



Consumers  
Power

**POWERING  
MICHIGAN'S PROGRESS**

Palisades Nuclear Plant: 27780 Blue Star Memorial Highway, Covert, MI 49043

February 15, 1996

U S Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

**DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT**  
**LICENSEE EVENT REPORT 96-002 - INITIATION OF TECHNICAL SPECIFICATIONS**  
**REQUIRED SHUTDOWN DUE TO SAFEGUARDS CABLE FAULT**

Licensee Event Report (LER) 96-002 is attached. This event is reportable in accordance with 10CFR50.73(a)(2)(i)(A) as the completion of any nuclear plant shutdown required by the plant's Technical Specifications.

SUMMARY OF COMMITMENTS

This letter contains 3 new commitments and no revisions to existing commitments. The new commitments are as follows:

1. Revise the Construction cable installation specification to require the use of pulling lubricant specified by cable manufacturers.
2. Perform testing of the faulted cable from bus 1D to determine the cable failure mechanism. Review use of Yellow 77 with manufacturer.

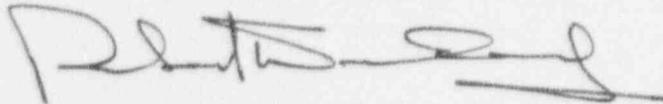
9602260228 960215  
PDR ADOCK 05000255  
S PDR

**260071**

A CMS ENERGY COMPANY

JE22

3. Evaluate the faulted cable test results and determine if any action is required for existing plant cables that could experience common mode failure.



Richard W Smedley  
Manager, Licensing

CC Administrator, Region III, USNRC  
Project Manager, NRR, USNRC  
NRC Resident Inspector - Palisades

Attachment

**ATTACHMENT**

**CONSUMERS POWER COMPANY  
PALISADES PLANT  
DOCKET 50-255**

**LICENSEE EVENT REPORT 96-002  
INITIATION OF TECHNICAL SPECIFICATIONS REQUIRED SHUTDOWN  
DUE TO SAFEGUARDS CABLE FAULT**

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) <b>Consumers Power Company Palisades Plant</b>	DOCKET NUMBER (2) 0 5 0 0 0 2 5 5	PAGE (3) 1 OF 0 5
---	--------------------------------------	----------------------

TITLE (4) Licensee Event Report 96-002, Initiation of Technical Specifications Required Shutdown Due to Safeguards Cable Fault

EVENT DATE (5)			LER NUMBER (8)			REPORT DATE (6)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		
0 1	1 6	9 5	9 6	0 0 2	0 0	0 2	1 5	9 6	N/A		
									0 5 0 0 0		
									N/A		
									0 5 0 0 0		

OPERATING MODE (8) <b>N</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11)									
POWER LEVEL (10) 1 0 0	20.402(b)	20.405*	50.73(a)(2)(iv)	73.71(b)						
	20.405(a)(1)(i)	50.38(c)(1)	50.73(a)(2)(v)	73.71*						
	20.405(a)(1)(ii)	50.38(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract						
	20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	below and in Text,						
	20.405(a)(1)(iv)	50.73(a)(2)(iii)	50.73(a)(2)(viii)(B)	NRC Form 366A)						
	20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)							

LICENSEE CONTACT FOR THIS LER (12)										
NAME <b>Clayton M Mathews, Licensing Engineer</b>							TELEPHONE NUMBER			
							AREA CODE			
							6 1 6	7 6 4 - 8 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	
B	E A C B L		X 9 9 9	N						

SUPPLEMENTAL REPORT EXPECTED (14)							EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO							0 7	0 1	9 6	

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

On January 16, 1996, at 0536, with the plant operating at 100% power, the 2400V AC Safeguards Bus experienced a phase-to-phase fault. This fault initiated protective relaying which fast transferred buses 1C, 1D and 1E from safeguards power to start-up power. The plant response to the phase-to-phase fault and resultant fast transfer was as designed. The fault caused the loss of the safeguards power source and placed the plant in a 24 hour Technical Specifications action statement. The reactor was shut down and the plant cooled down to less than 300°F within the time required by Technical Specifications.

