UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30303-8931

MARCH 29, 2000

Duke Energy Corporation
ATTN: Mr. H. B. Barron
Vice President
McGuire Nuclear Station
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: SAFETY SYSTEM ENGINEERING INSPECTION (NRC INSPECTION REPORT NOS. 50-369, 370/2000-03)

Dear Mr. Barron:

This refers to the Safety System Engineering Inspection (SSEI) conducted on February 21 - March 3, 2000, at your McGuire facility. The primary objective of this SSEI was to assess the adequacy of calculations, analyses, and other engineering documents that were used to support the nuclear service water system performance during normal and accident or abnormal conditions.

The inspection found the system was operational overall and would perform the safety functions required by the design bases. The inspection found that engineering activities supported operation and reliability of the system. No violations of NRC requirements were identified during the inspection.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be placed in the NRC Public Document Room.

Sincerely,

/RA/

Edward H. Girard, Acting Chief
Engineering Branch
Division of Reactor Safety

Docket Nos. 50-369, 50-370
License Nos. NPF-9, NPF-17

Enclosure: NRC Inspection Report

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-369, 50-370
License Nos.:	NPF-9, NPF-17
Report Nos.:	50-369/2000-03, 50-370/2000-03
Licensee:	Duke Energy Corporation
Facility:	McGuire Nuclear Station, Units 1 & 2
Location:	12700 Hagers Ferry Road Huntersville, NC 28078
Dates:	February 21 - March 3, 2000
Team Leader:	J. Lenahan, Senior Reactor Inspector Engineering Branch Division of Reactor Safety
Inspectors:	N. Merriweather, Senior Reactor Inspector C. Smith, Senior Reactor Inspector R. Moore, Reactor Inspector
Approved By:	Edward H. Girard, Acting Chief Engineering Branch Division of Reactor Safety

EXECUTIVE SUMMARY

McGuire Nuclear Station
NRC Inspection Report 50-369/2000-03, 50-370/2000-03

This inspection included a review of the licensee's calculations, analyses, performance test procedures and other engineering documents that were used to support the design and performance of the nuclear service water (RN) system during normal and accident or abnormal conditions. A risk-informed approach was used for selection of components and attributes for the inspection. The report covered a two-week period of inspection.

Overall, the inspection found that maintenance and operation of the system was consistent with the design and licensing bases. No violations were identified.

Maintenance

- The service water system has been well maintained with no evidence of system leakage, damaged or degraded equipment. The system has performed reliably.

Engineering

- The design control procedures complied with the requirements of 10 CFR 50.59 and 10 CFR 50, Appendix B, Criterion III. (Section E1.1)

- Design changes to the nuclear service water system were determined to be technically adequate. (Section E1.2)

- The design of the nuclear service water electrical components, including control circuits, and interfaces were consistent with NRC requirements, and the licensing and design bases for the system. The quality of electrical design calculations was generally good, in that no unverified assumptions were noted, appropriate methodologies were used, and appropriate design controls were used in processing calculation revisions. (Section E1.3)

- Instrument loop uncertainty and setpoint calculations were determined to be technically adequate. The calculations used an approved methodology and considered appropriate sources of instrumentation inaccuracies. Instrumentation surveillance procedures were acceptable and adequate for maintaining the design bases for the nuclear service water system. Instrument flow indications and alarm set point values complied with the requirements of the licensing basis. (Section E1.4)

- The mechanical design bases for the nuclear service water system was adequately documented and supported by calculations, design analysis, and test performance documentation. The quality of calculations was good in that the format was consistent, design inputs and assumptions were documented, methodologies were reasonable, conclusions were clearly stated, and inputs between calculations were consistent. Design bases criteria were appropriately translated into procedures and surveillance acceptance criteria used to verify system operability. The licensee had identified and resolved original design deficiencies. (Section E1.5)

- Operation of nuclear service water equipment was consistent with licensing basis information contained in the Updated Final Safety Analysis Report (UFSAR). Design bases information and the UFSAR were generally consistent and reflected plant as-built conditions. (Section E3.1)

- Surveillance test procedures were adequate for maintaining the system design bases and implemented Technical Specification requirements. The surveillance test procedures were being performed in accordance with Technical Specification requirements. (Section E3.2)

- The licensee had properly evaluated the issues in the operating experience or 10 CFR Part 21 reports for impact on McGuire and that appropriate corrective actions had been implemented to resolve the issues. (Section E7.1)

Report Details

Introduction

The objective of this Safety System Engineering Inspection (SSEI) was to assess the adequacy of calculations, analyses, other engineering documents, and maintenance practices that were used to support the performance of the nuclear service water (RN) system during normal and accident or abnormal conditions. The inspection was performed by a team of inspectors that included a Team Leader, and three Region II Inspectors. The systems, structures, and components (SSCs) examined during the inspection were selected by reviewing the licensee's probabilistic risk model to determine the dominant SSCs ranked by their importance in their potential contribution to dominant accident sequences and/or initiators. Acceptance criteria utilized by the NRC inspection team included the McGuire Improved Technical Specifications (ITS), the Updated Final Safety Analysis Report (UFSAR), industry initiatives implemented by the licensee, licensee procedures, and the design bases for the RN system.

