May 19, 2003

Mr. Douglas E. Cooper
Site Vice President
Palisades Nuclear Plant
Nuclear Management Company, LLC
27780 Blue Star Memorial Highway
Covert, MI 49043-9530

SUBJECT: PALISADES NUCLEAR GENERATING PLANT
NRC SPECIAL INSPECTION REPORT 50-255/03-05

Dear Mr. Cooper:

On April 4, 2003, the U.S. Nuclear Regulatory Commission (NRC) completed a special inspection at your Palisades Nuclear Generating Plant to review the circumstances surrounding two Alert emergency declarations on March 18, and March 25, 2003. The enclosed report documents the inspection findings which were discussed on April 4, 2003, with you and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The team reviewed selected procedures and records, observed activities, and interviewed personnel.

On March 18, 2003, a fire started in a safety-related breaker cubicle in the cable spreading room. An emergency plan Alert (the second lowest of four emergency classification levels) condition was declared due to a fire that could impact safety-related equipment. Your staff secured from the Alert after about 2 hours when the fire was extinguished and the source of the fire was identified.

On March 25, 2003, plant maintenance workers were installing signposts in the parking lot to designate parking spaces. One of the signposts was driven into a conduit and damaged a cable which contained protective relay circuitry for all sources of offsite power. An Alert was declared due to the loss of offsite power combined with the loss of shutdown cooling. The Alert was downgraded to an Unusual Event (the lowest of four emergency classification levels) after about 1 hour when shutdown cooling was restored. Your staff secured from the Unusual Event on March 27, 2003, when offsite power was restored.

Both of these events could have been avoided. Inadequate breaker maintenance procedures coupled with a number of human performance errors in the operations and maintenance areas resulted in the March 18, 2003, cable spreading room fire. In addition, a weakness in the implementation of your corrective action program was a primary contributor to the March 25, 2003, loss of offsite power event. Both the human performance and problem identification and resolution areas were previously identified as substantial cross-cutting issues

and were discussed in our March 4, 2003 annual assessment letter to you. The human performance substantial cross-cutting issue was closed in our letter since no findings involving human performance had been identified since the first quarter of the 2002 assessment period. However, the human performance errors which occurred on March 18, 2003 indicates that this area may again be a challenge which warrants your immediate attention. The problem identification and resolution area was a substantial cross-cutting area which remained open in our letter since improvements in this area had only recently been implemented. The March 25, 2003 event indicates that these improvements have not been fully effective and that further improvements are necessary before this area can no longer be considered a substantial cross-cutting issue.

Based on the risk and deterministic criteria specified in Management Directive 8.3, "NRC Incident Investigation Program," and Inspection Procedure 71153, "Event Followup," and due to the equipment performance problems which occurred, a Special Inspection was initiated in accordance with Inspection Procedure 93812, "Special Inspection," to evaluate the facts and circumstances surrounding the events as well as the actions taken by your staff in response to the unexpected system performance issues encountered. The inspection focused on: (1) the sequence of events for each Alert; (2) the adequacy of your evaluation of the events and corrective actions; (3) any common causes or relationship between the two events; (4) the operational performance issues associated with the repeated attempts to restart charging pump P-55A; (5) any equipment performance issues during the two events; (6) maintenance performance issues associated with the missing arc chutes for the charging pump P-55A breaker; (7) design issues associated with the offsite power configuration and any changes to address the event; and (8) the emergency plan actions to address the events.

Based on the results of this inspection, two self-revealed findings of very low safety significance which involved violations of NRC requirements were identified. However, because these violations were non-willful and non-repetitive and because they were entered into your corrective action program, the NRC is treating these findings as Non-Cited Violations in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

The NRC identified one finding for which the final risk significance remains to be determined at a later date. The finding concerned the failure of site management to take adequate corrective actions after a series of events during digging and excavating on station property between the protected area and the switchyard. This finding did not present an immediate safety concern because compensatory measures were put in place while long-term corrective actions were being determined and implemented.

If you contest the subject or severity of a Non-Cited Violation, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, U.S. Nuclear Regulatory Commission - Region III, 801 Warrenville Road, Lisle, IL, 60532-4351; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Palisades facility.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Geoffrey E. Grant, Director
Division of Reactor Projects

Docket No. 50-255
License No. DPR-20

Enclosure: Inspection Report 50-255/03-05(DRP)

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-255
License No:	DPR-20
Report No:	50-255/03-05
Licensee:	Nuclear Management Company, LLC
Facility:	Palisades Nuclear Generating Plant
Location:	27780 Blue Star Memorial Highway Covert, MI 49043-9530
Dates:	March 24 through April 4, 2003
Inspectors	C. Phillips, Senior Operations Engineer, Team Leader J. Lara, Senior Resident Inspector, Kewaunee C. Brown, Resident Inspector, Clinton J. Lennartz, Senior Resident Inspector, Palisades R. Krsek, Resident Inspector, Palisades H. Gonzales, Nuclear Safety Intern
Approved by:	Geoffrey E. Grant, Director Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000255-03-05; Nuclear Management Company; 03/24 - 04/04/2003; Palisades Nuclear Generating Plant; Special Inspection - March 18, 2003, Alert due to cable spreading room fire and March 25, 2003, Alert due to loss of offsite power and temporary loss of shutdown cooling.

This report covered a 2-week period of special inspection by Region III inspectors and resident inspectors. Two Green findings and one finding with a significance which is yet to be determined were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green" or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealed Findings

Cornerstone: Initiating Events

- Green. A finding of very low safety significance was self-revealed during an event when an operator failed to adhere to a procedure for operating the chemical volume control system and repeatedly attempted to close a charging pump breaker after the breaker tripped. In addition, the operator failed to trip primary coolant pumps before primary coolant system pressure dropped below the minimum pressure for primary coolant pump operation. The primary cause of this finding was related to the cross-cutting area of Human Performance.

  The finding was more than minor because it could be reasonably viewed as a precursor to a significant event. The repeated operation of an electrical breaker contrary to procedural requirements was a contributing cause to the March 18, 2003, cable spreading room fire. The finding was determined to be of low safety significance because the failure to follow the procedure did not result in a loss of shutdown cooling or loss of reactor inventory. This issue was determined to be a Non-Cited Violation of Technical Specification 5.4.1, which required the implementation of written procedures covering the chemical volume control system and the reactor coolant system. (Section 04.1)

- Green. A finding of very low safety significance was self-revealed during an event when the licensee failed to have adequate maintenance procedures in place to ensure that when an electrical breaker was removed to be refurbished, that the arc chutes were reinstalled before the breaker was placed back in service.

  The finding was more than minor because it could be reasonably viewed as a precursor to a significant event since a fire resulted in the P-55A charging pump breaker when the arc chutes were not reinstalled after the breaker had been refurbished. The finding was determined to be of low safety significance because the failure to follow the procedure did not result in a loss of shutdown cooling or loss of reactor inventory. This issue was determined to be a Non-Cited Violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." (Section 07)

- TBD. The licensee failed to take effective corrective actions to address a series of events involving digging and excavating between the protected area and the switchyard.

  The finding was more than minor because it could be reasonably viewed as a precursor to a significant event in that a maintenance technician drove a signpost into the ground and damaged an electrical cable that resulted in a loss of offsite power and a loss of shutdown cooling. No violation of regulatory requirements was identified since the act of driving the signpost into the ground was not an activity affecting quality. (Section 02.2)

B. Licensee-Identified Violations

No findings of significance were identified.

REPORT DETAILS

Summary of Plant Events

Synopsis of Events

On March 18, 2003, a fire started in a safety-related breaker cubicle in the cable spreading room. Although the fire did not spread beyond the cubicle, the room filled with smoke. The licensee declared an Alert based on the existence of a fire that could affect safety-related equipment. The licensee secured from the Alert about 2 hours later when it was determined that a threat no longer existed.

