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

(704)875-4000

DUKE POWER

March 21, 1991

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 369/91-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/91-03 concerning both trains of the Control Room Ventilation system being inoperable because of a Design Deficiency. This report is being submitted in accordance with 10 CFR 50.73(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,

T.L. McConnell

DVE/ADJ/cbi

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) Both Trains Of The Control Room Ventilation System Were Inoperable Because Of A Design Deficiency And Management 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 2 | 1 9 | 9 1 | 9 1 | — 0 0 3 | — 0 0 | 0 3 | 2 1 | 9 1 | McGuire 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) | 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) | X 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)

| | | 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 February 18, 1991, Design Engineering (DE) personnel were performing a review of Nuclear Station Modification (NSM) MG-52065 to examine recommended additions to the NSM package. During the course of the review, DE personnel reevaluated the fact that loss of non-essential electrical power to chlorine detectors and radiation monitors associated with the Control Area Ventilation (VC) system would cause the Outside Air Intake Isolation valves for the VC system to close and that they could not be reopened from the Control Room. It was then determined that compensatory actions in place could not be achieved within the timing requirements for the assumptions of the Control Room dose analysis. Subsequently, at 2140, on February 19, 1991, both trains of the VC system were declared inoperable and Technical Specification (TS) Action statement 3.0.3 was entered for both units. A temporary modification was initiated to remove the automatic closure function from the radiation monitors and chlorine detectors. Also, changes to the procedures for responses to high chlorine or radiation alarms were initiated. At 0245, on February 20, the modification and procedure changes were completed and TS Action Statement 3.0.3 was exited. Unit 1 and Unit 2 were in Mode 1 (Power Operation) at 100 percent power at the time the event occurred. This event is assigned a cause of Design Oversight and a contributing cause of Management Deficiency. Appropriate modifications and procedure changes will be implemented to resolve the problem.

EVALUATION:

Background

There are two independent trains of the VC [EIIS:VI] and Chilled Water (YC) [EIIS:KA] systems which are designed to maintain a habitable environment in the Control Room [EIIS:NA] during normal and accident conditions. Based on the habitability requirements as defined in the Final Safety Analysis Report (FSAR) criteria, the system is designed as an Engineered Safeguards Features [EIIS:JE] system with absolute and carbon filtration [EIIS:FLT] in the outside air intakes and with equipment redundancies for use as conditions require. The Control Room is designed to be maintained at a positive pressure of >/= 0.125 inches water gauge (w.g.), relative to outside atmospheric pressure during an accident to prevent entry of contaminants. Two 100 percent capacity Outside Air Pressure Filter Trains pressurize the Control Room by providing approximately 2000 cfm of filtered outside air.

TS Bases 3/4.7.6, VC system, states, in part, that the operability of the VC system ensures that the Control Room will remain habitable for Operations personnel during and following all credible accident conditions. The operability of this system in conjunction with Control Room design provisions is based on limiting the radiation exposure to personnel occupying the Control Room to 5 rem or less whole body, or its equivalent. This limitation is consistent with the requirements of General Design Criterion 19 (GDC-19) of Appendix A, Code of Federal Regulations, Title 10, Part 50 (10 CFR 50).

FSAR Section 15.6.4.3, Environmental Consequences for Loss-Of-Coolant Accidents, Control Room Operator Dose, states, in part, that the maximum postulated dose to a Control Room Operator is determined based on the releases of a Design Basis Accident. The offsite radiological consequences are calculated based on certain assumptions and parameters, which include that the unfiltered inleakage into the Control Room is 10 cfm.

The VC system has two outside air intake structures [EIIS:NN] for each train. Each structure is monitored by a Radiation Monitor [EIIS:MON] for the presence of radiation and has two redundant isolation valves [EIIS:ISV]. When a radiation signal is received by either Control Room Outside Air Intake Radiation Monitors, 1EMF-43A or 1EMF-43B, the intake which is the source of contamination automatically closes. Should both intakes close, the operator will override the intake radiation monitors and by inspection of the Control Room readouts, open the unit intakes with least radiation. This will ensure pressurization of the Control Room at all times.

Chlorine Detectors [EIIS:DET] monitor the outside air intake structures of the VC system for the presence of chlorine gas. Each structure is monitored by one detector and has two redundant isolation valves. If gas is detected by either detector of the train, the train intake structures will be automatically secured by means of closing four intake isolation valves and a local/remote alarm [EIIS:ALM] will be generated. The major parts of a

chlorine detector are the electrolyte tank [EIIS:TK] that houses a wick, a blower [EIIS:BLO] unit, and an electronic unit.