II. Maintenance

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Maintenance and Material Condition of Facilities and Equipment

a. Inspection Scope (IP 93809)

The team assessed the material condition of the RN system based on a walk down inspection and review of equipment maintenance and operating history documented in work orders, event reports, equipment trending, and problem investigation program (PIP) reports.

b. Observations and Findings

The piping, equipment, and equipment spaces were well maintained with no evidence of system leakage, damaged or degraded equipment or supports. Housekeeping in the equipment spaces was generally good. The team also performed a walk down inspection and verified the piping was installed in the configuration shown on the design documents. The team verified that system alignment was in accordance with normal plant operating conditions. The system has been maintained in an A-2 maintenance rule status. The documented maintenance history on critical system equipment such as pumps, isolation and throttle valves, continuous vent valves, and heat exchangers indicated reliable equipment performance. The preventive maintenance program for heat exchangers inspection and cleaning was adequate to monitor and maintain the design thermal performance of safety related heat exchangers. Although minor documentation deficiencies were noted, the program for inspection of system piping for degraded conditions was adequate and consistent with the licensee's commitments related to GL 89-13, Service Water System Problems Affecting Safety Related Equipment. The system engineer demonstrated a high level of knowledge and familiarity with the service water system and was fully aware of industry experience relating to the system.

c. Conclusions

The RN system has been well maintained with no evidence of system leakage, damaged or degraded equipment. The system has performed reliably.

III. Engineering

E1 Conduct of Engineering

E1.1 Design Change Control and 10 CFR 50.59 Processes

a. Inspection Scope (IP 93809)

The team reviewed the licensee's procedures which control the design change process, including implementation of 10 CFR 50.59 requirements.

b. Observations and Findings

The licensee's design control procedures adequately addressed the following: design inputs, design verification, control of design output documents, preparation of design calculations, post-modification testing, and control of field changes. The procedures provided good controls for maintaining the design bases and for implementation of design changes. Procedures also specified requirements for maintenance of design documents, environmental qualification of electrical equipment, maintenance of the equipment data base system, and review and changes to the UFSAR.

The team reviewed Nuclear Station Directive NSD-209, 10 CFR 50.59 Program Manual. This procedure implemented the requirements for performing safety evaluations in accordance with 10 CFR 50.59. The procedure provides detailed instructions for performing safety evaluations of temporary and permanent changes to the plant, including procedures. Other regulatory requirements such as fire protection, security, and emergency preparedness were also addressed in procedure NSD-209. The procedure requires that all personnel (managers, screeners, and evaluators) involved in preparation and review of safety screens and evaluations be trained and qualified in accordance with this procedure and procedure NSD-110, Technical Review and Control. All safety screenings and safety evaluations are required to be prepared by a qualified individual, be independently reviewed by a qualified reviewer, and be reviewed and approved by a supervisor.

c. Conclusions

The design control procedures complied with the requirements of 10 CFR 50.59 and 10 CFR 50, Appendix B, Criterion III.

E1.2 Review of Design Changes and 10 CFR 50.59 Safety Evaluations

a. Inspection Scope (IP 93809)

The team reviewed design change activity on the RN system including associated 10 CFR 50.59 evaluations to determine if the implementation of these activities was consistent with regulatory requirements and the design and licensing bases were appropriately updated.

b. Observations and Findings

The plant modification documentation reviewed by the team demonstrated that the design controls implemented by the licensee were consistent with regulatory requirements and station procedures. Procurement of materials for modifications was appropriate for the equipment application. Equivalency evaluations for replacement components, such as the pump impellers, and obsolete equipment adequately addressed the applicable critical characteristics. The design and licensing bases were appropriately updated to reflect changes in the as-built system condition. 10 CFR 50.59 safety evaluations for modified equipment were adequate.

The team also reviewed four minor plant modifications to the instrument and controls systems. Three of these were for changes to instrument set points to reduce the occurrence of nuisance alarms and one to improve operation of the Containment Ventilation Cooling Water system pumps which automatically start upon a low pressure signal from the non-essential header. The team noted that the design change packages did not provide a technical basis for the set point values specified and the set points were not traceable back to a source of design input. Discussions with licensee's engineering personnel revealed that in accordance with the requirements of calculation No. MCC-1210.04-00-0061, Instrument Uncertainty Program Loop Summary Categorization, Revision 0, these instrument loops did not require a documented calculation. In response to the team's request for objective evidence which demonstrated the technical adequacy of the design changes, the licensee provided vendor information and performed informal calculations for the specified set points. The team reviewed the results of the calculations and had no further concerns.

c. Conclusions

Design changes to the nuclear service water system were determined to be technically adequate.

E1.3 Electrical Design Review

a. Inspection Scope (IP 93809)

The team reviewed electrical drawings, calculations, and other design and licensing bases documentation to determine if the RN system electrical components, including control circuits, and interfaces were consistent with the licensing and design bases for the system.

b. Observations and Findings

The electrical calculations demonstrated that the RN pump motors and cables were sized to handle both normal and emergency operating conditions. The motor load breaker protective relays were set to protect the cable and motor and provided coordination with the bus feeder breaker. The voltage drops on the 4160V buses and 600 V load centers, and motor control centers had been analyzed and verified to be acceptable for the electrical loads to perform their required safety functions under normal and accident conditions with both offsite and onsite electrical power. The licensee had design basis calculations that demonstrated under reduced voltage motor operated valves would perform their safety function. The licensee also had calculations

to show that the loads fed from the 125 volt dc (VDC) vital instrumentation and control power system would have adequate voltage available to perform under the worst case voltage condition. The calculations demonstrated that there was adequate margin in the capacity in the 125 VDC batteries to supply the RN design loads for the design duty cycle. The inspectors reviewed the diesel generator steady-state and dynamic loading calculations on a sampling basis and confirmed that risk significant RN loads had been properly addressed in the calculations. These calculations showed that the emergency diesels were capable of supplying the design loads with margin. Overall, the electrical calculations were good, in that no unverified assumptions were noted, appropriate methodologies were used, applicable design inputs were identified, and appropriate design controls were used in processing calculation revisions. The electrical calculations demonstrated that the RN electrical components were cable of performing their design function in accordance with the licensing basis for the plant.

