U.S. NUCLEAR REGULATORY COMMISSION

REGION II

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Licensee:	Duke Power Company
Facility:	McGuire Generating Station, Units 1 and 2
Location:	12700 Hagers Ferry Rd. Huntersville, NC 28078
Dates:	June 29 - August 9, 1997
Inspectors:	M. Sykes, Acting Senior Resident Inspector M. Franovich, Resident Inspector D. Forbes, Regional Inspector (Sections R1.1, R5.1 N. Economos, Regional Inspector (Sections M1.2, M1.3)
Approved by:	C. Ogle, Chief, Projects Branch 1 Division of Reactor Projects

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Enclosure

EXECUTIVE SUMMARY

McGuire Generating Station, Units 1 and 2
NRC Inspection Report 50-369/97-10, 50-370/97-10

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a six week period of resident and region-based inspection.

Operations

- In general, the conduct of operations was satisfactory. (Section 01.1)
- The inspector concluded that the licensee made NRC notifications in accordance with the requirements of 10 CFR 50.72. (Section 02.1)
- The licensee's trip response and recovery following the Unit 2 low reactor coolant flow automatic trip was good. The inspectors noted that the current program for replacement of the reactor coolant pump motors on a rotational basis is adequate to improve coolant pump motor reliability. Preventing similar failures prior to the completion of the coolant pump motor rewind program may be an operational challenge. (Section 02.2)

Maintenance

- Routine maintenance activities observed by the inspectors were completed satisfactorily. (Section M1.1)
- The inspectors determined that the installation and testing of the subject motor was performed by personnel that were adequately trained to perform their assigned tasks. Procedures used on this activity were well written and provided adequate direction and details to successfully complete the task. (Section M1.2)
- A review of fabrication records and nondestructive examination results disclosed that weld fabrication and associated activities were conducted in a satisfactory manner. (Section M1.3)
- Activities associated with the steam generator (S/G) replacement project were being performed by adequately trained personnel in a conscientious manner. Housekeeping of facilities where the S/Gs were being stored were maintained at an appropriate level. Material used was in compliance with applicable code requirements. (Section M1.3)
- The licensee's repair efforts were appropriate to ensure proper performance of main feedwater isolation valve 2CF28. The valve was verified to meet stroke time requirements and operated as designed to isolate feedwater following a safety signal. (Section M2.1)
- The repair of a failed instrument line at the Unit 1 moisture separator reheater crossover piping was adequately planned and executed. Pre-job

briefings emphasized personnel safety and the repair received good management oversight. (Section M2.2)

- Performance in planning and executing the repair of the number 3 main steam stop valve actuator stem was good. Appropriate emphasis was placed on personnel safety and the licensee made prudent decisions to minimize the probability of unplanned reactivity incidents. (Section M2.3)

- Corrective actions for the Unit 1A emergency diesel generator (EDG) 6L cylinder exhaust valve oil leak were prompt and effective. The root cause evaluation was thorough and it did not appear that a common mode failure existed. Station personnel were very knowledgeable of the EDG system. (Section M2.4)

- The inspectors concluded that the licensee's performance in meeting established work management goals was good. Prioritization of work activities was evident. Although no instances of missed preventive maintenance activities were identified, some process deficiencies were noted. (Section M3.1)

Engineering

- The licensee's decision to continue using the instrument air supply for nozzle dam seals prior to completing a Temporary Modification (TM) was, in this case, acceptable. The responsible engineer's immediate and detailed investigation of system performance was indicative of a good questioning attitude. A Non-Cited Violation was identified for the initial failure to implement the TM process. (Section E4.1)

- The Operating Experience Program has adequately assisted the McGuire Nuclear Station in timely evaluation and resolution of relevant industry issues. Site specific actions to resolve specific issues have adequately sustained nuclear safety and equipment reliability. (Section E6.1)

- The licensee's evaluation did not appear to address the validity of the isotopic gap fractions used in the Updated Final Safety Analysis Report (UFSAR) Table 15-35 for the fuel handling accident analysis for high burnup fuel prior to exceeding the burnup limit specified in Regulatory Guide 1.25 (basis for the table). Insufficient information existed to determine if the radiological consequences were acceptable for an accident involving high-burnup fuel; therefore, this issue is identified as an Unresolved Item. (Section E7.1)

Plant Support

- Radiological facility conditions and housekeeping in radioactive waste storage areas were good. Material was labeled appropriately, and areas were properly posted. All exposures were below regulatory limits and the licensee was continuing to maintain exposures As Low As Reasonably Achievable. (Section R1.1)

- Based on a review of training activities for radiation protection technicians, the inspectors determined radiation protection technicians were receiving an appropriate level of training to accomplish the work activities observed. (Section R5.1)

Report Details

Summary of Plant Status

Unit 1 began the period at 100 percent rated thermal power. On July 1, a leak was identified at an instrument line on the Unit 1 high pressure turbine crossover piping to a Moisture Separator Reheater (MSR). Unit 1 output was reduced to approximately 20 percent to complete repairs. Unit 1 was returned to 100 percent power on July 2. On July 3, the number 3 high pressure turbine stop valve closed with the unit at 100 percent power. On July 12, power was reduced to approximately 95 percent to realign the number 3 turbine stop valve to its normal position. Following restoration of full power later that day, Unit 1 operated at 100 percent for the remainder of the reporting period.

