Duke Power Company
McGuire Nuclear Station
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

(704)875-4000

DUKE POWER

November 30, 1990

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

Subject: McGuire Nuclear Station Unit 1 and 2
Docket No. 50-369
Licensee Event Report 369/90-16

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/90-16 concerning the Control Room Ventilation being inoperable because of improper installation. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i), (a)(2)(v) and (a)(2)(vii). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony L. McConnell

T.L. McConnell

DVE/ADJ/cbl

Attachment

xc: Mr. S.D. Ebneter
Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta St., NW, Suite 2900
Atlanta, GA 30323

INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, GA 30339

M&M Nuclear Consultants
1221 Avenue of the Americas
New York, NY 10020

Mr. Tim Reed
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Mr. P.K. Van Doorn
NRC Resident Inspector
McGuire Nuclear Station

IE22
1/1

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 7

TITLE (4) The Control Room Ventilation System Was Inoperable Because Of Improper Installation

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)
1 0	3 0	9 0	9 0	— 0 1 6	— 0 0	1 1	2 7	9 0	McGuire, Unit 2	0 5 0 0 0 3 7 0
										0 5 0 0 0

OPERATING MODE (9): 5

POWER LEVEL (10): 0 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)	X 50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	X 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
Alan Sipe, Chairman, McGuire Safety Review Group	AREA CODE 7 0 4 8 7 5 - 4 1 8 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 October 30 1990, Unit 1 was in Mode 5 (Cold Shu. wn) and Unit 2 was in Mode 6 (Refueling). Performance (PRF) personnel were testing the Control Room Ventilation (VC) system interaction with the Auxiliary Building Ventilation (VA) system while the VA system was in the post accident alignment. PRF personnel determined that one train of the VC system could not maintain the design pressure in the Control Room. Operations personnel declared the VC system inoperable at 1040, on October 31, 1990. This event is assigned a root cause of Improper Installation Portions of the ductwork penetrating the Control Room boundary were not sealed sufficiently to prevent air leakage from the Control Room. Corrective actions included testing and sealing all Control Room penetrations, doors, and ductwork. Operations personnel declared the VC system operable at 1100, on November 11, 1990.

NRC Form 366
(9-83)

EVALUATION:

Background

There are two independent trains of the VC [EIIS:VI] system which are designed to maintain a habitable environment in the Control Room [EIIS:NA], Control Room Area, and Switchgear [EIIS:SWGR] Rooms during normal and accident conditions. Based on these criteria, the system is designed as an Engineered Safeguards Features (ESF) [EIIS:JE] system with absolute and carbon filtration [EIIS:FLT] and with equipment redundancies for use as conditions require. The Control Room is designed to be maintained at a positive pressure of greater than or equal to 0.125 inches water gauge (w.g.), relative to outside atmosphere during an accident to prevent entry of contaminants. Two 100 percent capacity Outside Air Pressure Filter Trains are designed to pressurize the Control Room by providing approximately 1000 cubic feet per minute (cfm) of filtered outside air in addition to approximately 1000 cfm of filtered recirculated Control Room air.

The Operability Evaluation for Problem Investigation Report (PIR) 0-M89-0163, Revision 2 dated May 1, 1990, and expiring December 31, 1991, states, in part, that "All four Outside Air Intakes are to stay open except during testing and maintenance. The operating procedure for the VC system is to be modified to specify all four intakes to be open during normal and accident conditions."

Technical Specification (TS) 4.7.6.e.3 states that each VC system shall be demonstrated operable at least once per 18 months, by verifying that the Control Room can be maintained at a positive pressure of greater than or equal to 0.125 inches w.g.

There are two independent trains of the VA [EIIS:VF] system which are designed to provide a suitable environment for the operation of equipment and personnel access, maintain the Auxiliary Building [EIIS:NF] at a slightly negative pressure to minimize outleakage, provide monitored purging of the building to the unit vent [EIIS:VL], and provide a suitable environment for the operation of vital equipment during an accident.

Each train of the VA system consists of two Supply Fans [EIIS:FAN], two Unfiltered Exhaust Fans, and two Filtered Exhaust Fans serving a single filter package. The filter package consists of absolute and carbon filters. The filtered exhaust portion is an ESF system. Also included in the VA system are Engineered Safeguards Pump Room Air Handling Units [EIIS:AHU]. Other non-safety portions of the VA system include the Waste Handling Area Ventilation system which provides the ventilation for the Radwaste Areas, Contaminated Materials Warehouse Area, and the Waste Handling Area.

TS 3.7.7 requires the Auxiliary Building Filtered Exhaust systems to be operable in Mode 1 (Power Operation), Mode 2 (Startup), Mode 3 (Hot Standby), and Mode 4 (Hot Shutdown).

