. This was traced to the vent hole in the bonnet of RV-2013. A condition report was initiated to determine why the relief valve lifted. A primary coolant system leak rate was performed. Leakage had increased from .033 gpm to .3 gpm.

Another problem occurred during performance of procedure RO-21, "Control Rod Drive System Interlocks." Control rod drive mechanism (CRDM) 31 acted sluggish compared to the other control rod drives. Operations discussed the issue with system engineering. A determination was made to perform RO-22, "Control Rod Drive Drop Timing," for CRDM 31 to ensure there was no mechanical binding which could prevent the control rod from being inserted into the reactor core. The licensee subsequently decided to place the plant in cold shutdown and in order to facilitate repairs to RV-2013 and CRDM 31.

Cold shutdown was reached on October 11, 1997. The rod drive for CRDM 31 was replaced.

On October 13, 1997, with all repairs completed to CRDM 31 and RV-2013, the licensee commenced a reactor heatup to hot shutdown. On October 14, 1997, with the plant on the approach to critical, CRDM 39 was found to exhibit sluggish movement with respect to the remainder of rods in Group 4. CRDM 39 was subsequently declared inoperable. In order to facilitate troubleshooting and repairs, management directed the plant to be placed in a hot shutdown condition, requiring all rods to be inserted into the reactor core. Troubleshooting indicated that the motor's auxiliary contactors did not makeup properly. A decision was made to replace the contactors while holding the plant in a hot shutdown condition.

On October 15, 1997, with the relay contactor replaced, the plant proceeded on with the approach to critical with no further difficulties with CRDM 39. During the approach to critical all regulating rods were withdrawn without achieving a critical condition. Initial review of conditions by the inspectors determined that with all rods out, the estimated critical position (ECP) was within the bounds of the uncertainty analysis window indicated in technical specifications, although reactor engineering had predicted a critical rod position on regulating rod Group 4. The licensee subsequently inserted all regulating control rods and requested a resample of the primary coolant system boron.

Reanalysis of primary coolant system (PCS) boron concentration determined that the PCS boron concentration was within the limits of the established ECP critical boron concentration. The licensee determined that the ECP anomaly was due to boron-10 depletion. The estimated ECP was recalculated to compensate for depleted boron-10 concentration. A plant review committee (PRC) meeting was convened to review the condition report on ECP anomaly and agreed with reactor engineering's conclusions that the anomaly was due to boron-10 depletion. The ECP was calculated to be within the TS limits of 1 percent anomaly.

The new ECP was calculated with a lower boron concentration resulting in criticality with Group 4 rods partially withdrawn. Criticality was subsequently achieved on October 15, 1997, within limits of the reestablished ECP. The turbine was synchronized to the grid without incident. During the startup and attempts to achieve criticality, the inspectors noted good command and control with appropriate conservative decision making. Three way communication and use of procedures were noted by the inspectors. Good management oversight was also provided during the startup including the approach to criticality, with a reactivity manager and reactor engineering stationed on shift to augment shift coverage.

c. Conclusions

The inspectors concluded that the licensee provided good management oversight during the reactor startup including the approach to criticality with a reactivity manager and reactor engineering stationed onshift to augment shift coverage. Good conservative decision making took place on several occasions, specifically: to return the plant to a hot shutdown condition by inserting regulating rods during troubleshooting and repairs to

CRDM 39, to insert all regulating rods when ECP was not achieved on an all rods out condition, and to conduct a PRC meeting prior to continuation of a plant startup following the ECP discrepancy.

O8 Miscellaneous Operations Issues (92701 and 92901)

