NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
McGuire Nuclear Station - Unit 2	0 5 0 0 0 3 7 0	1 OF 0 7

TITLE (4) A HOLD DOWN BOLT WAS DISCOVERED MISSING FROM MISSILE SHIELD BLOCKS OVER THE REACTOR CAVITY DUE TO DEFECTIVE PROCEDURE - INADEQUATE INSTRUCTIONS

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)
0 8	1 4	8 7	8 7	0 1 1	0 1	0 3	2 5	8 8	McGuire - Unit 1	0 5 0 0 0 3 6 9
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

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)	XX 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)	XX 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)
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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)

YES (If yes, complete EXPECTED SUBMISSION DATE) XX NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On August 13, 1987, with Unit 2 at 100% power, Maintenance (MNT) discovered five missile shield hold-down bolts in the decontamination area. An investigation revealed a hold-down bolt was missing from one of the Reactor Cavity missile shield blocks. MNT notified Operations at 1006 on August 14, 1987. Design Engineering (DE) was contacted to evaluate the conditions and provide guidance on the operability of the shield blocks. At 1730, DE advised McGuire that the shield blocks were inoperable. Operations declared the shield blocks inoperable at that time. Unit 2 was shut down to Mode 3, Hot Standby. MNT discovered four other bolts not installed. MNT redrilled the bolt hole and installed the missing bolt along with the other bolts and verified all ten bolts were installed. Operations declared the shield blocks operable again at 0407 on August 16, 1987, and Unit 2 was back on line at 2345. MNT will modify the existing procedure or write a new procedure to provide detailed removal/installation instructions for the shield blocks. If additional actions are planned, a supplemental report will be submitted. A classification of Defective Procedure has been assigned to this event because procedures which relate to the missile shields did not contain any detailed instructions on the proper installation of the missile shield blocks.

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INTRODUCTION:

On August 13, 1987, Maintenance discovered five missile shield hold-down bolts in the decontamination holding area. An investigation subsequently revealed that a hold-down bolt was missing from one of the missile shield blocks [EIIS:BLK] over the Reactor [EIIS:RCT] cavity in the Unit 2 Containment Building [EIIS:NH], and the hole that the bolt should have gone through had been grouted. Maintenance then notified Operations at 1006 on August 14, 1987. Design Engineering was contacted to evaluate the conditions and provide guidance on the operability of the shield blocks. At 1730, Design Engineering contacted the station and advised that the shield blocks were inoperable, Operations declared the shield blocks inoperable at that time. In accordance with the action statement of Technical Specification 3.6.5.5, Unit 2 was shut down to Mode 3, Hot Standby. Maintenance redrilled the bolt hole and installed the missing bolt. Operations declared the shield blocks operable at 0407 on August 16, 1987, and Unit 2 was back on line at 2345 on August 16, 1987.

Unit 2 was in Mode 1, Power Operation, at 100% power, at the time of this event.

A classification of Defective Procedure has been assigned to this incident because the procedures which relate to the missile shields did not contain any detailed instructions on the proper installation (or verification of installation) of the missile shield blocks.

EVALUATION:

Background

There are five reinforced concrete blocks which cover the refueling cavity and Reactor Vessel [EIIS:RPV] in the Unit 2 Containment Building. The blocks are interlocked with a tongue and groove arrangement with the first, third, and fifth blocks bolted to the operating deck. The blocks immediately above the Reactor Vessel serve as a missile barrier in the event of an ejected rod [EIIS:ROD] accident. All of the blocks together serve as part of the Containment divider barrier which isolates the upper and lower Containment areas from each other.

Technical Specification 3.6.5.5 requires the divider barrier be operable and closed. If the barrier becomes inoperable, one hour is allowed to return the barrier to an operable status or the unit is required to be shutdown to Mode 3, Hot Standby, within the following six hours.

Description of Event

On the morning of August 13, 1987, a Maintenance (MNT) staff engineer walking through the decontamination holding area noticed five long bolts in a pile. They appeared to him to be the bolts used to hold down the missile shield blocks in the Containment Building. He contacted other MNT personnel, who then contacted the Construction and Maintenance Department (CMD) crew that installed the shield

blocks and confirmed that bolts had been installed in the shield blocks. The MNT staff investigated further to determine why five bolts were left over, and discovered that five of the original eleven bolts were not normally installed. The crew which removed and replaced the blocks during the recent outage reported that they replaced all the bolts they had removed, following the practice which has been used since the first refueling outage.

Further investigation by the MNT staff revealed the drawings called for ten bolts, two bolts in block PC1, and four bolts each in blocks PC3 and PC5. The original design called for three bolts in block PC1, but the center bolt was officially deleted during plant construction. When the shield blocks were first installed for Hot Functional Testing, the bolt holes would not line up and had to be redrilled. This work was performed under Variation Notice 28418 with the concurrence of Duke Design Engineering. One of the CMD supervisors over that work recalls another Variation Notice which changed the requirements from two bolts on each end of blocks PC3 and PC5 to one bolt on each end.