On March 25, 2003, while shutdown for a refueling outage, a maintenance worker installing a signpost in the parking lot struck an underground cable and cut and shorted together conductors for protective circuitry that impacted circuit breakers for all sources of offsite power. The licensee declared an Alert based on the complete loss of offsite power and the loss of shutdown cooling. About 1 hour after the Alert declaration, the licensee downgraded the event to an Unusual Event based on the recovery of shutdown cooling with both emergency diesel generators supplying power to the safety-related buses. The licensee secured from the Unusual Event on March 27, when power from a qualified offsite power source was restored to the safety-related buses.

March 18, 2003 Cable Spreading Room Fire

On March 18, 2003, the plant was in Mode 5 (Cold Shutdown) and in a solid plant condition. Two charging pumps were running at maximum speed with maximum letdown flow to expedite the chemical cleanup of the primary coolant to reduce the coolant activity levels in preparation for the refueling outage. The night shift operating crew was assigned to increase the concentration of boric acid in the primary coolant by gravity feeding boric acid solution from the "B" boric acid storage tank to the suction of the two running charging pumps. After the operators realigned the boric acid suction path from the volume control tank to the "B" boric acid storage tank, the P-55A charging pump breaker tripped. An operator attempted to restart the P-55A charging pump three times. Arcing within the P-55A charging pump breaker caused the failure of the wiring connections to the breaker anti-pump relay. Therefore, the breaker attempted to re-close more times than the number of times the operator manipulated the breaker control switch.

The rapid opening and closing of the breaker caused an arc to form within the breaker cubicle. The breaker design included an arc chute installed on each phase to extinguish any arc that may form upon breaker opening. However, due to the combination of an inadequate maintenance procedure and human performance errors when the breaker was previously refurbished, the P-55A charging pump breaker did not have the arc chutes installed. The absence of the arc chutes resulted in a phase-to-phase arc forming which increased in magnitude and ultimately damaged the breaker. The arc caused the cable spreading room to fill with smoke.

The arc current caused the breaker supplying power to load control center (LCC)-12 to trip to isolate the fault. The fire brigade responded promptly and the problem was quickly brought under control.

Shutdown cooling continued to operate during the event. The primary coolant system depressurized and due to human performance errors, the primary coolant pumps were not secured before plant pressure dropped below the minimum pressure for primary coolant pump operation.

March 25, 2003 Loss of Offsite Power

On March 25, 2003, with the plant in Mode 6 (Refueling), plant maintenance workers were installing signs in the parking lot designating parking spaces. One of the signposts was driven into a conduit and damaged a cable which contained a combination of energized indication circuitry and de-energized protective relay circuitry. The metal signpost cut and shorted together several of the conductors within the cable generating a fault signal to the breakers supplying offsite power to the 345 kilovolt (kV) Rear (R) bus.

The R bus was supplying power to nonsafety-related loads through the startup transformer. About 30 seconds later, the breaker between the safeguards transformer and the safeguards bus tripped open resulting in a temporary loss of power to the safety-related buses. The emergency diesel generators started and energized the safety-related 1C and 1D buses. Shutdown cooling was lost, but was restored after about 20 minutes when the emergency diesel generators started and shutdown cooling pumps were re-energized.

An Alert was declared based on the loss of offsite power combined with the loss of shutdown cooling. The Alert was subsequently downgraded to an Unusual Event after shutdown cooling was restored. A temporary modification was installed which re-routed the conductor for the protective relaying of the startup transformer. The licensee secured from the Unusual Event on March 27, 2003, when offsite power was restored.

Inspection Scope

Based on the risk and deterministic criteria specified in Management Directive 8.3, “NRC Incident Investigation Program,” and Inspection Procedure 71153, “Event Followup,” and due to the equipment performance problems which occurred, a Special Inspection was initiated in accordance with Inspection Procedure 93812, “Special Inspection.”

The purpose of the inspection was to evaluate the facts and circumstances surrounding the events as well as the actions taken by licensee personnel in response to the unexpected system performance issues encountered. In particular, the inspection focused on the following: (1) the sequence of events for each Alert; (2) the adequacy of the licensee’s evaluation of the events and corrective actions; (3) any common causes or relationship between the two events; (4) the operational performance issues associated with the repetitive attempts to restart charging pump P-55A; (5) any equipment performance issues during the two events; (6) maintenance performance issues associated with the missing arc chutes for the charging pump P-55A breaker; (7) design issues associated with the offsite power configuration and any changes as a result of the event; and (8) the emergency plan actions to address the events.

1 REACTOR SAFETY

Cornerstones: Initiating Events and Mitigating Systems

01 Sequence of Events (93812)

a. Inspection Scope

The inspector reviewed logs, alarm printouts, and other documentation; interviewed licensee personnel; and developed the following sequence of events for the March 18, 2003, cable spreading room fire and the March 25, 2003, loss of offsite power:

March 18, 2003 Cable Spreading Room Fire

Day	Time	Event Description
3/18	19:00	The plant was in Mode 5, water solid condition with primary coolant system (PCS) temperature at 120 degrees Fahrenheit (°F). A chemical soak of the PCS was in progress to reduce activity levels. Charging pumps P-55A and P-55B were running with increased letdown flow to aid in PCS cleanup. Primary Coolant Pumps (PCPs) 1A and 1D were running. The operating crew made plans to increase boron concentration in the PCS to that required for refueling activities by realigning the suction of the charging pumps from the volume control tank (VCT) to Boric Acid Storage Tank (BAST) T-53B.
	20:36	A nuclear control operator (NCO-1) realigned the charging pump suction from the VCT to BAST T-53B. NCO-1 unexpectedly observed that BAST level did not change and PCS pressure was decreasing. NCO-1 attempted to reduce letdown flow by closing the controller for the letdown backpressure regulator, however PCS pressure continued to decrease. NCO-1 noticed that charging flow had decreased from about 107 gallons per minute (gpm) to about 40 gpm and that charging pump P-55A had tripped. Licensee personnel later determined that when the suction source to the charging pump was changed, the suction pressure decreased. The charging pump low suction pressure switch had a time delay, but the switch had stuck in the tripped position. NCO-1 did not announce the charging pump trip or any other actions, either before or after they were taken. A second operator, NCO-2, announced the trip of charging pump P-55A. NCO-1 attempted to restart P-55A unsuccessfully, but failed to verify the on/off indication lights for the pump on the control panel. NCO-1 cycled opened and closed the suction valve to the BAST

and again attempted to restart charging pump P-55A. During this attempt, NCO-1 held the control switch closed for a longer period under the belief that the control switch had not been closed long enough during the previous attempt, but again did not visually verify the pump on/off indication lights. NCO-2 observed that the charging pump on/off indication lights cycled three or four times. NCO-1 attempted to start charging pump P-55A unsuccessfully a third time.

The control room supervisor (CRS) and shift supervisor (SS) noticed the charging pump low suction pressure alarm and increased activity at the control panel. The SS noticed that PCS pressure had decreased below the minimum pressure for PCP operation and directed the CRS to trip the PCPs. The CRS then made a statement to trip the PCPs, but did not specifically direct NCO-1 to trip the pumps. NCO-1 did not hear the statement by the CRS and therefore did not repeat it back. The CRS was distracted by a fire alarm from the cable spreading room and did not ensure his direction to trip the PCPs was carried out. The SS observed that the direction to trip the PCPs was not carried out and directed NCO-1 to trip the PCPs. The NCO-1 then tripped the PCPs. This entire sequence of events occurred over about 37 seconds.

