March 4, 2004

Mr. D. M. Jamil
Vice President
Catawba Nuclear Station
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNITS 1 AND 2 RE: ISSUANCE OF AMENDMENTS (TAC NOS. MB8106 AND MB8107)

Dear Mr. Jamil:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 212 to Renewed Facility Operating License NPF-35 and Amendment No. 206 to Renewed Facility Operating License NPF-52 for the Catawba Nuclear Station, Units 1 and 2. The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated March 20, 2003, as supplemented by letters dated June 10, September 30, and October 22, 2003.

The amendments revise the TSs to update the heatup, cooldown, criticality, and inservice test pressure and temperature limits for the reactor coolant system of each unit to a maximum of 34 Effective Full Power Years. Additionally, the amendments revise the Low Temperature Overpressure (LTOP) System TSs in order to reflect the revised pressure-temperature limits and the revised LTOP enable temperature.

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,

/RA/

Sean E. Peters, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosures:
1. Amendment No. 212 to NPF-35
2. Amendment No. 206 to NPF-52
3. Safety Evaluation

cc w/encls: See next page

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Sean E. Peters, Project Manager, Section 1
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cc w/encls: See next page

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Package No.: ML040650012 TS: ML040650308
ADAMS Accession No.: ML040650011 *See previous concurrence **No Significant Changes Made to SE

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DISTRIBUTION FOR THE CATAWBA NUCLEAR STATION, UNITS 1 AND 2 RE: ISSUANCE OF AMENDMENTS (TAC NOS. MB8106 AND MB8107)

Dated: March 4, 2004

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NORTH CAROLINA ELECTRIC MEMBERSHIP CORPORATION

SALUDA RIVER ELECTRIC COOPERATIVE, INC.

DOCKET NO. 50-413

CATAWBA NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 212
Renewed License No. NPF-35

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

   A. The application for amendment to the Catawba Nuclear Station, Unit 1 (the facility) Renewed Facility Operating License No. NPF-35 filed by the Duke Energy Corporation, acting for itself, North Carolina Electric Membership Corporation and Saluda River Electric Cooperative, Inc. (licensees), dated March 20, 2003, as supplemented by letters dated June 10, September 30, and October 22, 2003, 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 Renewed Facility Operating License No. NPF-35 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 212, which are attached hereto, are hereby incorporated into this license. Duke Energy Corporation 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 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:

Technical Specification
Changes

Date of Issuance: March 4, 2004

DUKE ENERGY CORPORATION

NORTH CAROLINA MUNICIPAL POWER AGENCY NO. 1

PIEDMONT MUNICIPAL POWER AGENCY

DOCKET NO. 50-414

CATAWBA NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 206
Renewed License No. NPF-52

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

   A. The application for amendment to the Catawba Nuclear Station, Unit 2 (the facility) Renewed Facility Operating License No. NPF-52 filed by the Duke Energy Corporation, acting for itself, North Carolina Municipal Power Agency No. 1 and Piedmont Municipal Power Agency (licensees), dated March 20, 2003, as supplemented by letters dated June 10, September 30, and October 22, 2003, 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 Renewed Facility Operating License No. NPF-52 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 206, which are attached hereto, are hereby incorporated into this license. Duke Energy Corporation 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 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Technical Specification
Changes

Date of Issuance: March 4, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 212

