



UNITED STATES  
 NUCLEAR REGULATORY COMMISSION  
 REGION II  
 101 MARIETTA STREET, N.W.  
 ATLANTA, GEORGIA 30323

Report Nos.: 50-369/84-34 and 50-370/84-31

Licensee: Duke Power Company  
 422 South Church Street  
 Charlotte, NC 28242

Docket Nos.: 50-369 and 50-370

License Nos.: NPF-9 and NPF-17

Facility Name: McGuire 1 and 2

Inspection Conducted: November 2 - 3, 1984

Inspector: *[Signature]* for *[Signature]* 2/20/85  
 F. R. McCoy Date Signed

Accompanying Personnel: R. Pearson

Approved by: *[Signature]* for *[Signature]* 2/20/85  
 C. Julian, Section Chief Date Signed  
 Operational Programs Section  
 Division of Reactor Safety

SUMMARY

Scope: This special, unannounced inspection involved fourteen inspector-hours on site in the area of event followup. The events included inability of upper head injection (UHI) accumulator isolation valves to close at the required accumulator water level and the existence of total dissolved nitrogen in the accumulator in excess of specified limits.

Results: In the areas inspected, three violations were identified: (1) operation of Units 1 and 2 with UHI inoperable in violation of Technical Specifications (see paragraph 4.b.); (2) failure to provide adequate instructions to assure proper installation of the Unit 1 UHI differential pressure transmitters (see paragraph 4.d.); and (3) failure to provide appropriate procedural acceptance criteria necessary to ensure that Unit 1 UHI accumulator system differential pressure instruments were correctly installed (paragraph 4.c.).

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## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees Contacted

- \*K. S. Canady, Manager Nuclear Engineering Services
- \*M. D. McIntosh, Plant Manager
- \*G. W. Cage, Superintendent of Operations
- D. J. Rains, Superintendent of Maintenance
- \*R. B. White, IAE Engineer
- \*D. Mendezoff, Licensing Engineer
- \*D. Bradshaw, Operating Engineer
- \*R. Phillips, Assistant Operating Engineer
- \*E. E. Estep, Project Services Engineer
- M. D. Beam, Construction Planning and Cost Supervisor
- S. Luttrall, Quality Assurance
- \*L. Kimray, Power Chemistry Coordinator
- K. W. Reece, IAE
- \*A. F. Batts, Quality Assurance
- \*E. D. McCraw, Compliance Engineer

#### NRC Resident Inspector

- W. T. Orders
- R. C. Pierson

- \*Attended exit interview

### 2. Exit Interview

The inspection scope and findings were summarized on November 5, 1984, with those persons indicated in paragraph 1 above, during a telephone conference call. Violations described in paragraph 4., operation of Units 1 and 2 with UHI inoperable in violation of Technical Specifications, resulting from failure to perform a functional test which would demonstrate that the UHI accumulator system would perform satisfactorily in service following replacement of UHI accumulator differential pressure instruments and failure to provide appropriate procedural acceptance criteria necessary to ensure the UHI accumulator system differential pressure instruments were correctly installed, were discussed in detail.

In addition, two unresolved items\*\* were identified (resolution of nitrogen gas entrainment in UHI accumulator water (see paragraph 5), and ascertaining full accumulator reference leg during normal operating and accident conditions (see paragraph 5)).

\*\*Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violations or deviations.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Failure of UHI Accumulator Isolation Valves to Close at the Required Accumulator Water Level

On November 1, 1984, an event was reported at McGuire Nuclear Station, under 10 CFR 50.72. This event was the failure of UHI accumulator isolation valves to close at the required UHI accumulator water level. On November 2 - 3, 1984, an inspector from Region II visited McGuire Nuclear Station in order to evaluate this event.

a. Sequence of Events

McGuire Nuclear Station Unit 1 was in Mode 3 with pressurizer pressure less than 1900 psi and with the UHI accumulator declared inoperable due to accumulator water chemistry not meeting Technical Specification Requirements (see paragraph 5). Additionally, McGuire Nuclear Station Unit 2 was operating at less than 45% power in Mode 1 with the UHI accumulator declared inoperable and isolated from the plant due to similar water chemistry problems.

