NORTHEAST UTILITIES
The Connecticut Light And Power Company
Western Massachusetts Electric Company
Holyoke Water Power Company
Northeast Utilities Service Company
Northeast Nuclear Energy Company

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Re: 10CFR50.73(a)(2)(v)
January 20, 1992
MP-92-75

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Reference: Facility Operating License No. NPF-49
Docket No. 50-423
Licensee Event Report 91-030-00

Gentlemen:

This letter forwards Licensee Event Report 91-030-00 required to be submitted within thirty (30) days pursuant to 10CFR50.73(a)(2)(v), any event or condition th at alone could hav prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

Stephen E. Scace
Director, Millstone Station

SES/GTB:ljs

Attachment: LER 91-030-00

cc: T. T. Martin, Region I Administrator
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2 and 3
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3

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NRC Form 366 (5-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

Estimated burden per response to comply with this information collection request: 50.0 hrs. Forward comments regarding burden estimate to the Records and Reports Management Branch (P-630), U.S. Nuclear Regulatory Commission, Washington, DC 20555, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Millstone Nuclear Power Station Unit 3	0 5 0 0 0 4 2 3	1 OF 0 5

TITLE (4)
Motor Control Center Auxiliary Control Relay Failure Due to Thermal Aging

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	DOCKET NUMBER(S)
1 2	1 9	9 1	9 1	- 0 3 0	- 0 0		0 1	2 0	9 2		0 5 0 0 0
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OPERATING MODE (9)	5	THIS REPORT IS BEING SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Gary T. Bohn, Senior Engineer, Ext. 5515	2 0 3 4 4 7 - 1 7 9 1

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 D	R L Y	1 2 1 2	Y							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

On December 19, 1991, at 1300 hours, while shutdown in Mode 5 (Cold Shutdown), an engineering evaluation concluded the failure of three normally energized auxiliary (control) relays for Motor Operated Valves (MOVs) was caused by insulation breakdown and electrical shorting of the relay coil. The failed Telemecanique model J10 relays caused a loss of control power and rendered the MOVs inoperable. The investigation concluded that a very high potential existed for additional relay failures due to the degree of thermal aging observed during inspections.

The root cause of the relay failure is accelerated thermal aging. The J10 Relays had been energized for approximately seven years. The vendor equipment qualification report qualified the relays for the life of the plant (i.e., 40 years). The relay failures were isolated to normally energized relays mounted in a ganged arrangement.

All Safety related (SR) J10s were inspected and all normally energized J10s in the SR MCCs were replaced. All non-SR J10s were evaluated and those that could possibly challenge the plant were replaced. A surveillance program to detect future problems will be implemented prior to refueling outage No. 4.

The accelerated thermal aging of the J10 relays appears to have generic ramifications due to the relays operation, mounting and maintenance being consistent with vendor recommendations.

NRC Form 366 (5-89)

1. Description of Event

On December 19, 1991, at 1300 hours, while shutdown in Mode 5 (Cold Shutdown), an engineering evaluation which was initiated in response to the failure of three normally energized auxiliary relays for safety related Motor Operated Valves (MOVs), concluded that the failures were due to thermal aging of the coil assembly and plastic parts near the coil. The failed relays are Telemecanique (former ITE/Gould) model J10 control relays. The auxiliary relay failures were caused by the electric shorting of the relay coil due to insulation breakdown. As a result of the relay failures, the circuit control power fuses blew. This caused a loss of control power and rendered the MOVs inoperable. The affected MOVs were all powered from the Train 'B' Safety Related 480VAC buses. The event investigation revealed that the thermal aging condition existed for all normally energized J10 relays located in the Motor Control Centers (MCCs). The investigation concluded that a very high potential existed for additional relay failures due to the degree of thermal aging observed from other MCCs inspected.

The failures occurred at 0945 on November 23, 1991, during a Train 'B' Loss Of Power Test (LOP) conducted by the plant. As a result of the test, which imposed a transient on the Train 'B' 480VAC safety related buses and the subsequent re-energization of the buses by the auto start of the 'B' Emergency Diesel Generator, control power was lost to three safety related MOVs (3CCP*MOV227, 3MSS*MOV18B, 3) HS*LCV112E). After re-energizing the Train 'B' buses, a loss of control power alarm was received in the control room. The initial investigation determined that the loss of control power was due to the failure (i.e., shorting) of the 49X auxiliary relays which caused the control fuses to blow. The 49X relays are normally energized J10 relays which provide a motor thermal overload bypass function for the safety related MOVs and an alarm input for loss of control power for the circuit. The failed relays were immediately replaced by plant maintenance electricians.

