

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Palisades Nuclear Plant	DOCKET NUMBER (2) 0 5 0 0 0 2 5 5	PAGE (3) 1 OF 0 5
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TITLE (4)
Startup Transformer Failure Results in Loss of Offsite Power and Manual Reactor Trip

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		
0 7	1 4	8 7	8 7	0 2 4	0 0	0 8	1 3	8 7	N/A		
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OPERATING MODE (9) N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)											
POWER LEVEL (10) 0 9 1 1	20.402(b)			20.408(e)			80.73(a)(2)(iv)			73.71(b)		
	20.408(a)(1)(i)			80.38(e)(1)			80.73(a)(2)(v)			73.71(e)		
	20.408(a)(1)(ii)			80.38(e)(2)			80.73(a)(2)(vi)			OTHER (Specify in Abstract below and in Text, NRC Form 305A)		
	20.408(a)(1)(iii)			80.73(a)(2)(i)			80.73(a)(2)(vii)(A)					
	20.408(a)(1)(iv)			80.73(a)(2)(ii)			80.73(a)(2)(vii)(B)					
20.408(a)(1)(v)			80.73(a)(2)(iii)			80.73(a)(2)(i)						

LICENSEE CONTACT FOR THIS LER (12)

NAME CSKozup, Technical Engineer	TELEPHONE NUMBER
	AREA CODE: 6 1 1 6 7 1 6 4 - 1 8 1 9 1 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	E A	X F M R	G O 8 0	Yes	X	T A	F C U M	1 2 0	No
X	S B	R V C	6 3 5	No	X	S B	R L Y W	1 Z 1	Yes

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On July 14, 1987 at 1322 a loss of offsite power occurred while the reactor was critical and operating at 91 percent of rated power. At 1330 the Site Emergency Plan was activated and an Unusual Event was declared based on the loss of offsite power.

The loss of offsite power occurred due to a fault on the 1-2 startup transformer [EA;XFMR]. The fault on the 1-2 startup transformer actuated protective relays which tripped the breakers for the 1-1, 1-2, and 1-3 startup transformers resulting in a loss of off-site power. The fault was preceded by the inadvertent actuation of the deluge fire protection system [KP] for the main transformers. A combination of the deluge water contamination and wind currents are attributed with providing the necessary path to ground for the fault. The deluge system was inadvertently activated during maintenance to correct an alarm problem on the deluge system for the main transformer.

After observing the loss of offsite power, the Shift Supervisor ordered a manual reactor trip because of the loss of cooling tower pumps [KE;P] which provide flow for the secondary heat sink. The Plant's two emergency diesel generators [EK;DG] provided power until 2048 on July 14, 1987 when offsite power was restored. The Unusual Event was terminated at 2049. After the trip the plant was maintained in hot shutdown using natural circulation flow until forced circulation flow was restored at 2221.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Description

On July 14, 1987 at 1322 a loss of offsite power occurred with the reactor critical at 91 percent of rated power. The loss of offsite power resulted in the loss of cooling tower flow to the main condenser. The Shift Supervisor directed the reactor to be manually tripped due to the forthcoming loss of condenser vacuum. The forced circulation ceased after the turbine generator coastdown was completed. The plant's two emergency diesel generators [EK;DG] provided power until offsite power was restored at 2048. The plant was maintained in hot shutdown using natural circulation flow until forced circulation flow was restored at 2221. An Unusual Event was declared at 1330 and was terminated at 2049.

On July 14, 1987 plant I&C technicians were working to correct an alarm problem on the main transformer deluge system [KP]. The system air pressure for the main transformer and the startup transformer deluge systems are cross connected. After calibration of the main transformer pressure switch, PS-1341 [EF;PS] the system air pressure was increased and then decreased to balance the system. The deluge system actuates on differential pressure across a diaphragm [KP;BLL]. One side of the diaphragm has system air pressure, the other side has heat actuated device (HAD) air pressure. Under normal circumstances the air pressure is the same on both sides of the diaphragm with a compensating vent maintaining this equilibrium. However, when the HAD sees a rapid rise in temperature, the air expands increasing the air pressure faster than the compensating vent can release it, thus pushing the diaphragm in and releasing a weight latching mechanism, allowing the deluge valve to open. In this inadvertent actuation, the air supply pressure was reduced quickly which resulted in the air pressure on the HAD side of the diaphragm to be greater and therefore, the diaphragm moved and released the weight latch.

Shortly after the deluge system actuated, a flashover arc jumped from the 'Y' phase insulator bushing cap [EA;INS] to the transformer case of the 1-2 startup transformer [EA;XFMR]. The flashover created a ground fault on the 'Y' phase. The ground fault was sensed by the primary and backup bus differential relay scheme which initiated trips on the 345KV switchyard 'R' bus air blast breakers [EA;BKR] and the startup power breakers to the cooling tower system. The normal fast transfer to the startup power after a reactor trip was blocked due to the faults sensed from the flashover arc. The diesel generators [EK;DG] loaded onto their respective bus via the normal shutdown sequencers as designed.

Reactor trip and loss of forced circulation emergency procedures and initial safety function checks were completed and natural circulation flow was verified by 1339. The major Plant equipment responded as expected during the Plant trip with the exception of the quick open feature for the atmospheric steam dump valves [SB;RV] and the turbine bypass valve [TA;FCV]. These valves did not open until between 18 and 31 seconds after the Plant trip. The Plant remained in hot shutdown on natural circulation flow from the trip until 2221 when a primary coolant pump [AB;P] was started.

