November 25, 1997

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

SUBJECT: ISSUANCE OF AMENDMENTS - MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 (TAC NOS. M99763 AND M99764)

Dear Mr. Barron:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 177 to Facility Operating License NPF-9 and Amendment No. 159 to Facility Operating License NPF-17 for the McGuire Nuclear Station, Units 1 and 2. The amendments consist of changes to the Technical Specifications (TS) in response to your application dated October 13, 1997, as supplemented by letters dated October 28 and November 5, 1997.

The amendments revise TS Table 3.3-4, "Engineered Safety Features [ESF] Actuation System Instrument Trip Setpoints." Specifically, the amendments support the replacement of the three safety-related narrow range Refueling Water Storage Tank level instruments with three safety-related wide range level instruments. The ESF trip setpoint for the refueling water automatic switchover to recirculation is revised to account for the difference in instrument uncertainty associated with wide range level instruments and provides additional operator response time margin.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

Original signed by:

Victor Nerses, Senior Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosures:
1. Amendment No. 177 to NPF-9
2. Amendment No. 159 to NPF-17
3. Safety Evaluation

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DATE	11/25 /97	11/21 /97	11/24//97	11/25 /97
COPY	YES NO	YES NO	YES NO	YES NO

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P PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Victor Nerses, Senior Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosures:
1. Amendment No. 177 to NPF-9
2. Amendment No. 159 to NPF-17
3. Safety Evaluation

cc w/encl: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CORPORATION

DOCKET NO. 50-369

McGUIRE NUCLEAR STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 177
License No. NPF-9

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the McGuire Nuclear Station, Unit 1 (the facility), Facility Operating License No. NPF-9 filed by the Duke Energy Corporation (licensee) dated October 13, 1997, as supplemented by letters dated October 28 and November 5, 1997, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (I) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-9 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 177, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented consistent with the refueling outage scheduled for June 1998.

FOR THE NUCLEAR REGULATORY COMMISSION

Herbert N. Berkow, Director
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Technical Specification
Changes

Date of Issuance: November 25, 1997

ATTACHMENT TO LICENSE AMENDMENT NO. 177

FACILITY OPERATING LICENSE NO. NPF-9

DOCKET NO. 50-369

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
3/4 3-31	3/4 3-31
B 3/4 1-3	B 3/4 1-3

TABLE 3.3-4 (Continued)
ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
7. Auxiliary Feedwater (continued)		
f. Station Blackout - Start Motor-Driven Pumps and Turbine-Driven Pump (Note 1)		
1) 4 kV Loss of Voltage	3174 ± 45 volts with a 8.5 ± 0.5 second time delay	≥ 3122 volts
2) 4 kV Degraded Voltage	≥ 3678.5 volts with ≤ 11 second with SI and ≤ 600 second without SI time delays	≥ 3661 volts
g. Trip of Main Feedwater Pumps - Start Motor-Driven Pumps	N.A.	N.A.
8. Automatic Switchover to Recirculation RWST Level	≥ 180 inches	≥ 175.85 inches
9. Loss of Power		
a. 4 kV Loss of Voltage	3174 ± 45 volts with a 8.5 ± 0.5 second time delay	≥ 3122 volts
b. 4 kV Degraded Voltage	≥ 3678.5 volts with ≤ 11 second with SI and ≤ 600 second without SI time delays	≥ 3661 volts
10. Engineered Safety Features Actuation System Interlocks		
a. Pressurizer Pressure, P-11	≤ 1955 psig	≤ 1965 psig
b. T_{avg}, P-12	≥ 553°F	≥ 551°F
c. Reactor Trip, P-4	N.A.	N.A.
d. Steam Generator Level, P-14	See Item 5b. above for all Trip Setpoints and Allowable Values.	

Note 1: The turbine driver pump will not start on a blackout signal coincident with a safety injection signal.

BORATION SYSTEMS (Continued)

Refueling Water Storage Tank Requirements for Maintaining SDM - Modes 1-4

Required volume for maintaining SDM	presented in the COLR
Unusable volume (below nozzle)	16,000 gallons
Additional margin	23,500 gallons

With the RCS temperature below 200°F, one Boron Injection System is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single Boron Injection System becomes inoperable.

