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

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Millstone Nuclear Power Station Unit 1	05000245	1 of 4

TITLE (4)

Incorrect Fuses Caused the Automatic Depressurization System to be Inoperable

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	25	96	96	031	01	12	16	96	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	000	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)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	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)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Robert W. Walpole, MP1 Nuclear Licensing Manager	(860)440-2191

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

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

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 25, 1996, at 1515 hours, with the plant shutdown and the reactor in the COLD SHUTDOWN condition, it was determined that fuses installed in the Millstone Unit No. 1 DC control systems are not appropriately certified for their application.

These fuses were found in various control circuits, including those associated with the automatic depressurization system (ADS). This event was reported, pursuant to 10CFR50.73(a)(2)(v)(A), as a condition which alone could have prevented the fulfillment of a safety function required to shutdown the reactor and maintain it in a safe shutdown condition. This event was also reported, pursuant to 10CFR50.73(a)(2)(ii)(B) as a condition outside of the design basis of the plant, and was promptly reported on April 25, 1996, pursuant to 10CFR50.72(b)(2)(i) as a condition which resulted in the nuclear power plant being seriously degraded. Due to this condition, the ADS was believed to be inoperable for several operating cycles; therefore, this event was also reported pursuant to 10CFR50.73(a)(2)(i) as a condition prohibited by the plant's Technical Specifications. Additionally, this event was believed to represent a common mode failure, and therefore was reported pursuant to 10CFR50.73(a)(2)(vii) as a condition which caused independent trains or channels to become inoperable in a system designed to shutdown the reactor and maintain it in a safe shutdown condition.

On July 11, 1996, Overload Testing was conducted at higher DC voltages that assured that the protective fuses were operable.

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

I. Description of Event

On April 25, 1996, at 1515 hours, with the plant shutdown and the reactor in the COLD SHUTDOWN condition, it was determined that fuses installed in the Millstone Unit No. 1 DC control systems are not appropriately sized for their application.

These fuses were found in various control circuits, including those associated with the ADS. This event was reported, pursuant to 10CFR50.73(a)(2)(v)(A), as a condition which alone could have prevented the fulfillment of a safety function required to shutdown the reactor and maintain it in a safe shutdown condition. This event was also reported, pursuant to 10CFR50.73(a)(2)(ii)(B) as a condition outside of the design basis of the plant, and was promptly reported on April 25, 1996, pursuant to 10CFR50.72(b)(2)(i) as a condition which resulted in the nuclear power plant being seriously degraded. Due to this condition, the ADS was believed to be inoperable for several operating cycles; therefore, this event was also reported pursuant to 10CFR50.73(a)(2)(i) as a condition prohibited by the plant's Technical Specifications. Additionally, this event was believed to represent a common mode failure, and therefore was reported pursuant to 10CFR50.73(a)(2)(vii) as a condition which caused independent trains or channels to become inoperable in a system designed to shutdown the reactor and maintain it in a safe shutdown condition.

On July 11, 1996, Overload Testing was conducted at higher DC voltages that assured that the protective fuses were operable.

II. Cause of Event

Upon further investigations, it has been determined that this event is not reportable.

III. Analysis of Event

During the field inspection for the Millstone Unit 1 Fuse Control Program, Cooper Bussmann type FNA, FNM and MIN fuses were found in DC control circuits that operate the safety/relief valves (SRVs). The 10 ampere FNA, FNM and MIN fuses have a tested DC rating of 125 volts. The fuse vendor had indicated that at higher voltages, the fuse might be late to clear a fault, or else will not clear the fault at all.

The SRVs are the principle component of the ADS. Following a small break loss of coolant accident (SBLOCA), the ADS rapidly depressurizes the reactor vessel so that low pressure emergency core cooling systems (e.g., low pressure coolant injection and core spray) can initiate their safety functions. The failure of the ADS during a SBLOCA, without any high pressure injection systems (e.g., feedwater coolant injection), would result in the loss of core cooling. The SRVs are also used by the operator to depressurize the reactor vessel during non-LOCA scenarios to help mitigate multiple failures. For example, the emergency operating procedures will direct the operator to depressurize the reactor vessel by opening 4 of the SRVs in a main steam isolation valve closure event if uncovering of the core is imminent. If the control power fuses are assumed to fail when the SRVs are required to open, the operator action to open the SRVs will be delayed until power to the SRVs is restored; however, additional methods exist for depressurizing the reactor vessel.