Decreasing PCS pressure required the trip of the PCPs at 235 pounds per square inch absolute (psia) per Standard Operating Procedure (SOP)-1, “Primary Coolant System.” However, the A and D PCPs were not secured until reactor pressure was about 135 psia.

Off Normal Operating Procedure (ONP)-25.1, “Fire in Safety Related Area,” was entered due to the cable spreading room fire alarm.

20:39 The fire brigade was dispatched to respond to the cable spreading room fire alarm.

20:47 An Alert was declared per the station Site Emergency Plan due to a fire with the potential to affect safety-related equipment.

22:20 Procedure ONP-25.1 was exited when the fire brigade determined that the fire was no longer present.

22:38 The Alert was terminated after the licensee’s investigation determined that the fire was extinguished and was isolated to the circuit breaker for charging pump P-55A.

March 25, 2003 Loss of Offsite Power

Day	Time	Event Description
3/25	11:15	The plant was in Mode 6. The 345 kilovolt (kV) switchyard front (F) bus was supplying power to the safeguards transformer and through Breaker 152-401 to the safeguards bus (see the last page of this report for a simplified diagram of the electrical distribution system). All safety-related 2400 volt alternating current (Vac) buses were energized from the safeguards bus. The 345 kV switchyard rear (R) bus was supplying power to the startup transformer, which was available as a backup power source to the safety-related 2400 Vac buses. All 4160 Vac buses and nonsafety-related 2400 Vac buses were energized from startup transformer feeder breakers. The main generator output breakers were closed. Motor-operated disconnect M26H5 was open, interrupting backfeed power to the main transformer. The reactor vessel head was removed and the reactor cavity was partially flooded to about 6 feet above the reactor vessel flange. Nozzle dams were installed in the reactor coolant loops. Service air was supplied to the nozzle dams to prevent leakage from the reactor vessel to the coolant loops. Primary coolant system temperature was 94°F.
	11:16	Building and grounds workers replaced two signposts for parking signs alongside the site access road. The signposts were installed by pounding them directly into the ground using an impact tool. The second signpost installed was inadvertently driven into a buried conduit and shorted together protective relay conductors. This caused the protective relays to actuate and resulted in a loss of offsite power and a loss of shutdown cooling. The control room received numerous alarms indicating that all switchyard circuit breakers feeding the R bus had opened. Shortly thereafter, Breaker 152-401 also opened, resulting in a loss of offsite power. Operators entered ONP-2.1, “Loss of AC [Alternating Current] Power,” and ONP-17, “Loss of Shutdown Cooling.” Both emergency diesel generators (EDGs) started and closed onto their respective buses. Service air was initially lost and was subsequently realigned to backup nitrogen bottles to provide air to the nozzle dams.
	11:21	Control room operators verified that the 1C and 1D buses were re-energized from their respective EDGs.

	11:26	The shift supervisor declared an Alert per the Site Emergency Plan for the loss of offsite power and loss of shutdown cooling event.
	11:36	Control room operators restored shutdown cooling to service. Primary coolant system temperature increased from 94°F to 104°F while shutdown cooling was unavailable.
	11:57	Control room operators stabilized PCS temperature. The highest PCS temperature reached was 104°F.
	12:06	Control room operators authorized re-opening containment penetration M7-10 service air to restore air to the nozzle dams.
	12:22	Operators restored the service air lineup to containment.
	12:31	The site emergency director downgraded the emergency classification from an Alert to an Unusual Event with shutdown cooling restored and the EDGs providing power to safety-related buses 1C and 1D.
	13:37	Control room operators exited ONP-17 and continued actions to restore offsite power.
	14:25	Operators reset relay 486 S-X1 in order to re-energize the R bus. Restoration of the R bus was necessary in order to restore offsite power transmission line reliability.
	14:27	Operators opened disconnect 24R2 to isolate the startup transformer from the R bus. Control room operators then restored the R bus. Control room operators did not restore power to the startup transformer because the cause of the loss of offsite power remained unknown.
	17:30	Operators closed Breaker 152-401 and energized non-safeguards loads. The cause of Breaker 152-401 to trip remained unknown. However, licensee management concluded that there was no existing electrical bus or breaker fault and closed Breaker 152-401 to supply power to nonsafety-related bus 1E. The EDGs continued to supply power to safety-related buses 1C and 1D.
3/27	5:39	The Shift Supervisor authorized the installation of temporary modification TM-2003-012 for R bus relay 486 S-X1. This temporary modification replaced conductors associated with R Bus relay 486 S-X1 with wires in another cable. This allowed for the realignment of offsite power to safety-related buses 1C and 1D through the startup transformer.

	14:47	Operators energized nonsafety-related buses 1E, 1B, 1A, 1G and 1F from the startup transformer.
	15:30	Operators paralleled the startup transformer to EDG 1-1 to supply power to the 1C bus.
	15:46	Emergency diesel generator 1-1 was secured.
	17:23	Operators paralleled the startup transformer to EDG 1-2 to supply power to the 1D bus.
	17:35	Operators exited ONP-2.1.
	17:37	Emergency diesel generator 1-2 was secured. The Unusual Event was terminated following the restoration of offsite power.
4/4	6:13	Work Order (WO) 24321140, implementing engineering action request (EAR) 2003-0086, was completed. Control circuits for offsite power protective relays were transferred to alternate conductors and the offsite power protective relays were fully restored.

b. Findings

No findings of significance were identified.

02 Adequacy of Licensee Evaluation of Events and Corrective Actions (93812)

02.1 March 18, 2003 Cable Spreading Room Fire

a. Inspection Scope

On March 18, 2003, charging pump breaker 52-1205 failed and caught fire. The breaker was contained in LCC-12 in the cable spreading room. The site emergency director declared an Alert due to the potential impact of the fire on other safety-related equipment. The team assessed the licensee's root cause investigation efforts for this event. The team interviewed control room operators, electrical maintenance workers and licensee personnel involved with the investigation. As part of the inspection effort, the team reviewed the licensee's root cause investigation results and performed independent reviews of the licensee's troubleshooting activities. The team also reviewed design drawings, design basis documents, and the Updated Final Safety Analysis Report. The team reviewed maintenance controls practices including previous breaker maintenance and calibration activities.

b. Findings

No findings of significance were identified.

The team determined that the licensee's troubleshooting efforts were structured and methodical. A failure mode analysis approach was used to establish a timeline and potential failure modes chart. This approach facilitated the structured review of potential failure modes for both the charging pump P-55A supply breaker as well as the low suction pressure trip of charging pump P-55A which initiated the event. Licensee personnel demonstrated a focus on gathering as-found data for the sequence of events, maintenance records, pressure transmitters, operator actions, and operator statements. Additionally, the licensee performed an extensive as-found investigation into the extent of damage to LCC-12 that housed the failed breaker. Similarly, the licensee performed a rigorous extent of condition review to determine if any other breakers were missing arc chutes and whether problems encountered with the charging pump low suction pressure trip switches were isolated or generic.

At the end of the inspection, the licensee's root cause investigation was not complete and therefore corrective actions were not yet formalized. The licensee identified that the cause the cable spreading room fire was the failure to reinstall arc chutes in the P-55A breaker when the breaker was reinstalled into LCC-12 after it was refurbished in May 2002. Following the event, the licensee sent the breaker to the manufacturer for a complete failure mode analysis. The manufacturer identified that the breaker failure was caused by an arc forming between phases on the breaker and then moving over the backing insulator to form an arc directly between the breaker stabs entering LCC-12. The missing arc chutes resulted in a normal arc, formed when a breaker opens, not being extinguished as designed. A combination of the operator attempting multiple motor starts in a short time, a stuck low suction pressure trip switch, and burnt wires to the anti-pump coil in the breaker, caused the breaker to rapidly close and trip open multiple times when the operator held the control switch in the close position. This allowed a continuous arc to form, and initiated the fire in the breaker cubicle.