Unit 2 began the period at approximately 28 percent power following an unplanned shutdown to repair an approximately 70 gpd steam generator leak in the 2A steam generator. Unit 2 reached 98 percent power on July 1. Power output was limited because of reduced steam pressure from significant steam generator tube plugging. Feedwater heating steam was throttled back to increase main turbine pressure and power output reached 100 percent. On July 11, Unit 2 automatically tripped on low reactor coolant system flow as a result of the failure of the 2D reactor coolant pump motor. While shutdown, the licensee determined that 10 of 48 ice condenser inlet doors were inoperable because of upward ice condenser floor movement. After repairs to the failed reactor coolant pump motor and lower ice condenser inlet doors were made, Unit 2 was returned to Mode 1 on July 22. On August 4, power was reduced to approximately 95 percent to complete Moderator Temperature Coefficient measurement. Unit 2 was returned to 100 percent power on August 5 and continued to operate at 100 percent power for the remainder of the reporting period.

Review of Updated Final Safety Analysis Report (UFSAR) Commitments

While performing inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that were related to the areas inspected. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures, and/or parameters.

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; specific events and noteworthy observations are detailed in the sections below.

O2 Operational Status of Facilities and Equipment

O2.1 10 CFR 50.72 Notifications

a. Inspection Scope (71707)

During the inspection period, the licensee made the following notifications to the NRC. The inspectors reviewed the events for impact on the operational status of the facility and equipment.

b. Observations and Findings

- On July 11, 1997, the licensee made a report in accordance with 10 CFR 50.72 due to an automatic Unit 2 trip on low reactor coolant system flow. The low flow condition was the result of a reactor coolant pump trip due to a stator fault.

- On July 12, 1997, the licensee made a report in accordance with 10 CFR 50.72 due to an unplanned Unit 2 ice condenser inlet door actuation. The licensee subsequently retracted the notification after verification that the actuation was not an Engineered Safeguard Feature actuation.

- On July 18, 1997, the licensee made a report in accordance with 10 CFR 50.72 due to 10 of 48 Unit 2 lower ice condenser doors being declared inoperable. The doors were suspected to have been inoperable during Modes 1, 2, 3, and 4.

c. Conclusions

The inspectors concluded that the licensee reported the above events in accordance with the requirements of 10 CFR 50.72.

O2.2 Automatic Unit 2 Reactor Trip - Low Reactor Coolant Flow

a. Inspection Scope (93702, 40500)

On July 11, Unit 2 automatically tripped from 100 percent reactor power due to low reactor coolant flow with reactor power greater than 48 percent. The main turbine automatically tripped following the reactor trip. Both motor driven auxiliary feedwater pumps started on low-low steam generator level in one steam generator. The 2D Reactor Coolant Pump (RCP) tripped, causing the low reactor coolant flow condition. The inspectors responded to the event, interviewed operations personnel, and evaluated equipment performance.

b. Observations and Findings

Following the reactor trip, the licensee conducted extensive investigations of the 2D RCP motor and associated power supplies. The

RCP safety and non-safety breakers tripped on overcurrent. Upon further evaluation of the power supply equipment and the coolant pump motor, the licensee noted that stator winding insulation damage was evident and a stator fault had occurred. The reactor coolant pump motor protective relaying operated as designed to separate the coolant pump from its power source. As a result of this failure, the licensee removed the damaged stator and replaced the stator with a completely rewound spare stator.

The licensee previously developed a rewind/replacement program to improve RCP motor performance. The program was developed to inspect and rewind each of the Unit 1 and Unit 2 RCP motors on a rotational basis. The 2D RCP motor was scheduled for replacement during the next scheduled Unit 2 outage. The licensee had the 2D motor stator refurbished by the vendor previously, following a similar failure of the 2B RCP motor stator in May 1996. At that time, the refurbishment included improving the structural support of the stator windings to reduce the rate of insulation breakdown. Each stator winding end turn was also secured to the stator support ring.

The inspectors also reviewed the licensee post-trip review report. The report identified equipment that did not operate as expected during the transient. The equipment included the A main feedwater pump speed controller, auxiliary feedwater discharge valve to the C steam generator, and the A auxiliary feed pump motor inboard bearing oil feeder. The inspectors verified that the equipment deficiencies were adequately evaluated and/or repaired prior to Unit 2 restart.

c. Conclusions

The inspectors concluded that the licensee's reactor trip response and recovery was good. The inspectors also concluded that, once completed, the current program for replacement of the RCP motors should improve RCP motor reliability. However, the inspectors noted that similar operational challenges may result prior to the completion of the reactor RCP motor rewind program.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (61726 and 62707)

The inspectors observed all or portions of the following work activities:

- PT/1/A/4350/02B — 1B Emergency Diesel Generator (EDG) Operability Run Monthly

- PT/2/A/4401/14B — Unit 2 Component Cooling (KC)/Residual Heat Removal (ND) Heat Exchanger Valve Stroke Timing
- PT/2/A/4200/28B — Unit 2 Train B Slave Relay Test

b. Observations and Findings

The inspectors witnessed selected surveillance tests to verify that approved procedures were available and in use, test equipment in use was calibrated, test prerequisites were met, system restoration was completed, and acceptance criteria were met. In addition, resident inspectors reviewed and/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.

c. Conclusion

The inspectors concluded that these routine activities were completed satisfactorily.

