U.S. NUCLEAR REGULATORY COMMISSION

REGION II

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Licensee:	Duke Energy Corporation
Facility:	McGuire Nuclear Station, Units 1 and 2
Location:	12700 Hagers Ferry Road Huntersville, NC 28078
Dates:	October 24, 1999 - December 11, 1999
Inspectors:	S. Shaeffer, Senior Resident Inspector M. Franovich, Resident Inspector D. Jones, Regional Inspector (Section R1)
Approved by:	C. Ogle, Chief, Projects Branch 1 Division of Reactor Projects

Enclosure

EXECUTIVE SUMMARY

McGuire Nuclear Station, Units 1 and 2
NRC Inspection Report 50-369/99-08, 50-370/99-08

This integrated inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covered a seven-week period of resident inspections and also included a regional inspection in the areas of environmental monitoring and transportation of radioactive materials.

Operations

- The licensee successfully conducted refueling and restart activities for Unit 1 without incident or significant equipment problems. (Section O1.1)

- Operator response to demineralizer system leakage was prompt and in accordance with applicable procedures. The leakage events did not significantly impact plant operation. Corrective actions to remove fouling from the demineralizer system piping were successful and reduced immediate operational concerns. (Section O2.1)

- The licensee's freeze protection activities, including annual functional checks, were initiated and completed in a timely manner. Corrective actions for previous problems have been effectively implemented. Current cold weather support equipment required minor repair. Overall, the licensee's preparations to protect plant equipment and systems from freezing conditions were acceptable. (Section O2.2)

- The McGuire plant is susceptible to a reactor coolant system draindown with potential steam binding of the emergency core cooling system pumps because of the plant's design. However, the licensee's corrective actions for Information Notice 95-03 and Generic Letter 98-02, administrative controls, plant procedures, operator training, and operations practices reduced the plant's vulnerability to this type of common mode failure of the emergency core cooling system. (Section O2.3)

- A non-cited violation was identified for failing to meet Technical Specification requirements for the low temperature over-pressure protection system for Unit 1. The licensee's immediate corrective actions were appropriate to address this Technical Specification non-compliance. The licensee had dissenting comments on this issue. (Section O4.1)

Maintenance

- Maintenance and surveillance activities reviewed were adequately completed. (Section M1.1)

- No significant material condition problems for the Unit 1 ice condenser were identified. Maintenance and surveillance activities required to support operability of the ice condenser were appropriately implemented. Identified deficiencies were appropriately documented in the licensee's corrective action system. An unresolved item was identified pending NRC review of the impact of three ice baskets missing connector screws in excess of previously established acceptance criteria. (Section M2.2)

Plant Support

- The licensee had maintained an effective program for the control of liquid and gaseous radioactive effluents from the plant. The radiation doses from those releases were a small percentage of regulatory limits. (Section R1.2)

- The licensee had complied with the sampling, analytical and reporting requirements for the radiological environmental monitoring program, the environmental sampling equipment was being well maintained, and the monitoring program was effectively implemented. (Section R1.3)

- The licensee had established appropriate procedures for properly preparing radioactive materials for shipment. One non-cited violation was identified for failure to ship contaminated equipment in accordance with Department of Transportation regulations. (Section R1.4)

Report Details

Summary of Plant Status

Unit 1

Unit 1 began the inspection period in No Mode, with the reactor vessel defueled, for the End-of Cycle (EOC) 13 refueling outage. The unit restarted on November 4, 1999, and reached 100 percent power on November 8, 1999. On November 12, 1999, unit power was temporarily reduced to approximately 88 percent, due to perturbations in the main condenser vacuum requiring setpoint adjustments to a steam jet air ejector controller. After the vacuum and other secondary equipment issues were successfully resolved, the unit was returned to approximately 100 percent power. On November 19, 1999, unit power was reduced to approximately 91 percent to allow troubleshooting of a high generator stator coil temperature. Between November 19, 1999, and December 9, 1999, the unit operated at reduced power (between 89 and 96 percent) until a corrective action plan could be developed to correct the stator cooling system problem, identified as copper oxide fouling. On December 10, 1999, the unit further reduced power to approximately 85 percent to initiate chemical cleaning of the main generator stator. The cleaning process was in progress at the end of the inspection period.

Unit 2

Unit 2 began the inspection period at 100 percent. On November 19, 1999, the licensee completed the first of several planned power reductions to approximately 65 percent power as part of a fuel conservation plan to support the next scheduled refueling outage. The unit returned to approximately 100 percent on December 7, 1999, and remained at full power for the duration of the inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments Including Refueling, Containment Readiness, and Restart Inspections Conducted During the Unit 1 Refueling Outage (71707)

The inspectors conducted frequent reviews of ongoing plant operations. In general, the conduct of operations regarding both units was professional and safety conscious. Unit 1 refueling activities were conducted without incident or significant equipment problems. The inspectors observed portions of the ongoing refueling preparations and monitored reloading of the Unit 1 reactor, verified appropriate Technical Specifications (TS) requirements were met, and observed a variety of plant system realignments for operational readiness. No major problems were noted.

Prior to Unit 1 restart, the inspectors also performed Mode 4 and Mode 3, Unit 1 containment walkdowns in portions of the upper and lower containment. In general, the material condition was acceptable with only minor problems noted. No loose debris which could have had a significant impact on the emergency core cooling system (ECCS) emergency sump was identified. The inspectors also reviewed the licensee's list of identified deficiencies and noted that the number of identified items (minor leakage

indications, instrumentation line damage, etc.) was limited and the items were appropriately repaired or dispositioned prior to restart of the unit.