The team concluded that although the root cause investigation was not complete at the end of the inspection, the licensee's evaluation of the event was proceeding satisfactorily and the root cause investigation efforts were adequate.

02.2 March 25, 2003 Loss of Offsite Power

a. Inspection Scope

On March 25, 2003, the plant experienced a loss of offsite power to the nonsafety-related and safety-related buses providing power to equipment necessary to maintain shutdown cooling of the PCS. The team reviewed the licensee's root cause investigation results and performed independent reviews of the licensee's offsite power system design and troubleshooting activities. The team also reviewed design drawings, design basis documents, and the Updated Final Safety Analysis Report. The team also interviewed licensee personnel involved with the root cause investigation.

b. Findings

Introduction

The team identified a performance deficiency in that the licensee failed to address a repetitive problem of weak controls over excavation and digging activities. The finding is greater than minor, but is unresolved pending completion of a significance determination review. No violation of regulatory requirements was identified.

Description

The licensee used a failure mode analysis approach to establish a timeline and potential failure modes chart. This approach facilitated the structured review of potential failure modes, which could have resulted in the loss of offsite power. The licensee focused on gathering as-found data, and identified the circuit breakers and relays that were impacted. The licensee reviewed all potential failure modes to identify the likely cause of the event. The licensee identified several conductors within a common cable which were routed to various relays that could have caused the loss of offsite power to occur.

The licensee identified that a single cable carried protective relay circuitry for all the affected breakers. Through interviews and information provided by plant personnel, the licensee identified that the event was caused by cables being damaged during the installation of a signpost in a parking lot outside the facility's protected area. The metal signpost breeched the plastic conduit wall and penetrated the outer jacket and insulation of one of the cables routed in the conduit. This conduit was routed between the plant and the switchyard about 30 inches underground. The damaged cable carried the conductors associated with the protective relaying scheme for the offsite power system. The damaged cable actuated protective relaying associated with the switchyard. These actuations resulted in the opening of various circuit breakers including Breaker 152-401, main generator breakers, and all four circuit breakers supplying the switchyard R bus. Collectively, the opening of these circuit breakers removed all offsite power to the plant .

However, there were two instances during the licensee's recovery efforts that should have received more careful consideration. First, licensee personnel made the decision to close Breaker 152-401 prior to completing a physical inspection of the breaker. At the time of this decision, the root cause for the breaker trip was unknown. Licensee personnel determined there was no clear indication of an existing electrical fault and decided to close the breaker and re-energize nonsafety-related buses from the safeguards bus. The team concluded that although there was no obvious indication of an electrical fault, more consideration should have been given to the possibility of a mechanical failure. The team concluded that licensee management had missed an opportunity to identify a mechanical problem within the breaker, had one existed. Second, when the licensee determined that the loss of offsite power occurred at the same time a signpost was driven into the ground, it was also known that two signposts were involved. The licensee had excavated the first signpost hole and found minor damage to an underground conduit. The licensee had also developed a temporary modification (TM-2003-012) to relocate the protective relay conductors. The licensee planned to move ahead with the implementation of the temporary modification before excavation of the second signpost hole. Regional NRC management questioned why

the second signpost hole was not excavated prior to proceeding with the temporary modification. The licensee then identified that it was the second signpost that caused the damage to the protective relay circuitry cable.

Licensee personnel identified that a contributing cause to the loss of offsite power to the safety-related buses was the use of a common cable to provide controls for the R bus load shed relays as well as the F bus load shed/fast transfer relays. Part of the licensee's corrective actions included separating the conductors for protective relays to different cables.

The licensee's root cause investigation assessed the adequacy of existing plant policy regarding excavation and digging activities within the licensee's property. Similarly the team performed independent reviews of the licensee administrative controls in this area. During those reviews, the team independently identified that there were several previous corrective action program (CAP) documents pertaining to problems encountered during excavating or digging activities. Documents reviewed by the team included the following:

- CAP 19522, Unidentified Cable Severed During Excavation, dated June 1999;
- CAP 08000, Unknown Cables Cut While Digging to Install Fire Protection Piping, dated August 2000;
- CAP 26496, Equipment Operator Damaged an Underground Telephone Cable While Excavating, dated October 2000;
- CAP 14634, During Excavation Work Digging Equipment Damaged Two Plastic Conduits, dated July 2001;
- CAP 30724, Severed Power Cable to the Meteorological Tower, dated May 2002;
- CAP 31300, Underground Cable Hit by Municipal Project Resulting in Power Outage, dated September 2002; and
- CAP 31378, Unmarked Phone Line Cut During Installation of Domestic Water, dated September 2002.

Based on discussions with plant personnel and a review of corrective actions associated with the above CAP documents, the team concluded that the licensee had failed to address a repetitive problem of weak controls of excavation and digging activities. The lack of established controls in the form of administrative policies and procedures in this area contributed to the lack of awareness and sensitivity to potential safety consequences which could arise during such activities. The licensee's preliminary root cause evaluation similarly concluded that the root cause of the event was that the plant did not have a written policy or process for excavating and trenching activities.

The team concluded that although the root cause investigation was not complete at the end of the inspection, the licensee's evaluation of the event was proceeding satisfactorily and the root cause investigation efforts were adequate.

Analysis

The team determined that the licensee's failure to develop and implement corrective actions for a repetitive problem of excavating and digging activities damaging buried components was a performance deficiency warranting a significance evaluation. The team concluded that the finding was of greater than minor risk significance in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening." This conclusion was based on the licensee's failure to develop and implement corrective actions for several previous similar events. When the loss of offsite power event occurred the plant was shutdown with the reactor vessel head removed and the reactor cavity flooded to about 6 feet above the reactor vessel flange. Inspection Manual Chapter 0609, "Significance Determination Process," Appendix A, "SDP Phase 1 Screening Worksheet for IE [Initiating Events], MS [Mitigating Systems], and B [Barrier Integrity] Cornerstones," states that if the finding is assumed to degrade the safety of a shutdown reactor then use Appendix G, "Shutdown Operations Significance Determination Process." Utilizing IMC 0609, Appendix G worksheet, "PWR [Pressurized Water Reactor] Cold Shutdown and Refueling Operation RCS [Reactor Coolant System] Open and Refueling Cavity Level <23 Feet," the team determined this was a finding that increased the likelihood of a loss of offsite power and therefore required a Phase 2 analysis. In addition, a Phase 3 analysis was required since the potential for this event to occur also existed when the plant was operating at power.

This is an Unresolved Item (URI 50-255/03-05-01) pending the completion and review of these analyses. The licensee entered this issue into their corrective action program as CAP 034500.

Enforcement

The maintenance technician driving the signpost into the ground was not performing an activity affecting quality. Therefore, no violation of regulatory requirements was identified.

03 Event Common Cause Review and Assessment (93812)

a. Inspection Scope

The team interviewed individuals involved in both events, and reviewed pertinent logs, information, and procedures to identify any common causes or relationships between the two events.

b. Findings

No findings of significance were identified.

The team did not identify any common causes or relationship between the two events.

04 Operator Performance Issues (93812)

04.1 March 18, 2003 Cable Spreading Room Fire

a. Inspection Scope

The team reviewed operator performance during the March 18, 2003, cable spreading room fire through interviews of the on-shift operating crew, a simulator training instructor, and licensee management. The team also reviewed operating logs, operating procedures, abnormal operating procedures, alarm response procedures, annunciator alarm printouts, system drawings, and operator training records.

b. Findings

Introduction

A Green finding associated with a self-revealed event was identified when a control room operator repeatedly attempted to start charging pump P-55A and failed to trip the Primary Coolant Pumps when required. One Non-Cited Violation of Technical Specification 5.4.1 was identified.