On the morning of August 14, 1987, a MNT crew entered the Unit 2 Containment Building for routine periodic MNT, and were asked to survey the shield block bolts. Shortly before 1000, the crew reported that only seven bolts were visible, and that the eastern bolt on block PC1 was not only missing, but its hole appeared to be grouted. MNT contacted Operations at 1006 and advised them of the missing bolt, and additionally advised Station Management. The operability of the shield blocks could not be determined at that point, because there was no documentation available at the station which indicated the bolts were related to operability. At 1145, Design Engineering was contacted for assistance in determining the operability of the blocks and in resolving the questions concerning how many bolts were required.

At 1730, Design Engineering contacted McGuire and advised that the missing bolt in block PC1 caused the missile shield and divider barrier to be inoperable. Operations immediately declared the missile shield/divider barrier inoperable and declared an Unusual Event in accordance with RP/0/A/5700/01, Notification of Unusual Event, procedure. Technical Specification 3.6.5.5 action statement required a unit shutdown to Mode 3, Hot Standby, unless the shield blocks were returned to operable status within one hour; thus, Unit 2 commenced a shutdown at 2000 and reached Mode 3, Hot Standby, at 2345.

The review by Design Engineering revealed that all design requirements would be met with only one bolt installed at each end of blocks PC1, PC3, and PC5, but could find no documentation related to the Variation Notice which would have authorized the use of that configuration. Additionally, the approved drawings all showed two bolts on each end of blocks PC3 and PC5.

On August 15, 1987, the bolt hole was redrilled in block PC1, the retainer plate for the bolt replaced, and the bolt was installed. Additionally, the other two bolts for block PC5 were installed. This work was completed at 0415 on August 16, 1987; whereupon, Operations declared the shield blocks operable and secured from the Unusual Event. Unit 2 was put on line again at 2335 that evening.

Conclusion

The root cause of this incident was the lack of a procedure with detailed instructions on how to install the shield blocks. The available evidence suggests that the most likely time for this event to have originally occurred was during the process of redrilling the bolt holes during the initial block installation. The blocks were under the control of the Construction Department at that time, where detailed procedures were not used and work was performed from drawings. Field originated changes were initiated and approved by means of the Variation Notice program where provisions were made for Design Engineering to review the changes and then incorporate them into the approved drawings. Variation Notices were used to redrill the bolt holes when they would not line up during the first installation, but there are no documents to show when the Variation Notice was applied to which bolt hole. It is possible that the east bolt hole on block PC1 was grouted, but simply overlooked during the redrilling process.

The document which former Construction personnel believe was a Variation Notice which addressed the number of required bolts per block cannot be found; therefore, its contents cannot be evaluated for their effect on the event. Design Engineering files, Quality Assurance files, plant files, and other miscellaneous files were searched to no avail. One possibility is that a Variation Notice was written, forwarded to Design Engineering where it was disapproved, and the paperwork simply discarded. It is also possible that its contents led the crew to believe that only one bolt on each end of the block was an authorized configuration, and that only one bolt in block PC1 had also been authorized. It is also possible that only one bolt was installed for Hot Functional testing since the blocks would be removed again shortly thereafter. Interviews with several personnel who participated in these activities did not provide any additional insight, nor any directions to recoverable paperwork which would reveal additional details.

When the shield blocks were administratively turned over to the Nuclear Production Department during the Unit 2 startup, the need for an installation procedure was not recognized. Personnel from the Construction Department (later reorganized into CMD) were to handle the removal and reinstallation of the blocks during refueling outages, and work of this nature does not have highly detailed procedures. Two procedures exist which involve the shield blocks, one which governs lifting of heavy loads in the Containment Building, and another which provides for the inspection of the seal [EIIS:SEAL] between the shield blocks and the operating deck. Neither procedure provides any information on the installation of the bolts.

The CMD crew which handled the shield block removal and reinstallation during the refuelings reinstalled what they removed, as was their accepted practice. Since there was no detailed procedure, they had nothing to alert them that something was amiss.

Since there are no specified torque values for the bolts, or other similar recordable data requirements, the Quality Control (QC) group was never involved, nor did any requirement exist to suggest to them to look for a procedure.

A classification of Defective Procedure has been assigned to this incident because the procedures which relate to the missile shields did not contain any detailed instructions on the proper installation (or verification of installation) of the missile shield blocks.

Unit 1 had been shut down prior to the time of this event for other reasons, and was inspected for proper bolt installation. Only one bolt was installed at each end of block PC3, and another bolt was missing from block PC5. The bolts were subsequently installed on ends of blocks PC3 and PC5 as called for on the design drawings.

Licensee Event Report (LER 369/87-03) evaluated an incident in January of 1987, where a set of water curbs around the Containment Air Return Fan [EIIS:BB] pits were inadvertently not reinstalled at the end of a refueling outage. The root cause was a lack of administrative controls to ensure the replacement of the curbs after their removal. Due to the similarity of the two incidents, this incident is considered recurring.