RENEWED FACILITY OPERATING LICENSE NO. NPF-35

DOCKET NO. 50-413

AND LICENSE AMENDMENT NO. 206

RENEWED FACILITY OPERATING LICENSE NO. NPF-52

DOCKET NO. 50-414

Replace the following pages of the Appendix A Technical Specifications and associated Bases with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
3.4.3-3	3.4.3-3
3.4.3-4	3.4.3-4
3.4.3-5	3.4.3-5
3.4.3-6	3.4.3-6
3.4.6-1	3.4.6-1
3.4.7-1	3.4.7-1
3.4.10-1	3.4.10-1
3.4.12-1	3.4.12-1
3.4.12-2	3.4.12-2
3.4.12-3	3.4.12-3
3.4.12-4	3.4.12-4
3.4.12-5	3.4.12-5
3.4.12-6	3.4.12-6
----	3.4.12-7
B3.4.3-1	B3.4.3-1
B3.4.3-2	B3.4.3-2
B3.4.3-3	B3.4.3-3
B3.4.3-4	B3.4.3-4
B3.4.3-5	B3.4.3-5
B3.4.3-6	B3.4.3-6
B3.4.6-2	B3.4.6-2
B3.4.7-3	B3.4.7-3
B3.4.10-1	B3.4.10-1
B3.4.10-3	B3.4.10-3
B3.4.10-4	B3.4.10-4
B3.4.11-3	B3.4.11-3
B3.4.12-1	B3.4.12-1
B3.4.12-2	B3.4.12-2
B3.4.12-3	B3.4.12-3
B3.4.12-4	B3.4.12-4
B3.4.12-5	B3.4.12-5

Remove	Insert
B3.4.12-6	B3.4.12-6
B3.4.12-7	B3.4.12-7
B3.4.12-8	B3.4.12-8
B3.4.12-9	B3.4.12-9
B3.4.12-10	B3.4.12-10
B3.4.12-11	B3.4.12-11
-----	B3.4.12-12
-----	B3.4.12-13

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 212 TO RENEWED FACILITY OPERATING

LICENSE NPF-35 AND

AMENDMENT NO. 206 TO RENEWED FACILITY OPERATING LICENSE NPF-52

DUKE ENERGY CORPORATION, ET AL.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated March 20, 2003, as supplemented by letters dated June 10, September 30, and October 22, 2003 (Refs. 1, 2, 3, and 4), Duke Energy Corporation, et al. (DEC, the licensee), submitted a request for changes to the Catawba Nuclear Station, Units 1 and 2, Technical Specifications (TS). The proposed changes revise 1) TS 3.4.3, "RCS Pressure and Temperature (P/T) Limits," to update the heatup, cooldown, and inservice test P/T limits; 2) TS 3.4.6, "RCS Loops - Mode 4," TS 3.4.7, "RCS Loops - Mode 5, Loops Filled," and TS 3.4.10, "Pressurizer Safety Valves," to reflect a revision in the Low Temperature Overpressure Protection (LTOP) system enable temperature from 285 °F to 210 °F; and 3) TS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," to reflect the revised P/T limits and the revised LTOP enable temperature, to allow credit for the residual heat removal system suction relief valves as pressure relieving devices for the LTOP system, and to allow a maximum of two pumps to be capable of injecting into the reactor coolant system. The proposed changes to TS 3.4.3 update the heatup, cooldown, and P/T limits for the reactor coolant system (RCS) for each unit to a maximum of 34 Effective Full Power Years (EFPY). The current P/T limits are valid to 15 EFPY.

2.0 REGULATORY EVALUATION

A basic assumption for light-water-cooled power reactors is that the reactor pressure vessel does not fail. The Nuclear Regulatory Commission (NRC) established reactor design requirements to prevent this type of failure. Title 10 of *The Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," requires that the RCS pressure boundary be designed with sufficient margin to assure that, when stressed under operating, maintenance, testing, and postulated accident conditions, the boundary behaves in a nonbrittle manner and the probability of rapidly propagating fracture is minimized. Furthermore, GDC 31 requires the design to reflect consideration of service temperatures and other conditions in determining the material properties, stresses, size of flaws, and effects of irradiation on the material properties.

To ensure that the reactor operates within the margins defined by GDC 31, 10 CFR Part 50, Appendix G describes the establishment of P/T limits for the reactor coolant pressure boundary materials and requires that the P/T limit curves for the reactor pressure vessel (RPV) be at least as conservative as those obtained by applying the methodology of Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1995 Edition through the 1996 Addenda.

In addition to 10 CFR Part 50, Appendix G, the NRC staff issued other guidance regarding P/T limit curves. Generic Letter (GL) 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and its Impact on Plant Operation," advised licensees that the NRC staff would use Regulatory Guide (RG) 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials," to review P/T limit curves. RG 1.99, Rev. 2, contains methodologies for determining the increase in transition temperature and the decrease in upper-shelf energy resulting from neutron radiation.

