U.S. NUCLEAR REGULATORY COMMISSION

REGION II

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Licensee:	Duke Energy Corporation
Facility:	McGuire Nuclear Station, Units 1 and 2
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Enclosure

EXECUTIVE SUMMARY

McGuire Nuclear Station, Units 1 and 2
NRC Inspection Report 50-369/98-09, 50-370/98-09

This integrated inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covered a six-week period of resident inspection. In addition, regional inspections were performed in the areas of operator licensing requalification program and preparation for construction of an independent spent fuel storage facility.

Operations

- A fire protection system leak occurred due to poor material condition which affected equipment operation in the auxiliary building. The leak could have been prevented through visual inspection of the subject gland type joint. Other indicators of fire protection system poor material condition were leakage past isolation valve 1RF156 and material deficiencies in its indicating mechanism, which resulted in the valve being found in the wrong position, as discovered during event response. Both problems challenged the fire protection system functionality in the auxiliary building and posed a potential personnel and flood hazard for system operation and maintenance. (Section O2.1)

- Operations and chemistry personnel adequately responded to the auxiliary building flooding event. The licensee's minor system modification to install an axial restraint on the affected leaking fire protection piping was adequate to correct the problem. (Section O2.1)

- Operators' response to the loss of a Unit 2 600 volt motor control center, 2EMXG, was excellent. Immediate actions taken were prompt, deliberate, and in accordance with procedures. (Section E2.1)

- The requalification program failed to identify the generic weakness in licensed operators' ability to perform a manual estimated critical boron concentration calculation. All 18 operators failed to perform the calculation correctly. (Section O5.1)

- The quality control process for evaluating the licensed operator requalification program biannual written examination failed to identify several weaknesses. As a result, the written examination was a poor tool to distinguish a competent operator from an incompetent operator. (Section O5.1)

- In general, the training staff and operations staff performed effective evaluations of the licensed operators during requalification program examinations. (Section O5.2)

- Two crews of licensed operators were evaluated as unsatisfactory and removed from licensed duties pending remediation. This action was taken based on unsatisfactory performance during simulator scenarios. An inspector followup item was identified pending NRC review of corrective actions for licensed operators' inability to perform a manual estimated critical boron calculation. (Section O5.3)

Maintenance

- Routine maintenance and surveillance activities were adequately completed. A negative observation was identified in the initial diagnosis and resolution of problems with the emergency diesel generator indicating lights for the 2A emergency diesel generator fuel oil booster pump. Specifically, the pump was out of service, due to a tripped power

supply breaker, for at least two weeks without resolution. The problem did not affect the emergency start capability of the diesel. (Section M1.1)

- Efforts to repair main feedwater pump high bearing temperatures were unsuccessful due to material condition problems preventing establishment of the work boundary. The secondary plant equipment performance and preventive maintenance activities to maintain reliability were insufficient to support the planned maintenance activities. (Section M2.1)

- Immediate licensee evaluations of a corroded hydrogen line within the Unit 1 refueling water storage tank suction piping trench were adequate. An inspector follow-up item was identified to review the potential for safety concerns due to the hydrogen line proximity to the refueling water storage tank. (Section M2.2)

- A material condition deficiency resulted in a substantial glycol leak in the Unit 1 ice condenser. (Section M2.3)

- Maintenance and engineering personnel response to an ice condenser ethylene glycol leak from a damaged air handling unit in the condenser and immediate corrective actions were good. No operability concerns were identified. (Section M2.3)

- The licensee's evaluation of inspectors' concerns regarding potential containment integrity impact from the combustion of ethylene glycol off-gas (formaldehyde) under postulated design basis accident conditions was adequate. (Section M2.3)

Engineering

- Design and function of the auxiliary building drain system during the fire protection flooding event was considered adequate. No safety-related equipment was adversely affected. (Section O2.1)

- The engineering support activities for the loss of power to the Unit 2 600 volt motor control center 2EMXG displayed excellent engineering knowledge, performance, and judgement. (Section E2.1)

- The design calculations for the spent fuel cask concrete pad and related structures were adequately performed in accordance with industrial standards. One inspector followup item was identified for the discrepancies in the design calculations. (Section E8.2)

Plant Support

- Several degraded conditions of the fire protection system were observed during the inspectors' walkdowns of the system. An inspector follow-up item was identified for potential overpressurization of piping in the safe shutdown facility. Overall material condition of the fire protection system was considered adequate; although several problems were identified. (Section F2.1)

Report Details

Summary of Plant Status

Unit 1

Unit 1 began the inspection period at approximately 100 percent power. On August 28, 1998, power was reduced to approximately 45 percent to perform troubleshooting on the 1B main feed water pump due to an elevated bearing temperature. On August 28, 1998, power was further reduced to 20 percent to inspect and clean a glycol spill from a degraded ice condenser air handling unit. The unit was returned to 100 percent power on September 1, 1998. The unit operated at approximately 100 percent power the remainder of the inspection period.

Unit 2

Unit 2 operated at approximately 100 percent power throughout the inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

Using Inspection Procedure 71707, the inspectors conducted frequent reviews of ongoing plant operations. In general, the conduct of operations was professional and safety-conscious. Operators were considered attentive to their duties. Specific events and noteworthy observations are detailed in the sections which follow.