The team also reviewed several electrical modification packages involving the RN systems and found that they were completed in accordance with the design control requirements, and no unreviewed safety questions were introduced with the change. The team found that the 50.59 Safety Evaluations had been properly documented. The specific modification packages reviewed are contained in an appendix to this report.

c. Conclusions

The design of the RN electrical components, including control circuits, and interfaces were consistent with NRC requirements, and the licensing and design bases for the systems. The quality of electrical design calculations was generally good, in that no unverified assumptions were noted, appropriate methodologies were used, and appropriate design controls were used in processing calculation revisions.

E1.4 Review of Instrumentation and Control Design

a. Inspection Scope (IP 93809)

The team reviewed setpoint calculations and associated surveillance procedures to insure that the plant parameters were being maintained as per the design bases.

b. Observations and Findings

The team conducted detailed reviews of instrument loop accuracy calculations prepared for the stand-by nuclear service water pond level and temperature instruments. Additionally, the team reviewed instrument loop accuracy calculations prepared for diesel generator cooling water heat exchanger and containment spray heat exchanger 1A. The calculations were prepared in accordance with the guidance of Engineering Directive Manual, EDM -102, Instrument Set point/ Uncertainty Calculations, Revision 1. Analytical limits established by the TS for the stand-by nuclear service water pond level and temperature were clearly identified and the instrument alarm set points were determined to be technically adequate. Flow indications in the control room for cooling water flow to the above heat exchangers were also technically adequate based on review of the instrument loop accuracy calculations.

The team compared the calculated instrument set point values to values incorporated in annunciator response procedures, calibration procedures and the nuclear service water instrument list and verified that they had been accurately incorporated. Flow balance

results for the nuclear service water system train 1A performed on December 12, 1999 and documented in procedure PT/1/A/4403/007, Revision 35, was also reviewed. The team verified that design flows and target flows listed in the procedure was consistent with calculated values and bounded the flow values listed in UFSAR Table 9-8 for plant design basis accident (DBA) scenarios.

c. Conclusions

Instrument loop uncertainity and setpoint calculations were determined to be technically adequate. The calculations used an approved methodology and considered appropriate sources of instrumentation inaccuracies. Instrumentation surveillance procedures were acceptable and adequate for maintaining the design bases for the RN system. Instrument flow indications and alarm set point values complied with the requirements of the licensing basis.

E1.5 Mechanical Design Review

a. Inspection Scope (IP 93809)

The team reviewed system design and licensing bases documentation to determine if calculation assumptions and design inputs were consistent with the as-built configuration and that applicable design limits and parameters were appropriately translated into surveillance and operating procedures.

b. Findings and Observations

System design calculations associated with flow and thermal performance were consistent with the as-built configuration and assumptions were clearly documented and verifiable. Design limits and parameters were appropriately translated into station procedures and incorporated as performance test acceptance criteria. It was determined by the licensee that routine system flow demand resulted in operation of the RN pumps at less than the optimum operating point on the pump curves which caused excess wear on the original pump impellers. To correct this deficiency, the pump impellers were modified in 1987 incorporating a different material which was more resistant to low flow induced degradation of the impellers, thereby increasing the reliability of the system pumps and reducing maintenance unavailability. Another original design deficiency identified and corrected by the licensee was the potential for air entrainment in the RN supply line to the auxiliary feedwater system due to the an elevation of a section of train A piping above the standby nuclear service water pond (SNSWP) elevation. A continuous vent line and an abnormal procedure operating configuration were established to assure the reliability of the RN supply to the auxiliary feedwater pumps. During walk down inspections, the team verified there was a continuous flow through the vent lines which discharged into equipment drain sumps.

The team also reviewed design calculations and analyses which demonstrated the capability of the SNSWP to serve as the ultimate 30 day heat sink for accident conditions. The licensing basis for McGuire requires the assumption that the normal source of cooling water, Lake Norman, is unavailable as a source of cooling. The team reviewed the calculation which re-computed the volume of water available for cooling in the SNSWP. This calculation used an updated 1999 topographic survey to compute the volume of water in the SNSWP between the service water intake line at elevation 700 and the SNSWP elevation of 739.5 which is the minimum pond elevation specified in