The inspectors observed portions of the Unit 1 restart activities including observations in the control room, independent monitoring of key reactor parameters using the operator aid computer, and review of completed procedures performed by operators and reactor engineering personnel. Operators were observed monitoring known adverse conditions with respect to their TS limits including minor leakage on pressurizer safety relief valve 1NC-2. No major problems were identified with the observed restart activities and the involved personnel exhibited adequate cognizance and control of unit parameters.

O1.2 10 CFR 50.72 and Other Required Notifications (71707)

On November 16, 1999, the licensee made a required 24-hour report in accordance with License Conditions C. (4) (Unit 1) and C.(7) (Unit 2) of the Facility Operating Licenses. Specifically, Selected Licensee Commitment 16.9-5 requires, in part, that all fire-rated assemblies and sealing devices separating safety-related and non-safety-related areas shall be operable. Contrary to this commitment, the licensee identified six fire penetrations, as part of an ongoing programmatic review of this area, which either did not meet the specified installation criteria or were not installed in four- and six-inch auxiliary to service building penetrations. The identification of these problems was during an ongoing programmatic review of the fire protection area by the licensee. Additional review of this issue will be performed as part of Inspector Followup Item (IFI) 50-369,370/98-07-10. The inspectors verified that the licensee took the required compensatory actions for the identified degraded conditions. The inspectors concluded that the licensee reported the above event in accordance with the requirements of the applicable license condition.

O2 Operational Status of Facilities and Equipment

O2.1 Operator Response to Identified Demineralizer System Leakage

The inspectors reviewed the licensee's response to leakage from demineralizer system valves which occurred on November 3, and November 5, 1999, during the restart of Unit 1 from the refueling outage. The inspectors responded to the control room and observed operator response to the leakage indications, attended discussions related to identifying the root cause of the events, and evaluated system parameters after corrective actions were implemented. Problem Investigation Process reports (PIPs) M99-5127, 5133, and 5152, related to this issue, were reviewed.

b. Observations and Findings

During the Unit 1 refueling outage, the licensee performed maintenance activities on a variety of 3-inch Grinnell diaphragm valves within the reactor coolant system (RCS) letdown and demineralizer piping. Maintenance activities included replacement of the valve diaphragms on demineralizer valves 1NV-320 and 1NV-321, located downstream of the RCS letdown isolation valves in the letdown filter room of the auxiliary building. On

November 3, 1999, with the unit in Mode 3, 1NV-320 developed a small leak, which was promptly identified and stopped by operators bypassing the mixed bed demineralizers. Corrective actions for the problem included retorquing of the subject valves' body to bonnet connection. The demineralizer system was then successfully placed back in service with no other leakage identified. On November 5, 1999, with the unit at approximately 5 percent power, 1NV-321 developed a similar leak. The leakage was quickly identified through local area radiation monitoring and confirmation of the leak was made by radiation protection personnel. As in the previous event, operators took actions to enter Abnormal Procedure (AP) AP/1/A/5500/10, NC System Leakage Within the Capacity of Both NV Pumps, and isolated the leak by bypassing the demineralizer beds. In both cases, the inspectors noted that the problems were quickly identified by radiological protection personnel and operators took the required actions to isolate the system from the RCS letdown flowpath. Following the second event, the licensee performed allowable over-torquing of all similar valves in the demineralizer system to provide additional margin for valves whose diaphragms were recently replaced.

Following the second leakage event, the licensee initiated a root cause investigation. The licensee performed a maintenance history review and determined that the two subject valves were installed by different technicians utilizing different torque wrenches. This eliminated some common mode failure scenarios. In addition, the as found torque values for 1NV-321 connectors were determined to be within limits. Review of available system pressure data indicated that the system had been experiencing pressure pulses and lifting of a system relief valve. Based on the available indications, the licensee determined that the pressure variations were mostly due to partial clogging of the demineralizer inlet resin strainer/trap, which was not periodically cleaned or inspected. The component was removed from service, inspected, and cleaned. Some fouling of the strainer by assumed resin fines and crud was identified and removed. Following these activities, the demineralizer beds were placed back in service and no other operational problems were experienced. The inspectors reviewed the scope of the licensee's corrective actions including retorque of those valves that had their diaphragms replaced during the outage and did not identify any problems. At the end of the inspection period, the licensee's root cause investigation was ongoing.

c. Conclusions

Operator response to demineralizer system leakage was prompt and in accordance with applicable procedures. The leakage events did not significantly impact plant operation and were immediately isolated. Corrective actions to remove fouling from the demineralizer system piping were successful and reduced immediate operational concerns.

O2.2 Cold Weather Preparations

a. Inspection Scope (71714)

Reviews were conducted of the facility's readiness for cold weather. The inspectors reviewed Nuclear System Directive (NSD) 317, Freeze Protection Program, Revision 1, and interviewed the freeze protection coordinator. Procedures and work orders were reviewed to determine what actions had been taken to prepare for cold weather. Selected portions of

critical plant structures, systems, and components (SSCs) that were considered vulnerable in freezing conditions were also independently inspected.

b. Observations and Findings

In response to previous freeze protection program deficiencies identified in 1996, the licensee revised NSD 317 in March 1997 to improve plant procedures and developed additional procedures for coping with extremely cold weather conditions. These programmatic and plant equipment improvements and corrective actions were evaluated and documented in NRC Inspection Reports (IRs) 50-369,370/97-18 and 96-10.

