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SUBJECT: LER 89-002-01:on 890125,plant in unanalyzed condition due to design & installation deficiencies.

W/8 ltr.

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June 22, 1989

United States Nuclear Regulatory Commission
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Washington, DC 20555

RE: Docket No. 50-410
LER 89-02
Supplement 1

Gentlemen:

In accordance with 10 CFR50.73, we hereby submit the following Licensee Event Report:

LER 89-02 Supplement 1 Is being submitted in accordance with 10 CFR50.73 (a) (2) (ii), "Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, or that resulted in the nuclear power plant being: (A) In an unanalyzed condition that significantly compromised plant safety; (B) In a condition that was outside the design basis of the plant; or (C) In a condition not covered by the plant's operating and emergency procedures."

This report was completed in the format designated in NUREG-1022, Supplement 2, dated September 1985.

Very truly yours,

J. L. Willis
General Superintendent
Nuclear Generation

JLW/POB/cjm

Attachments

cc: Regional Administrator, Region 1
Sr. Resident Inspector, W. A. Cook

Cert No P757405102

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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Nine Mile Point Unit 2	0 5 0 0 0	1 OF 8

TITLE (4) Nine Mile Point Unit 2 in an Unanalyzed Condition due to Design and Installation Deficiencies - Human Performance Deficiencies

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)
01	25	89	89	—	002	—	1	6	22	89	N/A	0 5 0 0 0
											N/A	0 5 0 0 0

OPERATING MODE (9): 4

POWER LEVEL (10): 000

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

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	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)	X 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	
Keith Ward, Manager Nuclear Design	315	349-4586

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 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 January 25, 1989 at 1503 hours, the Nine Mile Point Unit 2 (NMP2) Operators were notified of a deficiency that placed the station in an unanalyzed condition. Specifically, an unidentified electrical blockout (penetration) in a wall (designated as a pressure boundary) was found not to have been sealed. It was postulated that structural damage to the Control Building could occur during an internal flooding event as a result of this unsealed penetration. Subsequent to this discovery, an evaluation was performed which identified several other deficient watertight seals. During this time, the reactor mode switch was in shutdown and the reactor was in a cold shutdown condition (Operational Condition 4).

The immediate cause for this event was a combination of installation and design deficiencies. The root causes for this event were a combination of two human performance deficiencies: (1) poor work practices, and (2) inadequate change management.

The corrective actions taken are as follows: (1) Engineering Design Change documents were issued to correct the identified design deficiencies; (2) Work Requests were issued to correct the installation deficiencies; (3) An evaluation of other penetration seals in pressure boundaries was performed; (4) A Problem Report has been initiated.

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

I. DESCRIPTION OF EVENT

On January 25, 1989 at 1503 hours, the Nine Mile Point Unit 2 (NMP2) Operators were notified of a deficiency that placed the station in an unanalyzed condition. Specifically, an unidentified electrical blockout (penetration) in a wall (designated as a pressure boundary) was found not to have been sealed. It was postulated that structural damage to the Control Building could occur during an internal flooding event as a result of this unsealed penetration. During the postulated internal flooding event, water could flow through the unsealed blockout to flood the space between two non-pressure rated walls (one in the Control Building) causing those walls to be overstressed. If this occurred structural damage to the Control Building was possible. At the time of the notification, the reactor mode switch was in shutdown (Operational Condition 4), and the reactor was at approximately 108 degrees Fahrenheit and at ambient pressure.

The sequence of events for this incident are as follows:

On January 16, Niagara Mohawk (NMPC) Engineering was performing a design document review in order to prepare a list (for surveillance purposes) of watertight penetration seals for the postulated Circulating Water (CWS) internal flooding event. During this review, a NMPC engineer noticed an electrical blockout, that did not have an equipment identifier, on one of the drawings. Further investigation revealed that the blockout was also not identified on any other of the NMP2 design drawings nor was it listed on the Master Equipment List. As a result, NMPC Engineering performed a walkdown of the blockout and discovered that it was not sealed.

Between January 16 and January 25, NMPC Engineering performed an evaluation of this deficiency. Additionally, an Engineering Design Change (EDC #2S10044) was written (completed on January 25) to provide an equipment identifier and to specify the sealing requirements for the blockout.