Description of Event

In March of 1989, Self Initiated Technical Audit (SITA) 89-02 (MC) of the VC system was conducted at McGuire. During the course of this audit, it was found that the single failure of a non-essential electrical circuit for the chlorine detectors associated with the VC system will render the system inoperable by causing all eight outside air intake isolation valves to close. The closing of these valves will prevent pressurization of the Control Room which is in violation of TS requirements. Also, 10CFR50, Appendix A, Criterion 24, requires that a safety related system be protected from the effects of a single failure. The results of the investigation conducted at the time of the finding stated the following:

1. Root Cause(s) for the findings:

   At the time the Chlorine Detectors were purchased for McGuire, safety related detectors were unavailable. Chlorine protection was considered a non-safety function and McGuire was licensed with non-safety chlorine detectors.

   Anytime non-safety instrumentation is used to control a safety component, a failure mode on loss of power to the non-safety instrumentation must be selected. In this case, the VC intake valves close on loss of power to the chlorine detectors. Although this presents a problem because outside air would not be available for pressurizing the Control Room, closing the valves is the safe position for chlorine protection. Failing the intake valves closed is preferable to allowing them to remain open and potentially allowing radiation or chlorine into the Control Room.

   For an optimum design, the chlorine detectors for each intake should be powered by separate power supplies. This would add reliability by preventing both intakes from closing on total loss of non-safety power.

   In summary, the present design meets separation criteria and provides for proper failure of the safety valves on loss of non-safety power. However, the control circuit could have been optimized by powering the chlorine detectors from separate power supplies. This is not considered a violation of the single failure criteria, and root cause is not an issue.

2. Scope & results of the investigation performed to determine the extent of the finding:

   Procedures are in place at McGuire to reopen the VC air intake valves. These procedures were followed on October 12, 1989 (see

369/89-31), and the valves were reopened. This LER was written as a result of a blown fuse in the chlorine detector circuit which caused the intake valves to close. Station personnel feel that these procedures are adequate to address this issue. (Reference PIR 0-M89-0270.)

3. Corrective steps which have been taken and the results achieved:

As a result of LER 369/89-31, Station Problem Report (SPR) No. 2989 was written by station personnel to separately fuse each chlorine monitor. Implementation of this SPR will prevent a reoccurrence of the problem identified in the LER; however, the following additional changes should be made for increased reliability:

a. Power the chlorine detectors associated with each intake from separate non-safety power supplies.

b. Revise control circuitry to allow the bypass of the radiation monitors and chlorine detectors during maintenance.

At the time of this evaluation, no further corrective actions were deemed necessary.

In January of 1991, Operations (OPS) personnel began an evaluation of the compensatory actions required by OPS personnel in emergency situations. A concern had been raised because of the number of actions required. As a result, OPS personnel generated a memorandum to Project Services and DE personnel requesting a reevaluation of the need for a procedure response requiring OPS personnel to reopen the VC system air intake valves. Consequently, a meeting was held between OPS, Project Services, DE, and Mechanical Maintenance personnel to discuss the problem. Personnel involved decided to ask for a further change to be made to NSM MG-52065 deleting some of the automatic closure signals from the chlorine detectors and radiation monitors. This would simplify the compensatory actions required by OPS personnel.

On February 18, 1991, DE personnel began a review of NSM MG-52065. The purpose of the review was to examine the proposed recommendations for change from a safety standpoint. As a result, the fact that loss of non-essential power to the chlorine detectors or to the radiation monitors (EMF-43A and 43B) the VC system outside air intake isolation valves will close and cannot be reopened from the Control Room was evaluated. This was different than the evaluation performed after the finding by SITA Audit 89-02. The previous evaluation had not considered the effect of loss of power to the radiation monitors. Also, an evaluation of allowable time for not having the Control Room pressurized had been performed later and had identified only a 20 to 30 second response time for compensatory actions. At this time, it was determined that the compensatory action requiring OPS personnel to open the breaker for each valve and to manually open each valve, may not be achieved

within the time requirements for the assumptions of the Control Room Dose Analysis.

On February 19, 1991, DE personnel and OPS personnel determined the VC system might be inoperable and initiated PIR 0-M91-0033 to resolve the problem. Consequently, at 2140, on February 19, both trains of the VC system were declared inoperable and TS Action Statement 3.0.3 was entered for both units.

Temporary modifications were initiated to remove the automatic action on loss of power from the chlorine detectors and radiation monitors. Also, changes to the procedures for responses to high chlorine or radiation alarms were initiated.

At 0245 on February 20, 1991, the modifications were completed and appropriate procedure changes were implemented to have OPS personnel close the valves upon a high radiation or high chlorine alarm. Therefore, both trains of the VC system were declared operable and TS Action Statement 3.0.3 was exited for both units.

Conclusion

This event is assigned a cause of Design Oversight. At the time the chlorine and radiation monitor circuitry was designed, a failure mode on loss of power was selected in what was considered the most conservative direction. Failing the VC intake valves closed was preferable to allowing them to remain open and potentially allow radiation or chlorine into the Control Room. Although this presents a problem because outside air would not be available for pressurizing the Control Room, the intent at the time was considered to be conservative based on available technical information.

