UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

Report Nos.: 50-369/84-26 and 50-370/84-23

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

Inspection at: McGuire site near Huntersville, North Carolina

Inspection Conducted: August 20-22, 1984

Inspectors: D. P. Falconer — Date Signed: 9/20/84

S. D. Stadler — Date Signed: 9/20/84

R. H. Albright — Date Signed: 9-21-84

Approved by: C. A. Julian, Section Chief
Division of Reactor Safety — Date Signed: 9/21/84

SUMMARY

Scope: This routine, unannounced inspection entailed 62 inspector-hours (8 inspector-hours on backshift) at the site in the areas of event followup.

Results: No violations/deviations were identified.

REPORT DETAILS

1. Licensee Employees Contacted

*G. W. Cage, Superintendent of Operations
T. L. McConnell, Superintendent of Technical Services
*D. J. Rains, MNS - Superintendent of Maintenance
R. Phillips, Assistant Operating Engineer
M. G. Semmler, Assistant Engineer (MSRG)
*D. Mendezoff, Licensing Engineer
*K. W. Miller, Jr., QA Technical Support (Mechanical)

Other licensee employees contacted included technicians, operators, and mechanics.

NRC Resident Inspector

*R. Pierson, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on August 22, 1984, with those persons indicated in paragraph 1 above. The licensee acknowleged the inspection findings.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items*

Unresolved items were not identified during this inspection.

5. Upper Head Injection Vent Line Rupture

On August 20, 1984, an unusual event was declared when a small reactor coolant leak developed inside the Unit 2 containment at 7:15 a.m. while venting the upper head injection (UHI) system. The unit was in preparation for startup (1800 psi and 520 degrees F) from a July 27, 1984 maintenance outage. The unusual event was terminated at 11:00 a.m. when the licensee isolated the leak.

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*An Unresolved Item is a matter about which more information is required to determine whether it is acceptable or may involve a violation or deviation.

The leak occurred through a failed sight glass on the UHI vent line to the pressurizer relief tank (PRT). The sight glass (50 psig rating) failed when operators opened the vent line isolation valve (2NI356) in preparation for venting the UHI side of the UHI/RCS interface check valve.

Investigation by the licensee indicates that an operator failed to fully seat the vent line isolation valve (2NI341) that isolates the RCS side vent of the UHI/RCS check valve when he closed it at the conclusion of the RCS vent at 50 psig two days earlier. When operators opened the downstream vent line isolation valve 2NI356 in preparation for the UHI vent, RCS leakage by valve 2NI341 resulted in the vent line being pressurized to the RCS system pressure of 1800 psig and rupturing the sight glass.

Approximately 4800 gallons of RCS inventory was lost through the ruptured sight glass. Inventory loss rate was within the makeup ability of the chemical and volume control system. The leakage into containment resulted in a maximum compartment temperature of 129.5°F and an average relative humidity of approximately 85 percent.

The inspector discussed the health physics controls during the event with licensee personnel. Containment was immediately evacuated at event initiation. The in-containment radioactivity air concentration measured during the event was approximately 0.27 MPC, mainly Co-58. All personnel were required to wear plastic rain suits and SCBAs during containment entries to identify and isolate the leak. There were two personnel who had skin contamination. Both skin contaminations were small areas with a maximum of 250 counts per minute above background. An air sample taken in the vicinity of the broken sight glass, at approximately 3:00 p.m., measured 0.026 MPC, mainly Co-58.

The licensee analyzed a 50 ml sample of water from the leak which indicated Co-58 and Co-60 as the major contributors at 2.12E-2 µc/ml and 4.803E-3 µc/ml, respectively. The health physics controls during the event appeared adequate.

The licensee investigated lower containment for damage to instrumentation and piping in the vicinity of the ruptured sight glass. The inspectors conducted an independent survey of lower containment for damage. No problems were identified. The licensee repaired the sight glass and reinitiated unit heatup.

Discussions with numerous plant personnel indicate that the type of vent valve in use is often difficult to fully close. This valve has a history of performance problems and the licensee has provided supplementary training to the operators on proper manipulation technique.

The inspectors observed the licensee's reventing of the UHI system. The vent procedure and method was changed to require pyrometer readings down stream of the RCS vent isolation valves to verify that no RCS leakage exists

prior to opening the common vent line isolation valves leading to the PRT. Minor seat leakage was indicated during the vent at another RCS vent isolation valve. It was corrected by tightening-down on the valve. No other problems were observed during this vent process.