Furthermore, NUREG-0800, "Standard Review Plan" (SRP) Section 5.3.2, "Pressure-Temperature Limits and Pressurized Thermal Shock," provides an acceptable method of determining the P/T limit curves for ferritic materials in the beltline of the RPV based on the linear elastic fracture mechanics methodology of Appendix G to Section XI of the ASME Code. The basic parameter of this methodology is the stress intensity factor K_I, which is a function of the stress state and flaw configuration. The methods of Appendix G postulate the existence of a sharp surface flaw in the RPV that is normal to the direction of the maximum stress (i.e., of axial orientation). This flaw is postulated to have a depth that is equal to 1/4 of the RPV beltline thickness and a length equal to six times its depth. The critical locations in the RPV beltline region for calculating heatup and cooldown P/T curves are the 1/4 thickness (1/4T) and 3/4 thickness (3/4T) locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively. The methodology found in Appendix G to Section XI of the ASME Code requires that licensees determine the adjusted reference temperature (ART or adjusted RT_{NDT}). The ART is defined as the sum of the initial (unirradiated) reference temperature (initial RT_{NDT}), the mean value of the adjustment in reference temperature caused by irradiation (ΔRT_{NDT}), and a margin (M) term.

The ΔRT_{NDT} is a product of a chemistry factor and a fluence factor. The chemistry factor is dependent upon the amount of copper and nickel in the material and may be determined from tables in RG 1.99, Rev. 2, or from surveillance data. The fluence factor is dependent upon the neutron fluence at the maximum postulated flaw depth. The M term is used to account for uncertainties in the values of the initial RT_{NDT}, the copper and nickel contents, the fluence and the calculational procedures. RG 1.99, Rev. 2, describes the methodology to be used in calculating the M term.

As an alternative to the 10 CFR Part 50, Appendix G, paragraph IV.A.2.b requirements for P/T limit curve development, the licensee requested an exemption to use the ASME Boiler and Pressure Vessel Code, Section XI, Code Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T limit Curves for ASME Section XI, Division 1," requirements. However, since the submittal of Reference 1, the NRC published Revision 13 to RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." This revision included ASME Code Case N-640 as an acceptable code case. Furthermore, in

68 FR 40469, the NRC incorporated Code Case N-640 into 10 CFR 50.55a, "Codes and Standards," by reference. Therefore, an exemption would no longer be required. By letter dated December 4, 2003 (Ref. 5), the licensee withdrew this exemption request.

During low temperature operation, on the other hand, GDC 15, "Reactor Coolant System Design," requires that the RCS and associated auxiliary, control, and protection systems be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences.

The LTOP system controls RCS pressure so the integrity of the reactor coolant pressure boundary is not compromised by violating the P/T limits of 10 CFR Part 50, Appendix G. The reactor vessel is the limiting reactor coolant pressure boundary component for demonstrating such protection. The TSs provide the maximum allowable actuation logic setpoints for the power operated relief valves and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Appendix G requirements during the LTOP modes. The NRC staff approved WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," as a method for calculating LTOP setpoints and P/T limit curves.

To determine the LTOP enable temperature, the licensee requested an exemption to use the ASME Boiler and Pressure Vessel Code, Section XI, Code Case N-641, "Alternative Pressure Temperature Relationship and Low Temperature Overpressure Protection System Requirements, Section XI, Division 1," as an alternative to the 10 CFR Part 50, Appendix G requirements. However, Revision 13 to RG 1.147 also listed Code Case N-641 as an acceptable code case. Furthermore, in 68 FR 40469, the NRC incorporated Code Case N-641 into 10 CFR 50.55a by reference. Therefore, an exemption would no longer be required. By letter dated December 4, 2003 (Ref. 5), the licensee also withdrew this exemption request.

To assess the format of the TS changes, the NRC staff uses, as a model, the accumulation of generically-approved guidance in the improved Standard Technical Specifications (STS). The STS for Westinghouse Plants are in NUREG-1431, Revision 2, "Standard Technical Specifications, Westinghouse Plants."

