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New York Power Authority

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April 12, 1996
JAFP-96-0163

United States Nuclear Regulatory Commission
Document Control Desk
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SUBJECT: DOCKET NO. 50-333
10CFR21 REPORT
LICENSEE EVENT REPORT: LER-96-002

Potential Common Mode Failure of Circuit Breakers in Both Safety Divisions Due to Design or Installation Error

Dear Sir:

This report is submitted in accordance with 10CFR50.73(a)(2)(v) and in accordance with 10CFR21.

Questions concerning this report may be addressed to Mr. W. Verne Childs at (315) 349-6071.

Very truly yours,

MICHAEL J. COLOMB

AZ
MJC:WVC:las
Enclosure

190089

cc: USNRC, Region 1
USNRC Resident Inspector
INPO Records Center

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)
Potential Common Mode Failure of Circuit Breakers in Both Safety Divisions Due to Design or Installation Error

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 NAME	DOCKET NUMBER
									N/A	05000
02	12	96	96	-- 002 --	00	04	12	96	N/A	05000

OPERATING MODE (9): N

POWER LEVEL (10): 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)	X	OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)	X	50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		10CFR21

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Mr. W. Verne Childs, Senior Licensing Engineer	(315) 349-6071

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	EB	52	G080	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 15 single-spaced typewritten lines) (16)

On 2/12/96 while at 100 percent rated power, Residual Heat Removal Service Water (RHRSW) pumps A and C in safety division 1 failed to start upon operator demand. Investigation revealed a high resistance electrical contact in the pump motor circuit breaker close coil circuit. Evaluation of the failure determined that the electrical contact had high resistance due to repeated interruption of current approximately three times rated. Failure of the contacts occurred after 2,163 and 3,233 operating (close) cycles for pumps A and C respectively compared to a manufacturers design of 10,000 cycles. Since the contact failures occurred after a fraction of the design cycles, the event is considered to be a condition requiring a report under 10CFR21. In addition, since potential failures could affect any 4 kV circuit breaker in either or both safety divisions, this also requires a report under 10CFR50.73. The contacts were replaced in the failed circuit breakers and other safety-related circuit breakers with more than 1500 operating cycles. Additional corrective actions include permanent jumpering of the contacts and procedure changes to check the contacts during preventive maintenance until jumpering is complete.

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EVENT DESCRIPTION

On February 12, 1996 at 0027 hours during normal plant operation at 100 percent rated power while performing monthly pump and valve operability tests required by Technical Specification (TS) Surveillance Requirement 4.5.B.1.c.1 Residual Heat Removal Service Water (RHRSW) [BI] pump C failed to start upon operator demand from the Main Control Room [NA].

Operations personnel were dispatched to the safety-related 4160 VAC switchgear [EB] which contains the circuit breaker for RHRSW pump C to investigate the cause of the failure of the circuit breaker to close. No abnormal conditions such as blown fuses, circuit breaker protective relay trip device indicators (flags) or circuit breaker to cubicle misalignment were found. Indicators on the circuit breaker indicated that the closing springs were fully charged and that the circuit breaker was ready for closure upon demand. Operators withdrew the circuit breaker from the cubicle (racked-out) and then racked-in the circuit breaker without noting any abnormal conditions. Another attempt was made to start RHRSW pump C from the Main Control Room and again the circuit breaker did not close.

Operations personnel initiated a Deficiency/Event Report (DER) to document entry into the Limiting Condition for Operation and verified the remaining components of the containment cooling mode of Residual Heat Removal/Low Pressure Coolant Injection (RHR/LPCI) [BO] were operable as required by TS 3.5.B.2/4.5.B.2 which allow continued operation of the plant with one RHRSW pump inoperable for 30 days.

At 0844 hours Operations personnel attempted to start RHRSW pump A as part of a routine Primary Containment [NH] pressure suppression chamber (torus) pool cooling evolution. RHRSW pump A did not start as expected. Preliminary investigation did not reveal any cause for the failure to start.