Description

On March 18, 2003, the plant was in Mode 5 (Cold Shutdown) and in a solid condition with charging and letdown flow increased to aid in PCS cleanup. Operators were directed to increase the boric acid concentration in the PCS by realigning the charging water suction from the VCT to BAST T-53B.

Prior to the evolution, the CRS and NCO-1 discussed the activity, but did not involve the operating crew in a crew briefing. The CRS did not use a pre-job checklist during the discussion, nor did NCO-1 review or discuss the procedure requirements in SOP-2A, "Chemical and Volume Control System." Instead, with the CRS's knowledge, NCO-1 used a placard intended for use during emergency boration as guidance to perform the evolution. Since the valves to be operated were the same as those identified in the placard, the CRS and NCO-1 saw no immediate problem.

Operators calculated that 67.4 gallons of high concentration boric acid solution from the BAST were required to be added to raise PCS boron concentration to the desired level. However, operators did not calculate how long this evolution should require or recognize that the computer screen used to monitor BAST level updated only every 10 seconds. NCO-1 initiated actions to borate the PCS by shifting the charging pump suction from the VCT to BAST T-53B. The CRS performed a peer check of the valve manipulations and then proceeded with other duties. NCO-1 turned away to verify a decrease in BAST level, but did not observe an immediate change. NCO-1 then turned his attention back to the control panel and noted that PCS pressure was unexpectedly rapidly decreasing.

Operations management expectations were that operators announce problems and obtain supervisory approval prior to operating equipment unless the action is an immediate action within a procedure, which was not the case for this situation.

However, without informing anyone else in the control room about the rapidly decreasing PCS pressure, NCO-1 attempted to arrest the pressure drop by adjusting the backpressure regulator to reduce the letdown rate from the PCS. As PCS pressure continued to decrease, NCO-1 again attempted to adjust the backpressure regulator without verifying charging pump flow. Charging pump P-55A tripped on low suction pressure about 40 seconds after the VCT discharge valve was closed. At that point, a second operator, NCO-2, noted that the charging pump had tripped and announced the trip. NCO-1, without supervisor approval, then reopened the VCT discharge valve, shut the BAST suction valve, and repeatedly attempted to restart charging pump P-55A. In 9 seconds, NCO-1 unsuccessfully attempted to start pump charging pump P-55A three times.

Step 5.2.3 of Procedure SOP-2A limited the attempted starts of P-55A to one attempt. Step 7.5.5.f of SOP-2A required verifying charging flow after shifting to gravity feed. The licensee's investigation later revealed that P-55A charging pump Breaker 52-1205 had no arc chutes installed. In addition, the licensee's investigation identified that the breaker's anti-pump relay had its wires burned off, likely from an arc either before or during an earlier attempt to close the breaker and start the pump. The licensee's investigation also identified that the pump low suction pressure trip switch had stuck closed so that the low suction pressure trip was locked in. With the anti-pump relay damaged and the breaker trip signal locked in, the actions of NCO-1 to hold the breaker control switch in the close position resulted in electrical arcing within the breaker. Without the arc chutes installed, a fire started within the charging pump P-55A breaker cubicle. The arc was extinguished when the upstream supply breaker to LCC-12, Breaker 52-1202, opened as designed on overcurrent.

With NCO-1 attempting to restart the charging pump, PCS pressure continued to decrease. Neither NCO-1 nor the CRS noticed that PCS pressure was trending toward the minimum pressure for PCP operation. The SS did notice the trend in PCS pressure and directed the CRS to trip the PCPs. The CRS made a statement to trip the PCPs, but did not use effective three-way communications to ensure that NCO-1 understood and complied with the direction. NCO-1 did not hear the direction given. As a result, the PCPs were not tripped until the SS directed NCO-1 to trip the PCPs. Consequently, PCS pressure decreased to below the minimum operating pressure for PCP operation, a condition that led to minor damage to the 1D PCP seal.

The other running charging pump, P-55B, tripped when LCC-12 bus supply breaker 52-1202 tripped on high current. Operators verified that adequate shutdown margin existed, that shutdown cooling remained in operation, and that PCS cooldown rates had not been exceeded. Operators secured PCS letdown and controlled bleedoff flow to maintain primary coolant system inventory.

Analysis

The team determined that the control room operator failed to follow procedure requirements by repeatedly attempting to restart charging pump P-55A, and to secure the PCPs prior to PCS pressure dropping below the minimum pressure for PCP operation. The team concluded that the finding had more than minor risk significance in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue

Disposition Screening," because it could reasonably be viewed as a precursor to a significant event. Inspection Manual Chapter 0609, "Significance Determination Process," Appendix A, "SDP Phase 1 Screening Worksheet for IE, MS, and B Cornerstones," states that if the finding is assumed to degrade the safety of a shutdown reactor then use Appendix G, "Shutdown Operations Significance Determination Process." Utilizing IMC 0609, "Significance Determination Process," Appendix G worksheet, "PWR Cold Shutdown Operation and RCS Closed and S/Gs [Steam Generators] Available for DHR [Decay Heat Removal]," the team determined that since the event did not result in an inadvertent change in PCS temperature or a loss of level, the finding was of very low safety significance (Green).

Enforcement

Technical Specification 5.4.1 requires that written procedures be established, implemented, and maintained covering the activities specified in Regulatory Guide 1.33, Appendix A. Item 3.a of Appendix A included procedures for the operation of the reactor coolant system, and item 3.n included procedures for the operation of the chemical and volume control system. Step 5.2.3 of Procedure SOP-2A, "Chemical and Volume Control System," Revision 50, limited the attempted starts of charging pump P-55A to one attempt. Procedure SOP-1, "Primary Coolant System," Attachment 2, Revision 51, Step 3, stated, "The plant shall be maintained to the left and above the Minimum Pressure for PCP Operation Curve whenever the Primary Coolant Pumps are operating." Contrary to the above, on March 18, 2003, a nuclear control operator attempted to start charging pump P-55A three times after it tripped and failed to trip the PCPs prior to PCS pressure dropping below the minimum pressure for PCP operation.

However, because of the very low safety significance and because this issue was entered into the corrective action program, it is being treated as a Non-Cited Violation, consistent with Section VI.A.1 of the Enforcement Policy (NCV 50-255/03-05-02). This issue was entered into the licensee's corrective action program as CAP 034027.

04.2 March 25, 2003, Loss of Offsite Power

a. Inspection Scope

On March 25, 2003, the resident inspectors responded to the control room after the offsite power supply to the plant was lost unexpectedly. The team observed the control room operators' response to the event. The team verified that ONP-17, "Loss of Shutdown Cooling," General Operating Procedure (GOP)-14, "Shutdown Cooling Operations," and the Emergency Plan were implemented in a timely and accurate manner to address the event.

The team walked down control room panels to monitor key plant parameters including primary coolant system heatup rate. The team also verified that the emergency diesel generators were operating properly to provide power to plant equipment necessary to re-establish shutdown cooling.

The Alert was downgraded to an Unusual Event after shutdown cooling was restored and terminated on March 27, 2003 when offsite power was reliably re-established.

b. Findings

No findings of significance were identified.

The team concluded that control room operators responded effectively and in accordance with plant procedures to the loss of offsite power and resultant loss of shutdown cooling. Consequently, the event was mitigated in a timely manner. The CRS demonstrated positive command and control while directing operator actions and the team noted that communications between the control room operators were clear and concise while addressing the event.

The CRS immediately entered ONP-17 and methodically initiated actions to re-establish shutdown cooling which limited primary coolant system heatup to only 10°F.