The limitation for a maximum of one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all charging pumps except the required OPERABLE pump to be inoperable below 300°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV. Allowing two Centrifugal Charging pumps to operate simultaneously for ≤15 minutes increases the margin of safety with respect to the Reactor Coolant pump seal failure resulting in a LOCA in that the Reactor Coolant pump seal injection flow is not interrupted during pump swap. For the 15 minute period during which simultaneous Centrifugal Charging pump operation is allowed, the safety margins as related to the mass addition analysis are not appreciably reduced. Technical Specification 3.4.9.3 requires two PORVs to be operable during this period of operation, thus a mass addition transient can be relieved as required assuming the two PORVs function properly.

The boron capability required below 200°F is sufficient to provide a SHUTDOWN MARGIN of 1% delta k/k after xenon decay and cooldown from 200°F to 140°F. The minimum borated water volumes and concentrations required to maintain shutdown margin for the Boric Acid Storage System and the Refueling Water Storage Tank are presented in the Core Operating Limits Report.

The Technical Specification LCO value for the Boric Acid Storage Tank and the Refueling Water Storage Tank minimum contained water volume during Modes 5 and 6 is based on the required volume to maintain shutdown margin, an allowance for unusable volume and additional margin as follows:

Boric Acid Storage Tank Requirements for Maintaining SDM - Modes 5 & 6

Required volume for maintaining SDM	presented in the COLR
Unusable volume (to maintain full suction pipe)	4,199 gallons
Additional margin	4,100 gallons

Refueling Water Storage Tank Requirements for Maintaining SDM - Modes 5 & 6

Required volume for maintaining SDM	presented in the COLR
Unusable volume (below nozzle)	16,000 gallons
Additional margin	23,500 gallons

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUKE ENERGY CORPORATION

DOCKET NO. 50-370

McGUIRE NUCLEAR STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 159
License No. NPF-17

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the McGuire Nuclear Station, Unit 2 (the facility), Facility Operating License No. NPF-17 filed by the Duke Energy Corporation (licensee) dated October 13, 1997, as supplemented by letters dated October 28 and November 5, 1997, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (I) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-17 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 159, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Herbert N. Berkow, Director
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Technical Specification
Changes

Date of Issuance: November 25, 1997

ATTACHMENT TO LICENSE AMENDMENT NO. 159

FACILITY OPERATING LICENSE NO. NPF-17

DOCKET NO. 50-370

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
3/4 3-31	3/4 3-31
B 3/4 1-3	B 3/4 1-3

TABLE 3.3-4 (Continued)

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f. Station Blackout - Start Motor-Driven Pumps and Turbine-Driven Pump (Note 1)		
1) 4 kV Loss of Voltage	3157 ± 45 volts with a 8.5 ± 0.5 second time delay	≥ 3108 volts
2) 4 kV Degraded Voltage	≥ 3703 volts with ≤ 11 second with SI and ≤ 600 second without SI time delays	≥ 3685.5 volts
g. Trip of Main Feedwater Pumps - Start Motor-Driven Pumps	N.A.	N.A.
8. Automatic Switchover to Recirculation RWST Level	≥ 180 inches	≥ 175.85 inches
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Note 1: The turbine driven pump will not start on a blackout signal coincident with a safety injection signal.

BORATION SYSTEMS (Continued)

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Unusable volume (below nozzle)	16,000 gallons
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 177 TO FACILITY OPERATING LICENSE NPF-9

AND AMENDMENT NO. 159 TO FACILITY OPERATING LICENSE NPF-17

DUKE ENERGY CORPORATION

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

By letter dated October 13, 1997, as supplemented October 28 and November 5, 1997, Duke Energy Corporation (the licensee) submitted a request for changes to the McGuire Nuclear Station, Units 1 and 2, Technical Specifications (TS). The requested changes would replace the existing three safety-related narrow range refueling water storage tank (RWST) level instruments with three Class 1E safety-related wide range level instruments. As part of this instrumentation modification, the licensee will install the transmitters in a single large enclosure that is part of the RWST missile wall, and will install heaters and associated temperature instrumentation in the enclosure to maintain ambient conditions in the enclosure between 15.6°C (60°F) and 21.1°C (70°F) with an outside temperature of -20.6°C (-5°F). This safety evaluation addresses this new instrumentation design and installation.