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	9 0	— 0 1 6	— 0 0	3 OF 7

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

Description of Event

On October 30, 1990, PRF personnel began performing procedure PT/0/A/4450/08C, Control Area Ventilation System Performance Test, which included restricted change number 28. The restricted change placed the VA system in the post accident alignment. This procedure was performed to determine if the requirement that all four Outside Air Intakes remain open, as specified in the Operability Evaluation for PIR 0-M89-0163, Revision 2, dated May 1, 1990, was still applicable. This restricted change to the procedure was also being performed to determine the interaction between the VA system and the VC system under normal and post accident conditions. At the time of this test, Unit 1 was in Mode 5 and Unit 2 was in Mode 6.

The results of the performance test revealed that if one of the VC Outside Air Pressure Filter Fans fails to operate as required in the accident mode, and all four VA Filtered Exhaust Fans operate as designed, the Control Room pressure could not be maintained at a positive pressure of greater than or equal to 0.125 inches w.g. as required by TSs. Operations (OPS) personnel declared both trains of the VC system inoperable at 1040, on October 31, 1990.

PRF personnel began an extensive testing sequence to determine under which alignments the VC system would not adequately pressurize the Control Room. These alignments utilized different configurations of VA trains, VC trains, and Outside Air Intakes. These tests revealed that the VC system could only maintain the Control Room at a neutral to slightly positive pressure when both trains of the VA system were aligned in the post accident alignment and a single train of VC was operating.

Maintenance Engineering Services (MES) personnel and Maintenance (MNT) personnel began an extensive search of the Control Room walls, door [EIIS:DR] seals [EIIS:SEAL], ductwork [EIIS:DUCT], and penetrations [EIIS:PEN] in an attempt to find and seal all leakage paths from the Control Room. The search was conducted using smoke sticks to visually inspect for leaks. This smoke test was conducted under work request (WR) 504177.

Results of these inspections revealed the largest problem to be located in a section overhead of the Control Room where several sections of ventilation ductwork are located. The individual ducts were insulated and the envelope around all the ducts was insulated. The insulation [EIIS:ISL] encompassing all the ducts was located next to the ceiling and against the walls in areas that were extremely hard to access.

The insulation on the ductwork was removed and all areas where the ducts penetrated the Control Room boundary were then sealed with foam insulation. All penetrations that appeared to have any leakage of air from the Control Room boundary were resealed. All doors accessing the Control Room were smoke tested and adjusted as necessary. These sealing efforts are documented in WRs 504216, 504217, 504200, 504199, 504198, and 504190.

On November 9, 1990, the VC system was again tested per procedure PT/0/A/4450/08C, VC System Performance Test, (including restricted change number 28) by PRF personnel. This test procedure revealed that the sealing efforts for the Control Room had been successful. Various alignments of VA, VC, and Outside Air intakes were tested. The worst case was determined to be one train of VC Outside Air Pressure Filter Fans operating, all VA Filtered Exhaust Fans operating, and two of the four Outside Air Intakes open. In this alignment the Control Room pressure was measured at a positive pressure of 0.225 inches w.g.

Based on the results of this performance test, Design Engineering (DE) personnel issued an Operability Evaluation on November 10, 1990, stating that the VC system was operable. This Operability Evaluation further states that the condition of operability requiring all four Outside Air Intakes to remain open is no longer required. This requirement was documented in PIR 0-M89-0163. The requirement to maintain tight door seals still remains in effect.

The VC system was declared operable per TSs on November 11, 1990, at 1100.

Conclusion

This event is assigned a root cause of Installation Deficiency, caused by Improper Installation. The ventilation ductwork passing through the Control Room boundary was not sealed sufficiently to prevent air leaking from the Control Room when a large differential pressure was induced across the Control Room Boundary. This large differential pressure was created by placing the VA system in the post accident alignment with a single train of the VC system operating. The date of the improper installation could not be determined.

An ongoing effort has been made by MNT and PRF personnel to seal the Control Room. These efforts were successful under previous testing alignments of the VA system. Twenty-one WRs were performed in 1989 on door seals and various Control Room penetrations in an effort to improve the sealing ability of the Control Room. As of November 8, 1990, another twenty-one WRs have been performed in 1990. These efforts did help to seal the Control Room but the areas around and above the insulated ductwork were not found until the insulation was removed from the area encompassing the ductwork and the insulation on each individual duct was removed. Both units being shutdown presented a unique opportunity to disassemble ductwork to search for possible air leakage paths without placing both units outside of the limits of TSs. These air leakage paths were repaired with foam insulation by MNT personnel.

The problem of inadequate Control Room sealing was made worse and became more apparent because of maintenance and modifications made to the VA system. On September 12, 1990, an addition to the VA system was placed in operation. This VA system addition was installed because of an addition made to the Auxiliary Building to include a new Waste Handling Area. The ventilation

units for this area are non-essential but would continue to operate during a Loss of Coolant Accident without a Blackout (Loss of Power).

Ventilation services for some Auxiliary Building areas were reassigned to this new Waste Handling Area Ventilation system. This resulted in a smaller area assigned to the VA Filtered Exhaust system. This reassignment enabled the VA Filtered Exhaust Fans to maintain a more negative pressure in the Auxiliary Building. Pressure was measured at approximately 0.75 inches w.g. negative with both trains of VA Filtered Exhaust running.