O2 Operational Status of Facilities and Equipment

O2.1 Fire Protection System Leak in Auxiliary Building

a. Inspection Scope (71707)

The inspectors evaluated the licensee's response and corrective actions following a spill of approximate 26,000 gallons of fire protection system water in the auxiliary building.

b. Observations and Findings

On September 2, 1998, control room operators were informed of water accumulation in the radwaste/chemistry areas on the 716 foot elevation of the auxiliary building. Further investigation revealed that a fire protection piping connection in the Unit 2 spent fuel pool (SFP) cooling system room had developed a leak. The room was equipped with large capacity floor drains and flood barriers. The SFP pump operation was not affected during the event. The inventory from the leak filled the floor drain tank and subsequently backed up into other auxiliary building areas causing the boric acid tank transfer pumps to be submerged. These pumps and associated motors were evaluated by the licensee following the event and were determined not to have been adversely affected by the water.

Immediate response to the event included chemistry realigning the floor drains to the auxiliary floor drain tanks to clear the accumulated water from the affected equipment areas and corridors. The licensee also implemented a fire impairment plan within one hour until repairs were completed and the system was returned to its standby configuration. Operators were able to reduce the leak by closing other fire protection system valves. However, during the event response, operators were unsuccessful in stopping the leakage past valve 1RF156, as discussed below. This valve was discovered in the closed position; however, leakage occurred past the valve seat. This valve is normally open. Other valves were successfully closed to isolate the flange leak.

The fire protection system leak occurred due to the failure of a compression type flange joint connection at the interface of the exterior and interior fire protection system piping. The inspectors examined the failed connection and noted indications of gradual separation (slipping) due to poor structural support of the piping system at that location. No axial support had been provided to dampen axial pipe movement. The inspectors visually observed, following the event, that pipe separation had been occurring over a period of time as indicated by corrosion on areas of the pipe that had slipped from the joint (corrosion on scoring marks on the pipe wall from the set screws on the joint).

On September 4, 1998, the licensee implemented a minor modification to install axial support to prevent recurrence. In addition, the licensee indicated that this type of pipe connection was the only one of its kind in the auxiliary building. The inspectors confirmed this during the system walkdown in the auxiliary building. Additional corrective actions, including extent of condition reviews, were under evaluation at the end of the inspection period.

On September 3, 1998, the inspectors performed detailed walkdowns of other critical equipment and areas in the auxiliary building that were susceptible to flooding and confirmed that no other major accumulations of water were present that could have adversely impacted safety-related equipment. The McGuire floor drains were designed to provide a direct path to tanks at the lower elevations of the auxiliary building to prevent major accumulations of water at a single location which could challenge auxiliary building structures (i.e. floor loadings).

The overall impact of this 26,000 gallon leak on safety-related equipment located in the auxiliary building was minimal. The inspectors reviewed available licensing and design basis documentation and confirmed that the floor drain system was operated and maintained consistent with recommendations.

The inspectors reviewed the root cause of valve 1RF156 being found closed instead of in its normally open position. Valve 1RF156 (supplied from flow control valve 1RY114) is a butterfly valve on a redundant 12 inch line that supplies water to a section of fire protection system on the 750 foot elevation in the auxiliary building. In effect, closure of this valve reduced the available supply path to only one supply line (path from flow control valve 1RY113). The licensee informed the inspectors that on May 25, 1998, a work request was written to repair the broken position indicator during completion of PT/0/A/4400/04A, Fire Protection System High Velocity Flush and Chlorination. At the time, operators did not suspect a problem with the valve since the manual operator traveled from stop-to-stop. This resulted in a false indication that the valve was open when it was actually closed. Following the flood event, maintenance personnel disassembled the valve and determined that the manual operator would move in this condition; however, the valve disc and indicator would remain stationary. The licensee

repaired the valve, including the indicating problem and seat leakage past the valve, and returned it to service. Additional corrective actions, including plant operator training on valve design and lessons learned, were under review at the end of the inspection period. A review of Technical Specifications (TS) logs indicated that the redundant supply path was available between May 25, 1998, and the time of the flood event. The inspectors considered this valve problem another example of an overall material condition weakness in the fire protection system that resulted in loss of defense-in-depth redundancy of the fire protection system.

c. Conclusions

A fire protection system leak occurred due to poor material condition which affected equipment operation in the auxiliary building. The leak could have been prevented through visual inspection of the subject gland type joint. Other indicators of fire protection system poor material condition was the leakage past isolation valve 1RF156 and material deficiencies in its indicating mechanism, which resulted in the valve being found in the wrong position, as discovered during event response. Both problems challenged the fire protection system functionality in the auxiliary building and posed a potential personnel and flood hazard for system operation and maintenance.

Operations and chemistry personnel adequately responded to the auxiliary building flooding event. The licensee's minor system modification to install an axial restraint on the affected leaking fire protection piping was adequate to correct the problem.

Design and function of the auxiliary building drain system during the fire protection flooding event was considered adequate. No safety-related equipment was adversely affected.

O3 Operations Procedures and Documentation

O3.1 Operations Procedures

a. Inspection Scope (71707)

During administration of requalification program simulator scenarios, the inspector reviewed licensee procedures.

b. Observations and Findings

The inspector noted that two annunciator response procedure's (ARP) immediate action steps required that emergency boration be performed. These actions conflicted with TS requirements. The ARPs for Control Rod Bank LO Limit, and Control Rod Bank LO-LO Limit, windows A9, and B9 respectively, on panel 1AD-2, required, in an immediate action step:

2. Go to AP/1/A/5500/013 (Boron Dilution)

The boron dilution procedure subsequently required the operators to perform an emergency boration per AP/1/A/5500/38, "Emergency Boration." Performing an emergency boration during all transients which cause either of the mentioned annunciators to alarm, may place an additional, undesired reactivity transient on the reactor plant. The shutdown margin (SDM) TS required an immediate emergency

boration if the rods are lower than the Core Operating Limits Report (COLR) position. This position is designed to coincide with the Control Rod Bank LO-LO limit light. However, a TS interpretation, for this case, defines "immediate" as 15 minutes. The rod insertion limit (RIL) TS required that the operators have 2 hours to correct the low rod position prior to emergency boration. Under certain plant transients, which could cause both annunciators to alarm (i.e. a runback or an instrument failure which results in undesired rod insertion), the operator would not be required to emergency borate as long as the Control Rod Bank LO-LO alarm could be cleared within 15 minutes. Also, the ARPs only require the operator to reference TSs for the RIL TS and not for both the RIL and the SDM TSs. In this case, the SDM TS is more restrictive than the RIL TS.