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Maintenance activities to backfeed the Plant through the main transformer [EF;XFMR] were commenced at 1550 and completed at 1950. These activities proceeded in a deliberate manner to allow the balance of switchyard breakers to be checked, verify status of the main transformer (that is used to backfeed), and to assure all relaying had properly functioned. Plant management's intent at this time was to proceed with the recovery phase cautiously since the Plant was operating very well under natural circulation and no risks for disrupting natural circulation were foreseen. At 1950, buses 1E, 1A and 1B were restored to service via backfeeding through the main transformer. However, on the first attempt to backfeed Bus 1C, a load shed signal was received and the 1C bus was reloaded onto the 1-1 D/G via the normal shutdown sequencer. The subsequent investigation revealed that two startup transformer auxiliary relays were not identified to be reset per the off-normal operating procedure. These relays were reset and buses 1C and 1D were powered from offsite power at 2048. Subsequently, the Off-Normal Operating Procedure for Loss of AC Power was corrected to include restoration of these two relays when backfeeding the 1C and 1D buses.

Cause Of The Event

The root cause of the fault is contaminants in the transformer deluge system water combined with wind currents which allowed the water spray to reach the top of the transformer bushing. These contaminants in the water spray provided a path to ground (ie, transformer case) for an electrical arc. There was no indication the arc traveled along the bushing surface or that the arcing was internal to the bushing or transformer. The contaminants were caused by water not being periodically flushed from the piping.

The proximate cause of the event was the inadvertent actuation of the deluge spray system on the startup transformer. The I&C technicians were performing maintenance on the deluge alarm system and had determined that pressure switch PS-1341 required calibration. After calibration, the system air pressure for the main transformer was repressurized for system operation. While raising the system air pressure to pressurize the main transformer deluge system, the regulator was adjusted such that the startup transformer deluge system pressure was too high. These two systems are tied together through a common air supply and pressure regulator. The system air pressure for the startup transformer was lowered by opening an air bleedoff valve. Just as the pressure reached the normal operating range, the startup transformer deluge system activated.

The delayed operation of the turbine bypass valve and the atmospheric steam dumps was determined to be a failure of turbine trip lockout relay 386/AST [SB;RLY] to make up properly during the event. An inspection of the relay revealed that the spacer between the contacts had broken. As a result of the spacer failure the contacts had shifted so they would not makeup as intended when the cam rotated. This resulted in the disabling of the quick open feature of the turbine bypass valve and the atmospheric steam dumps.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Corrective Actions

The contamination in the deluge water lines was caused by corrosion due to the stagnant water in the piping. This contamination will be reduced by quarterly flushes of the deluge system. This flush has been incorporated into the periodic fire system checklists. The deluge spray nozzles were tested to determine if the spray nozzles should be adjusted. The test showed none of the nozzles sprayed directly up into the bushing and that no adjustments were necessary. In addition, an engineering review of the deluge system is being conducted to determine possible actions which would minimize inadvertent actuations of the deluge system. This review will be completed by September 1987.

The turbine trip lockout relay (386/AST) was replaced prior to Plant startup. In addition, a review for similar relays in the Plant was conducted. Eleven similar relays were located and inspected. None of these eleven relays exhibited a similar spacer failure or any other anomalies. Because the 386/AST relay also provides logic to the feedwater pump speed ramp down, the closure of turbine generator moisture separator reheater valves and the feedwater regulator valve controls in addition to the turbine bypass and atmospheric steam dump valves, this relay failure is being evaluated to determine if it may have contributed to the anomalies observed on June 20, 1987. Those anomalies are described in Licensee Event Report 87-018, "Improper Valve Operation Results in Reactor Critical At Less Than 525°F". The evaluation of the failed relay effects on the June 20, 1987 event will be completed by September 1987.

The Palisades offsite power system is being evaluated to determine possible upgrades to the system to improve reliability. The identification of possible options for the upgrade will be completed in September 1987.

Analysis Of The Event

The loss of offsite power with a reactor trip is an analyzed transient with no adverse safety consequences. The Plant response to the reactor and turbine trip was consistent with its designed operation with the exception of the atmospheric steam dump valve and the turbine bypass valve which failed to quick open. The review of the primary coolant system parameters indicate that the Plant responded as designed even though the quick open feature did not activate. Natural circulation was established and verified with no problems. An independent assessment of the Plant trip was conducted by Plant Safety Engineering and they concurred with the Plant startup after the maintenance repairs.

During the transient, the secondary system was exposed to hydraulic disturbances. Secondary system equipment inspections revealed no signs of damage other than minor denting of insulation. During startup, Operations and System Engineering walkdowns were performed to look for additional damage which may not have appeared until after startup.

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As a precaution, the discharge piping of the feedwater pumps and the condensate pumps were non-destructively tested (NDT) for possible damage. The NDT results showed no damage.

Offsite power was lost for over seven hours after the trip. The Plant was ready to backfeed after approximately four hours, but management conservatively decided to further investigate the power system for any undetected damage before backfeeding offsite power through the main transformer.

This event is being reported per 10CFR50.73 (a)(2)(iv) as an event which resulted in the manual actuation of the Reactor Protection System.



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Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
LICENSEE EVENT REPORT 87-024 - STARTUP TRANSFORMER FAILURE
RESULTS IN LOSS OF OFFSITE POWER AND MANUAL REACTOR TRIP

Licensee Event Report (LER) 87-024, (Startup Transformer Failure Results in Loss of Offsite Power and Manual Reactor Trip) is attached. This event is reportable to the NRC per 10CFR50.73(a)(2)(iv).

Thomas C Bordine
Staff Licensing Engineer

CC Administrator, Region III, NRC
NRC Resident Inspector - Palisades

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