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November 27, 1990

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

Subject: McGuire Nuclear Station Unit 1 and 2
Docket No. 50-369
Licensee Event Report 369/90-13-01

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/90-13-01 concerning the Unit 1 and 2 Spent Fuel Pool Ventilation being declared inoperable because of Design Deficiencies. This report is being revised and submitted in accordance with 10 CFR 50.73(a)(2)(i). 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

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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): McGuire Nuclear Station, Unit 1

DOCKET NUMBER (2): 0 5 0 0 0 3 6 9

PAGE (3): 1 OF 8

TITLE (4): Unit 1 and 2 Spent Fuel Pool Ventilation Systems Were Declared Inoperable Because Of Design 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)
0 3	2 9	9 0	9 0	0 1 3	0 1	0 6	2 5	9 0	McGuire, Unit 2	0 5 0 0 0 3 7 0
										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)	[ ] 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 (AREA CODE)
Alan Sipe, Chairman, McGuire Safety Review Group	704 875-4183

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) [X] NO

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

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

On March 29, 1990, Problem Incident Report (PIR) 2-M90-0094 was submitted to Design Engineering by Performance personnel identifying flow discrepancies on the Unit 2 Fuel Pool Ventilation (VF) system. Performance personnel obtained different flow readings when performing two methods for flow determinations. Performance personnel notified Operations (OPS) personnel of the discrepancies and OPS personnel declared the Unit 2 VF system, Trains A and B, inoperable because of flows outside of the required Technical Specification (TS) flow rates. At this time, Unit 1 was in Mode 6 (Refueling) and Unit 2 was in Mode 1 (Power Operation) at 100 percent power. The flow discrepancies leading up to the PIR began on February 22, 1990 when Performance personnel were taking flow readings as directed by procedure PT/2/A/4450/09B, Spent Fuel Ventilation System Performance Test. After further discussion and evaluation by Performance and Design Engineering (DE) personnel, it was determined that Unit 1 VF system was experiencing similar flow discrepancies. OPS personnel declared Unit 1 VF system inoperable on April 10, 1990. At this time, Unit 1 was in Mode 5 (Cold Shutdown) and Unit 2 was in Mode 1 at 100 percent power. At the time this event was determined to be reportable, both Unit 1 and Unit 2 were in Mode 1 at 100 percent power. This event is assigned a cause of Improper Installation and a contributory cause of Design Selection Deficiency. DE and Performance personnel will evaluate acceptable options and take the appropriate actions as necessary to correct the problems associated with the VF system design deficiencies.

EVALUATION:

Background

The VF system [EIIS:VG] provides normal ventilation requirements for the Fuel Pool Area [EIIS:ND]. The exhaust system serves to reduce the consequences of an airborne radiological release that might occur should there be a fuel handling accident within the Fuel Area.

The exhaust system consists of one 100 percent capacity filter [EIIS:FLT] train and two 100 percent capacity fans [EIIS:FAN] and associated ductwork [EIIS:DUCT].

Air flow monitors [EIIS:MON] located in the discharge of the supply units and exhaust fans provide air flow rate indication [EIIS:FI] on the Heating, Ventilation, and Air Conditioning (HVAC) Control Board [EIIS:ECBD]. A flow differential of at least 8000 cubic feet per minute (cfm) between supply and exhaust is maintained to prevent reverse flow of Fuel Pool Area air to the surroundings. Design flow rate for the exhaust filter train is 35,000 cfm +/- 10 percent.

TS 3/4.9.11 states, in part, the VF exhaust system shall be demonstrated operable by verifying the pressure drop across the combined High Efficiency Particulate Air (HEPA) filters and charcoal adsorber [EIIS:ADS] banks is less than 6 inches Water Gauge while operating the system at a flow rate of 35,000 cfm +/- 10 percent and maintaining an exhaust flow rate of at least 8000 cfm greater than the supply flow rate. Otherwise, suspend all operations involving fuel movement within the storage pool or crane [EIIS:CRN] operation with loads over the storage pool until the VF exhaust system is restored to operable status.

Performance personnel now use two methods for verifying VF system flow. The first method requires taking readings with a manometer from an installed air flow element in the ductwork. The second method requires performing a pitot traverse of the ductwork. Both methods measure the velocity pressure. The pitot traverse method is the industry standard for field measurements and is normally used to verify the accuracy of the installed air flow element.