O8.1 (Closed) Violation 50-255/94014-1A: Operations failed to ensure that the control rod drive mechanisms (CRDMs) were mechanically locked prior to inserting a reactor trip signal, resulting in the CRDM racks dropping into the reactor vessel upper guide structure. On November 7, 1996, preparations were being made to remove the reactor vessel head. Operations discussed the status of the uncoupling of the CRDMs, in support of reactor vessel head removal, with Refueling Services. It was understood that the Refueling Services procedure was the controlling document. Operations then withdrew 44 of the 45 control rod drive racks. However, control rod drive (CRD) number 33 was stuck. Maintenance personal began troubleshooting CRD 33. Operations, in a subsequent shift turnover, failed to specify the Refueling Services procedure as the document controlling the CRDMs. Maintenance, upon completing repairs to CRD 33, withdrew it and mechanically locked CRD 33 in place. The shift supervisor was notified of CRD 33 being repaired, withdrawn and locked into place. The shift supervisor assumed the next step was to place the reactor protection system in the reactor trip mode. The shift supervisor did not verify the status nor the controlling procedure of the control rod drive racks. When the shift supervisor directed that the reactor protection system be placed in the reactor trip mode, all control rod drive racks except CRD 33 reinserted into the reactor. The Refuel Services procedure allowed the control rod drive racks to be locked after all the racks were withdrawn.

On November 18, 1996, the licensee suspended all refueling work and conducted a standdown meeting to reinforce nuclear, radiation and industrial safety concerns with all work groups. Several events over the first two weeks of the outage were reviewed. A common theme between events was the lack of communications between work groups and alignment among workers.

Three specific responsibilities reinforced at the operations standdown meetings were:

- Shift supervisors will identify operations activities from the outage schedule with an understanding of the relationship between these activities and others. The purpose of this action is to contribute to informed decision making within the operations organization.

- Work control senior reactor operators are to route work activities having operations involvement to control room personnel for authorization. This action will provide a direct exchange of information between work control and control room personnel.

- Control room personnel are to ensure they have a complete understanding of activities requested of them and that proper adjustments to work activities or plant configuration have been made.

Also, the control rod drive blades and racks were inspected for damage due to the trip. No damage was identified. This item is closed.

08.2 (Closed) Violation 50-255/96014-01B: Operations shift did not return the isolation handle Y-50 to the normal position prior to returning the bypass handle to the automatic position, resulting in a loss of power to instrument AC bus Y-01. Circumstances that caused this event were similar to those detailed in 50-255/96014-01A. The event occurred on November 17, 1996. Reasons for this event included inadequate understanding of the work scope, inadequate communications, inadequate work control documents and improper equipment operation.

The same specific responsibilities reinforced at the November 18, 1996 operations department standdown meetings detailed in 50-255/96014-01A above, were also part of the corrective actions for this event. Additional corrective actions taken were:

- All operations personnel involved discussed this event and the barriers that could have prevented it. The discussion included responsibilities for proper communication, pre-job briefings, self checking and other aspects of operator conduct.

- The shift operations supervisor briefed all senior reactor operators on the need to identify and conduct pre-job briefs. The expectation was reinforced to conduct a pre-job brief whenever coordination between two or more work groups is required.

- The maintenance and construction manager reinforced pre-job brief expectations with maintenance and construction supervisors, using this event as an example.

This item is closed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (62707 and 61726)

The inspectors observed all or portions of the following work activities:

Work Order No:

- 24713553: CV-0733 Blowdown isolation valve: Troubleshoot increased stroke time
- 27412530: P-55B charging pump: Repack and reassemble pump
- 24514171: P-55B Seal lubrication pump: Reterminate seal lube motor leads
- 24712252220: Dry fuel storage cask: Loading, dry runs
- 081397HN01: Sluice T-50 Spent fuel pool demineralizer

- 24711013: Heater drain pump P-10B: Repack
- 24711141: Heater drain pump P-10B: Fitting upstream of MV-HED114 leaking. Repair

Surveillance Activities

- MO-38: Auxiliary Feedwater System Monthly Test Procedure (P-8C)
- SOP-8 Attachment 2: Testing of Main Turbine Valves/Protective Trips
- GOP-12: Heat Balance Calculation

b. Observations and Findings

The inspectors found the work performed to be professional and thorough. All work observed was done with the work package present and in active use. Work packages were comprehensive for the task and post maintenance testing requirements were adequate. The inspectors frequently observed supervisors and system engineers monitoring work. When applicable, work was done with the appropriate radiation control measures in place.

c. Conclusions

Overall, the inspectors observed good procedure adherence, maintenance and radiation worker practices. Specific observations are detailed below.