Failure of RHRSW pump A to start resulted in both pumps in subsystem A (Loop A) of the containment cooling mode of RHR/LPCI being inoperable. Continued reactor operation is permitted in this condition for seven days by TS 3.5.B.3/4.5.B.3 provided the redundant containment cooling subsystem (Loop B) is verified operable immediately and daily thereafter. Operators completed verification of the operability of containment cooling loop B at 0930 hours and demonstrated by actual pump starting that RHRSW pumps B and D operated properly.

Maintenance personnel performed troubleshooting of the circuit breakers and determined that in each case a switch contact in the circuit breaker closing circuit had a high electrical resistance that prevented energization of the circuit breaker closing coil (solenoid). The switches were replaced and the circuit breakers were tested with satisfactory results. RHRSW pumps A and C were declared operable at 1805 hours on February 12, 1996 (17 hours and 38 minutes after discovery of the initial problem with RHRSW pump C).

In an effort to determine the cause of the high switch contact resistance that resulted in failure of the circuit breakers for RHRSW pumps A and C to operate properly, evaluation of the failed switches, circuit breaker operating and maintenance history, and industry operating experience related to the circuit breakers was conducted. The evaluation revealed:

1. That the circuit breakers for RHRSW pumps A and C which experienced the failure to close upon demand had been operated (closed) 3,233 and 2,163 times, respectively, and the contact resistance was 300 to 1000 ohms and 200 to 400 ohms, respectively. The contact blocks for each of these circuit breakers and for the other safety-related circuit breakers with more than 1,500 close cycles were replaced.

2. An Equipment Failure Evaluation of the contact blocks which caused the circuit breakers for RHRSW Pumps A and C to fail to close revealed the following:

   - The published electrical current interrupting rating in the manufacturers catalog for the contacts of concern was 2.2 amperes (direct current, inductive load) while the circuit design results in interruption of an electrical current of approximately 6.0 amperes (direct current, inductive load).

   - Disassembly of a failed contact block showed evidence of arcing in the form of metal beads (similar to weld splatter), contact burning and an oxide layer on the contacts. Visual inspection of contacts removed from other circuit breakers with more than 1,500 operating cycles indicated a definite correlation between the number of cycles and the condition of the contacts. The contacts from a circuit breaker with 1,536 cycles were in good condition compared to contacts with more than 2,250 cycles.

   - Preventive maintenance procedures (based on manufacturers maintenance recommendations) for the circuit breakers did not include a measurement of the contact resistance for the contacts of concern or address replacement of the contact block based on the number of operating cycles (circuit breaker closures) or age.

   - The manufacturers design life of the circuit breakers is 10,000 circuit breaker close cycles.

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

3. Plant drawings and manufacturers drawings are not in complete agreement with respect to the contact block of concern.

   The contact block of concern is provided by the manufacturer for applications where the customer desires an indicator lamp which indicates that the closing springs are fully charged and thus the circuit breaker is ready for closure. This "springs charged" indication is not included in the FitzPatrick plant design. The elementary diagrams (Reference 1) for the circuit breaker for RHRSW pumps and all other safety-related 4160 VAC loads do not include the contact block while the manufacturers connection diagram (Reference 2) indicates that when the contact block is not furnished the contacts are to be jumpered. The terminology and sense of the notation (that is, the terminology and sense of "when not furnished the contacts are to be jumpered") is quite different than the notation used on the manufacturers elementary diagram (Reference 3) which indicates that the contacts of concern are to be "jumpered when <u>not used</u>" (emphasis added).

During the time period from the initial failure, February 12, 1996, to March 21, 1996, switch failure events were evaluated to determine whether or not the failures required a report under 10CFR21. On March 21, 1996 it was concluded that because of the potential for failures in both safety divisions; the potential for the defect to result in the failure to allow either automatic or manual (operator demand) closure of any safety-related 4 kV circuit breaker, and the observed failures at a fraction of the 10,000 cycle design life, the defect resulted in a "substantial safety hazard" as defined in 10CFR21.

