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

APPROVED BY OMB NO. 3150-0104

EXPIRES 04/30/99

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 3	05000423	1 OF 4

TITLE (4)

Technical Specification 3.0.3 Entry Due to Vital Inverter Failure Resulting In the "A" and "C" Recirculation Spray System (RSS) Pumps Being Inoperable While The "B" RSS Pump Was Out-of-Service For Maintenance

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
10	01	1998	1998	-- 039 --	00	11	02	1998	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	100	☐ 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
		☐ 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)
David A. Smith, Manager Unit 3 Regulatory Compliance	(860)437-5840

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	EF	INVT	E209	Y						

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	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 October 1, 1998, at 18:11, with the Unit in Mode 1 at 100 percent power, entry into Technical Specification (TS) 3.0.3 occurred due to the simultaneous loss of the A and B Recirculation Spray System (RSS) trains. The "A" and "C" RSS [Train A] pumps became incapable of automatic starting on a loss-of-power (LOP) due to a failure of vital AC Inverter 1 which supplies the "A" Emergency Generator Load Sequencer. At the time of the inverter failure, the "B" RSS pump [Train B] was out-of-service for surveillance testing and scheduled preventative maintenance. This resulted in not meeting the requirements of TS 3.6.2.2, "Containment Systems Recirculation Spray System," which requires that "Two independent Recirculation Spray Systems shall be OPERABLE." Entry into Technical Specification 3.0.3 is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B) as an operation or condition prohibited by the unit Technical Specifications.

The cause of this Technical Specification 3.0.3 entry was the F1 blown fuse inside vital AC Inverter 1 due to an electrical component problem(s) within the inverter.

There was minimal safety significance associated with this event. The "A' and "C" RSS pumps, while not capable of automatic starting on a LOP due to the Emergency Generator Load Sequencer being inoperable in accordance with TS, were capable of being manually loaded from the associated Emergency Diesel Generator and would have been available in the event of an accident. There were no safety consequences associated with event. RSS train B was restored to operable status, TS 3.0.3 was exited, and the reactor downpower stopped at 48 percent reactor power.

The six circuit boards responsible for the firing and coordination of the firing times of the silicon controlled rectifiers (SCRs) in Inverter 1 were replaced. The revision level of the circuit boards associated with the SCR firing network in each of the vital inverters will be evaluated.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Millstone Nuclear Power Station Unit 3	05000423	1998	-- 039 --	00	2 OF 4

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

I. Description of Event

On October 1, 1998, at 18:11, with the Unit in Mode 1 at 100 percent power, entry into Technical Specification (TS) 3.0.3 occurred due to the simultaneous loss of the A and B Recirculation Spray System (RSS) [BE] trains. The "A" and "C" RSS [Train A] pumps became incapable of automatic starting on a loss-of-power (LOP) due to a failure of vital AC Inverter 1 [INVT] which supplies the "A" Emergency Generator Load Sequencer (EGLS). At the time of the inverter failure, the "B" RSS pump [Train B] was out-of-service for surveillance testing and scheduled preventative maintenance. This resulted in not meeting the requirements of TS 3.6.2.2, "Containment Systems Recirculation Spray System," which requires that "Two independent Recirculation Spray Systems shall be OPERABLE." Entry into Technical Specification 3.0.3 is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B) as an operation or condition prohibited by the unit Technical Specifications.

On October 1, 1998, at 18:11, Technical Specification 3.8.3.1, "Onsite Power Distribution," Action b was entered when a fuse blew in vital AC Inverter 1 (VIAC-1 - 3VBA*INV1) and became inoperable, and the vital AC bus [EF] had to be placed on its alternate source. While on the alternate source the "A" EGLS [JE] is not capable of automatic operation on a LOP. This rendered both the "A" and "C" RSS [Train A] pumps incapable of automatic starting on a LOP. The "B" RSS pump [Train B] had been previously removed from service on October 1, 1998, at 05:32, for a surveillance testing and for a 6 month preventative maintenance sampling of motor oil.

Discussions occurred between the Shift and management personnel as to the applicability of Technical Specification 3.0.3. At 20:45, TS 3.0.3 was entered with a time of discovery of 18:11, which was when the fuse blew in vital AC Inverter 1.

At 21:20 the Unit entered AOP 3575, "Rapid Downpower," and began reducing reactor power. At 21:28 notification of the TS 3.0.3 required shutdown was made pursuant to 10 CFR 50.72(b)(1)(i)(A). At approximately 22:50 the "B" RSS pump was declared operable and, TS 3.0.3 was exited, and the reactor shutdown was stopped at 48 percent reactor power.

Discussion of Previous Inverter 1 (VIAC-1) Problems:

The 200 amp fuse (F1) associated with the silicon controlled rectifier (SCR) firing network (A4) within Inverter 1 had blown on two previous occasions resulting in entry into TS 3.8.3.1 Action b for a vital inverter out-of-service.

On August 23, 1998, fuse F1 located in series with the DC input to the inverter section of the Inverter (which provides electrical protection to one of the three SCR firing networks) was blown. A visual inspection of the internals of the inverter was performed, the blown fuse replaced and the inverter was returned to service.