M1.2 Volume Control Tank Gas Sample Leak into the Auxiliary Building

a. Inspection Scope

On August 12, 1997, during a routine volume control tank (VCT) gas sample by a chemistry technician, radioactive gas was released into the auxiliary building via the waste gas system contaminating several individuals. The inspectors observed the licensee's actions to identify the source of the system leakage and the impact on the contaminated individuals.

b. Observations and Findings

On August 12, 1997, waste gas compressor, C-50A, was tagged out of service (OOS) due to ongoing maintenance. During the time the waste gas compressor was OSS, a chemistry technician received permission from the operating shift to sample the VCT. During the sampling process, the purged gasses from the VCT were discharged to the waste gas surge tank room, subsequently contaminating the maintenance crew.

In reviewing the switching and tagging orders for the maintenance activity, the inspectors determined that the VCT sampling should not have had any effect on the maintenance activity. However, in reviewing the work instructions, Permanent Maintenance Procedure WGS-M-2, "Inspection and Repair of Waste Gas Compressors, C-50A and C50B," the

inspectors noted that the procedure requires the use of a relief valve gagging device to be installed on the discharge of C-50A. The procedure requires the use of a two inch long bolt to be installed as a gagging device on relief valve, RV-1114. This gagging device was installed to prevent an inadvertent relief valve lift during hydrostatic pressure testing following repairs. However, a proper size bolt was not available and a fluted tap was installed in its place. The installation of a gagging device resulted in breaching the system boundary. The fluted tap verses a threaded bolt further compounded the situation in that it resulted in a larger opening in the discharge piping. The installation of the gagging device resulted in inadvertently venting the waste gas surge tank to atmosphere, as the relief valve discharges to the waste gas surge tank. Thus once the VCT gasses were purged to the waste gas surge tank, they were vented back through the relief valve's discharge line to the auxiliary building atmosphere. The VCT sampling resulted in a release of radioactive gases to the waste gas surge tank room where the maintenance crew was working on the waste gas compressor. All five individuals working on the compressor at the time of the radioactive release were found contaminated. The failure to adequately control the breaching of the relief valve discharge piping is considered a violation of 10 CFR 50 Appendix B, Criterion V, in that Permanent Maintenance Procedure WGS-M-2, was inadequate for the circumstances and resulted in the contamination of the maintenance crew.

The operating crew was alerted to the high airborne conditions when radwaste area monitor, RE-1809, alarmed and tripped the auxiliary building supply fan, V-10. Radiation protection personnel were immediately notified and restricted access to the auxiliary building and obtained air samples of the area. The released gases were subsequently discharged to the stack and had an activity level of approximately 1300 counts per minute. The radioactive release alert alarm setpoint was 1,300,000 counts per minute.

The maintenance personnel working in the area of the waste gas surge tank room were informed of the problem and proceeded to access control. The repairmen were all monitored for contamination and all five alarmed the PCM-1B monitors at access control. All cleared the PM-7 monitors on egress to the protected area for whole body counting, after being detained at access control to allow the activity to decay. The maintenance workers were subsequently whole body counted with no positive results prior to leaving the site.

c. Conclusions

The inspectors concluded that the maintenance procedure was inadequate for the circumstances. The procedure allowed the waste gas surge tank to be vented to the auxiliary building atmosphere by allowing the gagging of relief valve, RV-1114, resulting in the contamination of five individuals during a routine VCT gas sample. The procedure did not appropriately alert operations personnel to the potential for a breach of the discharge piping. Therefore, adequate equipment controls were not provided to prevent personnel contamination. The inspectors also concluded that the use of a fluted tap by maintenance personnel when a two inch threaded bolt was specified in the work procedure, was inappropriate and contributed to the contamination of personnel.

M1.3 Complicating Factors on Plant Shutdown

a. Inspection Scope (62707)

The inspectors observed the plant shutdown for the forced maintenance outage. Several emergent equipment problems were noted.

b. Observations and Findings

The main purpose of the outage was to perform a weld repair to a cracked section of piping on the pump seal package controlled bleedoff line for P-50A primary coolant pump. The P-50A pump had small seal flow oscillations and occasional seal pressure spikes. The root cause for the line developing cracks had not yet been determined.