The corrective actions in LER 369/87-03 were, for the most part, unique to the Containment Air Return Fan pit curbs. One corrective action, however, applies directly to this event; specifically, Design Engineering was to provide a listing of all the Containment Building civil structures which perform a passive safety function and procedures were to be written to ensure the operability of all those structures. This study is now complete.

This event is not Nuclear Plant Reliability Data System (NPRDS) reportable.

CORRECTIVE ACTIONS:

Immediate: The Unit 2 shield blocks and containment divider barrier were declared inoperable and an Unusual Event was declared.

Subsequent:

1) The bolt hole was redrilled and the bolt installed on Unit 2 block PC1, and the remaining bolts for block PC5 were installed.

2) Ten bolts were verified to be installed in the missile shield blocks in accordance with the approved design drawings.

3) MNT personnel wrote the procedure, Missile Shield and Hatch Plug Removal and Replacement, to clarify the requirements for the missile shield blocks and other removable bolted hatches in the Containment Building.

4) MNT personnel planned and executed a preliminary civil structures walk-down of the Unit 1 Containment Building with the assistance of Design Engineering as a Mode 4 requirement.

5) Design Engineering completed a Design Study involving civil features of the Containment Buildings (Units 1 and 2) that have a Nuclear Safety impact.

Planned:

1) MNT personnel will use the results of the Design Study mentioned above to perform a physical inspection of all accessible civil structures in the Containment Building to ensure that the civil structures therein are installed according to Design Drawings. If items are found that are deficient, the items will be corrected and incorporated into periodic tests which will be performed each refueling outage. These items will be inspected each refueling outage until a satisfactory level of confidence has been achieved, at which time, the inspections will be curtailed.

SAFETY ANALYSIS

Mass and energy releases from two limiting Loss Of Coolant Accident (LOCA) transients have been analyzed. The first transient, a double-ended hot leg guillotine break (LBLOCA), provides the greatest differential pressure between the reactor cavity and upper containment, resulting in a force sufficient to displace the unbolted panel. The other transient, an 8 inch hot leg break (SBLOCA), is limiting in terms of containment pressure, according to FSAR Table 6.2.1-19, as the operating deck bypass area increases above the nominal 5 square feet value.

The impact of an unbolted missile shield panel on the containment pressure response was analyzed by Design Engineering personnel with a model computer simulation called FATHOMS, which is comparable to the short term response analysis model in the Final Safety Analysis Report (FSAR) called TMD. Lower Containment is modeled using six radial volumes, while the ice condenser is represented by twelve volumes (6 radial, 2 axial divisions). The upper plenum, reactor cavity, and dead-ended compartments are modeled as single volumes, but Upper Containment is divided into three axial volumes for enhanced resolution. The TMD model, by comparison, uses 4 axial divisions in the ice condenser, and uses a 6 volume representation of the upper plenum. The upper containment is modeled using one volume. To assess the adequacy of the FATHOMS model, the LBLOCA case was analyzed with the missile shield panel anchored, and the results were then compared to FSAR Figure 6.2.1-18. The FATHOMS model results compared well with and conservatively bounded the FSAR results. The FATHOMS model predicted a peak pressure of 6.5 psig, compared to 6.0 psig by the TMD model.

The LBLOCA case was analyzed with the missile shield panel completely removed throughout the transient, introducing an additional 85 square feet bypass area across the operating deck. The FATHOMS model predicted a peak pressure of 20.2

psig at 21 seconds into the transient. The LBLOCA case was also analyzed assuming the panel was completely displaced for the first three seconds, but then partially reseated at 3 seconds, thereby reducing the bypass area to 25 square feet. The intent of this analyses was to investigate the situation where sufficient differential pressure no longer exists to lift the panel, which the FATHOMS model predicted would occur at 3 seconds. The peak pressure was calculated to be 14.9 psig at 25 seconds. For the 8 inch SBLOCA case, the differential pressure across the missile shield was insufficient to displace the unbolted panel.

In summary, the worst case transient (LBLOCA) results in a containment pressure above the design pressure of 15 psig, but well below the ultimate strength of the containment, taken by NRC staff to be 48 psig (Safety Evaluation Report Supplement No. 7). A more probable transient, however, is the 8 inch SBLOCA case. For the SBLOCA the pressure drop across the missile shield panel is insufficient to lift the panel, so the existing FSAR analysis for SBLOCA remains valid.

There were no personnel injuries, personnel overexposures, or releases of radioactive material as a result of this event.

This event is considered to be of no significance with respect to the health and safety of the public.

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March 28, 1988

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station, Unit 2
Docket No. 50-370
Licensee Event Report 370/87-11-01

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 370/87-11-01 concerning a missing hold-down bolt from a missile shield over the Reactor Cavity. This revision is being submitted to clarify the description of the event, report additional corrective actions taken and planned, and provide a more indepth safety analysis. This report is being submitted in accordance with 10CFR 50.73(a)(2)(v) and (a)(2)(ii). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

SEL/250/jgc

Attachment

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