Additionally, the licensee proposed a revised setpoint for automatically switching the emergency core cooling water source from the RWST to the containment sump. The engineered safety feature actuation setpoint must be changed to account for an increase in instrument uncertainty, and to correct a previously discovered nonconservative trip setpoint value.

The October 28 and November 5, 1997, letters provided clarifying information that did not change the scope of the original Federal Register notice and the initial proposed no significant hazards consideration determination.

2.0 BACKGROUND AND SYSTEM DESCRIPTION

2.1 Background

The licensee proposes to replace the existing narrow range transmitters on the RWST with wide range transmitters to enhance Emergency Core Cooling Water System (ECCS) reliability and provide operational margin during post-accident conditions. Indication over the entire range of the tank level becomes available with wide range instrumentation. Also, operators will have additional response time for performing manual actions and to more quickly diagnose some instrument failure modes.

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The RWST is designed to provide a source of borated water, at refueling water boron concentration, to the ECCS during a design basis accident requiring safety injection. The RWST also provides a source of borated water to the refueling cavity during refueling operations and make-up water to the spent fuel pool.

The Refueling Water (FW) system is designed such that when the RWST level reaches the LOW level setpoint (in conjunction with a safety injection signal) it will automatically initiate switchover of the Residual Heat Removal ND (RHR) pumps to the containment sump. This is accomplished by automatically opening containment sump suction valves and closing the RHR suction valves from the RWST. The RWST LOW level alarms to alert the operator that the RHR pumps have been switched over automatically and the necessary manual actions for completing the transfer to cold leg recirculation must be started (i.e., begin transferring the remaining ECCS pumps to the containment sump). The RWST low level setpoint is established such that adequate time is provided for completion of all required manual operator actions to complete the switchover to cold leg recirculation prior to the loss of usable RWST volume and loss of suction to the ECCS pumps.

The licensee stated that the volume of the RWST from the bottom of the overflow line is 392,867 gallons. The proposed wide range level sensors use differential pressure (DP) sensors, with a vent line to atmosphere. The tank is also vented to atmosphere. The instrument taps are located in the side of the tank, 20 inches from the bottom, which is the same elevation as the bottom of the suction pipe at tank side entry level.

Technical Specification 3.1.2.5 includes a surveillance performed once per 7 days during Modes 5 and 6 to verify that the required contained volume of RWST water is available to meet shutdown margin requirements. The surveillance value is contained within the Core Operating Limit Report (COLR) and includes:

1. The required minimum water volume to maintain shutdown margin requirements,

2. The unusable volume below the outlet pipe nozzle, and

3. The additional margin, which is based upon instrument uncertainty, pump vortexing, and discretionary margin.

The required minimum RWST volume to maintain Shutdown Margin (SDM) for the current cycle as given in the COLR is: for Modes 1 - 4, 57,107 gallons, and for Modes 5 and 6, 3,500 gallons. The minimum contained water volume required is the sum of the SDM water plus the unusable volume and Additional Margin as outlined in the Technical Specification Bases Section 3.1.2.

The proposed Additional Margin value also accounts for the change in instrument uncertainty due to the replacement of the transmitters. The proposed change in the Additional Margin in TS Bases Section 3.1.2 for Modes 5 and 6 is from 6,500 gallons to 23,500 gallons, an increase of 17,000 gallons.

The proposed change in the switchover to recirculation setpoint accomplishes three objectives:

1. Accommodates the additional instrument uncertainty of the wide range instruments,

2. Provides additional time for the manual operator actions required to complete switchover to cold leg recirculation prior to the loss of usable RWST volume, and

3. Corrects a previously identified nonconservative Technical Specification value for the ECCS switchover setpoint.

In order to meet the above three objectives, the RWST level setpoint for automatic switchover to recirculation is proposed to be revised from ≥ 90 inches (allowable value ≥ 80 inches) to ≥ 180 inches (allowable value ≥ 175.85 inches) in Table 3.3-4 of the Technical Specifications.