Technical Specification Surveillance Requirement 3.7.8.1. The topographic survey was performed using an electronic depth sounder and a global positioning system (GPS) to accurately establish position. The electronic depth sounding results were checked at 30 random locations using a lead line for determining the water depth. The data from both methods showed close agreement. The team also reviewed calculation MCC-1223.24-00-0002 which calculated the heat input into the pond for the design accident conditions. This analysis is based on a loss of offsite power and a loss of coolant accident (LOCA) in one unit. The heat input was based on operation of the emergency diesel generators, removal of heat from the unit which experienced the LOCA, safe shutdown of the other unit, and provision of makeup water to the spent fuel pool. The heat input loads from calculation MCC-1223.24-00-0002 were used as an input into calculation MCC-1154.00-00-0002 which was used for the thermal analysis of the SNSWP. The thermal analysis used the SNSWP volume determined in calculation MCC-1223.24-00-0002 and Technical Specification 3.7.8 maximum water temperature of 82° Fahrenheit. The calculations showed that the SNSWP was capable of serving as the ultimate heat sink under accident conditions.

c. Conclusions

The mechanical design basis for the RN was adequately documented and supported by calculations, design analysis, and test performance documentation. The quality of calculations was good in that the format was consistent, design inputs and assumptions were documented, methodologies were reasonable, conclusions were clearly stated, and inputs between calculations were consistent. Design bases criteria were appropriately translated into procedures and surveillance acceptance criteria used to verify system operability. The licensee had identified and resolved original design deficiencies.

E3 Engineering Procedures and Documentation

E3.1 Nuclear Service Water System Operation

a. Inspection Scope (IP93809)

The team reviewed design and licensing basis documents in order to determine whether the normal and emergency operation of the system was consistent with the design basis and licensing documents.

b. Observations and Findings

The team selected the following equipment for review:

- Nuclear Service Water Pump Motors 1A & B.
- Nuclear Service Water Strainer Motors 1A & 1B
- Nuclear Service Water Discharge A Isolation Valves 0RN147AC and 0RN148AC
- Nuclear Service Water Essential Header 1A Return Isolation Valve 1RN296A
- Low Level Supply A Isolation Valves 0RN12A,C and 0RN13A

- Nuclear Service Water Channel 1A Supply Isolation Valve 1RN16A
- Nuclear Service Water Pump Motor cooler 1A Control valve 1RN68A
- Nuclear Service water Pump Motor Cooler 1B Control Valve 1RN161B

The team also reviewed operation of the following valves in order to verify that the nuclear service water pumps minimum recirculating flow protection requirements were being met.

- Component Cooling Heat Exchanger 1A Supply Isolation Valve 1RN86A
- Component Cooling Heat Exchanger 1A Outlet Temperature Control Throttle valve 1RN89A

McGuire Nuclear Station UFSAR section 9.2.2, specifies the design bases for the nuclear service water system and describes the normal system operation including normal station cooldown and cold shutdown. Engineered safety features actuation during a design basis accident (DBA) are also described for a containment high pressure signal (S signal) and a containment high-high pressure signal (P signal). The team reviewed design basis information specified in specification MCS-1574.RN-00-0001, Design Basis Specification for the RN System, Revision 13, and approved design output documents including electrical elementary schematics. The design basis specification was a comprehensive document which described the purpose of the system, system scope and boundaries, interfaces with other systems, functional requirements, design requirements, and the licensing basis for the RN system. The design requirements include a listing of controlling calculations, original design codes, and applicable regulatory design criteria. Based on the results of this review the team verified that equipment operation during accident conditions was consistent with the operation described in the UFSAR.

c. Conclusion

Operation of nuclear service water equipment was consistent with licensing basis information contained in the UFSAR. Design bases information and the UFSAR were generally consistent and reflected plant as-built conditions.

E3.2 Consistency of Surveillance Procedures with Design Criteria

a. Inspection Scope (IP 93809)

The team reviewed RN system surveillance procedures to verify that the procedures were consistent with the design and licensing basis, and implemented Technical Specification requirements.

b. Observations and Findings

The team verified that the licensee's RN system surveillance test procedures implemented Technical Specification requirements. The team also verified that acceptance criteria specified in the surveillance procedures were consistent with parameters specified in the design bases. The following procedures were reviewed:

PT/1/A/4400/002C, Nuclear Service Water Valve Verification, is performed every 31 days to verify correct positioning of valves in accordance with TS 3.7.7.1.

PT/1/A/4200/09A, Engineered Safety Features Actuation Periodic Test, is performed every 18 months to verify each service water pump start automatically on an actuation signal and that the automatic valves in the service water system actuate to the correct position on an actuation signal in accordance with TS 3.7.7.2 and 3.7.7.3.

PT/1/A/4600/003B, Daily Surveillance, is performed once per day to verify the water level in the SNSWP is greater than or equal to 739.5 feet and to verify the temperature of the water in the SNSWP is between the minimum and maximum design values. These requirements are specified in TS 3.7.8.1 and 3.7.8.2 and the design bases specification.

PT/0/A/4400/04, Stand by Nuclear Service Water Pond Dam Inspection, is performed every 12 months to verify no abnormal degradation, erosion, or excessive seepage of the SNSWP has occurred. This requirement is specified in TS 3.7.8.3.

The team verified that the licensee was correctly implementing the above listed surveillance requirements by reviewing the completed procedures listed below. These included:

Engineered Safety Features Actuation Periodic Test performed on Unit 1 in October, 1999.

Daily surveillance of SNSWP water level and temperature performed on random dates in July - September, 1999.

Inspections of SNSWP dam performed in December, 1996, November, 1997, May, 1998, and May, 1999.

Monthly valve position verification surveillance performed on various Unit 1 valves during randomly selected months in 1999 and 2000.