The Engineering investigation determined the following:

1. Inspection of the failed relays revealed that the movable plastic armature carrier which surrounds the core and coil, and the retainer for the magnet yoke assembly, became discolored from blue to brown, embrittled and severely cracked. In addition, internal inspection of the coils revealed them to be charred and having a burnt smell with physical arcing indications on the coil assemblies.

2. A Review of LOP test data noted that the required 124 J10 relays had performed their safety functions for the 'B' Train test.

3. The failed J10 relays were mounted in small independent compartments located above breaker stacks in the Motor Control Centers. The failed J10 relays were mounted shoulder to shoulder, in a horizontal ganged arrangement on a universal mounting strip supplied and designed by the vendor, Telemecanique. In all three cases, the relays mounted in the middle of the cluster failed.

4. A Review of electrical design drawings determined that all 49X and 74 auxiliary relays found in the MCCs were normally energized J10 relays. The 74 function is used as an alarm input for loss of control power. In addition, two standard mounting arrangements were found to exist in the relay compartments for three or five relay configurations. The five relay arrangement had four ganged relays mounted shoulder to shoulder and one mounted individually.

5. A Review of the Telemecanique technical data identified the failed relays to be "ITE/Gould Model J10" control relays with "120M" magnet block assemblies and standard G10JA126 120V, 60 cycle coil assemblies. Per the equipment qualification report, the relays were qualified for the life of the plant. However, the qualification process did not account for their use in the ganged arrangement, as per the vendor design. The qualification testing described in the qualification test report did not account for the potential heat degradation from coil energization on "weak link" materials such as the plastic armature carrier. The failed coils had been in service, and normally energized for approximately seven years.

6. Additional J10 relays used in 49X and 74 applications where inspected in eight different Motor Control Centers. The inspections included both Safety and Non-Safety Related applications and in all cases moderate to significant thermal aging was observed. The relays were physically removed and the internal coil and plastic carriage assemblies were inspected. In all cases, there was discoloration of the plastic carrier assembly and varying degrees of cracking and embrittlement. In addition, the surrounding relays in the ganged arrangement were inspected and found to have a significantly higher degree of discoloration on the inner shoulder (of the plastic carrier) than on the outer shoulder, open to air.

7. During the inspections of the additional J10 relays bus voltage was verified, both 480VAC line voltage and 120VAC control circuit voltage and in all cases the voltage was within acceptable limits for relay operation.

8. It should be noted that discoloration was observed on the normally energized J10s which were free standing within the MCC cubicles, but to a significantly lesser degree.

Engineering has postulated that the electrical stress of deenergizing and subsequently re-energizing the coils during the LOP Testing was sufficient to cause the weakened coil insulation to fail. There have not been any similar failures experienced at this plant in the past.

II. Cause of Event

The root cause of the failure of the J10 relays is accelerated thermal aging of the coil and plastic parts near the coil due to prolonged overheating. The problem is isolated to normally energized relays which are 'ganged' together.

After a review of the qualification test report documentation, it was discovered that the qualification test did not adequately test the normally energized relays mounted in the ganged arrangement.

The vendor had not considered the potential for accelerated aging and breakdown of the plastic components or the potential higher operating temperatures within the coil assemblies due to the standard "ganged" mounting configuration, per the vendors design.

It should be noted that Telemecanique did issue a 10CFR21 report to the NRC in October 1987, associated with overheating failures of special low voltage coils for the J10 relays specifically at the Seabrook Nuclear Station. At that time no information was forwarded to Millstone. Part of their resolution was the changing of the armature carrier, Part Number 403939, to a temperature stabilized material which Telemecanique indicated would be adapted as a new standard to its relay line. It appears this has not happened and aging of the plastic components was not considered for the J10 relays in service.

III. Analysis of Event

This event is being reported in accordance with 10CFR50.73(a)(2)(v), as an event or condition which alone could have prevented the fulfillment of the safety function of structures or system that are needed to mitigate the consequences of an accident. As part of the required actions in response to the December 19, 1991 engineering evaluation conclusions, an immediate notification was performed pursuant to 10CFR50.72(b)(2)(iii).