The inspectors discussed the status of freeze protection preparations with the freeze protection coordinator and reviewed the equipment problems identified during the performance of the following:

• IP/0/B3250/059	Preventive Maintenance, and Operational Check of Freeze Protection
• WO 85059712	Inventory of Emergency Freeze Protection Kit
• IP/1,2/B/3050/013C	Fueling Water Storage Tank Area Temperature Loop Calibration
• WO 98140633-01	Operations Annual Periodic Test
• PT/0//B/4700/38	Verification of Freeze Protection Equipment and Systems
• WO 96074556	Safe Shutdown Facility Cold Weather Protection Alignment

The majority of the current annual planned maintenance (PM) activities were completed well in advance of their respective due dates. Some implementation of heater alignments in non-safety related areas were intentionally delayed during October due to the continuation of warmer weather and were being completed during the end of the inspection period. Pre-seasonal checkouts were executed using various work orders for inspection and testing of electrical heat trace and instrument box heaters. The freeze protection coordinator had performed inspections of vulnerable areas and worked with maintenance personnel to adequately resolve deficiencies. The total number of deficiencies identified requiring a work order repair was six. The inspectors determined that the appropriate priority was given and work orders completed to resolve deficient plant heating and electrical heat tracing for accident mitigation systems, equipment important to safety, and balance of plant equipment that may cause plant transients. Selected walkdowns performed by the inspectors verified appropriate procedural implementation.

The inspectors noted that improvements in the scope and quality of the cold weather protection implementing procedures, repair of long-standing equipment problems, and implementation of various cold weather protection modifications resulted in the limited amount of problems identified during this year's cold weather preparations. The licensee's previous corrective actions in this area have been effective in increasing the reliability of cold weather protection equipment.

The inspectors also reviewed the licensee's monthly preventive maintenance procedure IP/0/B3250/059A Monthly Check of Freeze Protection and PT/0/B/4700/70, On Demand Freeze Protection Verification Checklist and determined that they provided adequate measures to ensure the subject cold weather equipment was maintained functional. The

inspectors verified that equipment recently installed to reduce plant risk was incorporated into the appropriate freeze protection procedure, as applicable. An example of this was the additional auxiliary feedwater tank on the turbine building roof and the new diesel-powered instrument air compressors located outside the turbine building. No problems with the procedures were identified. Selected walkdowns performed by the inspectors, verified appropriate procedure implementation of room heaters, thermostatic settings, and other related equipment.

c. Conclusions

The licensee's freeze protection activities, including annual functional checks, were initiated and completed in a timely manner. Corrective actions for previous problems have been effectively implemented. Current cold weather support equipment required minor repair. Overall, the licensee's preparations to protect plant equipment and systems from freezing conditions were acceptable.

O2.3 RCS Draindown During Shutdown and Common-Mode Failure (NRC Generic Letter (GL) 98-02)

a. Inspection Scope (Temporary Instruction 2515/142)

The inspectors evaluated the licensee's assessment of the Wolf Creek plant incident referenced in GL 98-02 and NRC Information Notice (IN) 95-03. McGuire corrective actions for IN 95-03 and GL 98-02, operations procedures, operator training materials, plant configuration control practices, shutdown risk assessment, and engineering calculations were reviewed. Using system drawings, the inspectors also walked down selected portions of the residual heat removal (RHR) system. Technical Specifications and the Updated Final Safety Analysis Report (UFSAR) were also reviewed. Preliminary information on a recent RCS Mode 4 draindown event at the Waterford plant was also reviewed and compared against the McGuire design and operational practices.

b. Observations and Findings

The inspectors determined that the McGuire plant was susceptible to the Wolf Creek event because of the system design. A flow path exists from the RHR system to the refueling water storage tank (RWST), which could lead to a common cause failure of the RHR and ECCS pumps. Valve ND-35 is a handwheel operated, normally locked, and normally closed 8-inch valve, in this common return from the A and B trains of RHR.

The return line connects to the common ECCS and containment spray suction line from the RWST. Both trains of RHR are normally interconnected with cross-connect valves ND-15 and ND-30 which are motor-operated valves located downstream of the RHR heat exchangers. Valves ND-15 and ND-30 are open in Modes 1-4 and are located upstream of ND-35. The following inspector observations and findings are provided:

- Each unit's valve ND-35 had a 4.5 x 6.5 inch placard placed on the valve with the following inscription:

Notice:
Operation of ND-35 during Modes 1, 2, 3, or 4 is prohibited unless specified by an AP. An evolution briefing is required prior to operation unless specified by an AP. NRC Information Notice 95-03 & PIP 0M95-0348.

- Valve ND-35 may be used during Modes 5, 6, and No Mode (reactor defueled). Most plant procedures involving use of ND-35 required the stationing of an operator at ND-35 if it is used and prohibit use of the valve when RCS level is below the reactor vessel flange.

- Each unit's valve ND-35 was locked closed in accordance with plant procedures. Valve ND-35 is operated with a local handwheel (no reach rod) with direct visual indication of valve position. Plant procedures required double verification of closure of ND-35. System engineering indicated that station personnel also use thermography to verify the valve is leak-tight following valve closure.

- Numerous licensee recommendations and improvements were incorporated into shutdown and startup procedures to reduce the time that RHR would be in-service above RCS temperatures that could cause suction line flashing under certain conditions. Additional procedural changes were implemented that placed restrictions on the use of ND-35 in Modes 5 and 6 and directed operator actions to be taken should RWST level change unexpectedly during evolutions involving ND-35.

- In 1993, an engineering calculation determined a threshold temperature for allowing RHR to be placed in-service below the point where steam binding of RHR pumps could occur. This calculation and subsequent procedure enhancements were performed to address potential suction line flashing identified in a Westinghouse advisory letter.

- In 1995, an engineering assessment of ND-35 structural integrity was performed including Probabilistic Risk Assessment (PRA) insights on likelihood of valve failure versus operator mispositioning the valve.