The inspector noted that the procedure required to perform a manual estimated critical boron (ECB) calculation, Enclosure 4.1 of OP/0/A/6100/006, "Estimated Critical Boron Calculation", revision 49, contained a procedure step with incomplete wording. The wording of the procedure step resulted in 16 of 18 licensed senior reactor operators (SRO) and reactor operators (RO) performing the ECB calculation incorrectly. Step 3.1.8, Case I, required:

Number of hours shutdown ____ hrs

The actual intent of the step was to record the number of hours shutdown plus the number of hours until the plant was expected to be critical.

c. Conclusions

The requirements of the two annunciator response procedures were not consistent with the requirements of TS. The number of licensed SROs and ROs that were unable to manually calculate an ECB highlights both a generic weakness in training on the procedure, and the incomplete wording of the procedure step. The licensee generated two problem investigation process (PIP) forms to address the ARP deficiencies, and is investigating the unsatisfactory performances on the manual ECB calculation. Pending further NRC review of these procedure revisions, this is identified as Inspector Follow-up Item (IFI) 50-369, 370/98-09-01: Tracking of Corrective Actions for Procedure Weaknesses in Two ARPs for Rod Insertion Limits and the Manual Estimated Critical Boron Calculation.

O5 Operator Training and Qualification

O5.1 Licensed Operator Requalification Program - Examination Content

a. Inspection Scope (71001)

The inspector reviewed, for quality of content, the simulator scenarios, job performance measures (JPM), and part B of the written examination. These tools were used to evaluate two licensed operating crews of SROs and ROs.

b. Observations and Findings

The inspector reviewed the biannual part B written examinations used to evaluate the licensed operators' level of knowledge. The part B examination was an all multiple choice test of 15 questions. There were no failures noted during the week of inspection.

The inspector was concerned with a missed opportunity to identify the operators' inability to correctly perform a manual ECB calculation. The operators were required to complete a four page worksheet and then pick from four possible answers. Although all operators performed the calculation incorrectly (see section O5.3), because of the multiple choice format, all but one selected the correct answer. The licensee was not aware of the operators' inability to perform the calculation. This task was better suited for a short answer format question. It was not until the inspector reviewed the actual calculations that the errors were identified.

The inspector is concerned with the validation process for the part B written examination. The following is a summation of items that could have been eliminated by a thorough quality control review:

i) Five out of fifteen questions were related to reactivity control. The examination is required to be a comprehensive evaluation of all topics taught during the two-year requalification cycle.

ii) The examination contained questions that teach the answer in the stem by listing which procedure and step is being implemented. In some questions, the only skill required is to page to the listed step and read the next items. SROs should be evaluated on their ability to diagnose plant conditions and determine which procedure they are required to implement.

iii) An SRO question on the part B written examination was identical to a job performance measure (JPM) given to the same group of SROs. The question required the operator to describe actions to be taken upon a loss of an emergency bus with a failure of the emergency diesel generator (EDG) to tie to the bus. A JPM required the operator to perform the identical task. This repeat of tasks did not meet NRC standards for evaluation.

iv) Of fifteen questions, one contained no correct answer and had to be deleted. One question contained an answer that was a value between two of the four listed answers. The actual answer was closer to a distractor than the listed correct answer.

The simulator scenarios and walkthrough examinations contained a broad range of tasks which met NRC standards for evaluation.

c. Conclusions

The inability to identify the operators' weakness in performing a manual ECB was a failure of the written examination as an evaluation tool. The quality control process for evaluating the written examination failed to identify several weaknesses. As a result, the part B written examination was a marginal tool to distinguish a competent operator from an incompetent operator.

O5.2 Licensed Operator Requalification Program - Evaluator Skills

a. Inspection Scope (71001)

The inspector observed the evaluators during simulator scenarios, a post-scenario critique, and during administration of the walkthrough examinations.

b. Observations and Findings

The post-scenario critique by the training staff and operations personnel was detailed and thorough. The evaluation team leader was open to comments by both trainers and the operations representatives. The team leader did not try to overrule the other evaluators during the competency grading sessions.

The inspector was concerned that the evaluators missed the SRO declaring the "B" Steam Generator (SG) isolated when it was not. During a faulted SG scenario, while in E-2, "Faulted SG Isolation", the SRO gave direction to an auxiliary operator (AO) to isolate two valves in the doghouse, 1SA-2 and 1SA-78. The AO reported back that he did not want to go in the doghouse because their was a large amount of steam issuing from it. The SRO completed the E-2 procedure and transitioned to E-1, "Loss of Reactor or Secondary Coolant." While in E-1, the SRO asked the RO if the "B" SG was isolated. The RO looked at his panel and replied, "yes." The RO was unaware of the status of the valves in the doghouse. The SRO then continued on in the E-1 procedure, instead of implementing the Response Not Obtained (RNO) step. At this time, the "B" SG ruptured and the crew transitioned to E-3, "Steam Generator Tube Rupture." The "B" SG was isolated completely while in E-3.