The licensee stated that with its proposed Technical Specification change, the requirements for delivered volume of water from the RWST assumed in the accident analysis are still met. The licensee stated that all the analyses were performed consistent with NRC-approved methodology.

2.2 System Description

The RWST level instrumentation system is designed to automatically initiate RHR pump suction switchover to the containment sump when the safety-related RWST level instrumentation indicates the RWST level has decreased to the RWST low level setpoint (in conjunction with a safety injection signal). This switchover is accomplished by automatically opening suction valves between the containment sump and RHR pumps, and closing the suction valves between the RWST and the RHR pumps.

The RWST level instruments also provide multiple safety-related RWST low level alarms to alert the operator to start necessary manual actions for completing the transfer to cold leg recirculation when the RHR pumps have been switched over to the containment sump. These actions require transferring the remaining ECCS pumps to the containment sump. The RWST low level setpoint is established such that adequate time is provided for completion of required manual actions for the switchover to cold leg recirculation prior to the loss of usable RWST volume and loss of suction to the ECCS pumps.

Presently, the three safety-related narrow range RWST level transmitters that provide level indication and initiate automatic switchover to recirculation function are offscale high during normal operation. These level transmitters are routinely checked for calibration and verified for acceptable operability. However, because the transmitters are normally offscale high, operators cannot diagnose certain instrument failures when the failures occur, including past

failures that were caused by exposure of the instruments to subfreezing ambient conditions and insect blockage of the instrument reference legs. Additionally, with the existing narrow range safety-related instrumentation, the operator cannot monitor the RWST level or confirm level instrumentation response until the RWST level decreases to just above the RWST low level setpoint for automatic switchover. Replacing the narrow range transmitters and associated main control room indicators with wide range transmitters and new indicators will allow the operators to monitor the entire range of RWST level with safety-related instrumentation.

The existing three level transmitters are located in separate metal enclosures between the RWST and the RWST missile wall. During periods of cold weather, the temperature in the enclosures is difficult to regulate because of their relatively small size. In the proposed installation, the new instruments will be installed in a larger single insulated heated enclosure that is between the RWST and the RWST shield wall.

To ensure the temperature in the new enclosure does not decrease below the lowest qualification temperature of the new instrumentation (40°F), the licensee will install two space heaters, powered from independent non-Class 1E power sources. Each heater is capable of maintaining the ambient temperature in the enclosure between 15.6°C to 21.1°C (60°F to 70°F) with an outside temperature of -20.6°C (-5°F), which is the lowest recorded outside temperature at the McGuire site. The backup heater operating range is 8.9°C to 21.1°C (48°F to 70°F). An alarm in the main control room will alert the operators when the heaters fail to maintain the instrument enclosure temperature above 10°C (50°F).

Two redundant heat tracing systems powered from independent nonsafety-related power sources are provided for the exposed portions of the RWST level instrument sensing lines. The status of the power sources is monitored by the operators in the main control room.

3.0 STAFF EVALUATION

The staff's evaluation of the proposed RWST level measurement instrumentation system is provided in the following sections.

3.1 LOCA Mass and Energy Release and Containment Response

The change in the RWST LOW level setpoint reduces the RWST volume that is delivered to the primary system in the injection phase of a LOCA. However, the total amount of water delivered to the vessel from all sources remains the same. The containment pressure is increased by the changes proposed by the licensee because of the increase in the water temperature delivered to the vessel. A reanalysis of the containment pressure response using the NRC-approved methodology of DPC-NE-3004 demonstrates that the peak containment pressure remains below the design limit for the proposed RWST LOW level setpoint.

The design internal pressure for the McGuire containment is 15 pounds per square inch gauge (psig). The GOTHIC containment reanalysis with the RWST level setpoint changes resulted in a peak pressure of 13.43 psig following the limiting large break LOCA. Since this value is less than the 15 psig design value, it was found to be acceptable.