The phase-to-phase fault was determined to be associated with the feeder cables going from the Safeguards Bus to the bus 1D supply breaker. The cables were replaced, tested and declared operable.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (4)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		OF	
Palisades Plant	0   5   0   0   0   2   5   5	9   6	0   0   2	0   0	0   2	OF	0   5

**EVENT DESCRIPTION**

On January 16, 1996, at 0536, with the plant operating at 100% power, the 2400V AC Safeguards Bus experienced a phase-to-phase fault. The Safeguards Bus protective relaying activated the differential relay on the Y phase. Also activated were the ground relays and alarms for buses 1C, 1D, and 1E. The result was a fast transfer of buses 1C, 1D, and 1E to start-up power. The phase-to-phase fault and subsequent fast transfer actuated the 1st level of undervoltage relays. The two faulted phases were the Z and X phases, as documented by the undervoltage relays and subsequent megger testing. A review of the Technical Specifications and the Standing Orders was conducted. A determination was made that a 24 hour Limiting Condition for Operation (LCO) action for Station Power Transformer 1-2 was the most limiting condition. When it became apparent that the problem could not be repaired, the plant was cooled down to less than 300°F where the Technical Specification 3.7.1 was no longer applicable.

Both sets (six cables) of cable were replaced from the Safeguards Bus to 1D bus. The new cables were installed through the turbine generator building. An independent review concluded that the modification was acceptable and in accordance with applicable codes, standards, and Palisades licensing requirements.

**ANALYSIS OF EVENT**

A plan was developed to locate the fault. A short to ground was noted when meggering the feeder cables from the Safeguards Bus to the buses 1C, 1D, and 1E. These cables were disconnected at the Safeguards Bus and meggered individually back to their respective switchgear. This testing determined that the cables A1203/A12-X02/1 were shorted to ground and that the faults were inside the underground duct bank conduit. The three cables parallel three other cables (A1203/A12-X02/2) that pass through another underground conduit. These six cables are the feeder cables from the Safeguards Bus to bus 1D.

When the A1203/A12-X02/1 cables were removed from the underground conduit, bare copper about the size of a quarter was noted on the Z phase at 156 feet from where the cables entered the underground duct in 1C switchgear room. Then, at 172 feet, a 9 inch section of cable (on X phase) was exposed all the way around the cable. No other damage to the cable jacket or cables was noted.

The area of damage to the cable was in a straight run of conduit inside the duct bank. The cables had been pulled from 1C switchgear room toward the Safeguards Bus, so damage from cable pulling tension is not suspected. If the cable and jacket had been damaged during installation, areas of damage on the cable jacket would indicate that the cable had been mishandled. Also, if the cable had been badly damaged during installation, the 16kV DC hypot test which was used at the installation time would have indicated low insulation resistance before the faults developed.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)  Palisades Plant	DOCKET NUMBER (2)  0   5   0   0   0   2   5   5	LER NUMBER (3)						PAGE (4)			
		YEAR	SEQUENTIAL NUMBER			REVISION NUMBER					
		9   6	0   0   2			0   0			0   3	OF	0   5

After the cables were removed from the conduit, a boroscope inspection of the conduit was conducted. During this inspection, a lot of carbon buildup was noted in the conduit near where the cable was damaged. Markings indicating the presence of water could be seen in the conduit near where the cable was damaged, but there was no water in the conduit at the time of inspection. The conduit did not seem to be damaged anywhere in a way to indicate that the conduit might have caused potential damage to the cable.

Some rags were pulled through the conduit and all the items that were removed were collected in a bag. The items in the bag consisted of about one large handful of sand/dirt, a 5/8 inch rusted nut, and flat pieces of dried cement that had been removed from the bottom of the conduit. The flat pieces of concrete were liquid that had seeped into the conduit while the concrete was being poured around the conduit and later dried in the bottom of the conduit. These flat pieces of dried concrete, which were about the size of a half dollar, were very sharp on the edges. There was no material indicating that any animals had been inside the conduit.

A list of probable causes was developed by plant personnel and two industry experts. One expert was from Sargent and Lundy and the other was from Consumers Power Company's Equipment Services Department. Both of these individuals have been involved in investigations evaluating cable failures. An investigation summary report was developed by each expert. Currently, the most likely causes are: 1) chemical attack, 2) water breakdown, 3) defective cable provided by the manufacturer, or 4) a combination of the three items listed above.

Sections of the cable were cut out as the faulted cable was removed and these sections have been sent off site to be evaluated by different testing laboratories. These evaluations are in progress.

Cable History

The failed cables were installed in 1989 as part of a project to increase cable ampacity. The cables were tested at the factory as part of a normal code requirement. The tests were in accordance with ICEA S-68-516 and the IEEE Flame Test. The testing also included a factory hypot test of the cable. Following installation, the cables were hypot tested again with 16kV DC and found to be acceptable on 10/27/89.