On September 23, 1998, the F1 fuse again blew. Trouble shooting of the inverter SCR firing network section found no degraded or failed components with the exception of Varistor RV1. This varistor (RV1) has a rated breakdown voltage of approximately 175 volts. RV1 showed signs of degradation since it was breaking down at 140 volts which is close to the DC input potential seen at the F1 fuse. This could have caused excess current to flow through F1 causing the fuse to blow. The varistor was replaced along with the F1 fuse and following a monitoring period of the output wave forms of the firing network, as well as, the over all wave forms of the inverter, the inverter was returned to service.

On October 1, 1998, at 18:11, the F1 fuse again blew and in conjunction with the "B" RSS pump being out-of-service resulted in the TS 3.0.3 entry. Trouble shooting of the inverter SCR firing network section found no degraded or failed components. The circuit boards responsible for the firing and coordination of the firing times of the SCRs within the SCR firing network sections of the inverter were replaced, i.e., the 4 SCR driver cards (J109-112) as well as the Driver

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Millstone Nuclear Power Station Unit 3	05000423	1998	-- 039 --	00	3 OF 4

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

Logic and Power Logic Cards (J9 and J8). The F1 fuse was replaced, and following a monitoring period of the output wave forms of the SCR firing network, as well as, the over all wave forms of the inverter, the inverter was returned to service.

II. Cause of Event

The cause of this Technical Specification 3.0.3 entry was the blown F1 fuse inside vital AC Inverter 1 due to an electrical component problem(s). This resulted in the "A" and "C" RSS [Train A] pumps being incapable of automatic starting on a LOP (since the "A" EGLS was inoperable) while the "B" RSS pump was out-of-service for maintenance.

The cause of the F1 fuse blowing inside Inverter 1 is believed to be the miss-firing of an SCR within the associated SCR firing network (A4) caused by a problem with either the Driver Logic and/or the Power Logic Cards which are responsible for the timing and the firing of the SCRs. The problem with the circuit boards could be with a component that is degrading and its effect on the existing circuitry (and/or with the compatibility between different revision levels of circuit boards) within the associated SCR firing network.

Discussions with the vendor, Elgar, and system engineering counterparts at other power plants identified that blowing the F1 fuse within Elgar inverters is a relatively common problem. A review of industry operating experience identified failures that could cause the F1 fuse to blow, i.e., noise, loose connections, degraded or failed solid state components due to heating or aging, and circuit board revision level compatibility, all centered around the miss-firing of an SCR.

The six circuit cards within Inverter 1 that were identified as potentially causing the problems were returned to the vendor for analysis. Elgar performed a Quality Assurance receipt inspection which included a visual inspection for bad connections, loose wires, bad solder joints, and signs of overheating. The circuit boards were then submitted to Elgar's Standard Nuclear Acceptance Test Procedure at both ambient and elevated temperature (122°F) conditions to determine if there were any components that were showing signs of breaking down. This test consisted of providing inputs and verifying the correct outputs characteristics for the cards. No deficiencies were identified that could be concluded would have resulted in blowing the F1 fuse if the board(s) had been installed in an operating inverter.

III. Analysis of Event

There was minimal safety significance associated with this event. The "A' and "C" RSS pumps while not capable of automatic starting on a LOP due to the Emergency Generator Load Sequencer being inoperable in accordance with the TS, were capable of being manually loaded from the associated Emergency Diesel Generator and would have been available in the event of an accident. RSS train B was restored to operable status, TS 3.0.3 exited, and the reactor downpower stopped at 48 percent reactor power. The timing of the applicable shutdown actions required by TS 3.0.3, which was entered when TS 3.6.2.2 could not be met were satisfied. The unit downpower was performed in accordance with the operating procedures and no equipment problems were noted. There were no safety consequences associated with this event

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Millstone Nuclear Power Station Unit 3	05000423	1998	-- 039 --	00	4 OF 4

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

IV. Corrective Action

The following corrective action(s) have been completed:

1. The six circuit boards responsible for the firing and coordination of the firing times of the silicon controlled rectifiers (SCR) within the SCR firing network sections of Inverter 1 were replaced.

The following corrective action(s) will be performed:

1. Evaluate the compatibility of the existing circuit boards (revision levels) associated with the SCR firing network sections in each of the Vital Inverters by January 15, 1999.

V. Additional Information

The results of the vital inverter circuit board (revision level) compatibility review will be evaluated as part of the Maintenance Rule Functional Failure Evaluation Program. Corrective actions developed as part of the Maintenance Rule functional failure evaluation for the vital inverter failure will be tracked under the Millstone Corrective Action Program.

Similar Events

LER 97-025-00 Historical Event: A Failure to Enter Technical Specification 3.0.3 Upon Loss of Vital AC Bus VIAC-1

Manufacturer Data

EIIS Codes

Systems:

Engineered Safety Features Actuation
[Instrumentation] System.....JE
Instrument and Uninterruptible Power System - Class 1E.....EF
Recirculation (Containment) Spray System.....BE

Components:

Inverter.....INVT