A contributing cause of Management Deficiency is assigned because when the SITA Audit detected the problem with the design, the corrective actions taken were not generic enough in nature to resolve the problem. SPR 2989 was written and approved to seperately fuse each chlorine detector. Recommendations were also made to power the chlorine detectors associated with each intake form seperate non-essential power supplies and to revise the control circuitry to allow the bypass of the chlorine detectors and radiation monitors during maintenance. At the time Management personnel involved felt that the procedures in place, requiring OPS personnel to reopen the intake valves on loss of power, and these proposed modifications were adequate to resolve the problem. This evaluation had not considered the effect of loss of power to the radiation monitors nor the evaluation performed later establishing a short 20 to 30 second response time to take compensatory action and open the intake valves. Therefore, no further investigation or corrective actions were deemed necessary. However, upon a second evaluation which included consideration of the allowabe time for not having the Control Room pressurized, DE personnel determined that the compensatory actions in place may not be achieved within the time requirements of the assumptions for the Control Room dose analysis.

When the deficiencies were discovered, appropriate actions were taken to delete the automatic isolation function from both the chlorine detectors and radiation monitors. Also, appropriate procedure changes were made to ensure that the appropriate intake valves would be closed upon receipt of a high radiation or high chlorine alarm signal. All appropriate notifications were made when the units entered TS Action Statement 3.0.3. During the time when the VC system was inoperable, OPS Control Room personnel were fully aware of the situation and no events occurred requiring them to take further action.

A review of the Operating Experience Program data base for the previous 24 months prior to this event revealed 3 LERs documenting Design Deficiencies with the VC system because of a design oversight. These were LERs 369/89-15, 369/90-10, and 369/89-31. LER 369/89-15 documented a design oversight with respect to the proper reference point for measuring Control Room pressure. LER 369/90-10-0 documented an unanticipated interaction of systems when the VC system heaters would not operate as designed. LER 369/89-31 documented a design oversight with respect to a similar problem as this LER and the corrective actions taken were not of generic enough nature to prevent this event from occurring as determined by further analysis. Therefore, the problem is considered to be recurring.

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

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

CORRECTIVE ACTIONS:

Immediate:

1) Temporary Modifications 6010 and 6011, removing the automatic closure function from the chlorine detectors and radiation monitors were installed as directed by work request 890295.

2) Changes were made to procedures OP/2/A/6100/10N, Annunciator Response For Panel 2AD13, OP/1/A/6100/10R, Annunciator Response For Panel 1RAD2, and OP/1/A/6100/10Q, Annunciator Response For Panel 1RAD1 specifying required actions for different accident scenarios.

Subsequent:

1) Procedure EP/1/A/5000/01, Safety Injection Or Reactor Trip, was changed to specify required actions for different accident scenarios.

Planned:

1) DE and Project Services personnel will evaluate and make permanent changes to the circuits for the chlorine detectors and radiation monitors involved.

| 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 1 | — 0 0 3 | — 0 0 | 7 OF 7 |

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

2) The previously installed temporary modifications 6010 and 6011 will be removed as directed by work request 890295.

SAFETY ANALYSIS:

The design requirements of the VC system are to supply filtered air at a controlled temperature and humidity to the Control Room and to pressurize the Control Room to prevent inleakage of unfiltered air. The VC system helps ensure that doses to Control Room personnel are As Low As Reasonably Achievable and 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 principle contaminant contained in air leaking into the Control Room is assumed to be radioactive Iodine which is very conservatively modeled in dose calculations. Very low amounts of Iodine would be expected to reach the area around the Control Room since this requires passage through either Auxiliary (VA) [eIIS:VF] or Turbine Building Ventilation systems [EIIS:VK] or passageways first.

No credit is taken for the VA filtration, with regard to Control Room dose calculation, in mitigating the Emergency Core Cooling System leakage source. However, this system is automatically switched to the filtered exhaust mode of operation on an accident or Blackout signal or if radiation is detected by the exhaust monitor [EIIS:MON]. The VA system has four 50 percent capacity trains for Units 1 and 2 which respond to an accident on either unit thus providing essentially redundant protection. Operation of the VA system in the filtered exhaust mode by either train of the system would serve to reduce the calculated dose to Control Room personnel.

In the event the Control Room atmosphere became unbreathable, self contained breathing apparatus (SCBAs) provided in the Control Room area could be employed. Radiation monitors in the Control Room would alert Control Room personnel of high radiation levels.

Both trains of the VC system were technically inoperable but were fully capable of operating.

During the event, there were no accidents that would have required operation of the VC system to maintain habitability of the Control Room.

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