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October 17, 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 369/90-10-01

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/90-10-01 concerning the Annulus Ventilation and Control Room Ventilation System filter train heaters that were inadequately sized because of a Design Deficiency. This report is being revised and submitted in accordance with 10 CFR 50.73(a)(2)(v) and (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)	DOCKET NUMBER (2)	PAGE (3)
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	1 OF 7

TITLE (4) The Annulus Ventilation and Control Room Ventilation System Filter Train Heaters Were Inadequately Sized Because of a Design Deficiency

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 4	2 7	9 0	9 0	— 0 1 0 —	0 1	0 6	1 3	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)	[X] 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	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)

[ ] 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)

In March of 1990, Catawba Nuclear Station personnel were reviewing the effects of potentially degraded grid voltage. It was discovered that the Annulus Ventilation (VE) and Control Room Ventilation (VC) system heaters would not operate as designed under all postulated operating conditions. After reviewing the McGuire VE and VC system heaters, it was determined they would not operate as designed under all postulated operating conditions. At the time of the discovery, Unit 1 was in Mode 5 (Cold Shutdown) preparing to enter Mode 4 (Hot Shutdown). Unit 2 was in Mode 1 (Power Operation) at 100 percent power. An Operability Evaluation was initiated on Unit 1 and Unit 2 VE and VC systems. Subsequently, Unit 2 VE system and Unit 1 and 2 VC systems were determined to be conditionally operable. However, Unit 1 VE system was determined to be inoperable. An emergency Technical Specification (TS) change request was submitted to the Nuclear Regulatory Commission (NRC) on May 9, 1990. The NRC approved the emergency TS change on May 11, 1990. Presently, the change to Unit 2 is administrative in nature only because it shares a common TS document with Unit 1. The change will only apply until July 16, 1991. After that time, the NRC will require the Unit 1 and a Unit 2 TS to read the same. This event is assigned a cause of design deficiency because of unanticipated interaction of systems due to design oversight.

EVALUATION:

Background

VE System

The main purpose of the Annulus Ventilation [EIIS:VD] (VE) system is to create and maintain a negative pressure zone in the annulus following a Loss of Coolant Accident (LOCA), to minimize the release of radioactive material following a LOCA, and to provide long term fission product removal. The system supplies two VE trains. Each train consists of a filter package [EIIS:FLT], a fan [EIIS:FAN] which draws in approximately 8000 cubic feet per minute (cfm) +/- 10 percent of annulus air, dampers [EIIS:DMP], instruments, and ductwork. The filter package is designed to help maintain the offsite radiation dose within the 10CFR100 guidelines which states in part the thyroid and the whole body doses at the exclusion area boundary and the low population zone are not to exceed 300 rem and 25 rem, respectively. The filter train consists of a moisture eliminator, a preheater, a prefilter, two high efficiency particulate air (HEPA) filters, and a gasketless carbon adsorber [EIIS:ADS]. Moisture is removed from the incoming annulus air by the moisture eliminator. The assumed 100 percent relative humidity is reduced to 70 percent or less by the preheater. Large particles are removed by the prefilter; removal of radioactive particles or particles which would effect the efficiency of the carbon adsorber are removed by the HEPA filter and iodine is removed by the carbon adsorber. The reduction in relative humidity to 70 percent or less is necessary in order to ensure the decontamination efficiency of 95 percent is maintained in the carbon adsorber.