The licensee performed an independent verification of all similar UHI vent line valves at the conclusion of the UHI system vent. Startup continued normally until the unit trip on August 21, 1984, detailed in paragraph 7.

The licensee's response to the event appears to have been adequate. Paragraph 6 below, details several concerns identified by the inspectors during the event review.

Within the area inspected, no violations or deviations were identified.

6. Kerotest Valve Problems

As stated in paragraph 5, the cause of the reactor coolant leak event on August 20, 1984, was that vent valve 2NI341 was not fully closed, which allowed reactor coolant pressure to leak by and rupture a sight glass. The type of valve utilized in this application is a Kerotest packless globe valve which is operated by a tee-handle, has only 1/8 inch stem travel, and requires only one turn from full open to full closed positions. This type of valve is both difficult to fully close and to verify that it is fully closed.

On August 22, 1984, the inspectors met with McGuire representatives from Operations, Maintenance, Quality Assurance, and Licensing, and via a conference call with Duke Design personnel familiar with Kerotest valves and problems. The licensee provided a copy of a Duke Power Company report on Kerotest valve application dated April 8, 1981. The report was generated in response to various problems identified with Kerotest valves including "valve plugging, seat leakage, poor throttling characteristics, bidirectional flow limitations, steam and seat damage, and maintenance difficulties." The report summary concluded the following:

> Never select a packless globe valve for applications unless zero stem leakage to atmosphere is an absolute requirement. Make sure the system has no potential for plugging the valve. Do not use this valve for throttling or bidirectional flow unless absolutely necessary and after the equipment group engineer has been consulted. Be careful not to overtorque the valve stem. The operator must be thoroughly familiar with this valve. Follow recommended welding procedures. Allow adequate room for maintenance.

The licensee has proposed a modification to the Safety Injection (NI) and Reactor Coolant (NC) systems to better facilitate venting of the Reactor Coolant System. This proposal points out the personnel and equipment

hazards associated with the present method of Reactor Coolant System venting and requests the installation of a third isolation valve in each of the vent lines with the capability of being operated from a remote location, and also the replacement and relocation of the sight glass. The proposed modification is presently in the design review stage and a final implementation decision has not been made.

The Region has reviewed concerns expressed by station personnel, the 1981 Duke report on Kerotest valve problems, the proposed Reactor Coolant System venting modification and identified hazards, the positions taken by station representatives at the August 22 Kerotest meeting, and the contribution of the Kerotest valves to the small LOCA event on August 20, 1984. Based on this review, the following recommendations have evolved:

a. Independent verification should be performed on all vents and drains connecting with the reactor coolant pressure boundary.

b. A program should be established for the systematic replacement of Kerotest valves utilized in the reactor coolant pressure boundary with another type of valve less prone to plugging, seat damage, and over-torquing.

c. A preventative maintenance program should be established for Kerotest valves, particularly when they are utilized in the reactor coolant pressure boundary where leakage is limited by technical specifications. An alternative to preventative maintenance would be the replacement of a percentage of these valves at each refueling outage.

d. Investigate further, including consultation with the vendor, the feasibility of establishing a standard torque to be applied to Kerotest valves when closing. The torque would be ensured by the use of torque wrench on the tee-handles, and would be sufficient to ensure zero leakage, but not great enough to cause damage to the seat or diaphragm. When the "standard torque" had to be exceeded to stop leakage, a maintenance request would be written.

e. Implement interim safety precautions and equipment modifications to alleviate the concerns and personnel hazards described in the proposed modification package.

f. Relocate, or adequately modify, Kerotest valves which are difficult to operate, or verify the position of, due to obstructions such as cable trays, piping, and walls. Several station personnel expressed the opinion that the valve involved in the event was not fully closed because it was up against a cable tray.

g. Provide additional Operations training or retraining to include as a minimum the following areas:

(1) Only one turn or less is required to fully open or close the valves.

(2) Valve travel is very small, only about 1/8 inch, and the damage which can be caused by overtorquing.

(3) The maximum torque which should be applied on closing. If this torque must be exceeded to stop leakage, a maintenance request should be written.

(4) Kerotest valves should never be throttled.