The inspector was concerned that the evaluators did not identify the lack of use of ARPs during the scenario.

c. Conclusions

The evaluators adequately discussed and documented their findings during the post-scenario critique. The critique was a high-quality, open, forum for discussion of the operators' performance. Shortcomings were identified in the performance of the observed evaluators tracking procedure steps through completion and annunciator response procedure usage.

O5.3 Licensed Operator Requalification Program - Operator Performance

a. Inspection Scope (71001)

The inspector observed licensed operator performance on the part B written examination, simulator scenarios, and walkthrough examinations. The operators were observed during the first week of the requalification program examination phase. The 18 licensed ROs and SROs were a mix of shift crew members and plant staff.

b. Observations and Findings

The inspector was concerned with the performance of both of the operating crews that were evaluated during the first week. Both crews were evaluated as unsatisfactory and were removed from licensed duties until completion of a remediation program. Both crews failed the simulator scenario portion of the operating examination. One individual was also evaluated as unsatisfactory.

One crew did not identify that an anticipatory transient without trip (ATWT) was in progress for 36 seconds. The crew was challenged with a stuck open power operated relief valve. As reactor coolant system (RCS) pressure decreased, the operating overtemperature delta temperature (T) setpoint lowered and a trip signal was sent to the

reactor protection system. A red first out annunciator was lit for overtemperature delta T. The simulator had an ATWT malfunction entered which blocked reactor trip signals. The reason the crew attempted to trip the reactor, even after the 36 seconds, was that they were approaching the low pressure scram setpoint. The crew never identified the overtemperature deltaT first out annunciator.

The same crew performed poorly on a failed Tcold instrument. The failure resulted in an uncontrolled rod insertion. The balance of plant (BOP) operator misdiagnosed the transient as a runback. The SROs failed to back-up the diagnosis and entered the wrong procedure. After realizing the error, the SRO directed the rods be taken to manual. The control rods had been inserting for two minutes and twenty seconds. This caused the Control Rod Bank Lo Limit annunciator to alarm. The RO did not reference the ARP for the annunciator. He also did not carry out the immediate actions required by the ARP. Reactor coolant system temperature decreased to 542 degrees Fahrenheit. The SRO directed the RO to restore average temperature (Tave) to reference temperature (Tref), however Tave was failed high. The RO acknowledged the order and began withdrawing control rods at random. There was no discussion on what temperature or indication should be used. The RO never restored Tave to Tref.

The SROs demonstrated a lack of command and control during both events. The ROs demonstrated a lack of diagnostic skills. Reactivity management was unsatisfactory.

The second crew was evaluated as unsatisfactory based on a failure to identify that a faulted SG was not isolated. The crew made serious errors in interpreting safety related parameters. The crew took incorrect action and terminated safety injection (SI). The crew did not correctly transition to E-2, "Faulted SG Isolation." The crew believed the large steam break was isolated when the main steam isolation valves were closed. The RCS pressure was allowed to degrade to 1300 pounds per square inch gauge (psig).

The inspector is concerned with a generic weakness in the operators' ability to perform a manual ECB. All 18 ROs and SROs were required to perform a manual ECB during part B of the written examination. The inspector identified 37 errors on the 18 operators ECBs. No operator performed the calculation without error. One operator made 5 errors. The errors consisted of reading the wrong graphs, reading the graph wrong, dropping negative signs, and misinterpreting data. The misinterpreting data error was responsible for 16 of the 37 errors and is discussed in section O3.1.b.(2) of this report. Pending further NRC review of the remediation and other corrective actions this is identified as IFI 50-369, 370/98-09-02: Tracking of Corrective Actions for Licensed Operators' Inability to Perform a Manual Estimated Critical Boron Calculation.

c. Conclusions

Two crews of licensed operators were evaluated as unsatisfactory and removed from licensed duties pending remediation. This action was taken based on unsatisfactory performance during simulator scenarios. An inspector followup item was identified pending NRC review of corrective actions for licensed operators' inability to perform a manual estimated critical boron calculation.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (61726 and 62707)

The inspectors reviewed a variety of maintenance and/or surveillance activities during the inspection period, including the following specific items:

- WO 98052879-01 Calibrate Flow Transmitter 2RNFT 5360 (Service Water)
- WO 98089878-01 Troubleshoot and Repair MCC 2EMXG Feeder Breaker
- WO 98042537-01 Troubleshoot and Repair EDG 2A Fuel Oil Booster Pump Power Supply
- IP/0/A/3090/021 Loop Calibration and Operational Test Procedure, Revision 13
- PT/1/A/4252/03A AFW Train A Valve Stroke Timing, Revision 22
- PT/1/A/4252/03B AFW Train B Valve stroke Timing, Revision 15

b. Observations and Findings

The inspectors witnessed selected surveillance tests to verify that approved procedures were available and in use; test equipment was calibrated; test prerequisites were met; system restoration was completed; and acceptance criteria were met. In addition, the inspectors reviewed or witnessed routine maintenance activities to verify, where applicable, that approved procedures were available and in use, prerequisites were met, equipment restoration was completed, and maintenance results were adequate. The inspectors observed, reviewed, and discussed with licensee personnel the troubleshooting and repair activities on the emergency diesel generator (EDG) 2A fuel oil booster pump power supply and the related activities on the normal power feeder breaker to motor control center 2EMXG. On September 28, 1998, personnel were not successful in a normal starting of the 2A EDG. The inspectors observed that a deficiency tag, dated September 14, 1998, was attached to the booster pump control switch stating that the indicating lights were not lit. It was discovered, during troubleshooting, that the lights were not lit because the pump supply breaker was tripped. This prevented the normal starting of the EDG. The inspectors verified that the booster pump was not required for emergency starting of the EDG.

