NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

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EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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)
MONTICELLO NUCLEAR GENERATING PLANT	05000 - 263	1 OF 10

TITLE (4)
During a Re-analysis of the High Energy Line Break, An Error was found in the Existing Analysis

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	04	96	96	003	00	05	08	96		05000
									FACILITY NAME	DOCKET NUMBER 05000

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
OPERATING MODE (9)	N		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
POWER LEVEL (10)	80 %		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
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iv)		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 (Include Area Code)
Tom Parker	612-295-1014

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)	✓ NO				

ABSTRACT LIMIT TO 1400 SPACES, I.E., APPROXIMATELY 15 SINGLE-SPACED TYPEWRITTEN LINES) (16)
NCR FORM 366 (5-91)

During re-analysis of High Energy Line Breaks (HELBs) in the Turbine Building, using a different analysis code, NSP personnel identified an error in the current licensing basis analysis. The error resulted in improper analyzed ambient temperatures in the vicinity of Division II MCC-142, Division II MCC-143 and the 4kV switchgear rooms for the limiting feedwater HELB. The re-analysis determined that these areas could become harsh environments; however the licensing basis analysis did not predict these areas to be harsh environments. Therefore, the equipment was not included in the Environmental Qualification Program.

Further evaluations were performed to assure operability of the required systems. Modifications will be installed during the current outage, such that the HELB of concern does not result in an analyzed harsh environment for Division II MCC-142, Division II MCC-143 and the 4kV switchgear rooms.

Description

While operating at 80% power, NSP personnel identified differences between the High Energy Line Break (HELB) analysis performed using a new analysis code and the current licensing basis HELB analysis for the Turbine Building (EIIS System Code: NM). The current licensing basis HELB analysis is based on the RELAP4/MOD5 thermal-hydraulic code. The HELB analysis was being re-analyzed using the GOTHIC/Version 4.0 thermal hydraulic code in place of RELAP4/MOD5. The GOTHIC analysis predicted higher temperature conditions in the vicinity of electrical equipment (EIIS System Code: EB, ED) than the previous RELAP4 analysis. The differences between the analyses was evaluated. A portion of the higher temperatures predicted with the GOTHIC analysis could be attributed to differences in the analysis codes ; however, an error was discovered in the modeling for the current licensing basis analysis as well. The modeling error was found to be the predominant cause for the higher predicted temperatures.

The purpose of the high energy line break analysis is to provide environmental time histories for the Environmental Qualification Program to assure that equipment is available to safely achieve a cold shutdown condition following high energy line breaks. In order to do this, environmental conditions for the equipment used to achieve cold shutdown are determined. The RELAP4 or GOTHIC thermal-hydraulic codes provide the temperature profiles, pressure profiles, and liquid levels.

Division II Motor Control Centers

The limiting feedwater line break[1] being re-analyzed was a "terminal end"[2] break located at one of the feedwater (EIIS System Code: SJ) pumps (EIIS Component Code: P) on the 911ft elevation of the Turbine Building. Following the break, the steam generated by the break fills the 911ft elevation in the vicinity of the feedwater pumps and is forced up the feedwater pump equipment access shaft (See dotted lines on Figure 1) and down the north hallway on the 911ft elevation (See dotted lines on Figure 2). The stairway between the 911ft and the 931ft elevations is enclosed at the 931ft elevation and isolates the Division II Motor Control Centers (MCCs), MCC-142 and MCC-143, on the 931ft elevation from the steam on the 911ft elevation. However, after rising through the feedwater pump equipment access shaft, the steam pressurizes the 951ft elevation enough to force flow down through the southeast stairway and through a hatch (area "A" on Figure 1; arrows show the flow path). The southeast stairway

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[1] The limiting feedwater line break is at the discharge of the feedwater pump and offsite power is available to pump the water in the hotwell to the turbine building floor.

[2] A break at the feedwater pump and discharge piping weld.

and the hatch were erroneously assumed to be enclosed in the RELAP4 analysis; preventing flow down from the 951ft elevation to the 931ft elevation. This downward flow through the stairway and hatch makes the environment in the vicinity of Division II MCC-142 and MCC-143 a harsh environment (greater than 120°F). See the Table 1.

4kV Switchgear Rooms

The GOTHIC model predicted that the Division I and II 4kV switchgear rooms would be at a higher temperature than the RELAP4 model. The northwest Turbine Building stairway between the 951ft and 931ft elevation also is predicted to pass flow down the 931ft elevation. Making the environment harsh for the Division II 4kV switchgear. A hallway connecting the east and west end of the 911ft elevation of the Turbine Building is predicted to pass more flow to the Division I 4kV switchgear by the GOTHIC model, making this area a harsh environment also. See the Table 1.