VC System

The Control Room Ventilation System [EIIS:VI] (VC) and the Control Area Chilled Water [EIIS:KM] System (YC) combine to perform the Control Room habitability function. This background will be restricted to the VC system. The VC system consists of three subsystems. The Control Room [EIIS:NA] subsystem provides a habitable environment for the main Control Room. The Control Room area subsystem provides heating and cooling for the electrical penetration rooms, battery rooms, motor control center [EIIS:MCC] (MCC) rooms, cable rooms, restricted instrument shop, and mechanical equipment room. The switchgear [EIIS:SWGR] subsystem provides heating and cooling for four essential switchgear rooms. The Control Room subsystem has two redundant trains (A and B). These trains are cross connected. Each train consists of a filter package and an air handling unit [EIIS:AHU] (AHU). Each filter package includes a preheater [EIIS:HTR], demister/pre-filter, a HEPA filter, a gasketless charcoal adsorber and one 100 percent capacity outside air pressure filter train (OAPFT) fan. Each AHU contains a water cooling coil and a fan. Both A and B trains share a smoke purge exhaust fan which is provided to remove smoke or noxious gases within the Control Room on demand. The preheater maintains the air at approximately 70 percent relative humidity or less to assure the efficiency of the carbon adsorber. The demister/pre-filter removes entrained water droplets (if any) and large particles of dust, etc., from the air stream before it reaches the HEPA filter. The HEPA filter then removes dust particles, smoke, etc. which may be either radioactive or harmful to the efficiency of the carbon adsorber. The gasketless carbon adsorber adsorbs radioactive iodine. The Control Room temperature should be maintained at approximately 75°F in order to assure habitability and proper electrical equipment operation during normal operation. During a LOCA the filter package and associated OAPFT fan of the related train shall be activated. When the OAPFT fan is actuated, about 2000 CFM of air is drawn through a two stage air heater and the filter package. The filtered air and the remaining Control Room return air then passes through a pre-filter and the Control Room AHU to the Control Room. The outside air makeup pressurizes the Control Room.

Technical Specification 4.6.1.8 states, in part, the VE systems will be demonstrated operable by verifying, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b. of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of the above mentioned Regulatory Position, for a methyl-iodide penetration of less than 1 percent. It is also necessary that the preheaters dissipate 43KW +/- 6.4 KW when tested in accordance with the American National Standards Institute ANSI N510-1975. The system flow rate shall be maintained at 8000 cfm +/- 10 percent during system operation when tested in accordance with ANSI N510-1975. The VE system shall be operable in Modes 1, 2 (Startup), 3 (Hot Standby), and 4.

Technical Specification 4.7.6 states, in part, the two independent VC systems will be demonstrated operable by verifying that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52 Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl-iodide penetration of less than 1 percent. Also, the system flow rate shall be maintained at 2000 cfm +/- 10 percent during system operation when tested in accordance with ANSI N510-1975. The heaters shall dissipate 10 KW +/- 1.0 KW when tested in accordance with ANSI N510-1975. The VC system shall be operable in all modes.

Description of Event

In mid-March of 1990, Catawba Nuclear Station personnel performed a review of their HVAC systems. They discovered the VE and VC system preheaters were not conservatively sized for all postulated operating modes. This discovery prompted a study by Design Engineering (DE) which determined the same problem existed at McGuire Nuclear Station (MNS). On April 27, 1990, Problem Investigation Report (PIR) 0-M90-0122 was submitted. DE responded by performing Operability Evaluations on both VE and VC systems. The Operability Evaluation was performed using the following conditions: a postulated degraded grid voltage scenario with a degraded switchyard voltage, a LOCA, and a loss of one main step-up transformer [EIIS:XFMR] with automatic bus transfer to the remaining main step-up transformer. On May 3, 1990, based on test performance data, it was determined Unit 2 VE and Unit 1 and 2 VC systems were conditionally operable with restricted flow rate and heater dissipation tolerances. An additional condition on Unit 2 VE, required monitoring and maintaining a minimum grid voltage.

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

The performance limits placed on the two systems require tighter restrictions than the current Technical Specification (TS) while still complying with the TS requirements.

The Unit 1 VE system, however, was determined to be inoperable by DE due to the inability of the preheaters to dissipate enough heat during the postulated degraded grid voltage condition to limit the air flow to a relative humidity of 70 percent or less as required by design.