c. Conclusions

The inspectors concluded that the reviewed routine maintenance and surveillance activities were adequately completed. A negative observation was identified in the initial diagnosis and resolution of problems with the emergency diesel generator indicating lights for the 2A EDG fuel oil booster pump. Specifically, the pump was out of service, due to a tripped power supply breaker, for at least two weeks without resolution. The problem did not affect the emergency start capability of the diesel.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Unit 1 Downpower for 1B Main Feedwater Pump Maintenance

a. Inspection Scope (62707)

The inspectors evaluated equipment performance and licensee activities associated with the planned unit power reduction to correct a high bearing temperature condition on the 1B main feedwater pump.

b. Observations and Findings

On August 28, 1998, operators performed a controlled Unit 1 power reduction to facilitate repairs to the 1B main feedwater pump. Although stable and not in excess of operating limits, the pump bearing temperatures were at the upper operating range. After reaching approximately 45 percent power, operators began to secure the 1B main feedwater pump for maintenance on the bearings. Operators later continued the unit downpower to approximately 20 percent power to correct an emerging ice condenser system glycol leak (see section M2.3). While securing the main feedwater pump, the gearbox for manual isolation valve 1CF5, the 1B main feedwater pump discharge isolation valve, failed when the valve was being closed. The licensee removed the failed actuator and installed a spare. Also, during isolation of valve 1CM272, condensate supply to 1B main feedwater pump, the licensee determined that the valve seat was significantly degraded and condensate booster pump flow could not be isolated to the pump.

The licensee decided to abandon the 1B main feedwater pump repair effort and return the unit to 100 percent power. The repair of the 1B main feedwater pump bearings was added to the outage work list and may be repaired during an extended forced outage.

c. Conclusions

Efforts to repair main feedwater pump high bearing temperatures were unsuccessful due to material condition problems preventing establishment of the work boundary. The secondary plant equipment performance and preventive maintenance activities to maintain reliability were insufficient to support the planned maintenance activities.

M2.2 Hydrogen Line in Refueling Water Storage Tank (RWST) Supply Trench

a. Inspection Scope (62707, 64704)

The inspectors reviewed the identification of a corroded hydrogen line located in the immediate vicinity of the RWST.

b. Observations and Findings

On July 28, 1998, the licensee identified corrosion on the hydrogen supply line from the bulk hydrogen storage house to the auxiliary building. The line is routed from the storage house underground into the Unit 1 RWST missile protected trench. The subject piping was one-inch diameter schedule 40 carbon steel piping. The trench provides a confined space for hydrogen gas to be trapped around the RWST piping if a hydrogen

line leak were to occur in the area. The licensee performed non-destructive examination of the piping and concluded that the hydrogen line integrity had not been compromised. The licensee stated that no hydrogen line was in the trench for the Unit 2 RWST.

The inspectors reviewed the line location and questioned if any evaluations had been performed to determine if the location of the hydrogen line posed a threat to the RWST tank or piping in the event of a hydrogen line leak in this area. The inspectors were also concerned that with the hydrogen line not being seismically qualified and a potential for ignition sources to be present (such as electrical heat trace) there may be a potential explosion in the event of a line rupture. This issue will be identified as IFI 50-369/98-09-03, Adequacy of Hydrogen Line Impact on Refueling Water Storage Tank. The inspectors will review the location of the hydrogen line with respect to compliance with applicable 10 CFR Part 50, Appendix A, General Design Criteria and fire protection requirements.

c. Conclusions

Immediate licensee evaluations of a corroded hydrogen line within the Unit 1 RWST suction piping trench were adequate. An IFI was identified to review the potential for safety concerns due to the hydrogen line proximity to the RWST.

M2.3 Glycol Leak in the Unit 1 Ice Condenser System

a. Inspection Scope (62707)

The inspectors reviewed the licensee's efforts to isolate and clean a glycol leak from an air handling unit (AHU) in the Unit 1 ice condenser. Discussions with maintenance, operations, and engineering personnel were conducted and the licensee's evaluation of the spill effects were assessed.

b. Observations and Findings

On August 28, 1998, licensee personnel investigated an adverse trend on glycol expansion tank makeup and discovered a leak in the 1A1 AHU inside the ice condenser's intermediate deck area. During the night shift on August 27, 1998, a total of 360 gallons of glycol were added to the system. The apparent cause of the leak was from the AHU squirrel cage blower and motor that had moved because of loose supports and subsequently damaged glycol coils in the AHU. Engineering and maintenance personnel isolated the AHU. The licensee estimated that a significant amount of the glycol went down the AHU defrost drain line to the containment floor and equipment sump; however, some glycol spilled onto some of the intermediate deck doors and entered portions of the ice bed in bays 1 and 2. At 20 percent reactor power, licensee personnel entered lower containment and identified a glycol/ice mixture in bays 1, 2, and 3. The spill was determined not to have adversely impacted the integrity of the ice bed.

Immediate corrective actions were to remove the spill from the floor and exercise the intermediate deck doors in the affected area. Floor to lower inlet doors gap measurements were taken in the affected bays to assess any floor growth and potential uplift that could cause lower inlet doors to become obstructed (see floor growth issues in special report 50-369,370/97-16). No problems were identified by the licensee. The inspectors concluded that this event should not pose a lower inlet doors operability issue

due to the licensee's modification in the previous refueling outage to remove door frame metal flashing at the bottom of each bay's inlet doors. This modification allowed uplift of the floor to occur without flashing that could rise with the floor and interfere with door operation following a design basis accident. Completion of this modification was field verified by the inspectors during the 1EOC12 refueling outage.

