



GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057-0191
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:
(717) 948-8005

June 4, 1992
C311-92-2074

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

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating Licensing No. DPR-50
Docket No. 50-289
LER 92-001-01

This letter transmits Licensee Event Report (LER) No 92-001-01 regarding an inadvertent Emergency Feedwater System (EFW) actuation which occurred on January 22, 1992 during planned maintenance due to an installation error. Public health and safety were not affected. This revision is being submitted to clarify the root cause to include inadequate startup testing as a contributor to the event.

This LER is being submitted pursuant to 10 CFR 50.73. The abstract provides a brief description of the event. For a complete understanding of the event, refer to the text of the report.

Sincerely,

T. G. Broughton
Vice President and Director, TMI-1

MRK

Attachment

cc: Region I Administrator
TMI-1 Senior Project Manager
TMI Senior Resident Inspector

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): THREE MILE ISLAND, UNIT 1
DOCKET NUMBER (2): 0 5 0 0 0 2 8 9
PAGE (3): 1 OF 0 6

TITLE (4): INADVERTENT EMERGENCY FEEDWATER INITIATION DURING PLANNED MAINTENANCE DUE TO INSTALLATION ERROR

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE | | | OTHER FACILITIES INVOLVED (8) | | |
|----------------|-----|------|----------------|-------------------|-----------------|-------------|-----|---------|-------------------------------|-------------------|--|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAMES | DOCKET NUMBER (3) | |
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THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11):

| | | | | | |
|-------------------------|----------------------|------------------|---|---------------------|---|
| OPERATING MODE (9): N | 20.406(a)(1)(i)(ii) | 20.406(i) | X | 50.73(a)(2)(iv) | 75.71(b) |
| POWER LEVEL (10): 1 0 0 | 20.406(a)(1)(i)(iii) | 50.73(a)(1) | | 50.73(a)(2)(v) | 75.71(c) |
| | 20.406(a)(1)(i)(iv) | 50.73(a)(2) | | 50.73(a)(2)(vi) | OTHER (Specify in Remarks, Drawings and in Text, NRC Form 886A) |
| | 20.406(a)(1)(i)(v) | 50.73(a)(2)(i) | | 50.73(a)(2)(vii)(A) | |
| | 20.406(a)(1)(i)(vi) | 50.73(a)(2)(ii) | | 50.73(a)(2)(vii)(B) | |
| | 20.406(a)(1)(i)(vii) | 50.73(a)(2)(iii) | | 50.73(a)(2)(viii) | |

LICENSEE CONTACT FOR THIS LER (12):
NAME: M. R. Knight, TMI-1 Licensing Engineer
TELEPHONE NUMBER: AREA CODE 7 1 7 9 4 8 - 8 5 5 4

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13):

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NRC | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NRC |
|-------|--------|-----------|--------------|-------------------|-------|--------|-----------|--------------|-------------------|
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SUPPLEMENTAL REPORT EXPECTED (14):
YES (If yes, complete EXPECTED SUBMISSION DATE): NO: X
EXPECTED SUBMISSION DATE (15): MONTH DAY YEAR

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

Inadvertent Emergency Feedwater (EFW) Actuation During Planned Maintenance Due to Installation Error

TMI-1 was operating at 100% power. During a planned maintenance activity, Emergency Feedwater (EFW) was inadvertently initiated for a short time. This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv). The actuation occurred due to a construction wiring error resulting from modifications during a previous outage. This event was caused by lack of drawing clarity, inadequate supervisory oversight and failure of the test procedure to verify separation between HSPS channels and trains as required in the modification test program. All equipment functioned as expected considering the wiring error. There was no adverse impact on nuclear safety. Wiring errors which could affect system operation have now been corrected. A detailed walkdown will be performed and the applicable drawings will be revised to reflect the as built configuration. TMI-1 has in place sufficient procedural controls to preclude or identify wiring errors and as such this event is considered to be an isolated case. The potential for single failures to cause an inadvertent EFW actuation had been previously evaluated and with the NRC's concurrence this was deemed acceptable. No additional action is considered necessary.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-330), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | | |
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TEXT (If more space is required, use additional NRC Form 366A's) (13)

Inadvertent Emergency Feedwater (EFW) Actuation During Planned Maintenance Due to Installation Error

I. Plant Operating Conditions before Event:

TMI-1 was operating at 100% rated power. The ICS was in full automatic control. Work was planned to be performed on the "1B" Inverter.

II. Status of Structures, Components, or Systems that were Inoperable at the Start of the Event and that Contributed to the Event:

None

III. Event Description:

This event occurred at approximately 1300 hours on January 22, 1992. The operating crew had performed the prerequisites for transferring the "B" 120 vac vital bus (VBB) [ED/BU] from its normal source, the "1B" inverter [ED/INV], to its alternate source (TPA), in accordance with Operating Procedure (OP) 1107-2, "Emergency Electrical System." During the transfer, it was necessary to temporarily deenergize vital bus VBB.