3.2 The Post-LOCA Dose Radiological Calculations

The setpoint changes will slightly shorten the time before the ECCS recirculation phase begins. Since containment spray will continue in the recirculation phase, there is no change in the removal of airborne radioactivity credited for the LOCA dose analysis. However, the recirculation phase will lengthen slightly, an increase of a few minutes. Consequently, the time during which radioactivity is leaking from ECCS equipment outside of containment increases slightly. The licensee calculated the increase in the thyroid dose at the EAB to be 4 mrem; this increase does not materially change the 150 rem thyroid dose currently reported for the LOCA at the EAB in Table 15-12 of the Updated Safety Analysis Report. The licensee calculated dose increases less than 1 mrem for the Low Population Zone and the control room. These doses continue to meet the dose acceptance criteria of 10 CFR Part 100 and General Design Criterion 19 in Appendix A of 10 CFR Part 50.

3.3 Post-LOCA Subcriticality

The licensee's analysis calculated the post-LOCA sump mixed mean boron concentration as a function of pre-trip Reactor Cooling System (RCS) boron concentration. Water mass contributions from the RCS, cold leg accumulators (CLAs), RWST, Ice Condenser, and intermediate ECCS piping were accounted for. Boron sources have either a fixed concentration or a variable concentration to account for fuel cycle burnup. High concentration borated water (e.g., RWST and CLAs) are conservatively minimized using COLR minimum allowed values minus associated measurement uncertainties. A conservative borated water mass contribution from the ice condenser was included. Potential borated water holdup in upper containment from the initiation of normal containment spray was taken into account.

The results of the analysis were compared with the required boron concentrations necessary to keep the core subcritical, with no credit taken for control rod insertion, during the sump recirculation mode. The analysis provides an available sump mixed mean boron concentration curve that must bound the required all-rods-out (ARO) critical boron concentrations for each cycle for all burnups. The required ARO critical boron concentrations are evaluated for each core design as part of the reload safety analysis process.

The impact the proposed modification has on this analysis is to alter one of the input assumptions, the assumed RWST volume. A sample calculation to illustrate the impact of the proposed RWST level modification showed that the limit for the maximum ARO critical boron concentration at any temperature was reduced by approximately 14 ppm for McGuire Unit 2 Cycle 12 at 4 effective full power days.

The licensee stated that the remainder of the Chapter 15 accidents are not impacted by the RWST level modifications. The LOCA blowdown, refill, and reflood phases of the analysis are not affected. The limiting peak clad temperatures (PCT) occur during the reflood phase of the transient. The end of the reflood phase has traditionally been identified as the point in time when the core has been quenched. The transfer to sump recirculation occurs during the post-reflood phase. Peak clad temperatures occur prior to sump recirculation. Therefore, it is concluded that the proposed RWST level modification does not impact the LOCA PCT analyses.

3.4 Net Positive Suction Head (NPSH)

The licensee stated that with the switchover to recirculation setpoint change, the system design will still provide enough injected water to ensure that the reactor remains shut down, as well as provide sufficient water depth within the containment sump to ensure adequate net positive suction head (NPSH) for the ECCS pumps and protect against vortexing. Also, adequate time is provided to ensure the completion of all operator actions necessary for switchover to cold leg recirculation prior to the loss of all usable RWST inventory and loss of suction to the ECCS pumps.

The licensee stated that the NPSH calculation verifies that the minimum NPSH available for ECCS pump operation meets the required NPSH. This calculation conservatively assumes no water in the containment sump. It also conservatively assumes a sump temperature that is higher than the analyzed sump temperature that correspondingly affects vapor pressure and available NPSH. The volume of water at static elevation head from the floor of the sump to the pump centerline is sufficient to meet pump NPSH requirements. Therefore, this Technical Specification submittal and associated modification does not affect the required or available NPSH.