On January 25, NMPC Engineering completed their evaluation and determined that this deficiency could adversely affect the structural integrity of the Control Building during the postulated CWS internal flooding event. NMPC Engineering notified the NMP2 Station Management of these findings later that day. As a result, the NMP2 Station Management notified the NMP2 Operator to issue an Occurrence Report and to initiate a Work Request (WR #146241) to seal the blockout.

On February 6 the blockout was sealed.

Subsequent to discovery of the first unsealed penetration, NMPC Engineering performed a document review and a walkdown of other watertight penetration seals affected by the postulated CWS internal flooding event. On February 1, the following deficiencies were noted:

1. Eight ductlines in a ductbank were sealed with a silicone foam seal that was not capable of maintaining leak tightness at flood pressures.

2. Three corebores through a double wall did not have caulk installed over the silicone foam seal on the water (flood) side of the penetration.

3. A conduit was found with no seal.

4. Eleven piping penetrations (thimbles) were found to be improperly sealed.

Engineering Design Change documents and Work Requests were issued to correct these additional deficiencies. By February 20, all the additional unsatisfactory penetrations were properly sealed.

There were no other inoperable systems which contributed to this event. No plant system or component failure resulted from this event.

II. CAUSE OF EVENT

A root cause analysis was performed using Site Supervisory Procedure S-SUP-1, "Root Cause Evaluation Program" and the Institute of Nuclear Power Operations Human Performance Evaluation System. The immediate cause for these unsatisfactory penetrations was a combination of design and installation deficiencies. The intermediate cause of the installation deficiencies was determined to be technical inaccuracies in the penetration design documents (release sheets) used by the installation vendor. The root cause for the inaccurate release sheets was determined to be the result of several human performance problems due to poor work practices.

The vendor correctly installed each penetration seal in accordance with the penetration release sheets. Portions of the penetration release sheets were prepared by the contractor's field engineer using applicable design documents. However, the field engineer did not provide an accurate interpretation of the design requirements when preparing some of the penetration release sheets. Work done in accordance with these inaccurate release sheets resulted in several deficient penetration installations. Subsequent verification of the installations did not identify the deficiencies.

The following deficient installations are considered to be the result of human performance problems due to poor work practices:

NOTE: Each of the following installation deficiencies are considered to be the result of isolated personnel errors. The reviews and walkdowns performed subsequent to the electrical blockout discovery did not identify any generic concerns.

(1) The unsealed conduit - This conduit was found not to be sealed in the field per the design requirements. The field engineer did not identify this conduit to be sealed during his walkdown of the associated pressure barrier. Additionally, it is surmised that the field engineer performed an inadequate review of the applicable design documents as a self check. A thorough review of the applicable design drawings would have identified this conduit as an item to be sealed.

(2) Nine piping thimbles - Eight of these thimbles had the required caulking installed on the wrong side of the penetration, and one did not have any caulking installed. For the eight, the contractor's field engineer incorrectly specified the side of the penetrations that required caulking. For the thimble lacking the required caulking, it is surmised that this installation deficiency was caused by an oversight by the contractor's field engineer.

(3) The three corebores - These corebores were through a double wall configuration and did not have the required caulking installed over the silicone foam on the flood side. The barrier, where these corebores are installed, was upgraded to a safety related pressure barrier in 1986. As a result of the upgraded status of the pressure barrier, the existent penetration seals for these corebores needed to be caulked in accordance with the design requirements. However, the contractor's field engineer made an incorrect determination that caulking was not necessary for these corebores.

(4) One piping thimble - This thimble was found to have a pipe penetrating it with movements exceeding those acceptable for the installed foam seal. (The excessive pipe movements could degrade the integrity of the penetration seal.) Design calculations correctly modeled the movements expected for this particular pipe. However, the calculations were incorrectly interpreted by the contractor's piping engineer. Therefore, this resulted in an incorrect seal being installed.

The root cause for the design deficiencies was determined to be the result of several human performance problems due to inadequate change management and to poor work practices.