Summary

This equipment, Division II MCC-142, Division II MCC-143, and both Divisions of 4kV switchgear, had not been previously analyzed to be in harsh environments and were not included in the Environmental Qualification Program.

Table 1

	Predicted Peak Area Temperature Following a Feedwater Line Break	
Equipment	License Basis Analysis	Analysis Reportability Was Based Upon
MCC-142, MCC-143	104°F	198°F
Division I 4kV Switchgear	105°F	137°F
Division II 4kV Switchgear	104°F	131°F
Code Used	RELAP4/MOD5	GOTHIC/Version 4.0

Cause

The personnel involved with the RELAP4 analysis were contacted in order to aid in root cause identification. The RELAP4 model erroneously assumed that the southeast stairway was enclosed by fire barriers, with two doors. Actually, there is only one door and it separates the 911ft and the 931ft elevation. No temperature rise was predicted by the RELAP4 model in the

931ft elevation where Division II MCC-142 and MCC-143 are located. The operating turbine floor (951 ft elevation) connection was not open to the Division II 4kV switchgear on the 931ft elevation during the analysis. This is the reason that the Division II 4kV switchgear did not increase in temperature. We believe, that the consultant misinterpreted the NSP drawings of the fire barriers. The barriers were being designed and constructed during the time the analysis was being performed. NSP personnel involved with the construction of the stairway enclosures were contacted to assure that the correct drawings were transmitted to the consultant. This misinterpretation of the fire barrier drawings was a personnel error during the RELAP4 modeling. The RELAP4 licensing basis analysis was performed under a 10 CFR 50, Appendix B, Quality Assurance Program.

The reason for the increase in analyzed temperatures in the Division I 4KV switchgear is due to differences in methodologies.

Safety Significance

In the event a feedwater line break did occur while the plant was at full power, ambient temperatures in the 4kV switchgear rooms and in the vicinity of the some of the Division II MCCs may have become harsh environments, according to the HELB re-analysis using GOTHIC. However, there is a high level of confidence that the equipment would remain available to perform its required function due to the short duration the equipment is exposed to this environment and the lag in temperature rise within the equipment.

The 4kV switchgear has been tested/analyzed to be able to withstand temperatures up to 131°F for 100 days. The HELB re-analysis results show that the ambient temperature in the Division I 4kV switchgear room is greater than 131°F for approximately 15.5 minutes during the postulated event, while the Division II 4kV switchgear room did not exceed 131°F. The temperatures inside the switchgear where the analyzed equipment is located would lag the room temperature. Therefore, it is reasonable to conclude that the 4kV switchgear would have operated properly. The Division II MCCs have been tested/analyzed to withstand temperatures up to 131°F for 4 days. The HELB re-analysis results show that the ambient area temperature for the Division II MCCs is greater than 131°F for approximately seven (7) minutes during the postulated event. The temperatures inside the MCC enclosure where the equipment is located would lag the area temperature. It is reasonable to conclude that the Division II MCCs would have also operated properly. Thus cold shutdown would have been able to be achieved.

The feedwater piping has been seismically evaluated to be able to withstand the design basis earthquake. Also, this piping is included in the formal program for monitoring flow induced erosion/corrosion in piping systems. No adverse erosion or other problems have been

identified in the feedwater piping. The feedwater piping has been monitored for wall thinning each outage since 1987 (including the current refueling outage) by the erosion/corrosion program. The thinning rates are within normally expected values. No piping replacement has been required in the feedwater piping. This suggests that failure due to either of these mechanisms is unlikely. In conclusion, a feedwater line break is an unlikely event.

Analysis of Reportability

This report is being made in accordance with 10 CFR Part 50, Section 50.73(a)(2)(v). This section requires reporting of "... a condition that alone could have prevented the fulfillment of safety function of structures or systems...." The re-analyzed HELB results identified an analyzed plant configuration such that multiple systems could be rendered inoperable following a postulated feedwater pump discharge line break; however, additional evaluations have determined that there is a high level of confidence that the required equipment would remain available to perform required safety functions.

Actions

Immediate Actions

Immediate actions were taken to evaluate operability of the equipment required to obtain cold shutdown following the verification that the harsh environments were predicted in the vicinity of MCC-142, MCC-143 and the 4kV switchgear rooms. Systems required to safely shutdown the reactor were fully operable.