Yellow 77 was used as a cable pulling lubricant in accordance with Palisades' cable installation specification. The cable manufacturer advises against using this pulling compound because of the potential adverse reaction between the pulling compound and the cable semiconducting outer jacket. Yellow 77 is an oil based lubricant that penetrates the semiconducting jacket and removes the carbon. Without the carbon to conduct, the jacket can become stressed which leads to premature failure of the cable. However, initial investigation of the cable insulation did not show any degradation that could be attributed to this lubricant.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)  Palisades Plant	DOCKET NUMBER (2)  0   5   0   0   0   2   5   5	LER NUMBER (3)			PAGE (4)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		9   6	0   0   2	0   0	0   4	OF	0   5

Starting on 5/19/95, the plant began to experience bus ground alarms for buses 1C, 1D, and 1E. Thirty momentary ground faults were documented on buses 1C, 1D, and 1E from 5/19/95 through 9/27/95. No other grounds were experienced until the phase-to-phase fault on 1/16/96.

Meanwhile, the following actions were ongoing to locate this momentary ground:

1. A temporary ground was placed and removed when no effect was noticed;
2. An engineering consultant was asked to review and recommend an action plan.
3. Documentation was kept for equipment that was energized during a ground.
4. Cables and equipment that could be deenergized were meggered.
5. Plans were formulated to megger other cables (including the safeguards cables) and equipment during the 1996 refueling outage, which is scheduled to commence November 2, 1996.

**CAUSE OF THE EVENT**

The root cause for the cable failure is presently indeterminate and is still under investigation. Testing is in progress to ascertain the root cause. The most likely causes, as developed by plant personnel and outside experts, are: 1) chemical attack, 2) water breakdown, 3) defective cable provided by the manufacturer, or 4) a combination of these three causes. The results of the root cause evaluation will be provided as a supplement to this LER.

**SAFETY CONSEQUENCES AND IMPLICATIONS**

Either the Safeguards Transformer or Station Power Transformer 1-2 supplies power to the Safeguards Bus. The Safeguards Bus, in turn, feeds power to Class 1E buses 1C and 1D and non-vital bus 1E. The Safeguards Bus supply to buses 1C, 1D and 1E is redundant to the 2400V AC Startup Transformer 1-2 feed to buses 1C, 1D, and 1E. The diesel generators are also available to supply buses 1C and 1D. Either startup power or diesel generators can supply normal and emergency power to necessary loads on buses 1C and 1D. With only one off site power supply available to feed the bus after the cable fault, and with the primary coolant system above 300 degrees Fahrenheit, the 24 hour Limiting Condition for Operation (LCO) for the unavailability of power from the station power 1-2 became the most limiting condition. Because the repairs could not be implemented before the LCO was exceeded, the primary coolant system was cooled down below 300 degrees Fahrenheit where the redundant power source was no longer required.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)  Palisades Plant	DOCKET NUMBER (2)  0   5   0   0   0   2   5   5	LER NUMBER (3)			PAGE (4)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		9   6	0   0   2	0   0	0   5	OF	0   5

**CORRECTIVE ACTIONS**

1. Corrective Actions Taken and Results Achieved

Both sets (six cables) of cable were replaced from the Safeguards Bus to 1D bus. The new cables were installed through the turbine generator building. An independent review concluded that the modification was acceptable and in accordance with applicable codes, standards, and Palisades licensing requirements.

Megger and Electrical Circuit Characterization and Diagnostics (ECCAD) tests were conducted on the other cables from the Safeguards Bus which feed buses 1C and 1E. The ECCAD results indicated all cables were acceptable. The megger results also indicated that all the cables were acceptable.

The cable pulling force and ampacity calculations for the faulted cables were recalculated and both were found to be acceptable.

A review of the plant responses provided by logs and data logger printouts was completed. The conclusion of the review was that the plant equipment responded as designed.

Preliminary results were presented to plant management and the Plant Review Committee (PRC) to assure all proposed actions that were needed prior to heatup would be identified and completed. The PRC concluded that it was acceptable to return the plant to operation while the remaining testing and root cause evaluations were being performed.

2. Corrective Actions to Avoid Recurrence

The following corrective actions will be taken to avoid recurrence of this event:

1. Revise the construction cable installation specification to require the use of pulling lubricant specified by cable manufacturers.
2. Perform testing of the faulted cable from bus 1D to determine the cable failure mechanism. Review use of Yellow 77 with manufacturer.
3. Evaluate the faulted cable test results and determine if any action is required for existing plant cables that could experience common mode failure.