3.5 Single Failures

IEEE Std 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations" as referenced in 10 CFR 50.55a(h), requires that any single failure within the protection system shall not prevent proper protective action at the system level when required. The proposed RWST level instrumentation will retain the same separation and independence as the existing three safety-related narrow range instruments. The trip logic for initiating switchover to the containment sump is two-out-of-three. Consequently, failure of a single RWST level channel will not prevent the RWST level system from performing its safety function. The staff, therefore, finds that the proposed configuration of three independent safety-related level instruments is acceptable.

3.6 Quality of Components and Modules

IEEE Std 279-1971 requires that components and modules shall be of high quality. Quality shall be achieved through the specification of requirements known to promote high reliability, such as requirements for design, manufacturing, inspection, calibration, and test.

The major components of the proposed RWST level instrumentation are the sensing lines from the RWST to the level instruments, level instruments, wiring from the level instruments to the RWST switchover logic relays and the control room, control room displays, and heaters for the new instrumentation enclosure.

In the existing configuration, the sensing lines from the RWST penetrations to the level instrument enclosures are adequately separated. In the proposed design, the tubing runs in the new enclosure will be parallel to each other. To ensure adequate separation and independence, the sensing lines from the RWST penetrations to the new level instrument transmitters will be secured with tubing mounting brackets. The staff finds the quality of the level instrument sensing lines to be acceptable.

Rosemount 1153D differential pressure transmitters will be used to measure the RWST level. These transmitters are manufactured as Class 1E nuclear safety-related components, and were qualified by the manufacturer in accordance with IEEE-323-1983, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Generating Stations," and ANSI/IEEE-344-1987, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations." The qualification practices described in these standards have been found acceptable to the staff. Additionally, the manufacturer provides traceability of the transmitter pressure retaining parts. The licensee stated that Rosemount Inc. is on the licensee's Approved Suppliers List for safety-related equipment. The staff finds the quality of level instruments to be acceptable.

As stated above, the proposed RWST level instrumentation channels will retain the same separation and independence as the existing three safety-related narrow range instruments. The wiring from the level instruments to the control room will be separated in safety-related cable runs. The staff finds the quality of level instrument wiring to be acceptable.

New safety-related RWST level displays will replace the existing narrow range displays in the control room. The replacement displays indicate 0-500 inches water level. The new displays will be of the same quality as the existing displays. The staff finds the quality of the displays to be acceptable.

The RWST level instrumentation enclosure heaters and power supplies are non-Class 1E. However, the redundant heaters in the enclosure receive power from independent power sources, and are monitored by the operator in the main control room. Additionally, the temperature in the RWST level instrumentation enclosure will not decrease to unacceptably low levels on loss of the heaters, and is monitored in the main control room with an alarm for low temperature. The staff finds the quality of the enclosure heaters and power supplies to be acceptable.

On the basis of the above evaluations, the staff concludes that the quality of components and modules in the proposed RWST level measurement system is acceptable.

3.7 Equipment Qualification

IEEE Std 279-1971 requires that type test data or reasonable engineering extrapolation based on test data shall be available to verify that protection system equipment performs as necessary to achieve the safety system requirements. General Design Criterion (GDC) 1 in Appendix A to 10 CFR Part 50 requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

In Table 1, the McGuire plant-specific environmental conditions for temperature, humidity, pressure, and radiation at the instrument location are compared to the Rosemount 1153D level instrument environmental qualification values obtained from the Rosemount Model 1153 Series D Product Data Sheet PDS 4388, Rev 1/92. The McGuire data were obtained from the McGuire Final Safety Analysis Report. The Rosemount 1153D differential pressure transmitters were qualified by the manufacturer in accordance with IEEE-323-1983 and ANSI/IEEE-344-1987.

Table 1. Comparison of McGuire Environmental Conditions with Level Instrument Environmental Qualification Values

Parameter	McGuire	Level Instrument
Temperature	15°C to 40°C* (-5°F to 104°F)*	4.4°C to 93.3°C (40°F to 200°F)
Humidity	>0% to 100% RH	0% to 100% RH
Pressure	Atmospheric	3.4kPa - 13.8MPa 0.5 psia - 2000 psig
Radiation	10 Gy TID	5×10^5 Gy TID

*Lowest and highest recorded temperatures at plant site, based on historic meteorology data from McGuire FSAR Table 2-9.