OP 1107-2 includes actions and precautions which identify the loads on the bus, the effect of loss of VBB and what precautionary actions are to be taken. When VBB was deenergized in accordance with the procedure, the following events occurred in addition to those described in the procedure:

1. Main Steam supply valve, MS-V13A [SB/V], opened and the turbine-driven EFW Pump (EF-P1) developed discharge pressure sufficient to produce flow into the Once Through Steam Generators (OTSGs).
2. Valve controllers associated with EFW control valves, EF-V30B/D [BA/V], switched to 50% operating level setpoints, an operating range level input, and received a level signal less than the 50% setpoint. Both control valves opened and EFW flow was initiated to both OTSGs [AB/SG].
3. Annunciator J-1-3/J-1-4 [IB/ANN] "EFW ACTUATED OTSG A/B" went into alarm.

The operator identified the improper system response, placed EF-V30B/D in "manual" and closed both valves. This terminated flow to the OTSGs very shortly after it had been initiated.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATIONESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS
INFORMATION COLLECTION REQUEST 500 HRS. FORWARD
COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS
AND REPORTS MANAGEMENT BRANCH (F-530), U.S. NUCLEAR
REGULATORY COMMISSION, WASHINGTON, DC 20545 AND TO
THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE
OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

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TEXT (if more space is required, use additional NRC Form 306A s: (17))

The Control Room Operator (CRO) sent an Auxiliary Operator (AO) to EF-Pi [BA/P]. The CRO attempted to close MS-V13A from console center. MS-V13A did not close.

Within the first minute following the EFW actuation the overhead Annunciator J-1-3/J-1-4 cleared and the CRO was able to close MS-V13A from the Control Room. These events occurred without any EFW functions being placed in "defeat."

EF-V30B/D continued to indicate that an actuation signal was present after the overhead annunciator was clear (the AUTO Light was "on" above each valve controller). The operators attempted to clear this signal by placing the Train "B" Loss of Reactor Coolant Pumps (RCPs) Defeat/Enable Switch to "defeat." This action had no apparent effect.

An operator verified that the Heat Sink Protection System (HSPS) Train "B" cabinet had swapped to the backup power source as designed and that there were no unexpected indications locally at the HSPS cabinets. With EFW flow terminated and without any cause of actuation determined, the shift supervisor and operations management decided to reduce the present vulnerability by restoring power to VBB from TRA.

When VBB was reenergized from TRA, EF-V30B/D transferred (without any operator action) into "Auto," with 0% setpoint and a good startup level input. This is the normal state for these controllers.

With power restored to VBB all indications for HSPS both locally and in the Control Room appeared normal.

The actuation occurred due to a modification construction error during TMI-1's Cycle 8 Refueling Outage (8R) which had gone undetected until this time. 8R occurred between January and March, 1990. Two train "B" nests had been powered from the Channel 11 DC distribution bus (located in HSPS Section A2, Rack 3) instead of the "B" Train DC distribution bus (located in Section A2, Rack 4) as required. The net effect was that deenergizing VBB caused a loss of power to a portion, but not all, of the Train "B" nests.

The causes of this event were identified as follows:

1. The 8R construction drawings were not clear and could easily be misinterpreted. It was believed that all of the problems associated with drawing presentation and wiring errors had been identified and corrected prior to turnover. The subject installation error went undetected. Problems with drawing clarity were addressed in the Post 8R critique of the HSPS modification to prevent a recurrence in future modifications.

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TEXT CONTINUATIONESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS
INFORMATION COLLECTION REQUEST: 900 HRS. FORWARD
COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS
AND REPORTS MANAGEMENT BRANCH (P&20), U.S. NUCLEAR
REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO
THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE
OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT IF MORE SPACE IS REQUIRED, USE ADDITIONAL NRC FORM 366A (6-89)

2. The Startup and Test (SU/T) group was not involved during the initial phase of construction as has been a practice in other outages including the most recent 9R outage which occurred between September and November, 1991. As a result, no TMI-1 cognizant SU/T engineer was present during 8R at the work site to provide technical guidance to the construction workers during the initial construction phase of the modification. Inadequate supervisory oversight was identified as a probable contributor to construction errors described above during the 8R critique and recommendations from the critique were implemented to increase SU/T involvement during construction of complex modifications with safety significance.

3. The generic electrical testing that verifies all construction wiring should have corrected this problem early in the test program. Functional testing requirements to verify power separation between HSPS channels and trains should have identified and resulted in correction of the wiring problems. Inadequate implementation of the SU/T modification test program requirements allowed the power supply wiring error to go undetected during both generic and functional tests.

IV. Component Failure Data:

There were no component failures associated with this event.

V. Automatic or Manually Initiated Safety System Responses:

All equipment associated with a Train "B" EFW actuation functioned as expected considering the improper wiring configuration. MS-V13A opened after receiving an actuation signal caused by loss of power to modules [JB/IMOD] within the actuation control logic.

Based upon observations during the event and subsequent testing it was concluded that the actuation signal to MS-V13A and MS-V13B cleared before MS-V13B received an "open" demand. By design, MS-V13B is opened approximately 40 seconds after MS-V13A.