In an attempt to resolve water chemistry problems associated with the Unit 1 and Unit 2 UHI accumulators, actions were taken by the licensee to depressurize, drain, and refill both accumulators. During the draining of the Unit 1 accumulator on October 31, 1984, the UHI accumulator isolation valves failed to close. These valves are required to automatically close by Technical Specifications when the water level is lowered to  $76.25 \pm 3.3$  inches above the bottom inside edge of the water-filled accumulator in order to prevent injection of nitrogen gas into the reactor vessel during UHI injection.

This event led to an investigation by the licensee which revealed on November 1, 1984, that the four Unit 1 UHI accumulator differential pressure instruments had been incorrectly connected to the accumulator during a plant modification in April 1984. This plant modification replaced the UHI accumulator Barton differential pressure instruments with Rosemont differential pressure instruments. Additionally, this investigation revealed that the functional testing associated with this modification consisted only of a calibration test of the differential pressure instruments. This did not provide a sufficient method for verifying proper installation of the differential pressure instruments or for demonstrating that the UHI accumulator would function satisfactorily in service following this modification.

During subsequent corrective actions associated with correctly connecting the differential pressure instrument to the accumulator and properly functionally testing the accumulator with respect to this work

on November 2 -3, 1984, it was determined by the licensee that the accumulator differential pressure instrument trip set points had previously been erroneously set in March 1983, due to an engineering error in the calibration procedure which established those set points.

As a result of the problems noted with the Unit 1 accumulator, an investigation was conducted by the licensee from November 1 to November 4, 1984, in order to determine the condition of the Unit 2 UHI accumulator. This investigation revealed that:

- (1) Unlike Unit 1, the four Unit 2 UHI accumulator differential pressure instruments had been properly connected during a plant modification in January, 1984 which replaced the Unit 2 accumulator differential pressure instrument.
- (2) As was the case with Unit 1, the Unit 2 accumulator differential pressure instrument trip set points had been erroneously set in February 1983 due to the same engineering error in the calibration procedure.
- (3) The functional testing associated with replacing the Unit 2 UHI accumulator differential pressure instruments consisted only of a calibration of the differential pressure instruments and did not provide a sufficient method for demonstrating that the UHI accumulator would function satisfactorily in service.

b. Operation Of Units 1 And 2 With UHI Inoperable

As a result of an engineering error in Calibration Procedure 1P/O/A/3000/03E change 0 and Change 1 the differential pressure set point at which the Unit 1 and Unit 2 differential pressure instruments would generate a valve closure signal for the accumulator isolation valves was 24 inches of water pressure higher than that required for proper valve closure. This condition existed on Unit 1 since March 23, 1983 and Unit 2 since initial entry into Mode 3 on April 21, 1983. In the case of Unit 1, following the April 1984 differential pressure instrument modification described in paragraph 4.c, this condition would not have had an effect on UHI actuation since automatic valve closure could not occur for that Unit. For Unit 1 prior to the April 1984 modification and for Unit 2 this condition could have resulted in charging approximately 3200 gallons (22% of tank capacity), less than the prescribed quantity of borated water for UHI injection under accident conditions.

Since March 23, 1983, Unit 1 was operated in modes requiring operable UHI with the UHI accumulator inoperable due to an erroneously set valve closure trip setpoint. Since April 21, 1983, Unit 2 was operated in modes requiring operable UHI with the UHI accumulator inoperable due to an erroneously set valve closure trip setpoint.