The last documented comparison performed between the installed air flow element and the pitot tube traverse was carried out in February, 1984 under procedure PT/0/A/4450/12, Nuclear Air Cleaning System Air Flow Measurement. At that time, the measured readings agreed within 1 percent. This comparison was done on Unit 1 VF system, Train B.

Description of Event

On February 22, 1990, Performance personnel performed procedure PT/2/A/4450/09B, Spent Fuel Ventilation System Performance Test on the Unit 2 Spent Fuel Pool Ventilation (VF) system. This procedure verifies and documents the proper operation of the VF system. The test includes measuring the air flow on the Fuel Handling Area Exhaust Fans (exhaust flow) and the Fuel Handling Area Supply Air Handling Unit (supply flow).

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

Performance personnel obtained flow measurements using the installed flow elements of the supply and exhaust flows on Train A of the Unit 2 VF system. They measured 19,238 cfm and 21,256 cfm, respectively. Performance personnel also took flow measurements using the installed flow element of the supply and exhaust flows on Train B of the Unit 2 VF system. The flows were 21,075 cfm and 29,476 cfm, respectively. The exhaust flows on trains A and B were below the required minimum flow of 31,500 cfm required by TSs. Performance personnel notified OPS personnel and OPS personnel declared Unit 2 VF system inoperable. Performance personnel submitted work request (WR) 89189 on February 22, 1990 to clean the flow elements, internally and externally. A Preventive Maintenance (PM) Program has subsequently been set up for semi-annual cleaning of the installed flow elements on Unit 1 and Unit 2 VF systems. Maintenance personnel completed the WR on February 26, 1990. On March 1, 1990, Performance personnel retested the Unit 2 VF system flows. The supply flows were measured using the installed flow element. The exhaust flows were measured using the pitot tube traverse method. The flows failed again on the low end. On March 8, 1990, the prefilters were changed out under WR 75325. After the Performance retests were satisfied, the Unit 2 VF system, Train A was declared operable. Train B was still inoperable because of exhaust flows greater than the upper flow rate (38,500 cfm) required by TSs.

WR 89216 was generated by Performance personnel on March 14, 1990, to have the supply and exhaust flows balanced to achieve a flow rate between 31,500 cfm and 38,500 cfm, with supply flow 8000 cfm less than the associated exhaust flow. After troubleshooting the Unit 2 VF system on March 29, 1990 with Maintenance personnel under WR 89216 and PT/2/A/4450/09B, Spent Fuel Ventilation System Performance Test, Performance personnel determined the Unit 2 VF system Train A should be declared inoperable again. This inoperability determination was based on the test results of the more credible pitot traverse method. The pitot traverse method indicated flows of 27,049 cfm on Train A and 28,066 cfm on Train B. Whereas, the installed flow element indicated flows of 32,630 cfm on Train A and 36,290 cfm on Train B.

The Unit 2 VF system, Train A was declared inoperable by OPS personnel on March 29, 1990 because of flows less than the flows required by TSs. PIR 2-M90-0094 was submitted to DE by Performance personnel on the same day because of the questionable results obtained on the Unit 2 VF system. Performance personnel checked the flows on the Unit 1 VF system on April 9, 1990. The Unit 1 VF system was declared inoperable by OPS personnel on April 10, 1990 as a result of the test data documented by Performance personnel. Subsequently, Unit 1 VF system was included in the PIR submitted to DE personnel changing it to PIR 0-M90-0094.

Conclusion

This event has been assigned a cause of Improper Installation. When measuring air flow with an installed flow element or by the pitot tube traverse the American Conference of Governmental Industrial Hygienists (ACGIH), Section 9, recommends the measurement be made 7.5 duct diameters downstream of any air flow disturbances, such as an elbow. It also states that when a measurement is made closer than the recommended distance that the measurement is suspect to doubt and should be checked against a measurement taken at a second location. If these two measurements do not agree within 10 percent, then a third measurement should be made and the average of the two measurements that are closest should be used.