Concurrently, Unit 1 was in a refueling outage and preparing to change from Mode 5 to Mode 4. TS 4.6.1.8 requires the VE system to be operable in Mode 1, Mode 2, Mode 3, and Mode 4. The options available to the MNS for operability of the Unit 1 VE system included operating the system at reduced flowrates and compensatory surveillance, re-designing the power distribution system, resizing the preheaters at a higher wattage capacity or requesting an emergency TS change. The first option could potentially violate the minimum time requirements to obtain a negative pressure due to the tight flow restrictions; the second option would require adding another transformer; the third option would be dependent on replacement parts. The second and third options would also require reanalyzing the MNS electrical system which would require a change to the diesel generator [EIIS:DG] rating. All three options would mean a delay of undetermined length in restarting Unit 1. Therefore, on May 9, 1990, a request was made to the NRC requesting an emergency Technical Specification revision. The request was revised and supplemented on May 10, 1990. The proposed revision would change the testing standard for the VE system carbon to another more restrictive standard. This standard is used for systems that do not utilize heaters to control relative humidity. Revising this carbon adsorption test method assures the VE system carbon adsorber maintains a 95 percent or greater decontamination efficiency under all anticipated operating conditions, without the use of heaters. As a result of the change in the test method, it was allowable to relax the requirements for the system heater dissipation test. The NRC staff reviewed the proposed revision and determined the use of the more restrictive test standard as a supplement to Regulatory Guide 1.52 provided adequate compensation for the postulated low voltage condition to the VE system. It also provided reasonable assurance the carbon efficiency would be maintained such that potential on-site and off-site doses would not be increased relative to the efficiency and doses associated with existing TS requirements. The proposed revision was approved by the NRC on May 11, 1990.

Conclusion

This event is assigned a cause of Design Deficiency because of unanticipated interaction of systems due to design oversight. The VE and VC filter train preheaters were not conservatively sized for a postulated degraded grid voltage scenario with the following conditions: a degraded switchyard voltage, a LOCA, and a loss of one main step-up transformer with automatic bus transfer to the remaining main step-up transformer.

DE personnel were able to compensate with minimum voltage and restrictive flow rates for Unit 2 VE and Unit 1 and 2 VC systems for the postulated degraded grid voltage scenario, thus allowing conditional operability. However, Unit 1 VE system

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experienced difficulties that could not readily be overcome. The test data used in the evaluation revealed the Unit 1 preheater dissipation measurements were smaller than that of Unit 2. With a smaller wattage dissipation, the Unit 1 preheater would have required a higher minimum voltage than that required on Unit 2. It was therefore determined Unit 1 switchyard would be unable to supply the needed voltage during a degraded grid voltage condition. The lower preheater capacity would potentially allow air flow with a higher humidity (greater than 70 percent) to pass through the carbon adsorber. This higher humidity could degrade the decontamination efficiency of the carbon adsorber, allowing for less iodine removal during an accident situation. Lowering the air flow to the heaters to compensate for diminished preheater capacity would put too great a restriction on the system. The VE system could potentially violate the required TS minimum time limits. In order to overcome the degraded decontamination efficiency of the carbon adsorbers, and return the air flow to its normal operating parameters, it was necessary to supplement the test standard currently used with a more restrictive testing standard, which in this case is American Society for Testing and Materials (ASTM) 3803-86, Test Method A. This method is utilized for systems that do not utilize heaters for humidity reduction. Using this method would ensure the system filter decontamination efficiency would be maintained at 95 percent or greater under all operating modes without the use of the VE system heaters. The method requires testing carbon samples at 30 degrees-C and at a relative humidity of 95 percent. The current method, Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, is used for systems that use heaters for humidity reduction. It requires testing carbon samples at 80 degrees-C at 70 percent relative humidity. Even though the heaters are not being credited for using this test method, they would still be in operation. While in operation, even under postulated degraded voltage conditions, the relative humidity would not exceed approximately 85 percent. As a result of the test method change, it would also be allowable to relax the VE system heater power dissipation specification. The specification was 43 KW +/- 6.4 KW. This value would be changed to 43 KW + 6.4 KW/-17.5 KW. With the heater capacity degraded by 17.5KW during a degraded voltage condition, the air entering the carbon filter would be approximately 85 percent relative humidity. This humidity is well below the 95 percent relative humidity specified by the proposed Method A test criteria. This reduced humidity adds conservatism to the VE system operation under the new TS.

To implement these changes and ensure Unit 1 would not be delayed from entering Mode 4, an emergency TS change was requested. The NRC approved the change request with the stipulation that after July 16, 1991 both Unit 1 and Unit 2 TS would read the same.