Deficient design details and requirements accounted for the following unsatisfactory installations:

(1) The electrical blockout - Contractor engineers never labeled the electrical blockout (with an equipment identifier) on any of the applicable design drawings or penetration lists. (The blockout is shown on the existing design drawings; however, it was not labeled.) As a result, the contractor never placed the blockout on a tracking system to ensure it would be sealed.

Subsequent inspections of the affected wall failed to identify the deficiency; the unsealed blockout was physically covered by an electrical junction box making visual detection of the deficiency difficult.

As of this date, no other unlabeled penetrations have been identified; therefore, this deficiency is considered to be unique.

(2) The eight ductlines in a ductbank - These ductlines are located in an area that was not identified to be part of the postulated CWS flood boundary. This area was incorrectly omitted by contractor engineers when the flood boundaries for the CWS flood event were being determined. Subsequent reviews by contractor engineers failed to rectify this deficiency. This problem is considered unique since reviews conducted by NMPC engineers (as a result of this report) did not identify any other similar deficiencies.

(3) One piping thimble - In 1985, as part of the internal flooding design effort, contractor design engineers revised the sealing requirements for the area where this thimble was located. However, the design details for the thimble were not revised to reflect the new requirements. The failure to revise the thimble design details was caused by an inadequate review to identify all the documents affected by the change.

The contractor's field engineer used the piping thimble details to prepare the release sheet for this penetration. As a result, in early 1986 a seal was installed that did not satisfy the revised area sealing requirements.

This deficiency was identified during a walkdown by NMPC engineers in October 1986. The unsatisfactory installation was immediately brought to the contractor's attention. A design review conducted by the contractor engineers incorrectly determined that the installation satisfied the sealing requirements for its associated boundary. However, subsequent reviews (in February 1989) by NMPC engineers correctly determined that the installation was actually deficient and did not meet the boundary's sealing requirements.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73(a)(2)(ii) because the deficient penetrations in conjunction with an internal flooding event could have placed NMP2 in an unanalyzed condition and compromised plant safety.

NMPC Engineering has performed an analysis to determine the safety consequences of the unsatisfactory penetration seals. Using the postulated CWS internal flooding event as the basis, several event scenarios were analyzed for potential adverse safety consequences. Of the scenarios analyzed, those affecting the structural integrity of the Control Building, or the operability of the Service Water System or the Emergency Core Cooling Systems were determined to potentially compromise plant safety. The scenario having the greatest plant impact is discussed below.

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

A postulated single pipe break in either a CWS pump suction line or a CWS condenser discharge line could result in water flowing into the Turbine Building (TB) elevation 250 at a rate of approximately 100,000 gallons per minute. (Flooding the TB elevation 250 would result in a loss of the reactor feedwater and condensate systems.) From the TB elevation 250, water would flood the pipe tunnels beneath the plant. Water flowing through the inadequate penetrations in the pipe tunnels could flood both the NMP2 Service Water Pump Bays and the Reactor Building.

Flooding the Service Water Pump Bays would result in a loss of emergency service water.

Water flowing into the Reactor Building would eventually flood the Emergency Core Cooling System (ECCS) pump cubicles, resulting in a loss of ECCS capability.

As a result of this scenario, normal and backup water delivery systems to the reactor would be flooded and inoperable. NMP2 Operators would have to use alternate methods (discussed in the Plant's Emergency Operating Procedures) to provide coolant to the reactor.

Postulating a pipe break on the CWS condenser discharge line, NMP2 Operators can take immediate action to lessen the consequences. The Operators would have been alerted to a flooding condition because the sump pumps in the Turbine Building and Reactor Building would have alarmed in the Radwaste Control Room on high flow; especially if all the sumps were registering high flow. The radwaste operators are required to notify the Control Room per procedure. The Circulating Water Pumps and the condenser could have been isolated by closing the isolation valves. Additionally, the cooling tower distribution gates could be closed providing partial isolation of the cooling tower. These actions could limit the rate and the extent of flooding. However, had a CWS pump suction line broken, immediate Operator action would not be as effective in limiting the flood rate or the amount of water available for flooding.

The scenario discussed above can no longer occur since the deficient penetrations have been brought into compliance with internal flooding criteria.