The original scope of the outage was significantly increased however due to several other equipment problems encountered during the shutdown. Condensate recirc valve CV-0730 failed to open at lower turbine loads. This forced operators to stop the condensate pumps and complicated the shutdown. An air leak was found in the air controller pneumatic relay assembly. The licensee determined to bring the plant to cold shutdown instead of hot shutdown due to the emergent equipment problems. With the plant in cold shutdown, the licensee also chose to replace the primary coolant pump P-50B seal package. The upper stage of the seal package had destaged and the other three stages compensate for the failed stage. The P-50A and P-50C also have seal flow oscillations of .01 gpm and .05 gpm, respectively. Also, instrumentation cables for the P-50A motor temperature indication had to be replaced due to damaged conduit which allowed water inleakage from the cracked controlled bleedoff line. Failure of the instrumentation was the means by which the licensee determined the suspected source of the primary coolant system leak.

The shutdown was also complicated by the failure of the 1-G bus breaker 252-402 to transfer from the station power to startup transformer. This forced the operators to shut down cooling tower pump P-39B. Subsequently, the breaker fast transferred when the main turbine generator was tripped.

There were other less significant operator distractions. Control rod drive number 39 was noted to be sluggish moving a few inches out of synchronization with the other control rods in its group during withdrawal. Also, the temperature margin monitor low temperature over-pressure pre-trip alarm had drifted slightly out of calibration low, causing the annunciator to frequently alarm.

c. Conclusions

The inspectors noted the operators were challenged by a number of emergent equipment problems during the plant shutdown. This was indicative that the licensee continues to struggle with significant plant material condition issues.

M8 Miscellaneous Maintenance Issues (92902 and 92700)

M8.1 (Closed) LER 95005-00: Inadvertent actuation of the safety injection system. On July 21, 1995, which the plant shut down for refueling, two inadvertent safety injection signals were received while performing surveillance R0-12, "Containment High Pressure and Spray System Test." In both instances, the left channel of safety injection was inadvertently actuated. The cause of the first safety injection signal actuation was two wires being taped together after removal from a terminal in an attempt to isolate the safety injection system signal. The cause of the second safety injection signal actuation was a screwdriver inadvertently touching a terminal on the safety injection signal relay. All equipment which had not been isolated prior to the event responded as required.

The licensee determined the root cause of the first inadvertent safety injection system was inadequate communication between the system engineer procedure sponsor and electrical maintenance personnel. This was the first time the revised procedure was used and the first time electrical maintenance personnel performed the test. The licensee determined that the second inadvertent actuation was due to insufficient work space. The terminals were in a tight configuration where the wire was to be landed. Procedure R0-12 was revised to specify that the wires removed from the terminal were to be isolated and insulated from each other. Caution statements were added to the procedure regarding the tight work space, and suggested temporary insulation may be necessary. Also, the training department collected test related problems that occurred in the 1995 refueling outage for a case study lesson plan. This lesson plan was presented to the engineering, operations and maintenance departments. This item is closed.

M8.2 (Closed) VIO 50-255/96008-03: Unauthorized operation of plant equipment. During performance of emergency diesel generator preventive maintenance, an electrical technician started the supply ventilation fan to the emergency diesel generator room without authorization of operations personnel. The manipulation of the fan was contrary to guidance in administrative procedure AP 4.02, "Control of Equipment." The electrical technician's supervisor discussed the inappropriate action taken with the individual. The various department managers, in standdown or continuous training meetings, discussed with personnel the expectation that equipment control requirements in procedure AP 4.02 be followed. This item is closed.

M8.3 (Closed) LER 97004-00: Trip of high pressure safety injection pump while filling the safety injection tank. On February 21, 1997, during boron concentration sampling of safety injection tank T-82C, the tank was declared inoperable due to low level and pressure. The licensee entered a one hour allowed outage time per TS 3.3.2.a to obtain the sample. Concurrently, the high pressure safety injection pump P-66A tripped during initial filling of tank T-82C. The trip of pump P-66A concurrent with tank T-82C being inoperable was a condition prohibited by TSs, which required immediate entry into 3.0.3. Inspection of pump P-66A breaker by electricians found the Y-phase time over-current relay target dropped. Root cause of the time over-current relay trip was a small metal particle which lodged between the top surface of the induction disk and the relay's magnet. This prevented the induction disk from rotating back to the reset position. The particle was sent out for electron microscope examination. The laboratory analysis determined the particle was a fragment to a terminal screw.