This is a violation (369/84-34-01, 370/84-31-01)



- c. Failure to Perform a Functional Test Which Would Demonstrate that the UHI Accumulator Would Function Satisfactorily Following Replacement of UHI Accumulator Differential Pressure Instruments

Following replacement of the UHI accumulator differential pressure instruments on Unit 1 in April 1984 and Unit 2 in January 1984 the functional test associated with these modifications consisted only of a calibration of the differential pressure instruments in accordance with Calibration Procedure IP/O/A/3000/03E change 0 (Unit 2) and Change 1 (Unit 1). This calibration was performed with the differential pressure instruments isolated from the process and reference legs of the accumulator and simply checked that the instruments would provide the required output signal for a given differential pressure and if necessary reset the trip set point to be consistent with a given applied differential pressure. There was no test performed that would demonstrate that the instruments sensed the proper differential pressure with respect to UHI accumulator water level (either actual or simulated). Since April 25, 1984, Unit 1 was operated in modes requiring operable UHI with the UHI accumulator inoperable due to inability to automatically close accumulator isolation valves. For Unit 1, functional testing was inadequate and unable to detect that the differential pressure instruments were incorrectly installed resulting in inability to automatically close the accumulator isolation valves.

This is a violation (369/84-34-03)

Subsequent to this event, the licensee revised Calibration Procedure IP/O/A/3000/03E, "UHI Tank Level With Transmitter Current Loop Calibration" to provide for a calibration technique for UHI accumulator differential pressure instruments that uses simulated accumulator water level in conjunction with the actual accumulator reference leg level in order to calibrate the differential pressure instrument. This revised calibration procedure is considered to provide an adequate method for performance of accumulator functional testing associated with UHI accumulator differential pressure instrument work.

It appears appropriate that the licensee should review functional testing procedures associated with other plant differential pressure instruments in order to ascertain that such testing will demonstrate that affected structures, systems, and components will perform satisfactorily in service following work associated with these instruments. Where such testing is determined to be inadequate action should be taken to resolve these inadequacies. Inspector Followup Item (369/84-34-06 and 370/84-34-04).

- d. Failure To Provide Appropriate Procedural Acceptance Criteria Necessary To Ensure That Unit 1 UHI Accumulator system Differential Pressure Instruments Were Correctly Installed

The plant modification of April 1984 that replaced Barton differential pressure instruments with Rosemont differential pressure instruments

for the Unit 1 UHI accumulator was accomplished in accordance with shutdown request 7508 and Nuclear Station Modification Design Summary NSM MG-1210.

The Rosemont differential pressure instruments were connected to the accumulator with the accumulator process leg connected to the high pressure port of the instrument and the accumulator reference leg connected to the low pressure port of the instrument. This configuration was incorrect for proper operability of the Rosemont instruments.

The installing documents and configuration schematic used to replace the differential pressure instruments did not provide adequate direction with respect to connection of the Rosemont instrument to ensure that it was installed in the proper configuration for operation. Additionally there were no requirements associated with this work to trace the lines in order to assure that the proper line was connected to the proper instrument port.

This is a violation (369/84-34-02).

The need for detailed, comprehensive instructions in this particular application is especially important considering the following conditions which could provide sources of confusion during installation:

- (1) The Barton switches which were previously installed, were reverse rotation instruments rather than direct acting. Consequently, the high and low pressure parts of these instruments were located on reverse sides (left/right) of the instrument body when compared to direct acting instruments such as the Rosemounts.
- (2) The impulse lines for Unit 2 are piped into the valve manifold on reverse sides (left/right) when compared to Unit 1. Consequently, the differential pressure instruments are required to be hooked up differently on Unit 1 than on Unit 2. Unit 2 had previously been connected properly in January 1984. Had a mechanic observed the Unit 2 configuration in preparation for accomplishing the Unit 1 modification, he could have been misled by this observation.
- (3) The instruments are physically located such that it is difficult to determine which instrument part is high pressure and which instrument part is low pressure.

