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)
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	1 OF 0 6

TITLE (4): Flow Rates Listed in FSAR Could not be Achieved For the Unit 2 Hydrogen Skimmer System Due to Defective Procedure and Equipment Configuration

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 7	1 9	8 8	8 8	— 0 1 9	— 0 0	0 9	0 9	8 8	Unit 2	0 5 0 0 0 3 7 0
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	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)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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
Steven E. LeRoy, Licensing	AREA CODE 7 0 4 3 7 3 - 6 2 3 3

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 11/08/87, during a Unit 1 Containment Closeout Inspection, NRC noticed some Hydrogen Skimmer (VX) system dampers appeared to be closed. NRC questioned Operations about the positions of the dampers and Operations inspected and verified that each Unit 1 VX system dampers was in its pre-operational position. Because of NRC concerns, Operations agreed to perform a flow balance test on the Unit 2 VX system during the 1988 Refueling Outage. On 07/19/88, Performance took "As Found" flow measurements on the Unit 2 VX system and found that some damper compartment flows did not meet flow requirements. Design was consulted to evaluate the test results, and requested flow measurements be taken again using a more accurate measuring device. The required flow distributions for individual compartments were reanalyzed. The result of the re-analysis was a significant lowering of the flow rates required to limit potential local hydrogen concentration to less than four percent by volume. Design concluded that the VX system with its present flow balance condition is sufficient and the VX system is considered operable. This event is assigned a cause of Defective Procedure because the pre-operational flow balance test procedure for Unit 2 did not require proper flow rates to be drawn from individual containment compartments with each VX system fan operating independantly. This event is also assigned a cause of Design Deficiency because Design was satisfied that the completed pre-operational flow balance test procedure demonstrated the VX system would meet the Tech Spec requirements; therefore, Design waived the final test and flow balance of the VX system.

* U.S.GPO:1984-0-454-481/18758

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	8 8 —	0 1 9 —	0 0	0 2 OF 0 6

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

INTRODUCTION:

On November 6, 1987, during a Unit 1 Containment Closeout Inspection, NRC personnel noticed that some Hydrogen Skimmer (VX) system dampers appeared to be closed. NRC personnel questioned Operations personnel about the positions of the Unit 1 VX system dampers and Operations personnel inspected and verified that each Unit 1 VX system damper, was in its pre-operational position as evidenced by paint shadows on the damper actuators. Since some of the Unit 1 VX system dampers appeared to be closed, NRC personnel were concerned about the positions of the Unit 2 VX system dampers, and consequently, Operations agreed to perform a flow balance test on the Unit 2 VX system during the 1988 Unit 2 Refueling Outage.

On July 19, 1988, Performance personnel took "As Found" flow measurements using a velometer on Unit 2 Train A and Train B of the VX system and found that some VX system damper compartment flows did not meet the flow requirements listed in the McGuire Final Safety Analysis Report. Design Engineering was consulted to assist in evaluating the test results. Design Engineering requested that flow measurements be taken again using a more accurate measuring device, and the required flow distributions for individual compartments were reanalyzed in a manner consistent with Regulatory Guide 1.7, Revision 2, and 10CFR50.44. The net overall result of the re-analysis was a significant lowering of the flow rates required to limit the potential local hydrogen concentration to less than four percent by volume. Design Engineering concluded that the VX system with its present flow balance condition is sufficient and the VX system is considered operable. The NRC is evaluating the Unit 2 Operability Determination.

Unit 2 was in Mode 5, Cold Shutdown, at the time of this event and had been operational in all modes prior to this event.

This event is assigned a cause of Defective Procedure because the pre-operational flow balance test procedure for the Unit 2 VX system did not require that proper flow rates be drawn from individual containment compartments with each VX system fan operating independently. This event is also assigned a cause of Design Deficiency because Design Engineering was satisfied that the completed pre-operational flow balance test procedure demonstrated that the VX system would meet the Technical Specification requirements; therefore, they waived the final test and flow balance of the VX system. This event is also assigned a contributing cause of Design Deficiency because the physical arrangement of the VX system does not allow for flow balancing on an individual fan basis.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	8 8	— 0 1 9	— 0 0	0 3 OF 0 6

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

EVALUATION:

Background

The purpose of the VX system [EIIS:BB] is to prevent the accumulation of hydrogen in confined compartments of containment. As described by the McGuire Final Safety Analysis Report (FSAR) in Section 6.6, "Hydrogen accumulation is prevented by continuously drawing air out of each of the confined areas at such a rate as to limit the potential local hydrogen concentration to less than four percent by volume." The required purge flow rates for the confined compartments were originally calculated by Westinghouse in April 1972, consistent with AEC Safety Guide 7, dated March 10, 1981, and are listed in the McGuire FSAR, Table 6.6.2-1 (the original analysis was based on a hydrogen concentration of 3.5 percent by volume).