For this review, the NRC staff assured that the proposed P/T and LTOP limits and their associated TS changes met the above regulatory requirements.

3.0 TECHNICAL EVALUATION

The licensee proposed using ASME Code Case N-640 as the basis for establishing the P/T limit curves. This code case permits application of the lower bound static initiation fracture toughness (K_{IC}) curve as the basis for establishing the P/T curves in lieu of using the lower bound crack arrest fracture toughness (K_{IA}) curve that is invoked by Appendix G to Section XI of the ASME Code. ASME Code Case N-640 further permits the use of a postulated circumferentially-oriented flaw for the evaluation of RPV circumferential welds in lieu of the axially-oriented flaw that would be required by Appendix G to Section XI of the ASME Code. The other margins involved with the ASME Section XI, Appendix G process of determining P/T limit curves remained unchanged in the licensee's evaluation.

The licensee submitted ART calculations and P/T limit curves valid for up to 34 EFPY of facility operation for Units 1 and 2. Additionally, DEC presented surveillance capsule data from Catawba, Unit 1 for the Intermediate Shell Forging 05 and beltline region weld. The licensee found the limiting materials for the generation of heatup and cooldown operating curves to be the Lower Shell Forging 04 (for 1/4T) and the Intermediate Shell Forging 05 (for 3/4T). The ART values for the limiting materials at 34 EFPY were as follows:

Location	Limiting Materials	Fluence at 34 EFPY	Initial RT_{NDT}	Margin	ΔRT_{NDT}	ART
1/4T	Lower Shell Forging	1.19×10^{19}	-13	27.3	27.3	42
3/4T	Intermediate Shell Forging	$4.31X\ 10^{18}$	-8	17	21.9	31

For Catawba, Unit 2, the licensee determined that the most limiting beltline material at the 1/4T and 3/4T locations was Intermediate Shell Plate B8605-2. The ART values for the limiting material were as follows:

Location	Limiting Materials	Fluence at 34 EFPY	Initial RT_{NDT}	Margin	ΔRT_{NDT}	ART
1/4T	Intermediate Shell Plate B8605-2	1.20×10^{19}	33	34	53.6	121
3/4T	Intermediate Shell Plate B8605-2	$4.26\ X\ 10^{18}$	33	34	38.9	106

Regarding the detailed fracture mechanics evaluations performed to establish the proposed Catawba, Units 1 and 2 P/T limits, DEC submitted information on the throughwall temperature gradients resulting from heatup and cooldown transients and its determination of the applied stress intensity at the tip of the postulated 1/4T and 3/4T flaws due to thermal loading (i.e., K_{IT}) in Ref. 2. This information, along with knowledge of the applied stress intensity at the tip of the postulated 1/4T and 3/4T flaws due to pressure loads and the material property information cited above for both the limiting beltline plate and outlet nozzle forging, permitted the NRC staff to evaluate the acceptability of the proposed Catawba, Units 1 and 2 P/T limit curves.

3.1 P/T Limit Curves

As mentioned above, the licensee used ASME Code Case N-640 as the basis for establishing the P/T limit curves. Use of the K_{IC} curve in determining the lower bound fracture toughness curve in the development of P/T operating limits is technically correct. The K_{IC} curve appropriately implements the use of static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of an RPV. The NRC staff concluded that P/T curves

based on the K_{IC} fracture toughness curve as referenced by ASME Code Case N-640 will enhance overall plant safety by opening the P/T operating window with the greatest safety benefit in the region of low temperature operation. In addition, implementation of the proposed P/T curves, as defined by the technical basis supported by ASME Code Case N-640, would provide an adequate margin of safety against brittle failure of the RPV.

The NRC staff performed an independent calculation of the ART values for the limiting material using the methodology in RG 1.99, Rev. 2. Based on these calculations, the NRC staff verified that the licensee's limiting beltline material for the Catawba, Unit 1 is lower shell forging 04 for 1/4T and intermediate shell forging 05 for 3/4T location. For the Catawba, Unit 2 RPV, the limiting material is intermediate shell plate (B8605-2). The NRC staff's calculated ART values for the limiting materials agreed with the licensee's calculated ART values.