As shown in Table 1, the Rosemount 1153D qualification values for humidity, pressure, and total integrated dose envelope the McGuire environmental conditions, and, therefore, are acceptable.

The temperature envelope for the level instruments does not envelope the recorded range of temperature extremes observed in the vicinity of the McGuire station site. However, the licensee is installing heaters as described previously, and a temperature sensor and transmitter in the instrument enclosure to monitor the ambient temperature. The plant computer will provide alarming capabilities should the ambient temperature in the enclosure deviate from predetermined high and low values. A low temperature alarm will actuate at 10°C (50°F) to alert operators of a low temperature condition. The licensee states that an ambient temperature of 10°C (50°F) would indicate failure of the primary heater or the inability of the primary heater to maintain the desired area temperature. A low-low temperature alarm at 4.4°C (40°F) alerts the operators that the transmitters have reached their low temperature limit. High and high-high temperature alarms are also provided to alert the operators of a high temperature condition inside the enclosure. Since the qualification temperature of the level instruments is 93.3°C (200°F), and the instruments are located outside the containment building in an ambient environment, the upper temperature instrument qualification bounds the expected temperature conditions at the instrument location. The staff finds the level instrument environmental qualification for temperature to be acceptable.

The RWST level transmitter location within the RWST missile shield is subject to seismic levels less than one-fifth the seismic level to which the transmitters have been qualified (7g acceleration). The licensee evaluated the seismic response spectra against the new instrument installation and determined that the installation meets seismic requirements for the site. The instrument sensing lines will be secured to the enclosure wall with safety-related brackets such that a design-basis seismic event will not cause instrument sensing line failures. The staff finds the site seismic qualification for the RWST instrument installation is within the site seismic qualification envelope, and, therefore, is acceptable.

The licensee evaluated the electromagnetic environment for susceptibility and emissions of electromagnetic interference (EMI) in accordance with the guidelines of NRC approved EPRI Topical Report TR-102323. The licensee states that the RWST enclosure EMI environment meets the guidelines of EPRI TR-102323, Table 6-1. The staff, therefore, finds the electromagnetic qualification to be acceptable.

3.8 Channel Integrity

IEEE Std 279-1971 requires that the three RWST level instrument channels maintain necessary functional capability and integrity under extremes of conditions relating to environment, energy supply, malfunctions, and accidents.

The RWST level instrumentation is located in a temperature controlled enclosure in a mild environment outside the containment building. The new instruments will receive power from the same Class 1E sources as used by the existing instruments. The instruments will be mounted with separate Class 1E mountings. The three channels do not share common equipment that could cause multiple failures of more than one channel. The staff finds the channel integrity to be acceptable.

3.9 Channel Independence

IEEE Std 279-1971 requires that channels that provide signals for the same protective function shall be independent and physically separated to decouple the effects of unsafe environmental factors, electric transients, and physical accident consequences documented in the design basis. Channel independence prevents interactions between channels during maintenance operations or in the event of a channel malfunction. Regulatory Guide (RG) 1.75, Rev.2, "Physical Independence of Electric Systems," endorses IEEE Std 384-1974, which describes an acceptable method of ensuring that the circuits and electric equipment for systems that perform safety-related functions are physically independent.

The three RWST level channels are physically and electrically separated, thus providing channel independence. The instruments will be installed such that a single failure of one instrument will not cause failures in the other instruments. The logic for initiating switchover to the containment sump remains the same as in the existing narrow range temperature configuration (i.e., two-out-of-three). Separation between safety-related and nonsafety-related cabling is consistent with the guidance provided in RG 1.75. The staff finds the RWST level instrument channel independence to be acceptable.

3.10 Control and Protection System Interaction

IEEE Std 279-1971 requires that control and protection system interactions shall not degrade the safety-related functional performance and reliability of protection systems. Control and protection system interaction is divided into three major categories: isolation devices, single random failures, and multiple failures resulting from a credible single event.