M1.2 Installation of 1A Condensate Booster Pump Motor

a. Inspection Scope (62707,62700)

The inspection was performed to determine by work observation and document review the adequacy of handling, installing, and testing the subject Unit 1 motor.

b. Observation and Findings

The motor was removed from service in response to a persistent high vibration indication. At the time of the inspection, the motor had been returned from the vendor shop and the licensee was preparing to reinstall it back on the pump.

On August 6, 1997, the inspectors observed the lift, installation, aligrment and testing of the motor before it was coupled to the 1A condensate booster pump. The activities observed were performed under work order 97039871-05 and in accordance with the following procedures:

- Lift Plan — Task-05 7/31/97
- MP/0/A/7300/001 Rev.3 — Rotating Equipment - Preventive Maintenance
- MP/0/A/7700/009 — Coupling Alignment Soft Foot Check and Correction
- MP/0/A/7300/007 — Rotating Equipment Inspection and Vibration Measuring

The inspectors found the work performed under these activities to be professional and thorough. All work observed was performed with the work package present and in active use. Technicians were experienced and knowledgeable of their assigned tasks. The inspectors frequently observed supervisors and system engineers monitoring job progress. Quality control personnel were present when required by procedure. Equipment used to perform required tests were properly calibrated and in good working order. Motor inspections and tests performed included: winding resistance, insulation resistance, dielectric absorption (polarization), direct current (DC) step voltage (hipot), and visual inspection. These tests showed the motor characteristics and performance were within acceptable limits.

c. Conclusion

The inspectors determined that the installation and testing of the subject motor was performed by personnel that were adequately trained to perform their assigned tasks. Procedures used on this activity were well written and provided adequate direction and details to successfully complete the task.

M1.3 Steam Generator Replacement (SGR) Unit 2

a. Inspection Scope (50001)

The inspection was performed to determine the adequacy of the onsite manufacturing (OSM) facilities and fabrication shop activities for the SGR.

b. Observation and Findings

The inspectors toured the OSM facilities used for storage, machining, welding and nondestructive testing of the steam generators (S/Gs) before their installation. At the time of the tour, S/G status was as follows:

- S/G A Instrument nozzles were being prepared for welding a short piece of pipe to facilitate welding inside containment. All of the scheduled work was completed.
- S/G B Work on the secondary side nozzles was completed. Welding was in progress on instrument nozzles.
- S/G C All work scheduled on this S/G was completed. The S/G was pressurized and ready for transfer to the containment building.
- S/G D Welding on the secondary side nozzles was completed. The S/G was ready for security checks.

The inspector noted that access control was being maintained, housekeeping was adequate, and all S/G penetrations were adequately protected from foreign material entry.

Welding of Secondary Piping

Welding of dissimilar metal joints on the secondary S/G nozzles had been completed. These welds had been radiographed per applicable code requirements and radiographic procedure NDE 10c, Rev. 19. As such, the inspectors reviewed the following radiographs for film and radiographic quality documentation and compliance with code requirements, ASME Sections V and XI, 1989 Edition and Section III, 1971 Edition.

Weld	Size	Remarks
CAZFW50-21	6"x.719"	Accept
CAZFW50-28	6"x.719"	Accept
CAZFW50-24	6"x.719"	Accept
CAZFW50-32	6"x.719"	Accept
BBZFW71-33	3"x.438"	Accept
BBZFW71-02	3"x.438"	Accept
BBZFW68-02	3"x.438"	Accept
BBZFW68-37	3"x.438"	Accept

This review revealed that the radiographs met applicable code requirements and that the quality control activities were satisfactory.

Welding Activities in the Fabrication Shop

At the time of this inspection, production welding had not begun. However, technicians were performing weld preparations/machining on straight pipe sections and on elbows in preparation for the fabrication of spool pieces for use during S/G installation. For the most part, this activity will involve the main feedwater (CF) and auxiliary feedwater (CA) systems and to a lesser extent, other small bore piping. The inspector observed weld preparation machining and grinding in progress on the CF system, which appeared to be progressing in a satisfactory manner. Identification numbers were noted for material traceability review. Preliminary plans called for the following breakdown of weld fabrication between the fabrication shop and the field.

System	Fab Shop	Field	Total
CA	4	16	20
CF	36	22	58

The following is a list of pipe sections and fittings for which material traceability was checked for compliance with applicable code requirements.