The procedures implement the Technical Specification surveillance requirements and were performed at the frequencies specified in the Technical Specifications. Acceptance criteria in the surveillance procedures were as specified in the design bases specification.

c. Conclusions

Surveillance test procedures were adequate for maintaining the system design basis and implemented Technical Specification requirements. The surveillance test procedures were being performed in accordance with Technical Specification requirements.

E.7 Quality Assurance in Engineering Activities

E7.1 Review of Problem Investigation Process Reports

a. Inspection Scope (IP 93809)

The team reviewed Problem Investigation Process reports dating back to 1993 associated with RN which described issues identified through the operating experience assessment program and 10 CFR Part 21 reports. The team reviewed the reports pursuant to the requirements of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

b. Observations and Findings

The team noted that the issues described in the reports had been adequately evaluated for applicability to the McGuire plant and that reportability and operability had also been addressed. The team noted that for those items that were determined to be applicable to McGuire appropriate corrective actions had been taken by the licensee.

c. Conclusions

The licensee had properly evaluated the issues in the operating experience or 10 CFR Part 21 reports for impact on McGuire and that appropriate corrective actions had been implemented to resolve the issue.

V. MANAGEMENT MEETINGS

X1 Exit Meeting Summary

The Team Leader discussed the progress of the inspection with licensee representatives on a daily basis and presented the results to members of licensee management and staff at the conclusion of the inspection on March 2, 2000. The licensee acknowledged the findings presented.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

B. Barron, Vice-President, McGuire Nuclear Station
J. Bryant, Senior Specialist, Regulatory Compliance
M. Cash, Manager, Regulatory Compliance
B. Dolan, Manager, Safety Assurance
T. Geer, Manager, Civil, Electrical, Nuclear Engineering
D. Jamil, Manager, McGuire Nuclear Station
E. Merritt, Electrical Engineer
J. Peele, Manager of Engineering
J. Pring, Mechanical System Engineer

Other licensee employees contacted included engineers and administrative personnel.

NRC:

S. Shaeffer, Senior Resident Inspector

LIST OF INSPECTION PROCEDURES USED

IP 93809, Safety System Engineering Inspection

LIST OF ITEMS OPENED

None

APPENDIX 1

LIST OF DOCUMENTS REVIEWED

TECHNICAL SPECIFICATIONS

3.7.7, Nuclear Service Water System

3.7.8, Standby Nuclear Service Water Pond (SNSWP)

3.8.1, AC Sources - Operating

3.8.4, DC Sources - Operating

Technical Specifications Bases, Section B3.7.7, Nuclear Service Water System (NSWS)

Updated Final Safety Analysis Report (UFSAR)

UFSAR Section 7.4, Systems Required for Safe Shutdown

UFSAR Section 8.3.1, AC Power Systems

UFSAR Section 8.3.2, DC Power Systems

UFSAR Section 8.3.2.1.4, 125 VDC and 120 VAC Vital Instrumentation and Control Power Systems

UFSAR Section 9.2.2.4, Nuclear Service Water System and Ultimate Heat Sink.

CALCULATIONS

MCC-1124.05-00-0005, Standby Nuclear Service Water Pond, Rev. 2, dated 9/14/99

MCC-1150.01-00-0001, SNSWP Thermal Analysis During One Unit Shutdown and One Unit LOCA, Rev. 5, dated 5/12/97

MCC-1205.19-00-0012, Generic Letter 89-10 Butterfly Valve Electric Motor Operator Sizing Calculation, Rev 2

MCC-1210.04-00-0033, Loop Accuracy Calculation for RN to KD Heat Exchanger Flow, dated January 21, 1991.

MCC-1210.04-00-0044, Loop Accuracy Calculation for RN to NS Heat Exchanger Flow (Draft)

MCC-1210.04-00-0045, Loop Accuracy Calculation for SNSWP Temperature 0RN638, Rev 1.

MCC-1210.04-00-0046, Loop Accuracy Calculation for SNSWP Level Loop RN6000, Rev 2

MCC-1210.04-00-0061, Instrument Uncertainty Program Loop Summary Categorization, Rev 0.

MCC-1223.12-00-0008, Functional Design Verification of the ECCS and Containment Spray System, Rev 4, dated 9/18/97

MCC-1223.12-00-0010, Verification of Minimum Available NPSH for ECCS Pumps, Rev 1, dated 9/15/95

MCC-1223.24-00-0001, RN Pump Calculations, Rev 0, dated 11/13/75

MCC-1123.24-00-0002, Standby Nuclear Service Water Pond Design - Design Heat Input, Rev 2, dated 7/9/99

MCC-1223.24-00-0004, RN System Design Parameter Verification, Rev 1, dated 5/7/80

MCC-1223.24-00-0006, Oil Temperature at Centrifugal Charging Pump Bearings and Speed Reducer with Reduced RN Flow, Rev 1, dated 2/19/86

MCC-1223.24-00-0037, Past Operability for PIR 1-M90-0177, Rev 0, dated 9/28/90

MCC-1223.24-00-0043, Operability Evaluation for PIR 1-M91-0111, Broke Tie Rod on Actuator Spring Canister Valve 1RN-190, Rev 1

MCC-1223.24-00-0058, RN Train A Return Header Pressure vs Flow Rate, Rev 1, dated 8/1/94

MCC-1223.24-00-0059, RN Train A Return Header Continuous Vent Volumetric Flowrate, Rev 1, dated 10/22/94