While performing the analysis detailed in this section, NMPC Engineering determined that water could also flow into Nine Mile Point Unit 1 (NMP1) during the postulated CWS internal flooding event. Water flooding the NMP2 Turbine Building at elevation 250 could flow through the tunnel connecting NMP2 with NMP1. The impact on NMP1 is currently being determined.

Many of these penetrations have been in a deficient configuration prior to the receipt of the NMP2 operating license. Therefore, the duration for this event from license receipt (on October 31, 1986) to the date when the last deficient penetration was sealed (on February 20, 1989) is 843 days.

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

IV. CORRECTIVE ACTIONS

The deficiencies discussed in this report occurred during the construction phase of NMP2. At that time the contractor's Engineering Department was responsible for the NMP2 design and installation program.

Activities involving design, breaching, or installation of penetration seals at NMP2 are now controlled by NMPC procedures.. Site fire department procedure, S-FDP-3, "Breach Permit Procedure" and site Administrative Procedure, AP-5.2, "Unit 2 Procedure for Repair" control penetration breaching and resealing activities. These procedures require NMPC Engineering review for each penetration seal prior to and after installation. The combined use of these procedures provide accurate and consistent review of all sealing activities at NMP2.

The flood boundaries and pressure requirements have been properly identified on design drawings and recently verified by NMPC Engineering. This clear definition of flood boundaries in conjunction with the procedures discussed above, ensures that all penetrations are sealed to the proper design requirements. In addition, new penetrations are designed via the NMPC Design and Modification Programs.

The corrective actions for this event are as follows:

1) An Engineering Design Change (EDC #2S10044) was issued to provide an equipment identifier for the electrical blockout and to provide details for sealing the blockout. This was completed on January 25, 1989.

2) A Work Request (WR #146241) was issued to seal the blockout. This work was completed on February 6, 1989.

3) Subsequent to this event, NMPC Engineering performed a document review and a walkdown of 100% of the watertight penetration seals affected by the CWS internal flooding event. Additional deficiencies were identified (discussed in this report) and have been corrected as discussed in the Non-Conformance Report (NCR #2-89-0006). To ensure no other similar deficiencies existed in the plant, the following pressure barriers were reviewed:

   (A) A sample (approximately 25%) of the penetrations located in safety related flood boundaries (other than the CWS flood boundary); (B) A sample (approximately 8%) of the high and low pressure airtight boundary seals; (C) A sample (approximately 25%) of the safety related flood boundary walls (other than the CWS flood boundary).

   The results of these additional reviews were evaluated and no other deficiencies were identified.

4) A Problem Report (PR #1362) has been issued to evaluate the potential flooding of Nine Mile Point Unit 1.

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

V. ADDITIONAL INFORMATION

A. Failed Component Identification - Not Applicable

B. Previous Similar Events - None. However, the following LERs discuss other events at NMP2 caused by deficient penetration seal installations:

(1) LER 86-08 revision 1 (This LER was concerned with unsealed field routed embedded conduits.)
(2) LER 86-26 (This LER was concerned with improperly sealed conduits inside manhole #5.)
(3) LER 87-16 revision 1 (This LER discussed an event where certain abandoned and spare penetrations were discovered not to be sealed.)
(4) LER 87-18 (This LER discussed an event where a properly sealed penetration was later breached and not resealed.)
(5) LER 87-74 revision 1 (This LER concerned improperly sealed floor plug installations.)

Identification of Components Referred to in this LER

Component	IEEE 803 EIIS Funct	IEEE 805 System ID
Blockout (Penetration)	PEN	NN
Wall	N/A	NA,NN
Pumps	P	KE
Isolation Valves	ISV	KE
Cooling Tower	CTW	KE
Circulating Water System	N/A	KE
Control Building	N/A	NA
Piping/Electrical Tunnels	N/A	NN
Service Water System	N/A	BI
Feedwater and Condensate System	N/A	SD,SJ
Emergency Core Cooling System	N/A	BH,BO
Turbine Building	N/A	NM
Reactor Building	N/A	NG
Tunnel	N/A	MA
Administrative Building	N/A	MA

A 10CFR21 evaluation has been completed, and it has been determined that a substantial safety hazard existed.