Unique Tracking Code	Material	Heat #	Size
845047	SA234.GR.WP11	FP10C	18"dia. Ell sch. 80
846674	SA335.GRP11	952542	18"dia. sch. 80
846634	SA335.GR.P11	942558	16"dia. sch. 80
851806	SA234.GRWP11	1G4B2U1F9	18"X16" Reduce sch. 80
846636	SA335.GRP11	76977	16"dia. sch. 80
846753	SA335.GRP11	195097	18"dia. sch. 80

Information on this material was readily available and the reported analysis along with physical test results indicated that the material met minimum code requirements.

c. Conclusions

Results of this inspection revealed that activities associated with the S/G replacement project were being performed by adequately trained personnel in a conscientious manner. Housekeeping of facilities where the S/Gs were being stored were maintained at an appropriate level. Material used was in compliance with applicable code requirements. A review of fabrication records and nondestructive examination results disclosed that weld fabrication and associated activities were conducted in a satisfactory manner.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Main Feedwater Isolation Valve 2CF28 Corrective Maintenance

a. Inspection Scope (62707)

During the Unit 2 shutdown to repair a S/G A tube leak, the inspectors reviewed the licensee's repairs of the Unit 2 Steam Generator "C" Feedwater/Containment Isolation Valve, 2CF28.

b. Observations and Findings

A valve stem packing leak had been identified previously by the licensee and repair efforts were attempted; however, the packing leak was not corrected. As a result, the licensee had established a monitoring program to evaluate the packing leak daily and added the repair activity to the forced outage maintenance list. During the shutdown, the licensee was able to isolate that portion of the system and replace the degraded packing. The licensee repacked the valve and conducted valve stroke time testing. During the testing, the valve failed to meet opening stroke time requirements. The design function of the valve is to close to isolate feedwater flow to containment and provide a containment isolation boundary. The valve packing was reworked and the

valve was reassembled and stroke time tested satisfactorily. The valve was returned to service prior to operation at rated power.

Following the repair, the licensee eliminated the leakage monitoring plan, but continues to periodically monitor valve actuator temperatures to ensure that elevated operating temperatures do not increase the probability of hydraulic fluid degradation. (See Inspection Report 50-369, 370/97-04.)

c. Conclusions

The inspectors concluded that the licensee's repair efforts were appropriate to ensure proper performance of valve 2CF28. The valve was verified to meet stroke time requirements and operated as designed to isolate feedwater. Issues associated with elevated actuator assembly temperatures causing operational challenges were also evaluated and determined not to be a concern.

M2.2 Steam Leak at Unit 2 High Pressure Turbine Piping Instrument Line

a. Inspection Scope (62707)

On July 1, the licensee identified a main steam leak at an instrument line located on the Unit 2 crossover piping from the main high pressure turbine to a moisture separator reheater.

b. Observations and Findings

The licensee reduced power in an effort to reduce the steam pressure at the instrument line and installed an isolation valve on the severed line to isolate the leak. The instrument tap was used for turbine acceptance testing only and did not affect control systems. After completion of the repair, the licensee returned the unit to 100 percent power. The instrument tubing was sent to the licensee's metallurgical facility for additional metallurgical evaluation.

c. Conclusions

The inspectors attended pre-job briefings and noted that appropriate emphasis was placed on safety. Planning, execution, and management oversight of the repair activities were good.

M2.3 Unit 1 Main Steam Stop Valve Actuator Stem Failure

a. Inspection Scope (62707)

On July 5, the inspectors responded to the failure of the number 3 main steam stop valve actuator stem. The stem failure resulted in a brief increase in reactor power, to which control rods responded in automatic to maintain reactor power below thermal power limits.

b. Observations and Findings

The licensee and inspectors immediately responded to the high pressure turbine. No obvious indication of stem failure was noted; however, after careful review, the discharged actuator spring was evident. The actuator stem had failed, resulting in a fast closure of the stop valve. The closure of the stop valve is not in itself a turbine trip signal. Closure of all 4 stop valves or low auto stop oil pressure would have resulted in a turbine trip and reactor trip at thermal power levels greater than 48 percent.

The licensee developed detailed repair plans and executed the repair. Adequate nuclear and personnel safety precautions were developed and implemented. The licensee completed the repair and reduced reactor power prior to returning the stop valve to its normal position. The power reduction provided adequate reactivity margin in the event the valve went to the full open position once energized. This minimized the potential for exceeding the licensed rated thermal power output. The valve was returned to service with no difficulties.

The licensee, aware of the potential for failure, had previously begun a replacement project to replace the actuator stems on a rotational basis during outages. The licensee is evaluating the current replacement schedule for the remaining actuator stems.

c. Conclusion

The inspectors concluded that the licensee's performance in planning and executing the repair activity was good. Appropriate emphasis was placed on personnel safety and the licensee made prudent decisions to minimize the probability of unplanned reactivity incidents.

M2.4 Unit 1 A Emergency Diesel Generator (EDG) Cylinder Fluid Leak

a. Inspection Scope (62707)

On July 1[illegible], 1997, the licensee identified a cylinder leak on the Unit 1 A Emergency Diesel Generator during a quarterly performance test. The inspector reviewed the circumstances related to the issue, the root cause determination, and subsequent corrective actions. Maintenance and engineering personnel were interviewed, the affected cylinder head and replacement were examined, and the potential for common-mode failure of the EDGs was evaluated.

b. Observations and Findings

During performance of PT/1/A/4350/02A, Enclosure 13.6, Check of Diesel Generator 1A Cylinders for Fluid, the licensee discovered that the 6 left (6L) cylinder was leaking fluid out of the open petcock. The purpose of the test is to examine if moisture has accumulated in the

cylinder head. This periodic test (PT) was the first PT performed on the EDG since the rebuild earlier this year. The Unit 1 A and B EDG cylinder heads were rebuilt offsite by a vendor during the last Unit 1 outage as part of an overall effort to improve EDG performance.