3.10.1 Isolation Devices

IEEE Std 279-1971 requires that the transmission of signals from protection system equipment for control system use shall be through isolation devices, which shall be classified as part of the protection system. In the RWST level instrumentation design, the non-Class 1E circuits for the enclosure heater controls is separated from the Class 1E circuits for the three RWST level instruments. The isolation devices between the new transmitters and the nonsafety-related plant computer will be the same type as used for the existing transmitters. The staff concludes that the RWST level instrumentation system separation and isolation from the enclosure heater controls and the plant computer are acceptable.

3.10.2 Single Random Failure

IEEE Std 279-1971 requires that, in instances where a single random failure can cause a control system action which results in a condition requiring a protective function and can prevent proper actuation of a protection system channel designed to protect against the condition, the remaining redundant protection channels shall be capable of providing the protective function even when degraded by a second random failure. There are no RWST control system actions that can affect the RWST level instruments. The staff, therefore, finds that single random failures in control systems have been acceptably addressed in the RWST level instrumentation design.

3.10.3 Multiple Failures Resulting from a Credible Single Event

IEEE Std 279-1971 requires that, in cases where a credible single event can cause a control system action that results in a condition requiring a protective function and can concurrently prevent the protective function from those protection system channels designated to provide principal protection against the condition, one of two possible mitigating options must be met. The two options are (1) provide alternate channels not subject to the same credible event to limit the consequences of the event, or (2) provide equipment to detect the event and limit the consequences. There are no control system actions associated with the RWST level instruments. The staff, therefore, finds that the proposed design acceptably addresses multiple failures resulting from a credible single event.

3.11 Derivation of System Inputs

IEEE Std 279-1971 requires that, to the extent feasible and practical, protection system inputs shall be derived from signals that are direct measures of the desired variables. The RWST differential pressure transmitters measure the pressure head of the water in the RWST, which is a direct indication of RWST water level. The staff, therefore, finds these measurement devices to be acceptable for indicating RWST water level.

3.12 Capability for Sensor Checks

IEEE Std 279-1971 requires that means shall be provided for checking, with a high degree of confidence, the operational availability of each system input sensor during reactor operation. The proposed installation replaces the three existing narrow range RWST level indications in the main control room with three wide range indications (0 - 500 inches). These indicators will provide the operators with continuous indication of level instrument response to changing conditions in the RWST. Additionally, the operators will be provided with alarms for high and low enclosure temperature, and loss of an enclosure heater power source. The staff finds the above capability for checking the operational availability of each RWST sensor to be acceptable.

3.13 Capability for Test and Calibration

IEEE Std 279-1971 requires that capability shall be provided for testing and calibrating channels and the devices used to derive the final system output signal from the various channel signals. The RWST level instrument design provides test point connections that are easily accessible for performing instrument operability tests and calibrations. Administrative procedures will be used to allow a sensor to be taken out of service and tested during all reactor operating modes. The staff finds the above testing and calibration capabilities to be acceptable.

3.14 Access to Means for Bypassing

IEEE Std 279-1971 requires that the system design shall permit the administrative control of the means for manually bypassing channels or protective functions. Access to the means for bypassing the level transmitters will be under the licensee's administrative control. The administrative controls require that the reactor operators be notified before taking a RWST level instrument channel out of service. The administrative controls will also ensure that no more than one channel is removed from service for surveillance during Modes 1, 2, and 3, which are the TS modes requiring RWST level instrument operability. An indication in the main control room will remain illuminated whenever an RWST level instrument channel is taken out of service for surveillance or calibration. The staff finds the administrative controls for bypassing the level transmitters to be acceptable.

On the basis of the previous discussion, the staff concludes that the design of proposed RWST level instrumentation for McGuire, Units 1 and 2, is in accordance with the requirements of IEEE Std 279-1971, as referenced in 10 CFR 50.55a(h), and GDC 1 of Appendix A to 10 CFR Part 50, for quality of safety-related instrumentation, and, therefore, is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the North Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (62 FR 54859 dated October 22, 1997). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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