- The inspectors noted that the operators had placed RHR into service near Mode 5 conditions during each unit's previous outage. The extended use of steam dump valves, delayed RHR system entry until RCS temperatures were approximately 200°Fahrenheit (F). This practice provided additional margin to the suction line flash point. This change in shutdown practice was proceduralized.

- Specific operator training relating to the event at Wolf-Creek was not addressed in initial and requalification training. However, the RHR system lesson plan clearly discusses the consequences of ND-35 being open in Modes 1-4, including potential voiding of the 24-inch ECCS suction line in Mode 4. Operators were trained on plant procedures for shutdown, startup, and abnormal operating conditions (including AP for loss of RHR).

- Work control for emergent or scheduled maintenance on plant equipment (including ND-35, ND-18, or ND-30) requires a risk evaluation be performed using risk software ORAM-SENTINEL (Modes 1-4). For plant outage conditions (Modes 5, 6, and No Mode), outage risk is assessed in accordance with McGuire Site Directive (MSD) 403, Shutdown Risk Management.

During the review of plant operating procedures, the inspectors identified a procedure that did not reflect actual corrective actions indicated in PIP M95-0348. Specifically, the PIP indicated that all procedures concerning draining and filling the refueling canal while shutdown were revised to include extra precautions while using ND-35. These precautions were to have an operator stand by the valve while using it and not to use this flow path when drained below the reactor vessel flange. Procedure OP/1/A/6100/SO-3, Draining the Refueling Cavity, did not contain instructions, cautions, or requirements that an operator be stationed at ND-35 when in use. The licensee responded that the subject procedure and PIP 0M95-0348 would be reviewed for potential changes. Nuclear System Directive 208, Problem Investigation Process requires in Section 208.11.2, that actual corrective actions shall document actual work completed. Should the actual corrective actions differ from the proposed actions or no action is taken, adequate justification shall be included in the documentation. This non-compliance of 10 CFR Part 50, Appendix B, Criterion V, Instructions, Procedures and Drawings constitutes a violation of minor significance and is not subject to formal enforcement action. This non-compliance is in the licensee's corrective action program as PIP M99-5648.

c. Conclusions

The McGuire plant is susceptible to a reactor coolant system draindown with potential steam binding of the ECCS pumps because of the plant's design. However, the licensee's corrective actions to address NRC Information Notice 95-03 and Generic Letter 98-02, administrative controls, plant procedures, operator training, and operations practices reduced the plant's vulnerability to this type of common mode failure of the ECCS.

O4 Operator Knowledge and Performance

O4.1 Noncompliance with TS 3.4.12 During Unit 1 Startup from Refueling

a. Inspection Scope (71707)

The inspectors reviewed and evaluated licensee actions following identification of a failure to comply with TS 3.4.12, Low Temperature Over-Pressure Protection (LTOP) System. The inspectors discussed the circumstances which led to the event with station personnel, reviewed plant operating data, and evaluated other plant information.

b. Observations and Findings

On October 30, 1999, Unit 1 operated in Mode 5 with the RCS loop 1A cold leg temperatures below 107°Fahrenheit (F). For approximately 101 minutes, the unit was aligned with a centrifugal charging pump filling the RCS concurrently with a safety injection

pump filling and venting ECCS piping inside containment. At this temperature, the McGuire Nuclear Station TS prohibit operation in Mode 5 with more than one centrifugal charging or safety injection pump capable of injecting into the RCS, except during pump swapout of durations less than 15 minutes or unless other conditions regarding RCS relief capacity and temperature are satisfied. Specifically, TS 3.4.12, Condition A, requires that while in Mode 5 with a centrifugal charging pump and a safety injection pump capable of injecting into the RCS for longer than 15 minutes, that (1) the RHR suction relief valve be operable and that the RCS cold leg temperature be verified to be greater than 107°F with a cooldown rate of less than 20°F/hr, or (2) two power operated relief valves (PORVs) be secured open and block valves open and power removed, or (3) depressurize the RCS and establish RCS vent of greater than or equal to 4.5 square inches. These conditions of the TS are based on a plant-specific LTOP analysis for the McGuire reactor vessels.

Unit 1 operated with a charging pump injecting 80°F water from the volume control tank into the RCS loop 1A cold leg at 125 gallons per minute (gpm). Concurrently, the RHR system was aligned for shutdown cooling, discharging approximately 1300 gpm of water into the 1D and 1C RCS cold legs at a temperature of approximately 119°F. The licensee subsequently identified that the inappropriate configuration had existed and initiated PIP M99-5015 to document the problem.

Following discussions with station personnel, the inspectors concluded that the licensee was familiar with the requirements of the LTOP TS; however, the licensee in this case failed to use the correct control room instrumentation to verify the RCS conditions prior to racking in the power supply to the safety injection pump. The operators inappropriately referenced RHR heat exchanger outlet temperatures (based on operating data book guidance) and did not properly account for the RCS loop A cold leg temperature during their decision making. The inspectors reviewed station startup procedure OP/1/A/6100/SU-5, Filling the RCS, Revision 12, which specifically noted that TS 3.4.12 (LTOP) required actions are based on RCS cold leg temperature unless no reactor coolant pump (RCPs) are in operation. According to the licensee's documentation, when no RCPs are operating (as was the case), operating temperature limits stated in TS 3.4.12 Action Statements A.2.2.1 and A.2.2.2 shall be met by verifying that cold water addition to the RCS meet the specified RCS cold leg temperature limits (PIP M99-1295).

Subsequent corrective actions included swapping charging to the 1D cold leg since B train of RHR was in operation. A special order was also placed in the control room to prohibit the previous practice and required alignment of charging to a RCS loop which received RHR discharge flow. A root cause investigation was in progress at the end of the inspection period.