10 CFR Part 50, Appendix G also imposes a minimum temperature at the closure head flange and vessel flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20 percent of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 160 °F for core critical operation, 120 °F for normal, non-critical core operation, and by 90 °F for hydrostatic pressure tests and leak tests.

The NRC staff evaluated the licensee's P/T limit curves for acceptability by performing a finite set of check calculations based on information submitted by the licensee using the methodologies referenced in the ASME Boiler and Pressure Vessel Code (as indicated by SRP 5.3.2) and in Welding Research Council Bulletin 175. The NRC staff's calculations confirmed that the limiting RPV beltline materials, the closure head flange and vessel flange material properties were utilized in the development of the Catawba, Unit 1 and 2 P/T limit curves. The NRC staff verified that the licensee's proposed P/T limits satisfy the requirements in paragraph IV.A.2 of 10 CFR Part 50, Appendix G. Specifically, the NRC staff concluded that the P/T limit curves submitted by DEC appropriately accounted for the limiting conditions defined by the material properties of the limiting beltline materials (plates and welds) and were as conservative as those which would be generated by the staff's application of the methodology specified in Appendix G to Section XI of the ASME Code, as modified by ASME Code Case N-640. Furthermore, the proposed P/T limits also satisfy GL 88-11, because the method in RG 1.99, Rev. 2, was used to calculate the ART. Therefore, the NRC staff determined that the licensee's proposed P/T limit curves are acceptable for operation of the Catawba, Units 1 and 2 RPV through 34 EFPY of operation.

3.2 LTOP System

The LTOP system controls RCS pressure at low temperatures so that the integrity of the reactor coolant pressure boundary is not compromised by violating the P/T limits of 10 CFR Part 50, Appendix G, or those of ASME Code Case N-640. The RPV is the limiting reactor coolant pressure boundary component for demonstrating such protection. The TSs provide the maximum allowable actuation logic setpoints for the pressure relief devices and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Appendix G or ASME Code Case N-640 requirements during the LTOP modes of operation. The RCS overpressure protection is provided by having a minimum coolant input capability and having adequate pressure relief capacity. Limiting coolant input

capability requires that only one high pressure injection pump and one charging pump be capable of injecting into the RCS and isolating the accumulators. The pressure relief capability requires either two redundant RCS relief valves or a depressurized RCS and an RCS vent of sufficient size that acts to terminate an increasing pressure event.

The licensee proposed to use the residual heat removal (RHR) suction relief valves as an RCS vent path during LTOP system operation. The RHR suction isolation valves are open in the piping from the RCS hot legs to the inlets of the RHR pumps. While RHR isolation valves and RHR suction valves are open, the RHR suction relief valves are exposed to the RCS and are able to relieve pressure transients in the RCS. The pressurizer power operated relief valves (PORVs) are also available to comply with this TS. The licensee proposed to assume that a maximum of two pumps, either charging pumps or safety injection (SI) pumps, are capable of injecting into the RCS during the LTOP system operation.

DEC used WCAP 14040-NP-A, "Methodology Used To Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," to determine the PORV setpoints. The licensee performed an analysis to determine the charging pump and safety injection pump flow rates based on a conservative set of operating parameters. The flow rates selected for the LTOP analysis are based on the specific pump flow rate at the LTOP relief valve setpoint. The pump/system flow analysis results are as follows:

Pump/System Flow Analysis (400 psi setpoint)

Pump Combination	Flow (gpm)
One Centrifugal Charging Pump	475
Two Centrifugal Charging Pumps	660
One Safety Injection Pump	550
Two Safety Injection Pumps	690

One Centrifugal Charging Pump + One SI Pump 475 + 550 = 1025

The combined flow rates of either the two centrifugal charging pumps or two safety injection pumps flow rates can not be simply summed because both systems operate in parallel, the combined flow passes through the same piping system, increasing the overall backpressure and decreasing the relative contribution of each pump. However, the combined flow of one centrifugal charging pump and one safety injection pump pass through different piping systems and do not counteract each other. Therefore, the maximum total flow is the numerical sum of the single pump flow rates for two different systems. The licensee used a 1025 gpm flow rate as a mass input transient to calculate the peak pressure in the RCS.