The control room and auxiliary operators verified that the necessary plant equipment to support shutdown cooling operations was available and then re-established cooling flow to the reactor within 20 minutes of the initiation of the event.

05 Equipment Performance Issues - March 18, 2003 Cable Spreading Room Fire (93812)

a. Inspection Scope

The team reviewed the licensee's efforts to restore the facility following the March 18, 2003, cable spreading room fire. Additionally, the team reviewed the performance of equipment during the event.

b. Findings

No findings of significance were identified.

One equipment performance deficiency occurred when the P-55A charging pump breaker low suction pressure trip switch stuck in the tripped position and contributed to the event.

The team reviewed the circumstances surrounding the failure of the P-55A charging pump low suction pressure trip switch including a review of the maintenance and calibration records for this switch and other similar switches. No other instances of the P-55A charging pump low suction pressure trip switch or other similar pressure switches failing closed after actuating were identified.

The team reviewed the selective tripping design for the power sources to the P-55A charging pump. The team determined that the upstream power supply breaker to LCC-12, breaker 52-1202, functioned as designed and interrupted power to minimize the loss of power to plant components while isolating the fault.

The licensee examined LCC-12 and determined that other than smoke and soot, the damage was isolated to the charging pump breaker enclosure. The team also reviewed the results of the testing performed to identify potential cable damage or degradation. The licensee's investigation attributed all damage to LCC-12 to the arcing on charging

pump P-55A breaker 52-1205. The team's independent review did not identify any contradictory evidence.

Licensee corrective actions for this event included the installation of new wiring from LCC-12 to the breaker enclosure and the installation of a replacement breaker. Post maintenance testing on the new breaker was satisfactory. No concerns were identified.

06 Equipment Performance Issues - March 25, 2003 Loss of Offsite Power (93812)

a. Inspection Scope

The team reviewed the licensee's efforts to restore offsite power to the facility. Additionally, the team reviewed the performance of equipment during protective relay actuations.

b. Findings

No findings of significance were identified.

There were no significant equipment performance deficiencies during the event. The team reviewed the fast transfer design for the power sources to the safeguards buses. In accordance with the facility design, were the safeguards power source to be lost, a fast transfer would occur to the alternate supply from the R bus through the startup power transformer 1-2. This fast transfer, however, was dependent on the availability of the standby source, as indicated by available voltage. During this event, there was no transfer of power source to the startup power transformer since the R bus was the first power source lost. The team concluded that the electrical system fast transfer design functioned as expected in that a fast transfer did not occur to a de-energized bus.

The team reviewed the licensee's cable testing results to identify those with potential cable damage or degradation. Through megger testing of numerous conductors, the licensee identified several conductors which had less than nominal resistance readings. Cable MISC-1, which was the only cable actually damaged by the signpost, had five conductors with less than acceptable megger readings.

Licensee corrective actions to restore offsite power to the safety-related buses and re-establish system integrity included the repair of the damaged conductors and the use of existing spare conductors on other cables routed between the plant and switchyard. On March 27, the Shift Supervisor authorized installation of Temporary Modification TM-2003-012, "Restoration of Startup Power Transformers (1-1, 1-2, and 1-3) Protective Relaying," for R bus relay 486 S-X1. The team observed portions of the installation of temporary modification TM-2003-012. The modification was installed to provide for the use of undamaged conductors in existing cables and lifting of wires routed between the switchyard and the plant. The team reviewed the modification documentation, including the associated 10 CFR 50.59 screening. This temporary modification allowed the station to realign offsite power to safeguards buses 1C and 1D through the startup transformer. The team also reviewed the completed work order which installed cable splices to repair the damaged conductors in cable MISC-1. Based on a review of the records and an observation of activities, no concerns were identified.

07 Maintenance Performance Issues (93812)

a. Inspection Scope

The team reviewed the maintenance performance issues associated with the discovery that charging pump breaker 52-1205 was installed on May 24, 2002 without arc chutes. The licensee identified that the lack of arc chutes was the primary cause of the cable spreading room fire. The team reviewed work orders, maintenance procedures, calibration records, vendor technical manuals, electrical maintenance worker training and qualifications, clearance order practices, and selected corrective action documents. The team also interviewed the workers that installed the breaker without the arc chutes and other electrical maintenance personnel.

b. Findings

Introduction

A finding of very low safety significance was self-revealed during an event when the licensee failed to have adequate maintenance procedures in place to ensure that when electrical breakers were removed to be refurbished that the arc chutes were reinstalled before the breaker was placed back in operation. The finding was determined to be of low safety significance because the failure did not result in a loss of shutdown cooling or loss of reactor inventory. One Non-Cited Violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," was identified.

Description

The team reviewed the work orders that were used to remove and reinstall P-55A charging pump breaker 52-1205 prior to the event. Work Order (WO) 2491-2422 removed the breaker (Serial Number 42924-A14-2-4D) for refurbishment on October 18, 2001, in accordance with the requirements of Procedure Station Power System (SPS) E-17, "Temporary Installation and Removal of Spare Circuit Breakers," Revision 1. Procedure SPS-E-17, Step 4.2.1 required, "During performance of maintenance, removed parts are to be adequately packaged, identified, and stored so they are not lost, damaged, or lose traceability to the component from which they were removed." An entry in the WO remarks section indicated that the arc chutes had been removed, tagged, and stored in the electrical maintenance shop. Work Order 2411-3520, which reinstalled the breaker on May 24, 2002, made no mention of the arc chutes. However, there was no procedurally required certification of arc chute re-installation.

The team reviewed 16 WOs that had removed or installed similar breakers without finding any discernible pattern of recording the removal or re-installation of the arc chutes. Five WOs recorded arc chute removal for shipping, five WOs recorded arc chute installation prior to installation into an LCC, six WOs made no mention of arc chutes, and only three breakers had both the removal and re-installation of arc chutes recorded. There was no procedural requirement in SPS-E-17 to remove or install arc chutes. The SPS system engineer could not recall any specific action or incident that

required the removal of the arc chutes from K-Line breakers for shipping. The apparent intent was to prevent damage to the arc chutes during shipping.

Step 5.4 of Maintenance Procedure SPS-E-6, "ITE 480 Volt Breaker Inspection and Repair," Revision 11, contained instructions for removal, inspection, and re-installation of arc chutes. However, neither procedure SPS-E-6 nor any other procedure was used for removal or re-installation of the K-Line breaker arc chutes. The licensee completed a walkdown of all installed K-line breakers on March 18, 2003, and ensured that no other breakers were missing arc chutes.

The team reviewed the training records, training course contents, and qualifications of both of the workers that installed breaker 52-1205 without arc chutes. No issues were identified. When interviewed by the team, neither of the workers could identify a reason for not installing the arc chutes although both were aware of the function and importance of the arc chutes for proper breaker function. The workers had used a pre-job briefing checklist prior to reinstalling the breaker and both workers were very experienced. From the work instructions and interviews, the team noted that at one point the spare breaker and the refurbished breaker were side-by-side for comparison of the auxiliary contacts, but neither worker identified the absence of the arc chutes.

The team reviewed the work control processes for removing and reinstalling the breakers. The licensee staff informed the team that separate WOs were routinely used for breaker removal and reinstallation to facilitate declaring the installed spare and re-installed original breaker operable following WO closeout. The team reviewed Procedure 5.01, "Processing Work Requests/Work Orders," Revision 27, and found no requirement for separate work orders. The licensee staff agreed that no identified process or procedure required closing out the original WO. The team noted that information on the removal WO had not been carried forward to the re-installation WO (specifically the removal and storage of the arc chutes) and the licensee staff confirmed that there was no requirement to carry the information forward to the installation WO. The team also found that there was no process or procedure that addressed control of partial equipment shipments for repair and positive controls of the remainder of the equipment. Likewise, no processes existed for receipt of equipment components that also addressed control of the remainder of the equipment. Procedure 5.01 stated that, "The assigned supervisor or repair worker is responsible for control of parts associated with Work Orders;" however, the team found that there was no "assigned supervisor or repair worker" for closed work orders. Consequently, there was no assurance that information noted in a work order upon removal of an item would be available for reference during re-installation.