In the subsequent days following the leak and its isolation, a small fraction of the leak decomposed into formaldehyde gas most likely from contact with hot equipment and pipes in the lower containment. Formaldehyde posed a health hazard to plant personnel entering the containment. The licensee monitored and sampled the atmosphere to ensure appropriate stay-time and protective actions were taken for personnel exposed to the formaldehyde gas. However, the inspectors were concerned that the licensee did not evaluate or considered the potential for glycol effects on containment under a postulated post-accident scenario and if an unreviewed safety question existed. Specifically, if a significant amount of glycol leaked during post-accident conditions, could glycol off-gas pose a combustible gas challenge to containment with the igniter system energized.

The licensee performed a preliminary evaluation of decomposition gases of glycol under different containment environmental conditions. Formaldehyde gas was the limiting gas and has lower explosion limit of 7 volume percent (or 70,000 ppm) and ignition point of 572 degrees Fahrenheit under ideal conditions. The licensee approached the issue from a consequences perspective and bounded the issue assuming 1000 gallons of glycol (at 50 percent concentration) decomposed into formaldehyde gas. Assuming one million cubic feet free volume in containment, the concentration if dispersed uniformly, would be below 60,000 ppm. At the conclusion of the inspection period, the licensee stated that the original PIP on the glycol leak will be amended to document the combustibility issue and evaluate any procedural enhancements to alert operators of potential effects should a glycol leak develop. The inspectors concluded this preliminary evaluation was reasonable and proposed actions were acceptable.

c. Conclusions

A material condition deficiency resulted in a glycol leak in the Unit 1 ice condenser.

Maintenance and engineering personnel response to an ice condenser ethylene glycol leak from a damaged air handling unit in the condenser and immediate corrective actions were good. No operability concerns were identified.

The licensee's evaluation of inspectors' concerns regarding potential containment integrity impact from the combustion of ethylene glycol off-gas (formaldehyde) under postulated design basis accident conditions was adequate.

III. Engineering

E2 Status of Engineering Facilities and Equipment

E2.1 Trip of Power to Motor Control Center (MCC) 2EMXG

a. Inspection Scope (37551, 71707)

The inspectors observed various phases of the operations, maintenance, and engineering support activities for the loss of power to MCC 2EMXG, including root cause analysis, breaker testing, troubleshooting, and recovery procedure.

b. Observations and Findings

On September 30, 1998, operators received a series of alarms indicating a loss of a control room air handling unit. An inspector was in the control room during the initiation of the event and observed the operators' response to the loss, including operator monitoring of annunciators and parameters, supervisory control, the use of alarm response and operating procedures, the starting of standby equipment, and the determination of the applicable limiting conditions for operation (LCO). It was later determined that a breaker supplying power to an essential MCC had tripped via relay actuation. No fault condition was discovered. The subject circuit breaker, 2ELXD-5C, was between the 600 volt load center 2ELXD and MCC 2EMXG.

The engineering support activities were initiated through WO 98089878. The MCC supply breaker test data indicated that the three, one for each phase, slow trip times were to be from 130 to 220 seconds and the instantaneous trips from 0.08 to 0.17 seconds. The test indicated that the slow trip times were occurring at 115, 52, and 37 seconds, respectively. The instantaneous trips were from 0.12 to 0.14 seconds. The reason for this drift in setpoints as well as the cause of the breaker tripping were not identified by the end of the inspection.

The inspectors observed that the engineers took care in planning the activities, briefing personnel before performing work, verifying equipment lineup, adhered closely to the recovery procedure, and verifying test results. The engineers displayed sound technical judgement during the root cause analysis, by discussing several possibilities, and the recovery procedure. The engineers determined that the low slow trip times were the cause of the loss of power. A refurbished replacement breaker was installed within 24 hours of the failure.

c. Conclusions

Operators' response to the loss of a Unit 2 600 volt motor control center was excellent. Immediate actions taken were prompt, deliberate, and in accordance with procedures.

- The engineering support activities for the loss of power to the motor control center displayed excellent engineering knowledge, performance, and judgement.

E8 Miscellaneous Engineering Issues (92903)

E8.1 (Closed) IFI 50-369, 370/97-17-01, Adequacy of Hydrogen Mitigation System Operability Requirements

This issue involved an NRC identified difference between the number of hydrogen igniters in the Updated Final Safety Analysis Report (UFSAR) of 70 and the number identified in TS 3/4.6.4.3, which reflected 66 igniters. During previous inspections, the inspectors verified that all 70 igniters were surveillance tested per applicable periodic test procedures in an acceptable manner. On September 30, 1998, the NRC approved the improved TS for McGuire with an effective date in 90 days which modified the hydrogen igniter TS to reflect the actual number of igniters in the McGuire units. The inspector had no further concerns in this area. This item is closed.

E8.2 Concrete Pad Design Activities for Independent Spent Fuel Storage Installation (ISFSI)

a. Inspection Scope (60851)

The inspectors reviewed concrete pad and related design calculations and drawings and visited the pad location to determine if the activities met industrial standards and regulatory requirements.

b. Observations and Findings

McGuire Nuclear Station (MNS) plans to build an ISFSI on site to store casks containing spent fuel and use a general license to be issued under 10 CFR 72 Subpart K. MNS can be granted a general license if they notify the NRC at least 90 days prior to first storage of spent fuel as stated in 10 CFR 72.210. The dry cask storage system to be used at the MNS is a TN-32 system developed by Transnuclear, Inc., Hawthorne, NY. The storage system is under review and has not been approved by the Office of Nuclear Material Safety and Safeguards (NMSS) of the NRC for use by a general license. The construction of the storage pad and casks will be at MNS's own risk. TN-32 systems were installed at two other nuclear power plants under specific licenses approved by Office of NMSS.