The time overcurrent relay was a sealed unit. This would lead to the conclusion that the particle was introduced during manufacture. A new time over-current relay was installed and tested satisfactorily. This item is closed.

M8.4 (Closed) LER 50-255/97005-00: Operation outside design basis due to unacceptable Code repairs. Subsequent inspection after repairs to main steam isolation valves CV-0501 and CV-0510, determined that unacceptable repairs had been made to the valves' stuffing box pipe plugs which created steam leaks. These inadequate ASME Code violations were considered to have resulted in operation of the plant outside the design basis. This event was in detail in Inspection Report No. 50-255/96017 and 50-255/97005. This issue resulted in violations (50-255/97005-01, 02, 03). The corrective actions for this LER will be tracked under the violations; therefore this LER is closed.

III. Engineering

E1 Conduct of Engineering

E1.1 Licensee Appendix R Review (37551)

a. Inspection Scope

The inspectors reviewed the licensee's progress and recent findings that pertained to the Appendix R enhancement effort. Two recent significant findings are detailed below. The compensatory measures taken were reviewed for adequacy. Discussions were held with the system engineering supervisor and personnel supporting this effort. Applicable documentation and procedures were reviewed.

b. Observations and Findings

The licensee is presently working to complete the Appendix R enhancement effort and complete incorporation of the 1996 refueling outage modifications into the Appendix R data base. The applicable Appendix R analyses are being reviewed to be certain that all conclusions of the supporting calculations have been incorporated into the base Appendix R engineering analyses. Affected off normal procedures are being revised. The licensee identified the following Appendix R issues.

Design Issue One

On September 12, 1997, the licensee identified an error in a calculation assumption during an Appendix R design bases review. Specifically, the error involved an improper evaluation for effects that resulted in the spurious operation of valves due to the introduction of a hot smart short in the electrical interface between the component cooling water (CCW) and service water (SW) systems. A single spurious operation of a valve between the interface of the CCW/SW systems could result in the loss of CCW inventory to the lower pressure SW system. The time period in which the CCW inventory is lost would not allow for manual action to prevent an unanalyzed condition.

The licensee made a 1-hour nonemergency 10 CFR 50.72 notification for being in a condition outside of design bases. The part of the SW system involved was the seal cooling water for the essential safety system pumps. The most limiting of the three potential scenarios calculated that only 25 seconds would be available to close engineering safeguards pump cooling service water return valve, CV-0951. This valve is normally closed. An open item of this calculation acknowledged the 25 second requirement, but concluded since the essential safety system (ESS) pumps are not running during normal operation and the CCW supply and return valves (CV-0913 and CV-0950, respectively) to the ESS pumps' sealing cooling piping are normally closed, then the spurious opening of any one CCW/SW interface valve could not result in the loss of CCW inventory. Based on this information, another calculation did not consider actions for the required time period. This reasoning is in error because CV-0913 and CV-0950 are normally open and fail open on loss of air or loss of electric power. A single spurious operation of CV-0951 would require a 25 second operator response to mitigate the consequences, which is not possible. The licensee's compensatory measures are detailed in Section 01.3 of this inspection report.

Design Issue Two

The second event was reported to NRC via a 10 CFR 50.72. It involved the Appendix R analysis assuming all four primary coolant pumps being tripped if the fire causes an evacuation of the control room. The Off Normal Procedure for Alternate Shutdown did not reflect the analysis and only directed the operators to trip two of the four primary coolant pumps.

The procedure ONP-25.2, "Alternate Safe Shutdown Procedure," does not specifically address securing all the primary coolant pumps when the operators lose the ability to monitor the pumps, such as during a control room evacuation or a damage to the instruments. ONP 25.2 does not only cover fires where a control room evacuation is to take place, but also provides guidance for fires where the control room is still manned. The procedure assumes that monitoring of the primary coolant pumps is a condition of their continued operation.