The team reviewed the operational history of breaker 52-1205 and identified that the breaker cubicle door had been opened numerous times, after the breaker had been installed without the arc chutes, in support of eight work orders for protective tagging. At least one of those work orders included a wiring inspection by electrical maintenance workers. In addition to the above work orders, electrical maintenance technicians opened the breaker door to perform an inspection of the breaker dust shields. The licensee staff agreed that multiple opportunities for both operations and electrical maintenance personnel to identify that the arc chutes were missing had existed.

However, inspection of breakers for such missing components was not a normally performed activity.

Analysis

The team identified that the licensee performed activities affecting quality without a procedure or work instructions, specifically removing and/or replacing breaker arc chutes without instructions to do so. In addition, no procedural guidance existed to control equipment after it had been partially disassembled and the work order was closed out. The team concluded that the finding had more than minor risk significance in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because inadequate maintenance procedures and the installation of non-conforming equipment in safety-related components could be reasonably viewed as a precursor to a significant event. Inspection Manual Chapter 0609, "Significance Determination Process," Appendix A, "SDP Phase 1 Screening Worksheet for IE, MS, and B Cornerstones," states that if the finding is assumed to degrade the safety of a shutdown reactor then use Appendix G, "Shutdown Operations Significance Determination Process." Utilizing IMC 0609, Appendix G worksheet, "PWR Cold Shutdown Operation and RCS Closed and S/Gs Available for DHR," the team determined that since the event did not result in an inadvertent change in PCS temperature or a loss of level, the finding was of very low safety significance (Green).

The team concluded that the failure to install the breaker arc chutes also increased the probability of the initiation of a fire. Inspection Manual Chapter 0609, "Significance Determination Process," Appendix F, "Determining Potential Risk Significance of Fire Protection and Post-Fire Safe Shutdown Inspection Findings," states that one of the fire protection defense in depth elements is the prevention of fires from starting. The team determined that the failure to install arc chutes increased the likelihood of a fire in the cable spreading room. As such, further analysis was required as specified by IMC 0609, Appendix A, "SDP Phase 1 Screening Worksheet for IE, MS, and B Cornerstones," The team reviewed licensee engineering analysis EA-PSA-FIRE-IE-03-05 and concurred with the results which calculated a fire initiating event frequency of 4.7×10^{-4} per year. To calculate this frequency, the licensee determined that the frequency of a standing trip signal for breaker 52-1205 was 5.5×10^{-2} per year based on failure rates associated with one control switch, five external relays, and three internal breaker relays. In the March 18, 2003 event, the upstream breaker for breaker 52-1205 tripped and the fire was limited to the breaker cubicle. For their analysis, the licensee assumed that such a fire would not be limited to the breaker cubicle if the upstream breaker failed to trip. The team noted that this assumption was conservative because even if the upstream breaker failed to trip, a breaker further upstream would likely trip thereby limiting the duration of and energy contribution to the fire. The licensee identified the failure probability associated with the upstream breaker to trip open upon demand was 8.49×10^{-3}.

The team used the Phase 2 process outlined in IMC 609, Appendix F, to determine the significance of the event given the fire initiating event frequency developed by the licensee. The team noted that the Phase 1 process outlined in IMC 0609, Appendix F was not applicable because the finding did not involve fire protection features. For this evaluation, the team assumed that a fire which was not limited to the breaker cubicle

could develop into a widespread fire in the cable spreading room requiring plant shutdown from outside the control room. The team noted that such an assumption was conservative since the nearest exposed cables were more than 4 feet above the cubicle and there was a supply ventilation duct nearby with a design flow rate of 2000 cubic feet per minute which would tend to disperse hot gases from a cubicle fire before the gases came in contact with the exposed cables. Using the guidance of IMC 0609, Appendix F, and the licensee developed fire initiating event frequency, the team determined that the fire mitigation frequency (FMF) was -5.08. This FMF was calculated based on no credit for fire barriers or separation, moderate degradation for automatic suppression, and full credit for manual suppression outside of the control room. Based on a review of IMC 0609, Appendix F, Table 5.4, the team determined that the FMF correlated to an approximate frequency of 1 per 10^5 to 10^6 years. The failure to have arc chutes in place was greater than 30 days. Therefore, based on a review of IMC 0609, Appendix F, Table 5.5, the inspectors determined that the estimated likelihood rating was "F." Based on a review of the text associated with IMC 0609, Appendix F, Figure 4-3, and IMC 0609, Appendix F, Attachment 1, Example 1C, the inspectors determined that a -1 point credit for post-fire safe shutdown operation was applicable. Therefore, based on a review of IMC 0609, Appendix F, Table 5.6, "Risk Significance Estimation Matrix," the team concluded that the finding associated with the failure to install arc chutes was of very low safety significance (Green).

Enforcement

10 CFR 50, Appendix B, Criterion V, "Instruction, Procedures, and Drawings," states, in part, that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and that work shall be accomplished in accordance with these instructions, procedures, or drawings. Contrary to the above, on October 19, 2001, licensee personnel removed the arc chutes from charging pump breaker 52-1205 without procedural guidance, controls, or documentation, and had no adequate measures in place to prevent the non-conforming breaker from being returned to service on May 24, 2002.

However, because of the very low safety-significance and because this issue was entered in the corrective action program, it is being treated as a Non-Cited Violation, consistent with Section VI.A.1 of the Enforcement Policy (NCV 50-255/03-05-03). This issue was entered into the licensee's corrective action program as CAP 034187.

08 Design Issues Associated With Offsite Power Configuration (93812)

a. Inspection Scope

The team reviewed the offsite and onsite electrical distribution system as described in various licensing and design bases documents such as the Updated Final Safety Analysis Report. In particular, the team focused on the facility's design with respect to electrical and cable separation requirements. This issue was of concern in light of the event being caused by damage to multiple conductors in a single cable. This cable contained protective relay circuitry which affected the normal and alternate power sources to both safety-related buses.

b. Findings

No findings of significance were identified.

The team concluded that the design of the electrical circuitry was in conformance with the licensing basis. From a review of the licensee's Updated Final Safety Analysis Report and licensing documents, the team determined that the plant was designed and constructed prior to IEEE-308, "Standard Criterion for Class 1E Power Systems for Nuclear Power Generating Stations," requirements. Therefore, the facility may not meet all design criteria and testing requirements contained in IEEE-308. The adequacy of the licensee's electrical power system was reviewed by the NRC as part of the Systematic Evaluation Program. The results of these reviews were documented in NUREG-0820, "Integrated Plant Safety Assessment-Systematic Evaluation Program." The team concluded that the licensee's offsite power system, and conformance to existing design requirements relating to electrical separation and physical separation, had been previously reviewed and approved by the NRC as part of the evaluation program. No additional concerns were identified by the team.

Since the facility was designed prior to issuance of 10 CFR 50, Appendix A, General Design Criteria (GDC) 17, "Electrical Power Systems," the installation of a safeguards transformer in 1989 was considered a modification to improve the capability for reliable offsite power. Additionally, the design was considered to enhance conformance with, but not commit compliance to GDC 17.