Consideration was given to the availability of redundant equipment following a potential HELB in the feedwater line. The High Pressure Coolant Injection system was available for maintaining the plant safely in the Hot Shutdown condition. This system could have cooled the plant down, if desired, to around 365°F. The Safety/Relief Valves were available to depressurize the primary system.

Operability of the Reactor Core Isolation Cooling system following the postulated HELB was considered. One of the normally open steam supply motor operated valves for the Reactor Core Isolation Cooling system is supplied from MCC-133. This Motor Control Center is assumed to be damaged due to the feedwater line break. The Reactor Core Isolation Cooling system could be unavailable if the harsh environment in the vicinity of MCC-133 caused the Reactor Core Isolation Cooling system steam supply valve to close before the Motor Control Center was de-energized by a fault. Except of this unlikely sequence of events, Reactor Core Isolation Cooling system would be operable. In fact, the Reactor Core Isolation Cooling has

been evaluated to be operable for 4 hours without power from MCC-133. Thus, the High Pressure Coolant Injection system and the Safety/Relief Valves would have been fully operable and the Reactor Core Isolation Cooling system would have been available in most scenarios to mitigate the consequences of the postulated HELB.

Inspection of the feedwater piping of concern on a periodicity of every four hour was established. This action was taken within 30 minutes of identification of the reportable condition as required by plant administrative procedures. This compensatory action was established for the feedwater piping of concern in a timely manner, to ensure identification of any deteriorating condition which could result in an adverse impact on required equipment operability. The established piping inspection provided a means to detect minor leakage such that further compensatory actions could be taken prior to a potential feedwater line break at power. A leak before break analysis had been previously performed for a different compartment , but for the same piping of concern for the condition subject of this licensee event report. This previous analysis determined that a stable detectable crack would develop under all postulated loading conditions, that the crack could be detected and the plant safely shutdown prior to any equipment damage. This analysis was previously provided to the NRC staff by letter dated April 9, 1986. The leak before break analysis performed in 1986 was confirmed to be applicable to the HELB concern subject of this report. As noted previously, erosion/corrosion has not been observed as having any significant adverse impact on the feedwater piping associated with the HELB of concern. A high level of confidence in the ability to identify piping degradation via leakage prior to failure existed for the pressurized piping of concern.

Based on the ability to detect a precursor indication of a potential HELB and thus assure required system operability and the availability of systems to maintain the plant in a safe condition (should an unlikely HELB occur without precursor indication); continued plant operation was justified for the short duration of 6 days until the plant would be shutdown for the refueling outage scheduled to commence on April 10, 1996. The compensatory actions established to detect system leakage prior to failure, as supported by the 1986 fracture mechanics analysis, was determined to provide a high level of confidence of system operability on an interim basis until plant shutdown could be achieved to perform corrective actions in a controlled and pre-planned manner.

The process of operability determination is a continuous and ongoing process. In addition, Monticello strives to maintain open, timely and accurate communications with the NRC staff. Having performed an evaluation of the analyzed condition and having taken the necessary actions to ensure safe operation of the facility as well as the health and safety of the public, Monticello ensured this information was properly communicated to the NRC Staff. Based upon

timely feedback from the staff, Monticello performed additional evaluations of the identified concern. These evaluations did not replace the initial evaluation performed to ensure continued safe plant operation. These evaluations provided additional supporting information to further demonstrate the high level of confidence in the availability of required systems.

The further evaluation performed considered the duration of the harsh conditions and the ability of the affected equipment to operate. Environmental qualification records were reviewed and equipment qualification for equipment temperatures of 131°F for 100 days was supported for the 4kV switchgear. The review of environmental qualification records determined that the MCCs have been qualified for equipment temperatures of 131°F for 4 days. A GOTHIC case was run using input parameters based on plant parameters existing at the time of identification of the reportable condition (lower initial temperatures and a lower power level). This analysis, using realistic inputs, determined that the Division I and II 4kV switchgear would not exceed 131°F. Therefore, the 4kV Switchgear would be operable during a feedwater line break at the current operating conditions. The duration of the harsh environment was determined to be 4 minutes for MCC-142 and MCC-143. Therefore, there is reasonable assurance that the MCCs would have been operable also. In summary, the short duration of the harsh environment and the additional equipment qualification information, provided additional supporting information that operability of this equipment would not be affected at the plant conditions in the interim until the planned refueling outage.

Corrective Actions

1) It has been verified that the current GOTHIC model accurately reflects the current plant configuration for the limiting feedwater line break.

2) Modifications will be performed such that the HELB of concern does not result in harsh environments for the 4kV switchgear, MCC-142 and MCC-143 areas.