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

The DC system is an ungrounded 125 V system, having two pole circuit breakers and double fuses in all load circuits. The maximum voltage will not be across one fuse (exceeding its voltage rating) unless there is a ground on the DC system and a second fault causes the fault current to flow in only one fuse.

Both 125 VDC power supplies (primary and backup) could be tripped if a fault did not successfully clear and was transferred to the backup supply. This is considered unlikely because of the circuit design, and the fact that each DC circuit has two fuses (one each in the positive and negative leg). Only one of the fuses must open to isolate the fault. When the circuit breaker opens to transfer power to the backup supply, there is a brief moment when no voltage is present to continue the arcing inside the fuse. This is expected to allow the circuit to be interrupted. Since it was not known at the time whether the fuses will fail to isolate a fault at a voltage higher than that previously tested, a test of the breakdown voltage was planned to determine the actual voltage the fuses will tolerate before failing to clear a fault.

On July 11, 1996, Overload Testing of MIN, FNA and FNM fuses was conducted by National Technical Systems (NTS) to determine the consequences of elevated DC voltage on the clearing times (open circuit) for these fuses which the manufacturer rates for 125 Volts DC. Fuses of five, ten and fifteen amperes of all three types were blown at two to three times their current rating. The circuit voltage was raised until the power supply reached its upper limit of 157.2 V at 30 Amperes. At the maximum voltage obtained, all of the fuses were clearing successfully in approximately 40 milliseconds or less after the fuse link began to melt.

The overload test is more severe than a fault test when evaluating a fuse for voltage withstand according to the fuse manufacturers. Therefore these tests were performed at current values to simulate the worst case overload clearing conditions. The maximum voltage limit of the power supply prevented the determination of the fuse breakdown voltage, however the results are conclusive for demonstrating the operability of the circuits that contained these fuses. The purpose of this testing was to show that these fuses (at a higher than rated DC voltage) could isolate an overload on one of the safety relief valves without causing a trip of the circuit breaker that powers all six valves.

The Millstone Unit No. 1's 125 V system operates with the normal battery float voltage between 133 and 135 V DC and the maximum DC bus voltage of 143 Volts (charger trip voltage) when the batteries are being equalize charged. The actual fuse breakdown voltage could not be reached due to limitations of the test equipment. The NTS fuse testing demonstrated that the MIN, FNA and FNM fuses which were in service in the Millstone Unit No. 1 DC circuits would have operated correctly with a margin of at least 14 volts above the maximum bus voltage during all plant operations.

Although the actual fuse breakdown voltage was not achieved during these tests, the ability of these fuses to operate at DC voltages above the maximum possible bus voltage provides assurance that overcurrent protection was always present, and the protective fuses were operable before the reporting was made to the NRC. No additional testing is planned.

In addition, the fact that all DC circuits within the Fuse Control Program will have fuses with properly certified DC ratings, provides assurance that there will be overcurrent protection before the plant resumes operation.

Breakdown voltage was reached during fuse testing at NTS for Bussmann NON-10 fuses which were reported in LER 96-17. These fuses were also tested for DC use since they are not rated for DC service. These fuses began to have prolonged clearing times at 155 V dc and at the maximum of 157.2 volts the

clearing times were 100 and 158 milliseconds for two fuses compared to 30 to 40 milliseconds at lower voltages. This was indication of the threshold voltage where prolonged arcing occurred and is well above the maximum operating DC voltage.

IV. Corrective Action

All DC circuits within the Fuse Control Program will have fuses with properly certified DC ratings prior to startup for operating Cycle 16.

The broader and long term issue of fuse control is being addressed by the Fuse Control Program. This program will include a listing of all distribution fuses in use at Millstone Unit No. 1 in a master fuse list. This list will include the unique identification number for each fuse, and it will describe the specific fuse to be used. Fuse specification will include manufacturer, type designation and ampere rating. In addition to the creation of the master fuse list, the Fuse Control Program will ensure that the proper information is captured on plant drawings. Unique identification numbers will be assigned to each fuse to ensure that workers in the future are able to quickly and accurately replace fuses. These numbers will be reflected in the master fuse list, on the drawings, and on plant equipment. Implementation of the Fuse Control Program is on-going, and is committed to in Commitments B15607-1 and B15607-2.

V. Additional Information

Similar Events

A similar event was reported on March 20, 1996, as LER 96-017-00, documenting an event which occurred on February 16, 1996. LER 96-017-00 reported the existence of improper fuses installed in DC control circuits for the emergency gas turbine generator and the 480 volt load center breakers.

Manufacturer Data

None.