Several fire scenarios would result in a loss of component cooling water to the primary coolant pump seals and bearing coolers. Upon leaving the control room, operators do not have primary coolant pump monitoring capability or instrumentation to monitor the CCW system. The licensee's design basis for the primary coolant pumps indicated they are designed to operate without seal cooling for periods of up to ten minutes. Immediate corrective action was to initiate a procedure revision to direct operators to trip all four primary coolant pumps prior to control room evacuation.

This scenario assumes a fire is severe enough to cause a loss of CCW to the primary coolant pumps via loss of CCW pumps or closure of the CCW valves to/from containment but not severe enough to cause a loss of offsite power. Securing all primary coolant pumps for a fire of lesser severity may not be prudent. For this type of scenario the operators have additional guidance from ONP 6.2 "Loss of Component Cooling Water." This procedure directs further securing of the primary coolant pumps for degraded CCW

cooling. This guidance is felt to be adequate in the short term until ONP 25.2 can be clarified. Operator training includes the necessity of CCW cooling for primary coolant pump for operation, therefore the operators are encouraged to secure primary coolant pumps when CCW is no longer capable of being monitored.

c. Conclusions

The inspectors found the compensatory measures taken for the identified Appendix R issues to be adequate. The Appendix R enhancement review was found to be progressing slowly. However, the review appeared to be thorough.

E8 Miscellaneous Engineering Issues (92700 and 92903)

E8.1 (Closed) Licensee Event Report 95008-00: Bypassed containment high pressure trips on reactor protection system. The licensee discovered that all four channels of containment high pressure trip in the reactor protective system were inadvertently bypassed since a modification in 1992. The event was the focus of Inspection Report No. 50-255/95010), which resulted in violations 50-255/95010-01, 02 and 03. The corrective actions documented in the LER will be tracked by the violations; therefore, this LER is closed.

E8.2 (Closed) LER 95012-00: Unqualified electrical connection in containment service water outlet valve solenoid valve (SV-0824). The unqualified connection (wire nuts) was located in a pull box in the component cooling water room outside containment. This area is not affected by the loss of coolant accident pressure/temperature, but would be exposed to radiation effects due to the radioactive "shine" through the containment wall. The wire nut connections were replaced with environmentally qualified connections. A walkdown of junction boxes to check for environmentally qualified connections done in 1992 missed this pull box because the electrical drawings used did not identify pull boxes. Since the basis for the 1992 review were the electrical drawings the problem was not discovered, and a 1995 review done after the identification of SV-0824 used the cable and raceway schedule (E-33 series), which indicated the existence of a connection regardless of the box type designation. The remaining pull boxes were inspected. All remaining pull boxes identified on the E-33 series drawings were inspected, except four which required the erection of scaffolding or were prohibitive due to high radiation exposure. No other wire nut connections were found during this walkdown. Inspection of the remaining four boxes is not considered necessary. This item is closed.

E8.3 (Closed) Violation 50-255/96-003-02: Failure to maintain design basis document (DBDs) current. The inspectors identified that the required biennial review and revision on 14 of 36 DBDs had not been performed with a 2-year period. During review of this issue, engineering personnel identified several programmatic weaknesses and corrective actions were initiated.

Engineering personnel developed a DBD change request log. Outstanding change requests are now posted in front of controlled DBDs. All non-qualified DBD owners completed the necessary training. All DBDs were then subsequently reviewed to ensure the DBDs were updated in a timely matter. The inspectors performed a random review of DBDs. No over due change requests were identified.

The existing plant modification procedures specifically require the change initiator to prepare a DBD change request. However, operating procedures do not cover this area. This was addressed through a change to administrative procedure 3.07, "Safety Evaluations," by the addition of the following question on the safety review form: "Should this be included in a DBD update?" This item is closed.