In the past, the VA system was only tested to ensure it could meet the requirement of a negative 0.125 inches w.g. with one train of VA Filtered Exhaust operating. Testing with both VA trains operating is not required thus, test data is not available with both trains of VA operating. The conservative testing program to determine the interaction of the VA system and the VC system identified the problem with the VC system being unable to pressurize the Control Room during certain system alignments.

In conjunction with the addition of ventilation units, the Auxiliary Building has been undergoing sealing efforts by MNT personnel. The VA Filtered Exhaust ductwork was inspected and repaired as needed and obstructions in the discharge flow element were cleaned. These aggressive efforts to improve the VA system increased the flow of the VA Filtered Exhaust System and created a large differential pressure across the boundary between the Control Room and the Auxiliary Building. This resulted in the VC system being unable to maintain its design pressure of 0.125 inches w.g. with only one train of the VC system operating, two Outside Air Intakes open, and both trains of the VA system operating.

A review of the Operating Experience Program data base for the previous 24 months prior to this event revealed 14 LERs describing events associated with the VC system. The ability of the VC system to meet the design criteria of a positive pressure of 0.125 inches w.g. in the Control Room has been an ongoing problem. Therefore, this event is considered recurring.

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

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

CORRECTIVE ACTIONS:

Immediate: The VC system was declared inoperable by OPS personnel at 1040, on October 31, 1990.

Subsequent: 1) PRF personnel performed multiple Control Room pressurization tests involving different alignments of VA, VC, and Control Room Outside Air Intakes.

2) MNT personnel performed an extensive search to determine the source of the Control Room air leakage paths.

3) MNT personnel sealed all air leakage paths discovered during the smoke test of the Control Room.

4) PRF personnel performed PT/0/A/4450/08C, Control Area Ventilation Performance Test, to verify the operability of the VC system.

5) DE personnel issued an Operability Evaluation stating that the VC system was operable without the requirements of all four Outside Air Intakes being open.

Planned:

1) PRF personnel will trend the results of Control Room pressurization tests and initiate corrective actions as needed to maintain the integrity of the Control Room boundary.

2) MES personnel will establish a PM program to inspect and clean the VC air flow monitors [EIIS:MON] and associated air straighteners.

3) MES personnel will establish a PM program to inspect and clean the Tornado Check Valves [EIIS:V] located in the Outside Air Intakes flow path.

SAFETY ANALYSIS: In the event of a design basis accident, the VC system acts to limit Control Room operator dose to less than the General Design Criterion 19 limits, i.e., less than 5 Rem whole body or its equivalent. Since whole body doses are primarily due to exposure to noble gases which the filters do not remove, the VC system is not required to ensure acceptable whole body doses. However, the VC system reduces thyroid and skin doses by pressurizing the Control Room with filtered air to minimize unfiltered in-leakage.

The inoperable condition of the VC system, caused by the interaction with the VA system, is important because of its effect on the operator thyroid and skin doses. The actual amount of unfiltered in-leakage while the plant was in this condition is unknown. Therefore, the worst case accident doses can not be determined. However, several factors must be considered in evaluating whether a real safety concern existed.

Testing performed on the VA and VC systems indicated that the interaction of the two systems caused the VC system to be unable to pressurize the Control Room when only one train of VC system was operating and both trains of the VA Filtered Exhaust system were operating with the VA system Supply and Unfiltered Exhaust Fans shut off. Therefore, operator dose would have been unacceptable only in the event of an accident resulting in severe fuel damage

coupled with a single train failure of the VC system, while both trains of VA System Filtered Exhaust continued to operate.

However, if this scenario had occurred, it would have been possible to mitigate operator dose in spite of the VC system being inoperable. Immediate corrective actions at the initiation of the accident would not have been required since the highest frequency core damage sequences required one to two hours for core damage to actually occur. Even for faster sequences, which are very unlikely, thirty minutes is required for core damage. Therefore, there would have been some amount of time available for action before doses would have become unacceptable.

If core damage did occur and the Control Room was not pressurized due to the VA system interaction, radiation alarms [EIIS:RA] in the Control Room would alert the operators to the airborne contamination.

Radiation Protection personnel would be notified of a high radiation alarm and could implement protective actions including instructing the operators to wear protective clothing and self contained breathing apparatuses or filtered respirators; thereby, obtaining the thyroid, lens of the eye, and skin protection not provided by the VC system. Whole body doses would still be acceptable with or without the VC system since they are due to noble gas in-leakage which is unaffected by the VC system filters. This protective action would enable the operators to bring the plant to a safe condition. Since the VC system does not mitigate doses to the public at either the exclusion area boundary or in the low population zone, its inoperable condition would not increase those doses. Therefore, since doses to the public would remain acceptable and protective actions already in place would enable the operators to perform their functions, this event is not significant with respect to the health and safety of the public.