MCC-1223.24-00-0060, RN/SSS Supply to Unit 1 Turbine Driven Pump Suction Continuous Vent Volumetric Flowrate, Rev 0, dated 10/22/94

MCC-1223.24-00-0065, ND, NS, and KF Pump Motor Cooler Operability Evaluation, Rev 2, dated11/10/99

MCC-1223.24-00-0072, RN/KD Hx Tube Plugging Analysis, Rev 1, dated 5/13/98

MCC-1223.24-00-0073, RN Supplied Integral Essential Motor Cooler Tube Plugging Analysis, Rev 2 dated 3/16/98

MCC-1223.24-00-0076, RN/NS Heat Exchanger (Hx)Tube Plugging Analysis, Rev 1, dated 10/5/99

MCC-1223.24-00-0077, Reactor Coolant Pump Motor Stator Cooler Plugging Analysis, Rev 2, dated 11/16/99

MCC-1381.06-00-0001, Calculation for Percentage Impedance and Voltage Drop on Station Auxiliary Transformer, Revision 1

MCC-1381.05-00-009, Design Calculations for Cable Sizing for the Nuclear Service Water Pump Motor, dated 5/17/72

MCC-1381.06-00-0054, Summary of Analysis of Current SSF Diesel Generator Loads, Revision 1

MCC-1381.05-00-0094, Protective Relay Setting Calculation for Essential Switchgear, Revision 14

MCC-1381.05-00-0098, Auxiliary System Voltage and Transformer Tap Study (Unit 1), Revision 6

MCC-1381.05-00-0187, Summary of Analysis of Current Diesel Generator Loads, Revision 7

MCC-1381.05-00-0200, 125 VDC Vital Instrumentation and Control Power System Battery and Battery Charger Sizing Calculation, Revision 4

MCC-1381.05-00-0230, Voltage Drop on the 125 VDC Vital Instrumentation and Control Power System (EPL), Revision _ (Approved 6/4/93)

MCC-1381.05-00-0235, Voltage Drop on the 120 VAC Essential Auxiliary Power (EP1) System, Revision 1

MCC-1381.05-00-0237, Harmonic Voltage Levels on the 120 VAC Vital Instrument and Control (EPG) Power System, Revision 1

MCC-1381.05-00-0240, Analysis of Diesel Generator System Under Dynamic Loading Conditions Using the CYME Program, Revision 1

MCC-1503.13-00-0371, Operability Evaluation for PIR 0-M92-0074, Rev. 1

MCC-1552.08-00-0128, NI Hot Leg Injection Flow Balance Criteria, rev. 1, dated 2/6/97

MCC-1552.08-00-0237, Emergencv Procedure Set Points for NV Minimum Flow, Rev. 0, dated 7/12/94

PROCEDURES

AP/1/A/5500/20, Loss of RN, Rev. 14

EDM-101, Engineering Calculations/Analyses, Rev. 9

EDM-102, Instrument Setpoint/Uncertainity Calculations, Rev 1

EDM-103, Engineering Work Management, Rev 0

EDM-120, Environmental and Seismic Qualification of QA Condition 1 Electrical Enclosures, Rev 0

EDM-130, Engineering Drawings, Rev 7

EDM-170, Design Specifications, Rev 6

EDM-190, Document Quality Guidelines, Rev 2

EDM-200, Plant Engineering Roles and Responsibilities, Rev 5

EDM-201, Engineering Support Program, Rev 5

EDM-410, Inspection Program for Civil Engineering Structures and Components, Rev 5

NSD-110, Technical Review and Control, Rev 4

NSD-203, Operability, Rev 14

NSD-208, Problem Investigation Process (PIP), Rev 21

NSD-209, 10CFR50.59 Program Manual, Rev 9, dated April 3, 1997

NSD-301, Nuclear Station Modifications, Rev 18

IP/O/B/3004/006, NSW Pump A and B Discharge Flow Loop Calibration, dated 8/25/99

IP/O/A3090/21, Loop Calibration and Operational Test Procedure, dated 6/1/98

IP/1/A/3090/021A, Unit 1 Loop calibration and Operational Test Procedure, dated 2/24/99

OP/1/A/6400/006, Nuclear Service Water System, Rev 146

OP/1/A/6400/006/A, Nuclear Service Water System Valve Checklists, Rev 13

PT/1/A/4200/009A, Engineered Safety Features Actuation Periodic Test, Rev 127

PT/1/A/4600/003B, Daily Surveillance Items, Rev 76

PT/A/4400/04, Standby Nuclear Service Water Pond Dam Inspection, Rev 6

PT/1/A/4400/002C, Nuclear Service Water Valve Verification, Rev 13

PT/2/A/4403/05, Nuclear Service Water Train 2B Performance Test, Rev 23

PT/1/A/4403/007, RN Train 1A Flow Balance, Rev 35

PT/1/A/4403/008, RN Train 1B Flow Balance, Rev 29

PT/1/A/4200/17B, NI to Cold Legs Flow Balance, Rev 2

NUCLEAR STATION MODIFICATIONS

NSM MG 60, Main Control Board and HVAC Panel Rotary Switch modifications, Rev 0

NSM MG 128, Optical Isolator Replacement, Rev 0

NSM MG 831, SSF Control Circuitry Redesign for 1RN148A and 1RN4A, Rev 2

NSM MG 1238, Modifications to control circuitry for CCW pump bearing cooling water pump controls and air operated valve 1RC 125, Rev 0