Within 24 hours of discovery, the licensee replaced the 6L cylinder head and satisfactorily retested the EDG. A shop test was performed on the removed head to pinpoint the source of the oil leak, which was determined to be a leaking exhaust valve seal. Visual inspection did not reveal any obvious deformation of the seal itself. The inspector questioned the operability of the EDG in this condition and the licensee indicated that this excess oil is only present when the Before and After (B&A) lube oil pump is running. The B&A pump runs approximately 15 minutes out of each hour when the EDG is in standby operation. Any excess fluid accumulated in the cylinder head would burn off during EDG operation. During head removal from the engine, maintenance personnel also verified that no leakage was occurring from the piston.

c. Conclusions

Corrective actions for the Unit 1A EDG 6L cylinder exhaust valve oil leak were prompt and effective. The root cause evaluation was thorough and it did not appear that a common mode failure existed. Station personnel were very knowledgeable of the EDG system.

M3 Maintenance Procedures and Documentation

M3.1 Maintenance - Work Control Process Measures

a. Inspection Scope (62707)

The inspectors reviewed the licensee's work process measures to evaluate licensee effectiveness in scheduling and completing maintenance activities for safety-related and important to safety equipment. The inspectors focused on the licensee's preventive maintenance activities.

b. Observations and Findings

The inspectors reviewed Problem Investigation Process (PIP) Reports and work process measures, as well as interviewed maintenance and work control personnel, to evaluate preventive maintenance scheduling and completion. The inspectors noted that the licensee established an aggressive goal for Preventive Maintenance (PM) and Periodic Testing (PT) activity completion. According to licensee documentation, the licensee had a year to date scheduled PM/PT completion rate of 89 percent. This value was slightly below the station goal of 90 percent.

The inspectors discussed the performance with the Work Control and Maintenance organizations and determined that although the performance in completion of PM/PT activities had significantly improved, some

process deficiencies existed. Specifically, the licensee's work execution policy does not prohibit completion of a work order task when the maintenance activity cannot be completed as scheduled. Guidance documents do not explicitly require that the tasks be rescheduled when the maintenance activity cannot be completed. In the event that the work cannot be performed, Maintenance personnel are expected to make a specific notation stating that no work was performed and this information is to be reviewed by work control prior to entering the completed work order information into the automated Work Management System. In the unlikely event that the statement is not recognized during the review process, the work order will be entered into the system as complete and a new preventive maintenance schedule will be generated for the component. The current process does not require that a new work request/order be generated or that the original work order be voided. Voiding the work order results in an automatic rescheduling of the PM/PT. The inspectors emphasized that the ability to identify a preventive maintenance activity as complete when no maintenance has been performed was a work process deficiency. The inspectors referred this issue to licensee management.

c. Conclusions

The inspectors concluded that the licensee's performance in meeting established work management goals was good. Prioritization of work activities was evident. Although no instances of missed PM/PTs were identified, some process deficiencies were noted.

III. Engineering

E4 Engineering Staff Knowledge and Performance

E4.1 Temporary Modification for Instrument Air Use During S/G Maintenance

a. Inspection Scope (37551)

Following the Unit 2 shutdown to repair primary to secondary leakage, engineering personnel, conducting an instrument air system performance assessment, recognized that the maintenance personnel had improperly connected air supply hoses from the instrument air system to the primary loop nozzle dam seals. The inspectors evaluated the licensee's response to this issue.

b. Observations and Findings

The instrument air system was being used to supply air to maintain nozzle dam seals during steam generator maintenance activities. The engineer immediately realized that the use of instrument air as a supply for the nozzle dam seals required a temporary modification (TM), but none had been processed. The engineer immediately informed the maintenance crews that the air supply source for the seals should be the station air system. The engineer requested that the supply be realigned to station air until a temporary modification could be processed. The

maintenance crews realigned the system and station engineering was instructed to provided a TM package. However, Operations management, recognizing the potential safety consequences of the realignment, instructed the maintenance crews to continue using instrument air for reliability. Although station air is provided by the instrument air system, during certain events, station air may be isolated. The licensee had not formally evaluated the potential consequences of hose failures and the resulting affect on the instrument air system.

The inspectors interviewed Engineering, Operations and Maintenance personnel, and were informed that the use of instrument air was the preferred method for nozzle dam installation. The licensee recognized that the maintenance practice of connecting supply hoses to the instrument air system for nozzle dam installation had not been reviewed. The licensee immediately performed evaluations to justify the use of instrument air and completed the TM review to allow the maintenance crews to continue the repair activities. Following completion of steam generator maintenance, the TM was closed and actions were implemented to recognize instrument air as the preferred steam generator nozzle dam air supply. The initial failure to implement the TM process constitutes a violation of minor significance and is being treated as a Non-Cited Violation (NCV), consistent with Section IV of the NRC Enforcement Policy: NCV 50-369,370/97-10-02, Failure to Implement TM Process.

c. Conclusions

The licensee's decision to complete a TM and continue using the instrument air system was, in this case, acceptable. The responsible engineer's immediate and detailed investigation of system performance was indicative of a good questioning attitude. A NCV was identified for the initial failure to implement the TM process.