The original design of the offsite power improvement project was to install the new control circuits through an existing duct bank between the switchyard and the plant. Due to difficulties in replacing some existing cables, a new conduit run was installed and routed between the plant and switchyard. By design, the conduit was installed about 30 inches underground. It was this conduit that was damaged by the signpost being driven into the ground. Based on the fact that the licensee was not required to provide physical separation between circuits associated with the R and F buses, the licensee designed the circuits to use separate conductors within the same cable for the various protective relay circuitry. This design contributed to the loss of offsite power event.

The licensee's interim and permanent repairs to the damaged cables and modifications to the existing design included provisions to provide additional physical separation between the circuits for the safeguards transformer and the backup source through the R bus.

09 Review of Emergency Plan Response Actions (93812)

a. Inspection Scope

The team interviewed members of the control room crew, and reviewed the licensee's Site Emergency Plan, operating logs, technical support center narrative logs, and applicable event notification forms to determine if the licensee correctly classified the event and made the proper notifications in a timely manner.

b. Findings

No findings of significance were identified.

10 Exit Meeting Summary

On April 4, 2003, the team presented the preliminary inspection results to Mr. D. Cooper and other members of the Palisades Plant management and staff. The licensee acknowledged the information presented. The team asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

KEY POINTS OF CONTACT

Nuclear Management Company
T. Blake, Emergency Planning Manager
D. Cooper, Site Vice President
B. Dotson, Licensing Analyst
P. Harden, Engineering Director
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G. Packard, Operations Manager
R. Remus, Plant General Manager

U.S. Nuclear Regulatory Commission
S. Reynolds, Deputy Director, Division of Reactor Projects
J. Lennartz, Senior Resident Inspector
R. Krsek, Resident Inspector

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

50-255/03-05-01	URI	Corrective Actions to Address Digging and Excavating Events
50-255/03-05-02	NCV	Failure to Follow Operating Procedures
50-255/03-05-03	NCV	Failure to Have Adequate Maintenance Procedures

Closed

50-255/03-05-02	NCV	Failure to Follow Operating Procedures
50-255/03-05-03	NCV	Failure to Have Adequate Maintenance Procedures

LIST OF ACRONYMS USED

B	Barrier
BAST	Boric Acid Storage Tank
CAP	Corrective Action Program Document
CRS	Control Room Supervisor
DHR	Decay Heat Removal
EAR	Engineering Action Request
EDG	Emergency Diesel Generator
EST	Eastern Standard Time
FMF	Fire Mitigation Frequency
GDC	General Design Criteria
GOP	General Operating Procedure
gpm	gallons per minute
IE	Initiating Events
IP	Inspection Procedure
kV	Kilovolt
LCC	Load Control Center
LPSI	Low Pressure Safety Injection
NCO	Nuclear Control Operator
NCV	Non-Cited Violation
MC	Manual Chapter
NMC	Nuclear Management Company
NRC	Nuclear Regulatory Commission
ONP	Off Normal Operating Procedure
PCP	Primary Coolant Pump
PCS	Primary Coolant System
PSIA	Pounds Per Square Inch Absolute
PWR	Pressurized Water Reactor
RCS	Reactor Coolant System
SDC	Shut Down Cooling
SDP	Significance Determination Process
S/G	Steam Generator
SOP	Standard Operating Procedure
SS	Shift Supervisor
TBD	To Be Determined
URI	Unresolved Item
Vac	Volts Alternating Current
VCT	Volume Control Tank

LIST OF DOCUMENTS REVIEWED

Documents Reviewed

Palisades Administrative Procedure 4.28, Control of Palisades Switchyard Activities, Revision 0

Palisades Drawing SK-EAR-203-0086-2, Safeguards and Startup Offsite Power Source Between Plan and Switchyard, Revision 0

Plant Review Committee Overview of Offsite Power Recovery

NRC Evaluation of SEP Topic VII-3, Systems Required for Safe Shutdown, December 1981

Final Safety Analysis Report, Chapter 8

Palisades Offsite Reliability Improvement – Functional Description, GWO 8303, File 114.2, FC-800

Palisades Offsite Reliability Improvement – Design Plan, GWO 8303, File 110.2, FC-800

Palisades Nuclear Plant, Design Basis Document, 2400 VAC System, July 2001

Palisades Nuclear Plant, Design Basis Document, 345 kV Switchyard, January 1999

Work Request 294427, Perform Circuit Verification on Scheme Associated with Cable MISC-1

Integrated Plant Safety Assessment- Systematic Evaluation Program, NUREG-0820, October 1982

Integrated Plant Safety Assessment- Systematic Evaluation Program, NUREG-0820, Supplement 1, November 1983

Work Request 300477, Check and Megger Test Conductors for Cable MISC-1

Temporary Modification TM-2003-012, Restoration of Startup Power Transformers (1-1, 1-2, and 1-3) Protective Relaying

CAP034185, Emergency Assembly Area Over Capacity.

CAP034187, Alert Declared Due to Fire in Cable Spreading Room.

CAP034198, ‘A’ and ‘D’ Primary Coolant Pumps Tripped Below Minimum Operating Pressure.

CAP034237, Capture Operations Lessons Learned following LCC-12 Breaker Fire.

CAP034241, PC-0218A (Charging Pump P-55A Low Suction Trip) Out of Specification.

CAP034245, PC-0218B (Charging Pump P-55B low suction trip) Found Out of Specification.

CAP034399, Conduct Common Cause Evaluation on the Response to Alert Declaration.

CAP034622, Missed Opportunity to Update FSAR Text During SOP Procedure Revision.

CAP019120, Alert Declared Due to Fire in Cable Spreading Room.

CAP034538, P-55C Potentially Run Without Suction or Discharge Path.

CAP034623, Design Bases Calculation for Charging Flow Not Updated for Operational Change.

Procedure SOP-2A, Chemical and Volume Control System, Revision 50.

Procedure ONP-25.1, Fire Which Threaten Safety - Related Equipment, Revision 12.

Procedure 24912222,Temporary Installation and Removal of Spare Circuit Breakers, Revision 1

Procedure SPS-E-17,Temporary Installation and Removal of Spare Circuit Breakers, Revision 2

Procedure 4.14, Conduct of Operations, Revision 0.

Procedure 4.09, Control of Operator Aids, Revision 7.

Procedure 10.53, Use and Adherence of Procedures and Other Forms of Written Instruction, Revision 12.

Procedure 4.00, Operations Organization, Responsibilities and Conduct, Revision 23.

Procedure QO-27, Inservice Testing of CVCS Control, Motor-Operated and Check Valves, Revision 9.

Procedure 5.01, Processing Work Requests/Work Orders, Revision 27.

Procedure QO-17, Inservice Test Procedure - Charging Pumps, Revision 18.

Procedure 1.10, Plant System, Structure, and Component Labeling, Revision 2.

WO SPS 24912222 7, Charging Pump P-551 Breaker

WO SPS 24912222 7, Removed, Tagged and Stored Arc Chutes in Shop.

WO SPS 24113520 1, Charging Pump P-55A Breaker.

P&ID M-202 SH, 1B, Chemical & Volume Control System.

VTD-2881-0009, Installation Maintenance Instructions For Low Voltage Power Circuit Breakers.

VTD-2881-0010, Installation Maintenance Instructions For Low Voltage Air-Magnetic Power Circuit Breakers For K-Line 225A Thru 2000A.

GOP-14, Shutdown Cooling Operations, Revision 17

ONP-17, Loss of Shutdown Cooling, Revision 28

Operations Log Entries, March 25, 2003

EA-PSA-FIRE-IE-03-05; Fire Initiating Event Frequency for Missing Arc Chutes on 480VAC Circuit Breaker 52-1205; Revision 0

Palisades Simplified Electrical Distribution System