Following the original analysis, the NRC issued 10CFR50.44 and published Revision 2 of Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment following a Loss-of-Coolant Accident." Several of the assumptions in the original Westinghouse calculation for the VX system are no longer applicable under Regulatory Guide 1.7. However, Section 6.2.5 of the McGuire FSAR, which describes the design and functions of the Hydrogen Recombiners [EIIS:RCB] and the Hydrogen Purge system, have been consistent with Regulatory Guide 1.7, Rev. 2. A re-analysis was initiated by Design Engineering as a result of problems with McGuire Unit 2 in achieving flow distributions which were consistent with the original design analysis.

Description of Event

On November 8, 1987, during a Unit 1 Containment Closeout Inspection, NRC personnel noticed that some VX system dampers appeared to be closed. NRC questioned Operations about the positions of the Unit 1 VX system dampers [EIIS:DMP], and on November 9, 1987, Operations inspected and verified that each VX system damper was in its pre-operational position as evidenced by paint shadows on the damper actuators. Prior to Unit 1 initial criticality, painting on each damper body and actuator handle left a shadow mark on the damper position indicator. Each damper was verified to be in the same painted mark pre-operational position. Since some of the Unit 1 VX system dampers appeared to be closed, the NRC was concerned about the positions of the Unit 2 VX system dampers, and consequently, Operations agreed to perform a flow balance test on the Unit 2 VX system during the 1988 Unit 2 Refueling Outage.

On July 19, 1988, Performance (PRF) took "As Found" flow measurements on the Unit 2 VX system in an attempt to verify distribution and balance the system as needed while running either VX system Fan [EIIS:FAN] 2A or 2B. Flow measurements were performed using a hand held velometer across the intake of the dampers. When the FSAR values for individual compartment flow could not be achieved, Design Engineering (D.E.) was consulted to assist in evaluating the test results. D.E.

recommended the flow balance test be repeated using a more accurate flow measurement device, a flow hood, because the hood is relatively unaffected by the inlet velocity profile and does not depend on operator judgement for locating a representative flow area. D.E. also reevaluated the FSAR VX system flow values based on a hydrogen concentration of less than four percent which lowered the required VX system flow rates. After the flow balance test was repeated using the flow hood, some flow distributions increased significantly; however, results for medium range and higher flow rates did not vary as dramatically.

On July 21, 1988, flow measurement tests were terminated because the planned Unit 2 Operability Determination issued by D.E. did not rely on flow numbers but on the operability of the Hydrogen Mitigation system [EIIS:BB]. PRF evaluated the data to determine optimum damper positions. PRF observed that the "As Found" damper positions were essentially the same as the pre-operational positions as evidenced by paint shadows on the damper actuators. Two dampers, both serving the Reactor head area, were found closed and left in a throttled position. On July 22, 1988, D.E. issued an Operability Determination which was based on the fact that the maximum hydrogen concentration assumption used in the original design analysis of the VX system was more conservative than required, the hydrogen generation source term had been decreased by 10CFR50.46 and subsequent Emergency Core Cooling system analyses. Also, the Operability Determination stated that the Hydrogen Mitigation system was available and operable to provide added assurance that hydrogen would not build up to concentrations capable of being detonated. NRC rejected the Operability Determination because the bases for the Technical Specification requirements for the Hydrogen Mitigation system were not the same as for the VX system and NRC stated that the Hydrogen Mitigation system cannot be relied upon as a substitute for the VX system.

Between August 2, 1988 and August 15, 1988, D.E. pursued reevaluating the required VX system flow rates in a manner consistent with Regulatory Guide 1.7, Revision 2 and 10CFR 50.44. While some of the new assumptions have the effect of increasing the required flow rates, the majority have the result of reducing the required flow rates. The overall effect of the reevaluation has been a significant lowering of the flow rates required to limit the potential local hydrogen concentration to less than 4 percent by volume. On August 16, 1988, PRF completed flow measurements on Train B of the VX system. On August 19, 1988 D.E. issued a Unit 2 Operability Determination based on the re-analysis and concluded that the present flow balance condition of the VX system is sufficient and the VX system is considered operable. The NRC is evaluating the Operability Determination.