The Plant Manager and Vice President of Nuclear Operations were informed of this determination on March 21, 1996 and the NRC Emergency Operations Center was also informed.

<u>EVENT CAUSE</u>

The failure of the circuit breakers for RHRSW pumps A and C to close upon demand was due to a design and installation error (Cause Code B). The contacts failed at a fraction of the 10,000 cycle design life due to the repeated interruption of the closing coil current which is approximately three times the direct current, inductive load, interruption rating.

EVENT ANALYSIS

The event requires a report under 10 CFR 50.73(a)(2)(v). That is, the design error alone could have prevented the fulfillment of the safety function of systems needed to: 1) shut down the reactor and maintain it in a safe shutdown condition, 2) remove residual heat, 3) control the release of radioactive material, and 4) mitigate the consequences of an accident.

The actual failures involved the circuit breakers for RHRSW pumps A and C. Both pumps are in the same safety division (containment cooling loop A) and the redundant safety division containment cooling loop pumps were demonstrated to be operable. However, when the observed failures at a fraction of the design cycles are considered, it appears that a potential for multiple circuit breaker failures in both safety divisions may have existed. For example, if during a design basis Loss of Coolant Accident (LOCA) with coincident loss of off-site power, failure of Emergency Diesel Generator [EK] load circuit breakers to close in one safety division and the failure of the Core Spray System [BM] pump motor circuit breaker to close in the other safety division could result in a complete loss of accident mitigating low pressure Emergency Core Cooling System (ECCS) injection to the reactor vessel. Other combinations of potential circuit breaker failures result in different potential ECCS failures or on-site emergency AC power failures including station blackout.
The Authority also considers the failures to be substantial safety hazard which requires a report under 10CFR21.

CORRECTIVE ACTIONS

1. The contact blocks in circuit breakers for RHRSW pumps A and C were replaced. **[Complete]**

2. The contact blocks in other safety-related circuit breakers with a history of more than 1,500 close cycles were replaced. **[Complete]**

3. Procedures for preventive maintenance of the circuit breakers will be revised to include a check of the resistance of the contacts of concern and to require replacement when the resistance is excessive. **[Due Date September 1, 1996]**

4. The safety-related 4 kV circuit breakers which require automatic or manual closure to perform the intended accident mitigation function will be changed by permanent jumpering the contact of concern prior to startup following the 1996 refuel outage to eliminate the potential failure mode. **[Due Date December 10, 1996]**

5. The safety-related 4 kV circuit breakers which are normally closed will be changed by permanent jumpering the contact of concern during the next scheduled bus outage to eliminate the potential failure mode. **[Due Date November 1, 1998]**

ADDITIONAL INFORMATION

Failed Components:

Component Name:	General Electric Magne-Blast Circuit Breaker
Model Number:	AMH-4.76-250
Manufacturers NPRDS Code:	G080

Previous Similar Events:

None

References:

1. ESK-5BG, Revision 12, D.C. Emergency Diagram, 4160 V Circuit, Residual Heat Removal Service Water Pump 10P-1A

2. Vendor Drawing 1.41-168, Revision C, (GE Drawing 0121D4634) Wiring Diagram - 4 kV Switchgear, Breaker 10520 and 10620

3. Vendor Drawing 1.41-106B, Revision B, (GE Drawing 0108B1458, Revision 1) Elementary Diagram - Inspection Box 4 kV Switchgear

Attachment 1

LER-96-002

Commitment Status

Number	Commitment	Due Date
JAFP-96-0163-01	Revise maintenance procedure to include check of 4 kV circuit breaker close coil circuit resistance.	9/1/96
JAFP-96-0163-02	The safety-related 4 kV circuit breakers which require automatic or manual closure to perform the intended accident mitigation function will be changed by permanent jumpering the contact of concern to eliminate the potential failure mode.	12/10/96
JAFP-96-0163-03	The safety-related 4 kV circuit breakers which are normal closed will be changed by permanent jumpering the contact of concern during the next scheduled bus outage to eliminate the potential failure mode.	11/1/98