E8.4 (Closed) VIO 50-255/96008-04: Failure to follow surveillance procedure. On August 4, 1996, the licensee performed surveillance M0-7A-1, "Emergency Diesel Generators 1-1 and 1-2" for the emergency diesel generator 1-1. After the emergency diesel generator was started, but prior to loading the generator, the system engineer noticed the arm of the fuel rack was oscillating. The system engineer touched the fuel rack to stop the motion. The surveillance continued and the diesel declared operable. This manipulation of the fuel rack was contrary to the surveillance. The licensee re-performed the surveillance on August 14, 1996, without any intervention with the functionality of the fuel rack. The surveillance was completed satisfactorily. The system engineers supervisor discussed the inappropriate action taken with the individual. The various department managers, in standdown or continuous training meetings, discussed with personnel the expectation that equipment control requirements in administrative procedure AP 4.02, "Control of Equipment" be followed. This item is closed.

E8.5 (Closed) LER 96010-00: On July 17, 1996, the safety injection tanks (SITs) were being sampled for boron concentration. While filling SIT T-82C, high pressure safety injection pump P-66A tripped. T-82C was inoperable due to low pressure during the sampling evolution. With these two conditions, TS 3.0.3 was immediately entered. Two minutes later, TS 3.0.3 was exited when T-82C nitrogen pressure was restored. A 24-hour limiting condition for operation was then entered as required by TS 3.3.2.c.

Troubleshooting revealed that P-66A tripped due to the Y-phase time overcurrent (TOC) relay on the pump breaker not resetting after each successive start. The P-66A motor was checked and cleaned. The TOC relay was checked and calibrated. Then, P-66A was test started three times. Proper resetting of the relay was verified after each start. P-66A was declared operable, but degraded. On July 18, 1996, the LCO was exited. The relay was replaced on July 1996.

Dust or grease buildup was determined to have caused an interference, preventing the TOC relay from resetting. All similar relays were inspected for potentially degraded conditions. No problems were found. This appeared to be a random failure. This item is closed.

E8.6 (Closed) Violation 50-255/96014-04: Inadequate design control of a temporary modification to a polar crane solenoid. On November 6, 1996, temporary modification 96-050 to the containment polar crane did not contain adequate installation instructions for replacement of a single solenoid with two solenoids. The original solenoid was hard mounted and was provided with sufficient ventilation to prevent premature failure. As a result of inadequate preparation and review, temporary modification 96-050 did not provide instructions for mounting the second of two replacement solenoids. The second solenoid was installed using duct tape and tie-wraps in a manner which resulted in overheating and failure of the solenoid coil, which resulted in a minor electrical fire.

The licensee subsequently replaced the two 250 volt coils with a new 460 volt coil. This event was reviewed by the design engineering group and lessons learned were developed. Discussions covered conditions leading to the event and the need to consider all operating design characteristics. A review of all temporary modifications was conducted to verify that acceptable standards were used for installation. Administrative procedure 9.31, "Temporary Modification Control," section 7.2.3 was revised to add the requirement to verify physical installation when critical to a design. This item is closed.

IV. Plant Support

R1 Radiological Protection

R1.1 Spent Fuel Pool Resin Transfer

a. Inspection Scope (71750 and 83750)

The inspectors observed the spent fuel pool resin transfer activity. Discussions were held with the radwaste system engineer and supervisor on corrective actions instituted to prevent resin inventory monitoring problems which occurred during the previous resin sluice. The licensee received a violation for inadequate procedural controls for a December 23, 1996 standard resin sluice from the purification and deborating ion exchanger T-51B to spent resin storage tank T-100. Although there were several contributing factors that led to the violation, the inspector's main concerns in observing this resin transfer were the inadequate controls for monitoring tank resin levels and low sensitivity to radwaste systems deficiencies by operations, system engineering and radiation safety personnel.

b. Observations and Findings

The inspectors noted greater personnel resources were applied to the spent fuel pool resin transfer than in similar previous activities. A senior reactor operator managed the overall activities for the transfer of resin. A senior reactor operator was in constant direct communication with the several auxiliary operators responsible for valve manipulations and monitoring the radwaste system during the resin transfer. All the operators were knowledgeable of their tasks. Health physics performed initial radiation surveys of the tanks involved it the resin transfer, which were more detailed than previous surveys. The flush of the resin transfer was also performed longer than in the past to ensure all resin had been moved. Post radiation surveys of the tanks and in-line filters were also more extensive than in past resin transfers.