Since the TS change is limited in duration on Unit 2 VE and operating Unit 1 and 2 VC systems under restrictive conditions is not desirable, DE personnel are currently studying alternatives that can be employed to allow operation of the systems under all postulated operating modes.

A review of the Operating Experience Program Data Base for McGuire over the previous twenty-four months reveals three events with a cause of Design Deficiency associated with the VE system filter train preheaters. Therefore, this event is considered recurring. LER 369/89-17 documented an event where the VE system was determined inoperable because wiring for the filter unit preheater did not meet environmental qualification requirements. LER 369/89-27 documented an event where the VE system was inoperable due to the preheater not starting as a result of the differential pressure air flow permissive not being made. Non-reportable PIR 2-M89-0332 documented that aluminum lugs used to terminate copper VE filter preheater wiring were purchased and installed incorrectly. Corrective actions as a result of these events would not have prevented this event from occurring.

As a result of other events involving Ventilation System problems caused by Design Deficiency in general, this can be considered to be a recurring problem.

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

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

CORRECTIVE ACTIONS:

Immediate: None

Subsequent:

1) An Emergency Technical Specification change was requested by MNS for Unit 1 VE system on May 9, 1990 and approved by the NRC on May 11, 1990.

Planned:

1) Design Engineering is studying alternatives to alleviate the problem associated with the VE and VC system filter train preheaters.

2) The McGuire Safety Review Group will follow up with an addendum once Design Engineering has completed their study on the VE and VC system filter train preheaters.

SAFETY ANALYSIS:

The VE and VC systems are accident mitigation systems. The VE system is only assumed to function following a LOCA and is actuated by a containment Hi-Hi pressure signal of 3 psig. The purpose of the VE system is to create and maintain a negative pressure zone in the annulus, to minimize the release of radioactive material, and to provide long term fission product removal. During a postulated degraded voltage scenario, the preheaters would function; however, they would not be as efficient as required by TSs, in reducing the relative humidity of the air entering the filter train. This in turn would cause the carbon adsorbers to be less efficient in their removal of iodine. This reduced iodine removal would show up as increased radioactivity as it passes through the radiation monitors located in the Unit Vent [EIIS:VL]. These monitors would alert Control Room personnel of the increased activity at which point the VE system could be secured if OPS personnel determined the release to be excessive. If secured, the negative pressure zone created by the VE system would be lost. At this point, radioactivity could leak into the Auxiliary Building [EIIS:NF]. However, the Auxiliary Building Ventilation System (VA) [EIIS:VF] should be able to handle this inleakage. This system consists of two redundant trains and automatically switches to the filtered exhaust mode of operation on a Blackout, an accident, or if radiation is detected by the exhaust radiation monitor. When the VA system switches to the filtered exhaust mode, the supply unit is secured. Operation of the filtered exhaust unit without the benefit of the supply unit allows a negative pressure to be pulled on the Auxiliary Building, thereby, facilitating the removal of radioactivity from the Annulus.

The VC system is assumed to function post accident (not just LOCA) and is actuated by an Engineered Safety Feature (ESF) signal. Its purpose is to supply filtered air at a controlled temperature and humidity and to pressurize the Control Room to 0.125 inches water gauge (w.g.). A positive pressure of 0.05 w.g. inches is considered sufficient to prevent inleakage in excess of 10 cfm, which is the assumed leakage value used for radiation dose calculation in Chapter 15 of the Final Safety Analysis Report (FSAR). As stated above, during a postulated degraded grid voltage scenario, the preheaters would reduce the efficiency of the carbon adsorbers. With this decreased efficiency, the principal contaminant of concern, which could leak into the Control Room is iodine. Again, the VA system should help to mitigate the consequences of a radioactive release by automatically switching to the filtered exhaust mode.

In the event the Control Room atmosphere became uninhabitable, self contained breathing apparatus (SCBA) provided in the Control Room Area could be employed.

The VE and VC systems have not been challenged under the conditions set forth in the postulated degraded grid voltage scenario and during this event, neither the VE or VC systems were required to perform their safety functions under accident conditions.

The health and safety of the public were not affected by this event.