On October 22, 1984, prior to discovery of this event (yet after the plant modifications that replaced the subject instruments), the licensee stated that the work control process by which instruments and instrument lines are replaced had been revised to be under the work request control process rather than the shutdown request control process. The licensee issued a new procedure IP/O/A/3090/25 "Installation of Instruments and Instrumentation Lines" to accomplish this type

of work. This procedure now requires that, as part of the data sheet, "impulse lines are connected to proper high and low pressure ports" be verified as a required acceptance criteria.

The licensee has committed to more explicitly define this within the body of the procedure.

#### 5. UHI Accumulator Water Chemistry Out Of Specification

On October 27, 1984, during a routine surveillance verifying boron concentration of the Unit 1 UHI accumulator, the technician performing the sample suspected a possible excessive gas and air entrainment condition with respect to the water in the accumulator as a result of the sample appearing to be cloudy. On October 29, 1984, the licensee commenced total dissolved gas sampling of the Unit 1 accumulator to determine if an excessive gas entrainment of the water in the accumulator-did in fact exist. On October 30, 1984, three sets of samples at two sample points (high and low) were completed and analyzed for Unit 1. These samples indicated that the Unit 1 UHI accumulator water total dissolved nitrogen and air was in excess of technical specification limits by approximately 17%. Upon obtaining this confirmation that the water chemistry was out of specification, the licensee declared the Unit 1 UHI accumulator inoperable and took action to shutdown the unit to Mode 3 and decrease pressure to less than 1900 psi which is outside the applicable operating modes requiring operable UHI for Unit 1.

As a result of this event, five samples were drawn on the Unit 2 UHI accumulator to determine the chemistry condition. These samples indicated that the Unit 2 UHI accumulator water total dissolved nitrogen and air was in excess of technical specification limits by a factor of 10. Upon obtaining confirmation that the Unit 2 water chemistry was out of specification, the licensee declared the Unit 2 UHI accumulator inoperable, isolated the accumulator and decreased power to less than 45% which, as of November 1, 1984, is outside the applicable operating modes requiring operable UHI for Unit 2.

The licensee stated that he had confirmed that the problem with water chemistry was not a result of a ruptured diaphragm on either unit and indicated that the problem may be related to leakage from the accumulator resulting in surge tank water (which has a direct nitrogen gas interface) being admitted into the accumulators.

The licensee should continue to pursue identifying the cause of the nitrogen entrainment in the UHI accumulators and take actions to preclude a buildup to an out of specification condition as specified in the Technical Specifications. This is identified as an Unresolved Item (369/84-34-04, 370/84-31-02).

As a result of this event the licensee committed to sampling each accumulator daily for total dissolved nitrogen and air in order to ascertain that the entrainment is not an immediate acting occurrence. This sampling is to continue at this frequency until conditions dictate acceptability to

the licensee for modifying the frequency and subsequently terminating this special analysis.

During the performance of corrective actions to depressurize, drain, and refill the Unit 2 UHI accumulator the licensee evaluated the performance of the differential pressure instruments for Unit 2 with respect to decreasing level in the accumulator. Results of this evaluation were inconclusive in that the accumulator reference leg contained sufficient gas volume to render it incapable to support proper functioning of the differential pressure instruments. The licensee suspects the problem to be attributed to depressurization of the reference leg which would result in entrained gas within the reference leg water coming out of solution. There is cause for concern because the reference leg may not remain full of water during UHI injection under accident conditions due to decreasing pressures associated with the transient. If this condition should occur it could result, depending on the extent of degassing involved, in the differential pressure instruments failing to detect the proper differential pressure at the water level necessary to initiate closure of the accumulator isolation valves. This in turn could result in the valves remaining open and admitting nitrogen gas into the reactor during UHI injection under accident conditions. It is considered that the licensee should ascertain that gas accumulation in the reference leg is not occurring under normal operating pressure conditions and that gas accumulation and voiding of the reference leg will not occur during UHI injection under accident conditions. This is identified as an Unresolved Item (369/84-34-05, 370/84-31-03).