The accelerated thermal aging alone could have resulted in loss of equipment operability due to the loss of control power. In the case of safety related MOVs with 49X relays, the valves would fail "as is" and not perform any automatic or electrical manual initiated operations. In the case of pumps and motors with 74 relays, the equipment would stop and would not respond to any automatic or manual control.

The failure mode of the relays caused motor operated valves in different systems to become inoperable. Results of the engineering investigation determined the accelerated aging of the J10 relays is considered to pose a significant safety consideration. Based on Engineering Judgment the potential for Loss Of Safety Function or System was possible if the plants electrical systems had been challenged by a loss of power. It should be noted that if relays had failed, the failure would have been detected by a loss of MCC control power alarm. The plant surveillance program, (i.e., the 18 month Loss Of Power Test) did detect the failures prior to challenging the plant. The surveillance program mitigated the potential for greater failures to occur during normal plant operation.

IV. Corrective Action

The immediate corrective action was to replace the three relays which failed during the Loss Of Power Testing. An Engineering investigation was initiated to determine the cause of the relay failures.

Upon completion of the Engineering investigation as documented in "Description of Event," the plant established a program which:

1. Performed an inspection of all safety related J10 Relays, which included all MCCs and any other Cabinet/Panel which housed safety related J10s.

2. Performed 100% replacement of all the safety related normally energized 49X and 74 relays.

3. Evaluated and Replaced those J10 relays in non-safety related applications that could possibly challenge the plant.

Engineering has established a conservative life expectancy for the J10 relay of 5 years. This is based on the experience gained at Millstone, Engineering review of existing qualification report, information obtained from the Vendor and another nuclear utility that had an analysis program associated with special J10 relays. In addition, a surveillance program is being developed which will sample and evaluate the J10 relays on a routine basis, with planned implementation prior to refueling outage No. 4.

A plant design change is being initiated for changing out the now no longer manufactured Telemecanique J10 relays.

V. Additional Information

Telemecanique, the current manufacturer of the J10 relays has discontinued the manufacturing of these relays, as well as its 10CFR50 Appendix B program. They have provided no assistance in the evaluation of this incident, accelerated aging of components and indicated they no longer have the personnel to evaluate the material failures.

LER 86-051-00, LER 87-008-00, LER 87-034-00, "Reactor Trip Due To Low Steam Generator Level Caused By Failed Solenoid Valve" reported the failures of a solenoid valves, 3FWS*SOV41 series, which supply control hydraulics for the feedwater isolation valves. The first event found no equipment problems and the cause was indeterminate. The subsequent events identified equipment problems. This was failure of qualified equipment within its qualification life. Subsequent investigation found a voltage problem and the coils assemblies were replaced. These events are only related to this event by the fact that the failures were of qualified electrical devices and generic in nature. The failure mechanism of this event, accelerated thermal aging enhanced by the mounting arrangement, is unrelated.

LER 90-026-01, "Hydrogen Monitor Temperature Profile/Operating Specification Inconsistency Due to Inadequate Design Engineering Interface" reported the problem in maintaining the hydrogen monitor within calibration limits due to different temperature conditions found in the plant vice the equipment design temperature. A design modification was implemented to allow equipment operation under the temperature profile for the equipment location. This event is considered similar due to the impact that thermal conditions had on the plants safety related equipment, but would not have assisted in detecting or preventing this incident. This is due to the uniqueness of the confined thermal aging within the relay grouping, generated by the relays.

NPRDS was reviewed for similar failures of Telemecanique (ITE/Gould) J10 Relays and no other incidents were reported.

Northeast Utilities has reviewed this incident with its other nuclear units (i.e., Millstone 1 & 2 and Connecticut Yankee). The other units have evaluated their equipment and determined the problem is isolated to Unit 3. In addition, Seabrook Nuclear Station and Yankee Atomic Corp. have been contacted and informed about the event and the resultant investigation. Millstone 3 has also been in contact with INPO and has assisted in the preparation of a Significant Events Notification on this topic.

EIIS Codes

System Low
Voltage Power System, Class 1E - ED

Components
Relays - RLY

49X (thermal overload relay) 74 (control power relay)