E6 Engineering Organization and Administration

E6.1 Operating Experience Program Effectiveness

a. Inspection Scope (37551)

The inspectors reviewed the Duke Power Operating Experience Program (OEP) effectiveness in evaluating applicable information from within Duke Power Company and the industry on events and problems that may potentially impact nuclear safety and equipment reliability. The Operating Experience Assessment (OEA) Organization had the administrative lead for the implementation of the OEP responsible for receipt, evaluation, and resolution tracking of the issues.

b. Observations and Findings

The inspectors reviewed selected industry operating experience reports provided through the licensee's OEP, which documented events identified at Duke facilities and other power reactor facilities. The inspectors noted that the OEP had provided detailed information of events and findings at other facilities and had established a technical contact to

ensure that site specific reviews were completed.

The inspectors noted that the OEA provided timely notification of NRC and industry issues identified in Information Notices, Bulletins, and vendor advisory letters. The inspectors reviewed the following OEP items to evaluate OEP effectiveness:

- Information Notice 91-50, Supplement: Water Hammer Events Since 1991
- Operating Experience Database No. 97-014266, Auxiliary Feedwater Pump Overspeed Following Restart

The inspectors confirmed that this operating experience information was expeditiously distributed to the responsible station engineer and was adequately tracked through the licensee's Problem Investigation Process.

c. Conclusions

The inspectors concluded that the OEP has adequately assisted the McGuire Nuclear Station in timely evaluation and resolution of relevant industry issues. Site specific actions to resolve the issues have adequately sustained nuclear safety and equipment reliability.

E7 Quality Assurance and Engineering Activities

E7.1 Radiological Consequences of a Fuel Handling Accident Involving High-Burnup Fuel

a. Inspection Scope (37551)

During a review of the fuel handling activities in the Unit 1 spent fuel pool, the inspector reviewed UFSAR Section 15.7.4, Fuel Handling Accidents in the Containment and Spent Fuel Storage Facilities, and identified an issue with the UFSAR assumptions used for the spent fuel handling accident. Station personnel were interviewed and licensee documents were examined.

b. Observations and Findings

The inspector identified an unresolved issue concerning the isotopic gap fractions assumed in the McGuire UFSAR Table 15-35, Maximum McGuire Spent Fuel Assembly Fission Product Inventories Assumed for Fuel Handling Accidents. Gap fraction is defined as the fraction of the total isotopic inventory residing in the gap between the fuel pellets and the rod cladding. As noted on the bottom of UFSAR Table 15-35, the gap fractions are from Regulatory Guide (RG) 1.25, Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident and Storage Facility for Boiling and Pressurized Water Reactors. These gap assumptions are: (1) 10 percent of the total noble gases other than Krypton-85; (2) 30 percent of the Krypton-85; and (3) 10 percent of the total radioactive iodine in the rods at the time of the postulated accident.

The inspector reviewed RG 1.25 and identified as noted in regulatory position C.1, that the assumptions related to the release of radioactive material from the fuel as a result of a fuel handling accident are valid only in cases where the average burnup for the peak assembly does not exceed 25,000 MWD/ton. Regulatory position C.1 also notes that maximum fuel rod pressure is 1200 psig. The McGuire spent fuel pools contain high burnup fuel (e.g., 40,000 MWD/mtu).

The inspector questioned the licensee if the assumptions were evaluated prior to exceeding the burnup limit specified in RG 1.25. The inspector was concerned that the assumptions used may not be adequate given the higher burnups and that the rate of fission gas release would tend to increase with increased burnup and additional fragmenting of the pellets. This would affect the assumed internal rod pressure (a function of all fission gas) and the gap activity (a function of only dose contributing isotopes).

At McGuire, use of higher enriched fuel for storage in the spent fuel pool was approved in 1995. The inspector reviewed the license amendment request and subsequent NRC approval dated November 6, 1995. There was no specific evaluation of the release fraction assumptions, internal rod pressures, or reference to RG 1.25.

In response to the inspector's concern, reactor engineering personnel reviewed data from the Oconee nuclear station for high burnup fuel performance and indicated that fission gas release rates were on the order of several percent. The inspector noted that it appeared that this data was gathered through B&W lead test assemblies (LTAs) and that LTAs are typically restricted from being located in peak power locations in the core. Given this, fuel centerline temperatures would not have been as high as a peak assembly, and consequently fission gas release rates would have been low since release rates are directly dependent on fuel temperature.