NSM-MG-20637, Unit 2 RN Pump Impeller Replacement, dated 9/1/87

NSM-MG-11843, Unit 1 RN Pump Impeller Replacement, dated 3/2/87

MINOR MODIFICATIONS

MGMM-15233, Replace Valves 1NV-457A AND 1NV-458A, dated 8/7/97

MGMM-9650, Set Point Change to 1RN-PS5100 RV System Starting Setpoint as Backup to RN Systems, dated 8/31/98

MGMM-11257, Change Maximum Stroke Times for Valves ½ RN-69A, -162B, CA-15A, -18B, and -116B to 13 to 18 Seconds from 10 to 15 Seconds, dated 10/27/99

MGMM-3321, Change Set Point and Instrument Model for Instruments 1RNPS5001 AND 1RNPS5011, dated December 12, 1994

MGMM-7457, Change Set Point for Instruments 1RNFS5750, 5770, 5760, and 5780 from 45 GPM to 25GPM, dated November 25, 1996.

MGMM-9650, Change Set Point for Instruments 1RNPS5100 from 7.875 psig decreasing to 6.75 psig decreasing, dated September 8, 1998.

Exempt Change No. ME-VN-2545, Isolation Valves 1RN86A and 1RN187B Modified to Open to Intermediate Position Determined by Valves Limit Switch Settings, dated October 31, 1990.

DRAWINGS

MC-1499-RN.48, Instrument Detail, Standby Nuclear Service Water Pond Temperature, Rev 5

MCEE-112-00.30, and -01 Elementary Diagram Standby Shutdown Facility Transfer Scheme, Sheet .30 (Rev 5), and Sheet -01 (Rev 1)

MCEE-112-00.31 Elementary Diagram Standby Shutdown Facility Contact Development, Rev 6

MCEE-114-00.01, Elementary Diagram Diesel generator 1A Load Sequencer Part 2, Rev 6.

MCEE-114-00.02-01, Elementary Diagram Diesel Generator 1A Load Sequencer Relay Developments, Rev 6.

MCEE- 114-00.03, Elementary Diagram Diesel Generator 1A Load Sequencer Part 3, Rev 4.

MCEE-114-00.04, Elementary Diagram Diesel Generator 1A Load Sequencer Part 4, Rev 7.

MCEE-114-00.05, Elementary Diagram Diesel Generator 1A Load Sequencer Part 5, Rev 7.

MCEE-114-00.07, Elementary Diagram Diesel Generator 1A Load Sequencer Part 7, Rev 2

MCEE-115-00.13, -01, and -02 Elementary Diagram 4160V Switchgear #1ETA Nuclear Service Water Pump Motor 1A, Sheet .13 (Rev 10), Sheet -01 (Rev 5), and Sheet -02 (Rev 8)

MCEE-115-00.32, -01, and -02 Elementary Diagram 4160V Switchgear #1ETB Nuclear Service Water Pump Motor 1B, Sheet.32 (Rev 10), Sheet -01 (Rev 5), and Sheet -02 (Rev 6)

MCEE-115-00.39, Elementary Diagram 4KV Switchgear Breaker Internal Controls, Rev 2

MCEE-138-00.01, Elementary Diagram Low Level Intake Isolation Valve 1RN1, Rev 4

MCEE-138-00.04, -01, and -02 Elementary Diagram CCW Supply B Shutoff Valve 0RN4AC, Sheet .04 (Rev 11), Sheet -01 (Rev 5), and Sheet -02 (Rev 5)

MCEE-138-00.08, -01, and -02 Elementary Diagram Low Level Supply B Shutoff Valve 0RN10AC, Sheet .08 (Rev 8), Sheet -01 (Rev 8), and Sheet -02 (Rev 7)

MCEE-138-00.10, -01, and -02 Elementary Diagram Low Level Supply A Shutoff Valve 0RN12AC, Sheet .10 (Rev 12), Sheet -01 (Rev 8), and Sheet -02 (Rev 7)

MCEE-138.00-11, Elementary Diagram Low Level Supply A Shutoff Valve 0RN13A, Rev 6.

MCEE-138.00-14, Elementary Diagram RN Channel 1A Supply Isolation Valve1RN16A, Rev 6

MCEE-138-00.16, Elementary Diagram RN Strainer 1A Backflush Auto Supply and Drain 1RN21A and 1RN22A, Rev 11.

MCEE-138-00.17, Elementary Diagram Nuclear Service Water Strainer 1A Motor, Rev 9.

MCEE-138-00.18, Elementary Diagram RN Strainer 1B Backflush Auto Supply and Drain 1RN25B and 1RN26B, Rev 12

MCEE-138-00.20 Elementary Diagram Non ESS Header Supply 1A Valve 1RN40A, Rev 5

MCEE -138-00.21 Elementary Diagram Non ESS Header Supply 1B Valve 1RN41B,

Rev 9

MCEE-138-00.23 Elementary Diagram Reactor Building Non ESS Supply Isolation Valve 1RN43A, Rev 8

MCEE-138-00.26, and -01 Elementary Diagram 1A Supply To Auxiliary Feedwater Pumps Isolation Valve 1RN69A, Sheet .26 (Rev 8), and Sheet -01 (Rev 7)