The inspectors discussed the project with the licensee's engineers and visited the location to be used for the ISFSI. The storage site is located west of the plant, outside the current security fence, and near the component cooling water low level pump structure. Duke Energy Corporation (DEC) performed soil boring at the storage area and soil test analyses for the boring. Law Engineering and Environmental Services, Incorporated, Charlotte, NC, performed an independent evaluation, geotechnical model, slope stability analysis, and a site investigation. Law Engineering also reviewed Duke's soil testing and concluded in LAW project 30100-8-3479 that the planned location was adequate for construction of the ISFSI. The inspectors reviewed the LAW report and agreed with the conclusions.

The MNS engineers completed preliminary calculations and drawings for the concrete pad and the associated structures. The design calculations were performed for the storage of the TN-32 casks and for the storage of heavier casks to be developed by NAC International in the future. The weight of a cask including the spent fuel assemblies is about 116 tons for a TN-32 cask and 165 tons for a NAC cask. The inspectors reviewed calculations MCC 1140.00-00-0010, "Concrete Slab (Foundation)

Analysis for Dry Cask Storage" and -0011, "Concrete Trenches Design for McGuire N. S. ISFSI." The concrete design strength for the pad is 3000 pounds per square inch. The inspectors found the following discrepancies in the calculations as shown below:

- Calculation MCC 1140.00-00-0010

  1. Evaluated the seismic accelerations (0.20 g for horizontal and 0.14 g for vertical) based on the site seismic spectra for Safe Shutdown Earthquake (SSE). The site seismic accelerations were outside the allowable accelerations (0.12 g for horizontal and 0.08 g for vertical) permitted in TN-32 Safety Analysis Report (SAR). The SAR for TN-32 needs to be reevaluated for the higher seismic area application.

  2. Did not evaluate the concrete pad's ability to withstand a TN-32 cask vertical drop of 18 inches and tipover assumed in the SAR.

  3. Used regular steel as rebar supporting chairs which would corrode and then would corrode the rebar subsequently.

  4. Did not account for the tolerance or variance of the rebar concrete coverings.

- Calculation MCC 1140.00-00-0011

  1. Used lighter weights for transporter and cask than the ones in the calculation for the concrete pad design.

  2. Did not evaluate a critical section at the trench wall 9 inches below the surface.

  3. Did not evaluate a shear crack at the top corners of the trench walls.

The inspectors discussed these discrepancies with the licensee. The licensee stated that they would review and evaluate these discrepancies. Pending NRC review of the licensee's revised calculations, this is identified as IFI 50-369,370/98-09-04, Design Discrepancies In the Calculations MCC 1140.00-00-0010 and -0011.

c. Conclusions

The design calculations for the spent fuel cask concrete pad and related structures were adequately performed in accordance with industrial standards. One inspector followup item was identified for discrepancies in the design calculations.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 General Comments (71750)

The inspectors made frequent tours of the controlled access area and reviewed radiological postings and worker adherence to protective clothing requirements. Locked

high radiation doors were properly controlled, high radiation and contamination areas were properly posted, and radiological survey maps were updated to accurately reflect radiological conditions in the respective areas.

F2 Status of Fire Protection Facilities and Equipment

F2.1 Fire Protection System Review

a. Inspection Scope (71750, 64704)

In response to the fire protection system piping leak on September 2, 1998, as discussed in Section O2.1, the inspectors performed an expanded assessment of the system's material condition and maintenance practices. Field walkdown of piping, sprinklers, and Halon systems were performed. The UFSAR, the design basis document, fire protection training material, and the National Fire Protection Association (NFPA) code requirements were also consulted.

b. Observation and Findings

During the field walkdowns, several degraded conditions were identified in addition to the items discussed in section O2.1 of this report. Excessive jockey pumps seal leakage and leaks in fire protection piping systems in the basement of the service building were noted. According to the licensee, the leaks in the piping were pin hole leaks attributed to chlorine attack (the chlorination pump injects into the system at the affected piping). The inspectors questioned if ultrasonic testing (UT) has been performed to assess significance of pipe degradation. The licensee stated that no UT exams have been performed; however, they did not consider that the structural integrity of the piping was in question. Degraded equipment in the fire protection system is repaired on an as needed basis per the licensee's program.

In the safe shutdown facility (SSF), the inspectors observed that the line pressure in the fire system piping was reading approximately 190 psig in the SSF diesel room. The pressure gauge on the discharge side of the alarm check valve read 190 psig while the supply side was reading approximately 105 psig (normal supply line pressure). The inspectors were concerned that piping may be not be qualified for this pressure and may adversely impact important to safety equipment in the SSF. According to plant drawing MCFD-1599-01.00, Fire Protection System, this segment of pipe is Duke class H pipe that was rated for 150 psi. The inspectors also noted high pressure readings (approximately 180 psig) on the alarm check valves for fire suppression supply to the main turbine generator area. The system engineer noted that the local pressure gauges on alarm checks are not in the calibration program or required to be calibrated. Also, each main fire pump has a pressure control valve (PCV) set at approximately 145 psig that should limit system pressure. The inspectors did note, however, that these PCVs were not in a preventative maintenance (PM) program prior to last year's corrective action to a problem experienced with these valves during an auxiliary building flow test. A work request was written to investigate the line pressure. This issue will be identified as IFI 50-369, 370/98-09-05, Potential Overpressurization of Fire Protection Piping, pending the inspectors' review of the licensee's evaluation and verification of line pressure and system requirements.