The TS implications of allowing a centrifugal charging pump and a safety injection pump capable of injecting into the RCS were not recognized. This error resulted in the plant being in a more risk significant condition since the over-pressure protection from mass input type transients was not in effect as defined by station procedures. Since unexpected mass input event and pressure fluctuation can occur more quickly during Mode 5 shutdown conditions, allowing a centrifugal charging pump and a safety injection pump capable of injecting into the RCS compounded the potential for exceeding the pressure limitations specified in

10 CFR 50, Appendix G. The potential safety consequences of the event were mitigated by the fact that (1) no RCS over-pressure transient actually occurred, and (2) all three pressurizer PORVs and associated block valves were open; however, the licensee informed the inspectors that the PORVs were not secured open nor was power removed from the block valves as defined in plant procedures so that the conditions of TS 3.4.12 could be applied. This Severity Level IV violation is being treated as a Non-Cited Violation (NCV) consistent with VII.B.1 of the NRC Enforcement Policy. This violation is identified as NCV 50-369/99-08-01, Non-Compliance with TS 3.4.12 (LTOP) During Unit 1 Restart. This violation is in the licensee's corrective action program as PIP M99-5015.

The licensee's dissenting comments on this issue are provided in Section X1 of this report.

c. Conclusions

A non-cited violation was identified for failing to meet TS requirements for the low temperature over-pressure protection system for Unit 1. The licensee's immediate corrective actions were appropriate to address this TS non-compliance.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (61726,62707)

The inspectors reviewed a variety of maintenance and surveillance activities during the inspection period, focusing on testing and maintenance activities that included the following specific items:

- PT/0/A/4150/009, Revision 008, Reactor Coolant System Dilution
- OP/0/A/6100/06, Revision 053, Reactivity Balance Calculation
- OP/1/A/6200/004, Revision 106, Residual Heat Removal System
- PT/1/A/4600/03F, Revision 3, Containment Cleanliness and ECCS Operability Inspection
- TO/1/A/9600/114, Revision 0, KG System Flush
- TO/1/A/9600/115, Revision 0, Chemical Cleaning of Main Generator Stator

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 and non-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

maintenance and surveillance activities were properly approved by operations personnel and were included on the plan of the day. Work associated with risk significant SSCs, was properly evaluated to determine its impact on the plant's risk profile. Appropriate TS action statements and selected licensee commitments were implemented. Applicable Technical Specification Surveillance Requirement (TSSR) and/or the Core Operating Limits Report limits were also satisfied.

c. Conclusions

The inspectors concluded that the reviewed routine and non-routine maintenance and surveillance activities were adequately completed.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Ice Condenser (IC) Material Condition

a. Inspection Scope (62707)

The inspectors observed and evaluated the adequacy of the material condition of the Unit 1 IC and its associated equipment during the Unit 1 refueling outage. Ongoing work activities were monitored including: ice basket weighing and servicing, basket inspections and repairs, and corrective actions for identified hardware problems. As-found conditions were evaluated with respect to TS, the UFSAR, design criteria, and applicable licensee drawings and procedures. Areas of the IC were evaluated by the inspectors during a final inspection walkdown prior to restart of the unit from the refueling outage. Interviews were also conducted with the system engineer to discuss system monitoring and other issues. The inspectors also independently verified associated TS and procedural compliance issues.

b. Observations and Findings

During the 1EOC13 outage, the licensee completed numerous maintenance and surveillance activities associated with the unit's IC. The inspectors reviewed the scope of work performed and concluded that the licensee satisfactorily:

- Weighed nearly 100 percent of the 1,944 ice condenser baskets (1,832) to determine end-of-cycle as-found weights versus the computer predicted weights. One hundred twelve baskets could not be weighed because they were frozen in place.
- Determined that no measured ice basket weights were below TS limits.
- Determined that no abnormal degradation existed in the flow passages.
- Evacuated and refilled 319 baskets including the 112 baskets noted above.
- Performed internal camera inspections of the 319 serviced baskets (items identified detailed below).
- Reviewed floor (wear slab) growth past performance and as-left measurement data
- Determined that no abnormal sublimation existed within the ice columns.
- Performed all ice blowing activities requiring open containment penetrations during No Mode (reactor defueled).
- Completed TS surveillance tests prior to declaring the ice condenser operable.

During the refueling outage, the licensee performed detailed walkdowns and inspections of the ice condenser to evaluate its material condition. Notable items identified included the following (NRC identified items are also described):

Lower Plenum

Initial inspections identified minor frosting or ice buildup on the inlet and outlet piping to lower compartment beam coolers and evidence of minor floor wear pad movement similar to that identified in previous outages. The licensee evaluated the magnitude of the conditions and concluded that none of the problems affected operability of the ice condenser and the observations did not require any corrective actions in addition to continued observation of the on-line floor monitoring system. The inspectors reviewed the as-found conditions and concluded the licensee's actions were adequate. No other concerns were noted in the lower IC plenum.

Upper Deck Blankets

The inspectors observed the Unit 1 upper deck blankets for adequacy of material condition. The inspectors noted that each section of radial tape was contained at the blanket hinge end with clips to assure that the tape was retained during a design basis event. Sections of circumferential sections of tape at the outer wall had been applied properly. In addition, the blankets were in good material condition.

Intermediate Deck Doors

In general, the condition of the intermediate deck doors was considered adequate; however, the inspectors questioned a repair method of applying room temperature vulcanizing (RTV) sealant to a number of door depressions or perforations. The system engineer inspected the subject areas and initiated PIP M99-05378 to resolve the concern. Examples of this problem were also identified on Unit 2. The licensee evaluated the application of the RTV and concluded that, in its present quantity, the RTV would not impact operability of the intermediate doors or the containment sump. The inspectors reviewed the operability determination and did not identify any current operability issues. At the end of the inspection period, the licensee continued to evaluate this specific use of RTV.