The installed flow elements on the VF systems are not located the recommended distance of 7.5 duct diameters downstream of a major air flow disturbance because of design restraints. In most cases, the installed flow elements are located less than 7.5 duct diameters from an air flow disturbance. Even though the elements contain straightening vanes which were designed to compensate for air flow disturbances, these straightening vanes do not sufficiently improve the velocity profile being measured, as proven by the variance with other test methods. This is partly due to where the straightening vanes are located. It is recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) that the vanes be installed 3 duct diameters upstream of the installed air flow element. The straightening vanes are currently located less than 3 duct diameters (5 inches) from the installed air flow element. Pitot tube test port locations used that do not meet the 7.5 duct diameter criteria are not preferred, but are used for TS testing since moving the test ports to a more acceptable location is not a feasible option due to the duct layout.

This event has also been assigned a contributory cause of Design Selection Deficiency. DE personnel have concluded that the VF system exhaust fans were not sized to meet the maximum air flow (38,500 cfm) as specified in TSs. The fans were sized on the initial estimate. The initial estimate was done by DE personnel prior to the detailed duct drawings being provided. Laboratory Methods of Testing Fans for Ratings, published by ASHRAE and Air Movement and Control Association (AMCA), use a free inlet to test for fan performance. Therefore, when sizing a fan, the system effects should be taken into consideration. All possible losses should be considered and the fan should be conservatively sized. A review of past performance data indicates the fans have operated just above the minimum exhaust flow requirements of the TS since they were originally installed (as measured by the installed flow element). The fan motors have operated above their rated capacity in order to accomplish this requirement.

Performance, Mechanical Maintenance, and DE personnel developed several options to ensure short term and long term system operability. The preferred short term option is option 3 (reference page 7) which requires changing the system configuration from two 100 percent capacity fans to two 50 percent capacity fans to meet the existing system TS required flow rates. This modification would require a system design change since the VF exhaust system was based on two 100 percent capacity fans. This option is presently being evaluated under Preventive Maintenance (PM) WR 07386B. The operating experience of this option will be evaluated to determine long term feasibility.

A review of the McGuire Operating Experience Program (OEP) Data Base for the past twenty-four months prior to this event revealed two events involving Improper Installation. These were LERs 369/89-06 and 369/89-24. However, the equipment, procedures, in-progress activities, and groups were not similar to this event. The corrective actions were specific to those two events and would not have

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

prevented the event from occurring; therefore, this event is not considered recurring.

A review of the OEP Data Base for the past twenty-four months prior to this event revealed three events involving Design Selection Deficiency. These were Licensee Event Reports (LERs) 369/89-07, 369/89-17, and 369/90-02. However, the equipment, procedures, in-progress activities, and groups were not similar to this event. The corrective actions were specific to those events and would not have prevented this event from occurring; therefore, this event is not considered recurring.

As a result of other events involving Ventilation System problems caused by Design Deficiencies, this problem can be considered to be 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 result of this event.

CORRECTIVE ACTIONS:

Immediate: 1) Unit 2 VF system, Trains A and B, were declared inoperable on February 22, 1990.

Subsequent: 1) WR 89189 was generated by Performance personnel to clean filter element on Unit 2 VF system.

2) WR 89191 was generated by Performance personnel to repair the damper.

3) A PM WR was established to periodically clean air flow elements on Unit 1 and Unit 2 VF systems.

4) WR 75235 was generated by Planning personnel to change out filters on Unit 2 VF system.

5) After flow discrepancies were discoverd on Unit 2 VF system, DE personnel evaluated Unit 1 VF system operability. Subsequently, OPS personnel declared Unit 1 VF system inoperable.

6) DE personnel developed options (reference page 7 and 8) to resolve this event.

Planned: 1) DE personnel and Performance personnel will evaluate the option(s) chosen and take the appropriate actions as necessary to correct the problem associated with the VF system design deficiencies.

SAFETY ANALYSIS:

Prior to this event, the VF system had been used as specified according to its design basis function: under normal conditions, with the filter train bypassed, and with the filter train in service whenever there were operations involving fuel movement within the storage pool or crane operation with loads over the storage pool.

During VF operation, a negative pressure is always maintained between the supply and exhaust units thus maintaining a negative pressure in the Spent Fuel Pool Area. In the event of a radiological release, any activity released would be detected in the exhaust duct work by a radiation monitor. It would also be detected by the radiation monitor in the affected Unit Vent [EIIS:VL].