MCEE-138-00.27, Elementary Diagram 1A Diesel Generator HX Supply Isol. Valve 1RN70A, ReviMCEE-138-00.07, -01, and -02 Elementary Diagram SNSWP Supply B Shutoff Valve 0RN9B, Sheet .07 (Rev 6), Sheet -01 (Rev 5), and Sheet -02 (Rev 6)

MCEE-138-00.36 Elementary Diagram NS HX 1A Supply Isolation Valve 1RN134A, Revision 5

MCEE-138-00.39, -01, and -02 Elementary Diagram CCW Discharge A Isolation Valve 0RN147A, Sheet .39 (Rev 9), Sheet -01 (Rev 7), and Sheet -02 (Rev 9)

MCEE-138-00.40, -01, and -02 Elementary Diagram CCW Discharge A Isolation Valve 0RN148AC, Sheet .40 (Rev 9), -01 (Rev 5), -02 (Rev 6)

MCEE-138-00.43, -01, and -02 Elementary Diagram RN Channel Discharge Crossover Isol. Valve 0RN151B, Sheet .43 (Rev 5), Sheet -01 (Rev 4) , and Sheet -02 (Rev 5)

MCEE-138-00.44, -01, and -02 Elementary Diagram SNSWP Discharge B Isolation Valve 0RN152B, Sheet .44 (Rev 6), Sheet -01 (Rev 5), and Sheet -02 (Rev 6)

MCEE-138-00.63, -01, and -02 Elementary Diagram CCW Discharge B Isolation Valve 0RN283AC, Sheet .63 (Rev 8), Sheet -01 (Rev 10), and Sheet -02 (Rev 9)

MCEE-138.00.65, Elementary Diagram Essential Header 1A Return Isolation Valve1 RN296A, Rev 6.

MCEE-138-00.66 Elementary Diagram ESS Header 1B Return Isolation Valve 1RN297B, Rev 6

MCEE-138-00.68, -01, and -02 Elementary Diagram Containment Vent. System Supply Isolation Valve 0RN301AC, Sheet .68 (Rev 9), Sheet -01 (Rev 8), and Sheet -02 (Rev 7)

MCEE-138-00.69, -01, and -02 Elementary Diagram Containment Vent System Supply Isol. Valve 0RN302B, Sheet .69 (Rev 5), Sheet -01 (Rev 4), and Sheet -02 (Rev 6)

MCEE-138-00.73, Elementary Diagram Nuclear Service Water Annunciator Alarms, Rev 5.

MCEE-138-00.80, Elementary Diagram Train A Engineered Safeguards Modulating Control Valves, Rev 2.

MCEE-138-00.81, Elementary Diagram Train B Engineered Safeguard Modulating Control Valves, Rev 2

MCEE-0147-28.00 Elementary Diagram Aux. Feedwater System Nuclear Service Water Supply Valve 1CR0086A, Rev 1

Unit 1 Nuclear Service Water System(RN) Flow Diagrams

MCFD-1574-01.00, RN Trains-Common Components, Rev 5.

MCFD-1574-01.01, RN Trains-Unit 1 Pumps and Cross Connects, Rev 7

MCFD-1574.02.00, RN Train 1A Equipment, Rev 9.

MCFD-1574.02.01, RN Train 1A Equipment, Rev 4.

OVERCURRENT RELAY SETTING SHEETS

MCRS-0115-01.28	MCRS-0115-01.29
MCRS-0215-01.16	MCRS-0215-01.17
MCRS-0115-02.28	MCRS-0115-02.29
MCRS-0215-02.16	MCRS-0215-02.17

Maintenance Work Orders

94030357, dated 8/30/94	94049708, dated 12/15/94	94049709, dated 12/20/94
95037562, dated 4/14/96	95037561, dated 4/25/96	95003047, dated 1/4/96
98144500, dated 10/18/99	95088261, dated 11/13/97	95049284, dated 12/24/95
97034777 dated 10/24/97	98049190, dated 1/11/99	95003048, dated 1/1/96

PROBLEM INVESTIGATION PROCESS (PIP) REPORTS

PIP M-93-00565 - Limitorque Maintenance Update 92-02 (dated 1/27/93)

PIP M-96-02976 - Keys/Keyways for Fisher Model 656/7600 valves may be susceptible to failure (dated 10/22/96)

PIP M-95-01462 - Torque switch roll pin failures (dated 8/10/95)

PIP M-95-01369 - Potential clutch tripper jam-up in limitorque SMB-00 housing (dated 7/25/95)

PIP M-93-00566 - Elevated temperatures affects motor torque and current (dated 5/13/93)

PIP M-00-00830, UFSAR Information related to normal RN flow through KC HXs needs to be revised, dated 03/02/00

PIP M-99-00157, Maintaining RN Flow through KC HXs less than 2500 g.p.m. due to vibration concerns on the KC HX tubes, dated 01/14/99

MISCELLANEOUS DOCUMENTS

Specification MCS-1154.00-00-002, Rev 1, 1/11/93, Design Basis Specification - Nuclear Service Water Structures.

Specification MCS-1574.RN-00-0001, Rev 13, 6 /26/90, Design Basis Specification for the RN System.
Generic Letter 89-13, Service Water System Problems Affecting Safety Related Equipment, dated July 18, 1989

Duke Power Initial and Supplemental Response Letters to the NRC related to GL 89-13, dated 1/26/90, 11/19/90, 5/13/92, 7/14/93, 3/16/94, and 9/30/96

Service Water System Program Manual, dated 8/16/96