EF-P1 came up to speed and provided sufficient discharge pressure to deliver water to each OTSG. The motor-driven EFW Pump, EF-P2B, did not start because the HSPS actuation signal has an interposing relay powered from VBB which starts the pump. With VBB deenergized, the relay did not energize to start EF-P2B.

EF-V30B/D received invalid actuation signals and level inputs due to deenergized modules in the logic which provides the inputs to the controllers. Given the faulty inputs, the valves functioned as expected.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATIONESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS
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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
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FACILITY NAME (1)

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

VI. Assessment of the Safety Consequences and Implications of the Event:

- A. There is no adverse impact on nuclear safety from Train "B" modules being powered from Channel II. The Train "B" modules incorrectly powered from Channel II should receive power from Train "B" power supplies which are also powered from VBB. This condition would not result in a single failure which would have consequences worse than a failure of VBB which has been evaluated. If power is lost to VBB, the HSPS System is still capable of performing its design function. With a loss of power to VBB, Channel II is actuated and Train "B" is incapable of performing its design function, but Train "A" is unaffected by loss of VBB.
- B. The design basis for EFW/HSPS considered system failures in which the EF-V30 valves would fail closed or open. Loss of air or signal causes valve closure. Under conditions of partial train power failure, the EF-V30 valves on one train may fail open. This does not impact nuclear safety because a reasonable time period (at least 15 minutes) is available for operator action to locally isolate the failed valve and the ability to terminate flow to one or both OTSGs is still available from the Control Room. This can be accomplished with EF-P2A and EF-P2B control switches and EFW discharge header crossconnect isolation valves, EF-V2A/B [BA/V], pushbuttons.

VII. Previous Events of a Similar Nature:

None. Three previous EFW actuations have occurred at TMI-1 since the HSPS was installed. In the case of each previous EFW initiation, the system responded as designed when a valid actuation signal was sensed at the input to the system. The cause of previous events was external to the HSPS. The cause of this event was an internal wiring error. Therefore, the previous events were not similar.

VIII. Corrective Actions Taken:

1. Through entries in the night order book, the operating crews were advised of the events which had taken place and given instructions on the actions to be taken if power were lost to VBB.
2. The power cables from Train nests "A2-6-6" and "A2-6-7" have been rewired to provide proper termination from the Train "B" power supply. Functional testing, performed in accordance with a Special Test Procedure (STP-92-004), verified power separation between the HSPS channels and the "B" Train.
3. A walkdown of Channels I & II and Trains "A" & "B" was performed. It was verified from the walkdown that the channel and train nests are powered from the proper train and channel power supplies. No

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST. SEE OUR FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P&SD), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545 AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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| FACILITY NAME (1) THREE MILE ISLAND, UNIT 1 | DOCKET NUMBER (2) 0500028992 | LER NUMBER (6) | | PAGE (3) 06 OF 06 |
| | | YEAR | SEQUENTIAL NUMBER | |
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TEXT (if more space is required, use additional NRC Form 366A (6-89))

additional testing of the "A" Train power supply was required. Other discrepancies between the drawings and the existing configuration were noted during the walkdown. However, it was determined that these discrepancies would have no effect on system operation.

IX. Corrective Actions Planned:

Wiring errors that could affect system operation have been corrected. In order to correct the other noted discrepancies, a more detailed walkdown of the HSPS power supply wiring is required and will be performed at the next outage of opportunity. The affected HSPS drawings will be revised to reflect the as built configuration.

X. Conclusion

The potential for single failures, as occurred during this event, to cause an inadvertent EFW actuation were identified during TMI-1's Cycle 8 Refueling Outage (8R). Prior to startup from the 8R outage, modifications were performed to eliminate the potential for inadvertent MFW isolations resulting from a partial or total loss of power to the HSPS. However, evaluations during 8R confirmed that the consequences of an EFW actuation are acceptable. The prevention of inadvertent EFW initiation resulting from a single failure is not a regulatory requirement. This was reported to the NRC in a letter dated July 5, 1990 during TMI-1's Cycle 8 Refueling Outage (8R). With NRC concurrence it was concluded at that time that modifications to prevent EFW actuations on partial loss of power would not be required. Although, partial loss of power to the HSPS would not result in loss of safety function and does not result in a safety hazard, this event was undesirable. Having corrected the wiring errors that resulted in this event, GPU Nuclear continues to believe further modifications are not required.

The contributors to this event, which caused the wiring error, have been identified as a problem with drawing clarity and inadequate supervisory oversight by individuals knowledgeable of the HSPS design and the modification being performed. In addition, inadequate implementation of the SU/T modification test program allowed the wiring errors to remain undetected. The involvement of the SU/T group during the initial phase of construction, as in other outages including the most recent 9R Outage, and proper implementation of the SU/T modification test program requirements would have avoided the wiring error or identified its existence. Therefore, this event is considered to be an isolated case. No additional action is considered to be necessary.

* The Energy Industry Identification System (EIIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, "[SI/CFI]", where applicable, as required by 10 CFR 50.73(b)(2)(ii)(F).