Identified Foreign Material

The licensee identified approximately 25 small items of foreign material either in the ice baskets or in the flow channel area. The items consisted of small pieces of rope, duct tape, wire, tie wrap, tools, and other small items, totaling an estimated 2 cubic feet. The licensee was unable to remove approximately 19 of the items. Their location was documented in PIP M99-04864. The licensee concluded the identified material would not have affected the performance of the ice condenser in the past or during future operation. The inspectors agreed with the licensee's operability evaluation for the identified material.

Identified Missing Ice Basket Screws

During the performance of internal camera inspections of the evacuated ice baskets and other activities, the licensee identified 12 baskets with one or more screws missing from the basket coupling rings. The locations were documented in PIP M99-04374. The licensee's acceptance criteria for missing screws for each joint is that no more than two may be missing. Of the 12 identified locations, 5 baskets had 1 screw missing; 4 had 2 screws missing; 2 had 3 screws missing, and 1 basket had 4 screws missing (never installed). All of the baskets having missing screws which exceeded the acceptance criteria were located in Row 9 and were successfully replaced.

The licensee concluded that the identified missing screws were bounded by previous evaluations performed in PIP M98-2270 and Catawba PIP C99-01734. Specifically, the three baskets which exceeded the allowed acceptance criteria (more than 2 screws per joint missing) were located in Row 9 of the ice condenser, which the licensee concluded could not be ejected during a loss of coolant accident due to interference with structures located above the row 9 baskets, including steel support beams. During the outage, the licensee corrected the identified problems such that no baskets exceeded the allowable acceptance criteria for missing screws. An unresolved item (URI) will be identified pending NRC review of the licensee's past operability review concerning the three baskets with the number of missing coupling screws exceeding the specified acceptance criteria. This is identified as URI 50-369/99-08-02, Review of Past Operability Evaluations for Missing Ice Condenser Coupling Screws.

Flow Passage Inspections

A 100 percent flow blockage inspection was performed. No unexpected or abnormal flow blockage was identified. Total as-left blockage was estimated at 6 percent versus the 15 percent allowable TS limit.

Ice Basket Damage

Some minor damage to the top rings on a small number of ice baskets was noted during the inspection of the Unit 1 upper plenum. This damage was attributed to the licensee's previous use of certain tools to free-up frozen or stuck baskets and was not considered as significant. Four locations were identified which required corrective maintenance prior to unit restart. The licensee reviewed the specific areas and determined that they did not impact operability of the ice condenser. No significant basket damage was identified by the inspectors.

Inspections for Previous Glycol Spill

The licensee conducted detailed inspections for an inadvertent glycol spill into the ice bed which occurred during previous unit operation (previously reviewed in IR 50-369,370/98-09). The results of the outage inspections confirmed previous evaluations that the event did not affect the operability of the ice condenser. The inspectors verified that the subject glycol leak did not adversely affect the ice mass of the affected baskets or create any other

identified concern.

c. Conclusions

No significant material condition problems for the Unit 1 ice condenser were identified. Maintenance and surveillance activities required to support operability of the ice condenser were appropriately implemented. Identified deficiencies were appropriately documented in the licensee's corrective action system. An unresolved item was identified pending NRC review of the licencee's past operability review of the impact of three ice baskets missing connector screws in excess of previously established acceptance criteria.

III. Engineering

E8 Miscellaneous Engineering Issues (92903)

E8.1 (Closed) URI 50-369,370/97-10-01: Radiological Consequences of a Fuel Handling Accident Involving High-Burnup Fuel

This item documented the inspectors' concerns with potentially non-conservative radiological assumptions for a design basis spent fuel assembly (SFA) handling accident. Specifically, the release fractions for radioisotopes specified in the licensee's UFSAR were based on NRC Regulatory Guide (RG) 1.25, which noted that the limits were based on fuel with low burn conditions (i.e., assembly average burnup of 25,000 megawatt days (MWD) per metric ton uranium (MTU). The McGuire Nuclear Station has SFAs with burnups greater than 50,000 MWD/MTU (assembly average). This item was unresolved pending additional NRC review of the RG 1.25 assumptions. The NRC review was completed on November 24, 1999 (TIA 99-03), and concluded that adequate conservatism was provided in the subject assumptions. This item is closed

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. The inspectors observed that workers were adhering to the requirements of wearing protective clothing. The inspectors also determined that 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.

R1.2 Radioactive Effluent Control Program

a. Inspection Scope (84750)

The inspectors reviewed the overall results of the radioactive effluent control program as

documented in the Annual Radioactive Effluent Release Report for 1998. The amounts of radioactivity released and the resulting radiation doses for the years 1996 through 1998 were also tabulated to evaluate long term performance of the effluent control program relative to the design objectives in 10 CFR 50, Appendix I for radiation doses from plant effluents.

b. Observations and Findings

The inspectors compiled the data presented in the table below from the licensee's effluent release reports for the years 1996 through 1998. That data and the content of the report for 1998 were discussed with the licensee.