If the VF system were to shut down completely, with the loss of the supply and exhaust units, two bells would alarm, one at either end of the Spent Fuel Pool. In the event of a fuel handling accident without the benefit of the VF system it is possible there would be a slight release of radioactivity to the environment through the roll-up doors. However, since the Auxiliary Building is maintained at a negative pressure by the Auxiliary Building Ventilation System (VA) [EIIS:VF], any release of radioactive material should be pulled into the exhaust of the VA system via the filter train, past the inline radiation monitor and out through the Unit Vent.

Since the VF systems have been in operation, there have been no incidents that would challenge the ability of the system to mitigate the consequences of an accident.

This event did not affect the health and safety of the public.

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Available Options to Establish Present and Future System Operability

OPTION 1

Increase existing fan RPM which will result in an increase in air flow rate.

The existing fans are Clarage, model 50089, Class II. The fan manufacturer has been contacted and has confirmed the maximum recommended RPM as 1210 for a model 50089 Class II application. The existing fans are running at the following speeds: Fan 2A-1135 RPM, Fan 2B-1143 RPM. If the fan speed is increased beyond the manufacturers recommendation there is a risk of failure of the components listed below. The existing fans can thus be increased to a speed of 1210 RPM without structural modifications. Capacity is directly proportional to fan speed. At 1210 RPM, the existing 2A and 2B fans will provide approximately 6.6 percent and 5.8 percent more flow, respectively. This capacity increase will not provide a flow rate of 31,500 cfm, the minimum design capacity value considered the goal of a short term solution. In order to operate above 1210 RPM at no risk, the existing fans would require modification, as suggested by the fan manufacturer, which would include the following:

1. Replacement of fan wheel
2. Replacement of fan motors
3. Replacement of fan shaft

OPTION 2

A TS change can be pursued to allow the system to operate at a lower exhaust fan and supply unit fan flow.

The present Final Safety Analysis Report (FSAR) (pg. 9.4-20) commitment is to maintain the fuel handling area between 65°F and 90°F. Review of calculation MCC-1211.00-0008 indicates that with a supply air handling unit flow of 23,500 cfm, the worst case expected area temperature is 89.4°F. Present TS requirement is to provide at least 8000 cfm more exhaust air than supply air. DE personnel do not recommend changing this requirement. Therefore, the minimum required exhaust flow is 31,500 cfm which matches the existing TS requirement. This option is discussed for completeness and is not recommended to be pursued at this time.

OPTION 3

Change the system configuration from two 100 percent flow capacity fans to two 50 percent fans. Existing fan speed would be lowered to meet the existing system TS total flow requirements.

The present fuel handling ventilation exhaust system was licensed (FSAR Section 9.4.2.2) based on providing two 100 percent capacity fans. This modification would involve a system design basis change and would require NRC notification during routine FSAR update.

OPTION 4

Replace fans with one of same Model, 50089, but of Class III, or Class IV construction. New Class III fans will have the same overall dimensions, but will have a maximum allowable speed of 1455 RPM. Expected available capacity is 20 percent more than the existing Class II fans. These fans will require 100 HP motors.

OPTION 5

Increase the fan speed to achieve at least 31,500 cfm. Replace existing 50 HP motors with 75 HP and necessary power system upgrades to support same. The option would require running the fan above the manufacturer's maximum recommended speed.

OPTION 6

Accept current exhaust and supply flows as tested. Decrease the required differential between supply and exhaust from 8000 to 5500 cfm. Pursue a TS change to make this revision.

ADDITIONAL INFORMATION:

It was decided by DE and Performance personnel to implement Option 3 as the short term resolution to the VF system exhaust fan problem. Option 3 required modifying the exhaust fans by changing the system configuration from two 100 percent capacity fans to two 50 percent capacity fans. The modification was successfully completed for Unit 1 on July 11, 1990, under MEVN 2395, and for Unit 2 on August 7, 1990, under MEVN 2419.

The long term resolution of the VF system exhaust fans will be to return to two 100 percent capacity fans by purchasing new 75 HP motors and modifying fan components.