A second point raised by the licensee was that the new source term outlined in NUREG-1465, Accident Source Terms for Light-Water Nuclear Power Plants, suggests a value of 5 percent for gap activity. The inspector reviewed this and noted that the new source term may not cover high burnup fuel. Also, for reactor accident analysis, use of a 5 percent value as a core-average gap fraction may be appropriate since typically one-third of the core has low burnup (virtually no gap activity) and one-third of the core will have a moderate burnup (a very small amount of gap activity). However, for the fuel handling accident, the bounding accident involves the highest burned assembly and use of a core average value for gap activity would not appear to be appropriate.

c. Conclusions

The inspector concluded from the information reviewed, that the licensee may not have evaluated if the isotopic gap fractions used in UFSAR Table 15-35 for the fuel handling accident analysis were valid for high burnup fuel prior to exceeding the burnup limit specified in Regulatory Guide 1.25 (basis for the table). Insufficient information existed to

determine if the radiological consequences of an accident involving a highly burned fuel assembly are acceptable. Pending additional inspector review, this issue is identified as Unresolved Item (URI) 50-369,370/97-10-01, Radiological Consequences of a Fuel Handling Accident Involving High-Burnup Fuel.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R1.1 Occupational Radiation Exposure Control Program

a. Inspection Scope (83750)

The inspectors observed and reviewed licensee activities to determine the adequacy of the licensee's radiological controls, as required by 10 Code of Federal Regulations (CFR) Parts 20.1201, 20 1501, 20.1601, 20.1801, 20.1902 and 20.1904.

b. Observations and Findings

During the week of July 7-11, 1997, the inspectors made frequent tours of Radiologically Controlled Areas (RCAs). Units 1 and 2 were operational at the time of the inspection. The inspectors toured Auxiliary Building facilities, Units 1 and 2 Turbine Buildings, and selected radioactive waste processing and storage areas. During the tours, the inspectors performed observations of radiological protection activities, including pre-work briefings, personnel monitoring, radiological postings, and high radiation area controls. Radiologically Controlled Areas observed were appropriately posted and radioactive materials observed were appropriately stored and labeled. The inspectors reviewed Operational and Administrative controls for entering the RCA and performing work. These controls included the use of Radiation Work Permits (RWPs) to be reviewed and understood by workers prior to entering the RCA. The inspectors reviewed selected RWPs for adequacy of the radiation protection requirements based on work scope, location, and conditions. For the RWPs reviewed, the inspector noted that appropriate protective clothing and dosimetry were required. The inspectors performed independent radiation and contamination surveys of selected areas in the Auxiliary Building and outside storage areas. The inspectors surveys confirmed RWP requirements and licensee survey information.

At the time of the inspection, radiological housekeeping was observed to be good. Contaminated square footage was less than 0.05 percent (300 square feet) of the total RCA of 114,765 square feet. Records reviewed determined the licensee was tracking and trending Personnel Contamination Events (PCEs). The licensee had tracked approximately 148 PCEs for 1997. The 148 PCEs recorded included 43 skin contaminations and 105 clothing contaminations.

The inspectors reviewed and discussed with licensee representatives the 1997 Total Effective Dose Equivalent (TEDE) exposures for plant and contract personnel. Through reviews of selected dose records and discussions with licensee representatives, the inspector confirmed that all TEDE exposures assigned during the period were being maintained well below regulatory limits of 10 CFR Part 20 limits. At the time of the inspection, the licensee had not detected any internal exposures in 1997 at reportable limits. A discussion with licensee representatives and a review of pertinent records determined that the licensee had established an annual site exposure goal of approximately 288.3 person-rem as of July 1, 1997. Site exposure actually accrued in 1997 was approximately 251.3 person-rem. The total radiation exposure accrued as of July 1, 1997, was based on operational radiation exposure of 14.3 person-rem, a Unit 1 S/G replacement outage radiation exposure of 130.9 person-rem, a unit 1 refueling outage exposure of 98.8 person-rem, and a Unit 2 forced outage radiation exposure of 5.2 person-rem to repair S/G tube leaks.

The inspectors also observed ongoing work in the Retired Steam Generator Storage Facility to remove selected pieces of tubes from a retired S/G. This project was contracted through Duke Engineering Services (DES) and Argonne National Laboratory in support of a contract between the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE) as previously discussed in NRC Inspection Report 50-369,370/97-09. Work observed during this project included: pre-work briefings, the performance of contamination and radiation surveys, radioactive material control and storage, postings, contamination controls, airborne controls and radiation exposure controls. The use of tent containments, High Efficiency Particulate Air (HEPA) filtered ventilation, wireless communications, teledosimetry, cameras, and other work practices were effective methods the licensee was using to maintain radiation exposures As Low As Reasonably Achievable (ALARA). Specific work procedures and radiation work permits (RWPs) were reviewed and personnel were observed during the S/G tube pull project to be in compliance with the procedures and RWPs. The RWPs adequately addressed ALARA considerations, external and internal exposure controls, and contamination controls for the expected radiological hazards. Approximately 14 person-rem had been accrued early in the project, which was above the licensee's goal for that portion of the work scope by approximately 3 person-rem. The additional exposure was attributable to mechanical problems during tube cutting and tube pulling. Re-tooling of the tube cutting and pulling equipment enhanced performance and the licensee was able to reduce exposures below original goals after pulling 8 of 11 tubes to be pulled. The licensee originally established a goal of 35 person-rem for the entire S/G tube and tube sheet removal project. Based on observations of work and discussions with licensee and contractor personnel, the inspectors determined licensee management oversight of the project was good and the licensee had continued efforts to maintain exposures ALARA.

c. Conclusions

Radiological facility conditions and housekeeping in radioactive waste storage areas were good. Material was labeled appropriately, and areas were properly posted. All exposures were below regulatory limits and the licensee was continuing to maintain exposures As Low As Reasonably Achievable.