The inspectors noted the procedure covering resin transfer had been revised to include more thorough documentation of resin inventory. Precautions were added to the procedure to heighten personnel awareness regarding the interconnecting system flowpaths and the potential for abnormal radiological conditions such as plugging of radwaste filters.

c. Conclusions

The licensee's actions to improve the resin transfer process resulted in an error-free evolution for the spent fuel pool job. The inspectors noted good attention to detail and awareness of changing radiological conditions. Procedure revisions for tending resin inventory and heightening personnel awareness of the radiological significance of performing a resin transfer were successful.

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 October 17, 1997. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. A. Fenech, Senior Vice President,
Nuclear, Fossil, and Hydro Operations
T. J. Palmisano, Site Vice President - Palisades
G. B. Szczotka, Manager, Nuclear Performance Assessment Department
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D. P. Fadel, Director, Engineering
S. Y. Wawro, Director, Maintenance and Planning
R. J. Gerling, Manager, Design Engineering
P. D. Fitton, Manager, System Engineering
T. C. Bordine, Manager, Licensing
J. P. Pomeranski, Manager, Maintenance
D. G. Malone, Shift Operations Supervisor
M. P. Banks, Manager, Chemical & Radiation Services
K. M. Haas, Manager, Training

NRC

M. E. Parker, Senior Resident Inspector, Palisades
P. F. Prescott, Resident Inspector, Palisades

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities
IP 83750:	Occupational Radiation Exposure
IP 92700:	Licensee Event Reports
IP 92701:	Followup
IP 92901:	Followup - Operations
IP 92902:	Followup - Maintenance
IP 92903:	Followup - Engineering

ITEMS OPEN

~~50-255/97011-01~~	VIO	Failure to
50-255/97011-02	NCV	Failure to take adequate corrective actions for an Appendix R concern

ITEMS CLOSED

50-255/95005-00	LER	Inadvertent actuation of the safety injection
50-255/95008-00	LER	Bypassed containment high pressure trips on reactor protection system
50-255/95012-00	LER	Unqualified electrical connection in containment service water
50-255/96003-02	VIO	Failure to maintain design basis document (DBDs) current
50-255/96008-03	VIO	Unauthorized operation of plant equipment
50-255/96008-04	VIO	Failure to follow surveillance procedure
50-255/96010-00	LER	Trip of high pressure safety injection pump
50-255/96014-01a	VIO	Failure to ensure control rod drive mechanisms locked prior to inserting a reactor trip signal
50-255/96014-01b	VIO	Failure to position instrument AC bus Y-01 control handle to the correct position resulting in loss of power to bus
50-255/96014-04	VIO	Inadequate design control of temporary modification for polar crane solenoid

50-255/97004-00	LER	Trip of high pressure safety injection pump while following the safety injection tank
50-255/97005-00	LER	Operation outside the design basis due to unacceptable Codes repairs

LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
AC	Alternating Current
AP	Administrative Procedure
ASME	American Society of Mechanical Engineers
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CRD	Control Rod Drive
CRDM	Control Rod Drive Mechanism
CV	Control Valve
DBD	Design Basis Document
DRP	Division of Reactor Projects
ECP	Estimated Critical Position
ESS	Essential Safety System
GOP	General Operating Procedure
gpm	Gallons Per Minute
IP	Inspection Procedure
LCO	Limiting Condition for Operation
LER	Licensee Event Report
MO	Monthly Operating (procedure)
NRC	Nuclear Regulatory Commission
NCO	Nuclear Control Operator
NCV	Non-Cited Violation
ONP	Off Normal Procedure
OOS	Out Of Service
PCM	Personnel Contamination Monitor
PCS	Primary Coolant System
PDR	Public Document Room
QO	Quarterly Operations (procedure)
RO	Refueling Operations (procedure)
RPS	Reactor Protection System
RV	Relief Valve
SIT	Safety Injection Tank
SOP	System Operating procedure
SW	Service Water
SV	Solenoid Valve
T	Tank
TOC	Time Over-Current
TS	Technical Specification
VCT	Volume Control Tank
VIO	Violation
WGS	Waste Gas System