MCGUIRE RADIOACTIVE EFFLUENT RELEASES

LIQUID EFFLUENTS

	Curies Released			Dose* (mrem)	
Year	F&AP	^{3}H	D&EG	Total Body [3 mrem]	Organ [10 mrem]
1996	0.10	642	9.54E-3	6.30E-2 (1.05%)	8.46E-2 (0.42%)
1997	0.08	590	1.52E-3	6.50E-2 (1.08%)	8.84E-2 (0.44%)
1998	0.08	572	4.18E-3	2.29E-2 (0.38%)	2.75E-2 (0.14%)

GASEOUS EFFLUENTS

	Curies Released				Dose* (mrem)	
Year	F&AP	Iodines	Part.	^{3}H	Air [γ 10 mrad] [β 20 mrad]	Organ [15 mrem]
1996	26.00	4.88E-5	1.11E-4	69	γ 5.74E-2 (0.29%) β 3.74E-2 (0.09%)	1.66E-1 (0.55%)
1997	7.88	1.23E-7	4.70E-4	81	γ 4.98E-2 (0.25%) β 2.28E-2 (0.06%)	2.04E-1 (0.68%)
1998	9.12	6.99E-5	3.04E-5	127	γ 1.41E-1 (0.70%) β 5.77E-2 (0.14%)	5.44E-1 (1.81%)

* Dose to maximally exposed individual
F&AP Fission and Activation Products
^{3}H Tritium
D&EG Dissolved and Entrained Gases

[ ] Limits/Unit
( ) % of Limits/Unit
Part Particulates
γ Gamma
β Beta

The inspectors made the following observations from the above tabulated data and discussed those observations with the licensee. There were no significant changes in the amounts of activity released in liquid and gaseous effluents during the years 1996 through 1998 and the annual radiation doses to the public resulting from those releases were less than two percent of their respective regulatory limits.

The inspectors also observed a liquid radwaste release from Waste Monitor Tank B on November 17, 1999. By direct observation the inspectors determined that the release was performed in accordance with the applicable operating procedure. A permit was issued for the release based on analytical results which indicated that, after dilution by the condenser circulating water system, the radionuclide activity concentrations would be well below the limits specified in 10 CFR 20, Appendix B.

c. Conclusions

The licensee had maintained an effective program for the control of liquid and gaseous radioactive effluents from the plant. The radiation doses from those releases were a small percentage of regulatory limits.

R1.3 Radiological Environmental Monitoring Program

a. Inspection Scope (84750)

The inspectors reviewed the overall results of the radiological environmental monitoring program as documented in the Annual Radiological Environmental Operating Report for 1998. Those results were compared to the program requirements delineated in the Offsite Dose Calculation Manual (ODCM).

b. Observations and Findings

The inspectors noted that, in accordance with the ODCM, the report included a description of the program, a summary and discussion of the results for each exposure pathway, analysis of trends during the operational years as compared to the preoperational years, and an assessment of the impact on the environment based on program results. The report also included a tabulation of the summarized analytical results for the samples collected during 1998. From a review of those data the inspectors determined for selected exposure pathways that the sampling and analysis frequencies specified in the ODCM had been met. As indicated in the report, very low concentrations of man-made isotopes were occasionally detected in a few of the samples but were of no dose consequence. It was further concluded that any activity which may be present in the environment as a result of plant operations did not represent a significant contribution to the exposure of the public.

The inspectors also visited four air sampling stations, two surface water sampling stations, two drinking water sampling stations, and five radiation monitoring stations. The licensee had installed dual air sampling monitors to preclude missed samples due to equipment malfunction. The inspectors noted that the power cord to one monitor at one location had become disconnected, therefore, the licensee collected the sample from the backup sampler. Otherwise the sampling equipment was operable and in good working order, thermoluminescent dosimeters (TLDs) were in place at the radiation monitoring stations, and the sampling stations were located as indicated in the ODCM.

c. Conclusions

The licensee had complied with the sampling, analytical and reporting requirements for the radiological environmental monitoring program, the environmental sampling equipment was being well maintained, and the monitoring program was effectively implemented.

R1.4 Transportation of Radioactive Materials

a. Inspection Scope (86750)

The inspectors evaluated selected elements of the licensee's radioactive materials transportation program for consistency with the requirements delineated in 49 CFR Parts 170 - 179, 10 CFR Part 20, and 10 CFR Part 71.

b. Observations and Findings

The inspectors reviewed the licensee's procedures for shipping radioactive materials and determined that they adequately addressed the following: assigning the form, quantity type, and proper shipping name of the material to be shipped; classifying waste destined for burial; selecting the type of package required; labeling and marking the package; placarding the vehicle; assuring that the radiation and contamination limits are met; and preparing shipping papers.

The inspectors reviewed the shipping papers for five recent shipments and verified that the recorded hazardous material description information and emergency response information were accurate and in accordance with the requirements of 49 CFR 172 Subparts C and G. The records of the radiological surveys of the shipping packages and transport vehicles indicated that the radiation and contamination levels were well within the limits specified in 49 CFR 173, 441, and 443. The licensee's records also indicated that shipping package marking and labeling and vehicle placarding were in accordance with the requirements of 49 CFR 172 Subparts D, E, and F. The inspectors also determined the licensee had maintained records of shipments of licensed material as required.

The inspectors also verified that the licensee possessed a current "Quality Assurance Program Approval for Radioactive Material Packages" (NRC Form 311).

On October 25, 1999, the licensee shipped 15 containers of tools and equipment to the Farley Nuclear Station. The bill of lading for that shipment indicated that the shipment

consisted of eight containers of contaminated equipment and seven non-radioactive containers. On November 18, 1999, the licensee was informed by the consignee that contaminated equipment was found in three of the seven containers shipped as non-radioactive. The contamination levels ranged from 1000 to 6000 disintegrations per minute per 100 square centimeters (dpm/100 $cm^{2)}$) smearable contamination and 3,000 to 30,000 dpm fixed contamination. Shipment of contaminated equipment as non-radioactive containers constitutes a violation of 49 CFR 171.2 which stipulates, in part, that no person may offer a hazardous material for transportation in commerce unless the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by applicable requirements. This Severity Level IV violation is being treated as an NCV, consistent with Section VII.B.1 of the NRC Enforcement Policy. It is identified as NCV 50-369,370/99-08-03, Failure to Ship Contaminated Equipment in Accordance with Department of Transportation Regulations. This violation is in the licensee's corrective action program as PIP M-99-5321.

c. Conclusions

The licensee had established appropriate procedures for properly preparing radioactive materials for shipment. One NCV was identified for failure to ship contaminated equipment in accordance with Department of Transportation regulations.