(5) The locations of reactor coolant pressure boundary vents and drains and the normal and alternate access routes. Also the physical hazards and expected radiation levels for each route.

f. Approve and establish an early date for implementation for the proposed modification (MG2-0371) for venting of the reactor coolant system.

The above recommendations have been identified as Inspector Followup Item (369/84-26-01).

7. Loss of Offsite Power Transient

On August 21, 1984, at 9:48 p.m., McGuire Unit 1 experienced a loss of offsite power transient as a result of multiple 230 kv switchyard breakers opening due to a malfunction of the switchyard computer/remote breaker control system. The inspectors observed portions of the licensee's event response and recovery activities.

Sequence of Events

The licensee first identified problems with the switchyard computer control system on August 20, 1984, when it was discovered that the system load dispatcher had loss remote control capability of the breakers in the 230kv switchyard for which he had purview. The control outputs of the computer were disabled and trouble shooting was initiated. After completing minor corrective maintenance and reloading the computer software, the licensee attempted to re-enable the computer control outputs. When the "Enable" switch was depressed at 9:47 p.m. on August 21, every 230kv switchyard breaker and disconnect (except for the breakers that are controlled by the McGuire station PCB 8, 9, 11, 12) opened.

Unit 1 was operating at 100 percent power tied to the 230kv switchyard and two 230kv transmission lines. The unit tripped on High Flux Rate (greater than five percent increase in excore power in two seconds on two out of four excore nuclear instrumentation power range channels) as a result of spurious electrical spikes on the excore channels. Simultaneously, the two 230kv transmission lines tripped due to overload resulting in a loss of offsite power to Unit 1 (the 525kv switchyard to which Unit 2 is tied remained energized).

Station blackout logic was initiated. Both diesel generators started, equipment sequencing occurred as expected and natural circulation was established. Letdown isolated on a spurious spike on a pressurizer level channel.

Reactor coolant system cooldown was greater than expected (58 degrees F in 12 minutes) due to Unit 1 being aligned to supply the auxiliary steam header for the startup of Unit 2. Due to the excessive cooldown and depressurization of the RCS, the main steam isolation valves (MSIV) were manually closed and the steam generator Power Operated Relief Valves (PORVs) were used as the secondary heat sink.

Closing the Unit 1 MSIVs resulted in the isolation of the auxiliary steam header and trip of the Unit 2 Feedwater Pump/Turbine supplying feedwater for the Unit 2 startup. Unit 2 was subcritical in Mode 3 with the 'A' and 'B' shutdown control rod banks withdrawn. Unit 2 subsequently tripped on low-low steam generator level at 10:26 p.m. when operators were unable to recover steam generator level with auxiliary feedwater.

The licensee declared an unusual event due to the loss-of-offsite power to Unit 1. Power was restored to the 230kv switchyard at 10:20 p.m. The unusual event was terminated at 2:45 a.m., August 22 when the MSIVs were opened establishing a normal heat sink. Both units were stabilized at Hot Standby conditions following the event. A post trip review was conducted to determine the causes and effects of the transients and the corrective actions required prior to unit restart.

Post Trip Review

The licensee determined that the High Flux Rate trip was the result of a spurious signal on the excore channels due to voltage feedbacks that occurred during the electrical transient. Investigation of system parameters did not indicate any changes that could support an actual reactivity excursion. In addition, other instruments showed similar channel spikes.

The trip of the Unit 1 secondary side pumps on the loss-of-offsite power and subsequent closing of the MSIVs resulted in flashing and water hammers being generated in the condensate system. The licensee walked down the secondary side to locate possible damage caused by the transient. Minor damage to the condensate booster pump discharge pressure gages was identified and repaired.

During the transient, breakers opened on radiation monitors 38, 39 and 40 on both Units resulting in Containment Ventilation Isolation. The licensee is continuing the investigation of this occurrence.

Prior to unit restart, the licensee removed the interposing relays between the switchyard computer and the switchyard breakers. This prevents remote control of the breakers and the possibility of generating open signals to the breaker due to a similar malfunction. The licensee plans to investigate and correct the malfunction, and to reinstall the interposing relays one at a time to prevent another loss of offsite power. Long term design changes are being developed. This will be identified as an Inspector Followup Item (369/84-26-02).

Within the areas inspected, no violations or deviations were identified.