Preventative Actions

In-house expertise has been developed to perform the GOTHIC calculations. This will eliminate the need to transfer detailed plant information to consultants to perform these calculations, and the possibility of misinterpretation of information by the consultants.

Failed Component Identification - None

Previous Similar Events

A discrepancy in the High Energy Line Break analysis was reported in April 1986 via letter. This discrepancy was of a different type from the current RELAP4 discrepancy. The 1986 discrepancy involved the identification of a break location with more severe pipe whip, jet impingement, and compartment pressurization than the previous limiting breaks.

Figure 1
Simplified View of the Turbine Building (Looking West) Showing Potential Flow Path to the Division II MCCs

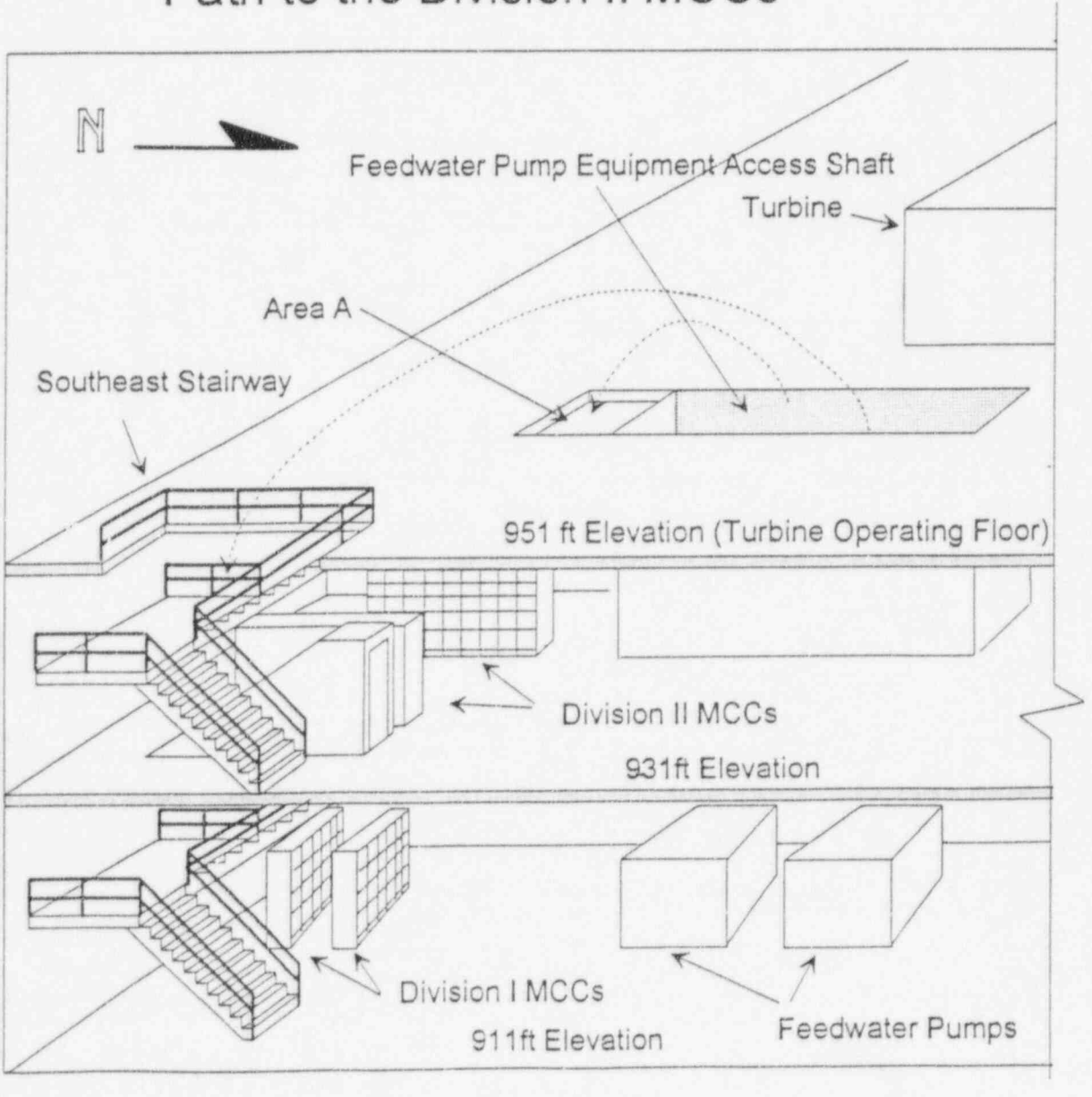

Figure 2
TURBINE BUILDING - ELEVATION 911'