The inspectors also examined the two flow control valves (RY-113 and RY-114) that supply water from the yard mains to the auxiliary building. Although covered with steel

plates, these valves are exposed to environmental conditions in the pits as rain water does leak through cover plates over the equipment. The inspectors verified that annual testing of these valves was being performed.

Fire protection engineers from the Duke sites have recently performed bench marking at another utility to gain additional operating experience. The system engineer was knowledgeable and conscientious of the system design, operation, and associated NRC regulatory and NFPA code requirements. Engineering management informed the inspectors that the fire protection system was being considered for an engineering support program (ESP) review board to further improve the reliability of the system. The inspectors considered this appropriate to ensure continued functionality of the fire protection system.

c. Conclusions

Several degraded conditions of the fire protection system were observed during the inspectors' walkdowns of the system. An inspector follow-up item was identified for potential overpressurization of piping in the safe shutdown facility. Overall material condition of the fire protection system was considered adequate; although several problems were identified.

V. Management Meetings

X1 Exit Meeting Summary

The resident inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on October 9, 1998. The licensee acknowledged the findings presented. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Barron, B., Vice President, McGuire Nuclear Station
Bhatnagar, A., Superintendent, Plant Operations
Boyle, J., Civil/Electrical/Nuclear Systems Engineering
Byrum, W., Manager, Radiation Protection
Cash, M., Manager, Regulatory Compliance
Dolan, B., Manager, Safety Assurance
Evans W., Security Manager
Geddie, E., Manager, McGuire Nuclear Station
Peele, J., Manager, Engineering
Loucks, L, Chemistry Manager
Thomas, K., Superintendent, Work Control
Travis, B., Manager, Mechanical Systems Engineering

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 40500:	Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 60851	Design Control of ISFSI Components
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observations
IP 64704:	Fire Protection Program
IP 71001:	Licensed Operator Requalification Program Evaluation
IP 71707:	Conduct of Operations
IP 71750:	Plant Support
IP 90712:	LER Review
IP 92903:	Follow-up-Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED

50-369,370/98-09-01	IFI	Tracking of Corrective Actions for Procedure Weaknesses in Two ARPs for Rod Insertion Limits and the Manual Estimated Critical Boron Calculation (Section O3.1)
50-369,370/93-09-02	IFI	Tracking of Corrective Actions for Licensed Operators' Inability to Perform a Manual Estimated Critical Boron Calculation (Section O5.3)
50-369/98-09-03	IFI	Adequacy of Hydrogen Line Impact on Refueling Water Storage Tank (Section M2.2)
50-369,370/98-09-04	IFI	Design Discrepancies in the Calculations MCC 1140.00-00-0010 and -0011 (Section E8.2)
50-369, 370/98-09-05	IFI	Potential Overpressurization of Fire Protection Piping (Section F2.1)

CLOSED

50-369, 370/97-17-01	IFI	Adequacy of Hydrogen Mitigation System Operability Requirements (Section E8.1)

LIST OF ACRONYMS USED

AFW	-	Auxiliary Feed Water
AHU	-	Air Handling Unit
AO	-	Auxiliary Operator
ARP	-	Annunciator Response Procedure
ATWT	-	Anticipatory Transient Without Trip

BOP	-	Balance OF Plant
CFE	-	Containment Floor and Equipment
CFR	-	Code of Federal Regulations
COLR	-	Core Operating Limits Report
CR	-	Control Room
DBA	-	Design Basis Accident
DEC	-	Duke Energy Corporation
ECB	-	Estimated Critical Boron Concentration
EDG	-	Emergency Diesel Generator
EOC	-	End of Operating Cycle
ESP	-	Engineering Support Program
F	-	Fahrenheit
GL	-	Generic Letter
IFI	-	Inspector Follow-up Item
IN	-	Information Notice
IR	-	Inspection Report
ISFSI	-	Independent Spent Fuel Storage Facility
JPM	-	Job Performance Measure
KV	-	Kilo-volt
LCO	-	Limiting Condition for Operation
LER	-	Licensee Event Report
LOCA	-	Loss of Coolant Accident
MCC	-	Motor Control Center
MNS	-	McGuire Nuclear Station
NFPA	-	National Fire Protection Association
NMSS	-	Nuclear Materials Safety andSafeguards
NRC	-	Nuclear Regulatory Commission
NRR	-	NRC Office of Nuclear Reactor Regulation
NSD	-	Nuclear Site Directive
PCV	-	Pressure Control Valve
PDR	-	Public Document Room
PIP	-	Problem Investigation Process
PM	-	Preventive Maintenance
PPM	-	Parts Per Million
PSIG	-	Pounds Per Square Inch Gauge
PT	-	Periodic Testing
RCA	-	Radiogically Controlled Area
RCS	-	Reactor Coolant System
RIL	-	Rod Insertion Limit
RNO	-	Response Not Obtained
RO	-	Reactor Operator
RP	-	Radiation Protection
RWST	-	Refueling Water Storage Tank
SAR	-	Safety Analysis Report
SDM	-	Shutdown Margin
SFP	-	Spent Fuel Pool
SG	-	Steam Generator
SI	-	Safety Injection
SRO	-	Senior Reactor Operator
SSE	-	Safe Shutdown Earthquake
SSF	-	Safe Shutdown Facility
T	-	Temperature

Tavg	-	Average Temperature
Tref	-	Reference Temperature
TS	-	Technical Specifications
UFSAR	-	Updated Final Safety Analysis
USQ	-	Unreviewed Safety Question
UT	-	Ultrasonic Testing
V	-	Volt
WO	-	Work Order