R5 Staff Training and Qualification in Radiation Protection and Control

R5.1 Training Activities for Radiation Protection Technicians

a. Inspection Scope (83750)

The inspectors observed licensee training to ensure personnel had been instructed in precautions and procedures to minimize exposure as required by 10 CFR Part 19.12 and applicable Technical Specification (TS) requirements.

b. Observations and Findings

The inspectors reviewed training requirements for radiation protection technicians. The continuing training schedule for 1997 consisted of selected topics to enhance worker performance in the area of radiological controls. Industry events were being incorporated into the training. In addition to observing work performed by radiation protection technicians, the inspectors interviewed technicians to assess their level of knowledge in the area of radiation protection. All persons observed performing work and interviewed by the inspectors appeared to be well trained.

c. Conclusions

Based on a review of training activities for radiation protection technicians, the inspectors determined radiation protection technicians were receiving an appropriate level of training to accomplish the work activities observed.

S8 Miscellaneous Security and Safeguards Issues (92904, 71750)

S8.1 (Closed) IFI 50-369,370/97-02-01: Protected Area Illumination

The inspectors reviewed the licensee's actions to address concerns relating to protected area illumination requirements. The licensee has developed more comprehensive procedures outlining expectations for security personnel commensurate with the potential safety significance. Since no violation of NRC requirements was identified and the licensee took prompt actions to resolve the concerns, this issue is closed.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on August 7, 1997. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Barron, B., Vice President, McGuire Nuclear Station
Boyle, J., Civil/Electrical/Nuclear Systems Engineering
Byrum, W., Manager, Radiation Protection
Cash, M., Manager, Regulatory Compliance
Cross, R., Regulatory Compliance
Dolan, B., Manager, Safety Assurance
Geddie, E., Manager, McGuire Nuclear Station
Herran, P., Manager, Engineering
Michael, R., Chemistry Manager
Robinson, M., Manager, S/G Replacement Project
Sample, M., S/G Maintenance
Thomas, K., Superintendent, Work Control
Travis, B., Manager, Mechanical Systems Engineering
Tuckman, M., Senior Vice President, Nuclear Duke Power Company

NRC

M. Sykes, Acting Senior Resident Inspector, McGuire
M. Franovich, Resident Inspector, McGuire
N. Economos, Regional Inspector
D. Forbes, Regional Inspector

INSPECTION PROCEDURES USED

IP 71707:	Conduct of Operations
IP 62707:	Maintenance Observations
IP 61726:	Surveillance Observations
IP 40500:	Effectiveness of Licensee Controls in Identifying and Resolving Problems
IP 92904:	Followup - Plant Support
IP 83750:	Occupational Exposure
IP 93702:	Prompt Onsite Event Response
IP 37551:	Onsite Engineering
IP 71750:	Plant Support
IP 50001:	Steam Generator Replacement
IP 92902:	Followup - Maintenance
IP 62700:	Maintenance Implementation

ITEMS OPENED, CLOSED, AND DISCUSSED

OPENED

50-369,370/97-10-01	URI	Radiological Consequences of a Fuel Handling Accident Involving High-Burnup Fuel (Section E7.1)
50-369,370/97-10-02	NCV	Failure to Implement TM Process (Section E4.1)

CLOSED

50-369,370/97-02-01	URI	Protected Area Illumination (Section S8.1)

LIST OF ACRONYMS USED

ALARA	-	As Low As Reasonably Achievable
ASME	-	American Society of Mechanical Engineers
CA	-	Auxiliary Feedwater
CF	-	Main Feedwater
CFR	-	Code of Federal Regulations
DES	-	Duke Engineering Services
EDG	-	Emergency Diesel Generator
ESF	-	Engineered Safety Feature
FME	-	Foreign Material Exclusion
FWST	-	Feedwater Storage Tank
GL	-	Generic Letter
GPD	-	Gallons per Day
IFI	-	Inspector Followup Item

IR	-	Inspection Report
MOV	-	Motor-Operated Valve
MSSV	-	Main Steam Safety Valve
NCV	-	Non-Cited Violation
NDE	-	Nondestructive Examination
NRC	-	Nuclear Regulatory Commission
NRR	-	NRC Office of Nuclear Reactor Regulation
OEA	-	Operating Experience Assessment
OEP	-	Operating Experience Program
PCE	-	Personnel Contamination Event
PDR	-	Public Document Room
PIP	-	Problem Investigation Process
PM/PT	-	Preventive Maintenance / Periodic Testing
RCA	-	Radiologically Controlled Area
RWP	-	Radiation Work Permit
SFP	-	Spent Fuel Pool
SG	-	Steam Generator
TEDE	-	Total Effective Dose Equivalent
TM	-	Temporary Modification
TS	-	Technical Specifications
UFSAR	-	Updated Final Safety Analysis
URI	-	Unresolved Item
USQ	-	Unreviewed Safety Question
VIO	-	Violation
WO	-	Work Order