V. Management Meetings

X1 Exit Meeting Summary

The resident inspectors presented the inspection results to members of licensee management on December 15, 1999. The licensee acknowledged the findings presented. No proprietary information was identified. At the exit meeting, the licensee provided the following statement addressing their position with regard to the NRC conclusions presented in Section O4.1:

> *Duke Energy respectfully disagrees that the conditions documented in PIP 99-5015 constitute a violation of Technical Specification 3.4.12. "Low Temperature Overpressure Protection (LTOP) System." In the operating configuration at that time, cold leg water for core cooling was being supplied by the discharge of the decay heat removal heat exchanger. In such a condition, where all reactor coolant pumps are off, this limiting condition for operation can be satisfied by monitoring this temperature. There is nothing in Technical Specifications or BASES at McGuire that define "cold leg temperature" in this context. Therefore, the meaning of "cold leg temperature" in this context is subject to interpretation.*
>
> *Various operating procedures in existence at the time of this occurrence directed control room operators to use the decay heat removal discharge temperature for the purposes of meeting this technical specification requirement. McGuire is aware of at least one four-loop Westinghouse Ice Condenser plant that modified technical specifications and subsequently the BASES to reflect use of decay heat removal temperature for the purposes of meeting this technical specification requirement.*

Duke Energy does agree that this could be clarified and will document a BASES change to clarify this position.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Barron, B., Vice President, McGuire Nuclear Station
Bradshaw, S., Superintendent, Plant Operations
Byrum, W., Manager, Radiation Protection
Cash, M., Manager, Regulatory Compliance
Dolan, B., Manager, Safety Assurance
Evans W., Security Manager
Geer, T., Manager, Civil/Electrical/Nuclear Systems Engineering
Jamil, D., Station Manager, McGuire Nuclear Station
Patrick, M., Superintendent, Maintenance
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 62707:	Maintenance Observations
IP 61726:	Surveillance Observations
IP 71707:	Conduct of Operations
IP 71750:	Plant Support
IP 84750:	Radioactive Waste Treatment, and Effluent and Environmental Monitoring
IP 86750:	Solid Radioactive Waste Management and Transportation of Radioactive Material
IP 92903:	Followup - Engineering
TI 2515/142:	Draindown During Shutdown and Common-Mode Failure (NRC GL 98-02)

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-369/99-08-01	NCV	Non-Compliance with TS 3.4.12 (LTOP) During Unit 1 Restart (Section O4.1)
50-369/99-08-02	URI	Review of Past Operability Evaluations for Missing Ice Condenser Coupling Screws (Section M2.2)

50-369,370/99-08-03	NCV	Failure to Ship Contaminated Equipment in Accordance with Department of Transportation Regulations (Section R1.4)

Closed

2515/142	TI	Draindown During Shutdown and Common-Mode Failure (NRC Generic Letter 98-02) (Section O2.3)
50-369,370/97-10-01	URI	Radiological Consequences of a Fuel Handling Accident Involving High-Burnup Fuel (Section E8.1)

Discussed

50-369,370/98-07-10	IFI	Review of Licensee's Revalidation of Fire Barrier Penetration Seals (Section O1.2)

LIST OF ACRONYMS USED

ALARA	-	As Low As Reasonably Achievable
AP	-	Abnormal Procedure
ECCS	-	Emergency Core Cooling System
EDG	-	Emergency Diesel Generator
EOC	-	End of Cycle
ESF	-	Engineering Safeguards Feature
F	-	Fahrenheit
GL	-	Generic Letter
GPM	-	Gallons Per Minute
IFI	-	Inspector Followup Item
IC	-	Ice Condenser
IN	-	Information Notice
IR	-	Inspection Report
KG	-	Main Generator Stator Cooling Water
LTOP	-	Low Temperature Overpressure Protection
MSD	-	McGuire Site Directive
MTU	-	Metric Ton Uranium
MWD	-	Megawatt days
NSD	-	Nuclear System Directive
NCV	-	Non-Cited Violation
NRC	-	Nuclear Regulatory Commission
ODCM	-	Offsite Dose Calculation Manual
PM	-	Planned Maintenance
PIP	-	Problem Investigation Process
PORV	-	Power Operated Relief Valve
PRA	-	Probabilistic Risk Assessment
PT	-	Periodic Testing

RCA	-	Radiologically Controlled Area
RCP	-	Reactor Coolant Pump
RCS	-	Reactor Coolant System
RG	-	Regulatory Guide
RHR	-	Residual Heal Removal
RP	-	Radiation Protection
RTV	-	Room Temperature Vulcanizing
RWST	-	Refueling Water Storage Tank
SSC	-	Structures, Systems and Components
SFA	-	Spent Fuel Assembly
SI	-	Safety Injection
SR	-	Surveillance Requirement
SSC	-	Structures, Systems and Components
TAC	-	Testing and Acceptance Criteria
TIA	-	Task Interface Agreement
TLD	-	Thermoluminescent Dosimetry
TO	-	Temporary Operations
TS	-	Technical Specifications
TSSR	-	Technical Specification Surveillance Requirement
TT	-	Temporary Test
UFSAR	-	Updated Final Safety Analysis Report
URI	-	Unresolved Item