Conclusion

This event is assigned a cause of Defective Procedure because pre-operational flow balance testing of the Unit 2 VX system did not require that proper flow rates be drawn from individual containment compartments with each VX system fan operating independently. PRF believed that the same flow resistance would be experienced with either fan operating; therefore, the pre-operational flow balance testing was

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	8 8	— 0 1 9	— 0 0	0 5 OF 0 6

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

performed on only one train of the VX system. Subsequent flow balance testing of the Unit 2 VX system showed that each VX system fan experienced different flow resistance. The pre-operational test procedure was implemented and approved with only one train of the VX system being flow balanced.

This event is also assigned a cause of Design Deficiency because the final turnover package for the Unit 2 VX system documented that D.E. personnel were satisfied that the completed pre-operational flow balance test procedure demonstrated that the VX system would meet the Technical Specification requirements; therefore, D.E. waived the final test and flow balance of the VX system. This event is also assigned a contributing cause of Design Deficiency because the VX system has a single header that draws air from each of the containment compartments by use of redundant fans located on either end of the header. Either fan is capable of drawing the total design basis flows from areas serviced; however, the equipment configuration of the system is such that balance of the individual compartment flow rates is difficult to achieve when operating each fan independently.

Two VX system dampers, both serving the Reactor [EIIS:RCT] head area, were found closed. It could not be determined during this investigation how long these dampers had been closed. There are no periodic surveillances on these dampers which would verify their positions.

A review of the McGuire Licensee Event Reports revealed no other similar events; therefore, this event is not considered recurring.

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

CORRECTIVE ACTIONS:

Immediate: PRF took "As Found" flow measurements while operating first one fan, then the other to determine optimum damper positions.

Subsequent: D.E. reevaluated flow rates using Regulatory Guide 1.7 and 10CFR50.44 and issued an Operability Determination for Unit 2.

Planned:

1) PRF will take "As Found" flow measurements on the Unit 1 VX system during the 1988 Unit 1 Refueling Outage.

2) Based on the results of the Unit 1 VX system "As Found" flow measurements, a revision may be submitted for this event.

3) D.E. personnel will evaluate modifying the Unit 1 and Unit 2 VX systems in order to achieve proper flow balancing of the system.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	8 8	— 0 1 9	— 0 0	0 6 OF 0 6

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

4) After Planned Corrective Action No. 2 is completed and implemented, PRF will perform a flow balance of the Unit 1 and Unit 2 VX systems to determine optimum damper positions and appropriately mark these positions.

5) Operations will develop a VX system Valve Checklist to verify the optimum damper positions that were determined in Planned Corrective Action No. 4.

6) A Special Task Force will be reviewing specific pre-operational test procedures for all systems that were not supplied by Westinghouse to determine if the Design Bases of the system was verified by the testing.

SAFETY ANALYSIS:

The re-analysis of the Hydrogen Skimmer system flow requirements, performed by D.E, did not lead to an increase in fission product inventory, containment leak rate, or off site dose. The new flow rates are adequate to ensure that the system can limit potential local hydrogen concentration to less than 4 percent by volume as required by the design basis. In addition, the new flow rates resulting from VX system re-analysis have no discernible effects on the post-accident containment pressure response, Containment Hydrogen Recombiner operation, Containment Purge dose, or Control Room dose, because the VX system flows primarily influence the redistribution of hydrogen and not the overall post-accident hydrogen production rate, fission product inventory, or ice condenser performance.

Two dampers, both serving the Reactor head area, were found closed. Although it is recognized that the Hydrogen Mitigation system cannot be relied upon as a substitute for the VX system, the Hydrogen Mitigation system was operable and would have provided added assurance that in the unlikely event of a design basis accident, the hydrogen would not build up to concentrations capable of being detonated.

The single failure analyses for the Hydrogen Recombiner and Purge system, severe accident Hydrogen Mitigation system, and Containment Air Return system as discussed in McGuire FSAR Sections 6.2.5, 6.2.7, and 6.6 have been reviewed and assessed by D.E. for any differences in consequences. The review concluded that the reanalyzed containment compartment flow rates, as well as the actual measured flow rates have no discernible effect on the performance of the VX system.

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

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

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DUKE POWER

September 9, 1988

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

Subject: McGuire Nuclear Station, Unit 1
Docket No. 50-369, -370
Licensee Event Report 369/88-19

Gentlemen:

Pursuant to 10CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/88-19 concerning Hydrogen Skimmer system flow rates. This report is being submitted in accordance with 10CFR 50.73(a)(2)(i)(B). 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/324/mff

Attachment

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