The peak system pressure resulting from a 400 psig PORV setpoint is 685.7 psig that is well below the heatup and cooldown limits for the reactor vessel beltline region. The limiting pressures during the steady state condition is 719 psig. Since the peak pressure is less than the most limiting pressure, the PORV setpoint and capacity are sufficient to protect the RCS from cold overpressure transients. This also supports operation during LTOP with two injection pumps configured to run for a long duration with no termination period.

The licensee also performed the heat input transient analysis to determine the RCS peak pressure. The calculated peak pressure of the RCS is 572.6 psig, which is quite below the

mass input transient analysis peak pressure of 685.7 psig. Thus, the mass input transient analysis bounds the results of the heat input transient analysis.

Additionally, to show adequate pressure relief capability during LTOP system operation, the licensee proposed using the capabilities of the RHR suction relief valves. With the DEC proposed pressure setpoint of 463 psig and a setpoint tolerance of +/- 10 percent for relief valve setting drift, the RHR suction relief valve capacity reaches 2027 gpm. The licensee used these values to calculate the peak pressures when the RHR relief valves are relieving at maximum capacity. These peak pressures vary depending upon the number of reactor coolant pumps (RCPs) that are assumed to be operating. With a maximum of two RCPs operating, the peak pressure calculated for the RHR suction relief valves is 602.3 psig. This value falls below the allowable pressure for the closure head/vessel flange region at 621 psig. Therefore, for both units, the RHR suction relief valves are adequate for all steady state conditions with two RCPs operating at RCS temperatures $\geq$ 70 ^{o}F.

However, to prevent exceeding the allowable pressure limits with the PORVs providing overpressure protection, the number of RCPs operating will be restricted to two RCPs for Unit 1 and one RCP for Unit 2 at RCS temperatures $\geq$ 70 ^{o}F. This difference in operable pumps occurs because of the lower pressure limits imposed on Unit 2 because of the RCS cooldown curves of Figure 3.4.3-6 of the TSs. The licensee's calculations also determined that with 4 RCPs operating, a peak pressure of 660.0 psig could occur. Referencing this value to the closure head/vessel flange region limits would require, for steady state conditions, Unit 1 RCS temperatures of $\geq$ 126 ^{o}F and Unit 2 RCS temperatures of $\geq$ 140 ^{o}F. Differences between the Unit 1 and Unit 2 P/T limit curves cause this difference in reference temperatures. The above pump and RCS cold leg temperature limits are reflected in the DEC proposed TS Tables 3.4.12-1 and 3.4.12-2.

Furthermore, the calculation results also show that a single PORV or a single RHR suction relief valve is adequate to mitigate the pressure increase from the worst case mass addition transient (mass input from one safety injection pump + one charging pump).

The licensee calculated the LTOP enable temperature using the method described in ASME Code Case N-641. The revised enable temperature will be reduced from 285 ^{o}F to 210 ^{o}F. The licensee complies with the LTOP requirements by providing RHR suction relief valves and pressurizer PORVs with adequate setpoints to provide overpressure protection at low temperatures in Modes 4, 5 and 6. The capacity of the RHR suction relief valves provide the licensee operational, maintenance, and test flexibility complying with LTOP TS.

The NRC staff has reviewed the proposed changes for the LTOP system and finds that the changes comply with 10 CFR Part 50, Appendix G, GDC 15, GDC 31, and WCAP-14040-P-A. The NRC staff finds that the proposed changes follow and implement NRC-approved methodologies. Therefore, the NRC staff finds the changes to the LTOP system to be acceptable.

3.3 TS Changes

3.3.1 Changes to TS 3.4.3

TS 3.4.3, "Reactor Coolant System Pressure and Temperature (P/T) Limits" provides the pressure and temperature limits for the RCS. Figures 3.4.3-1 and 3.4.3-2 provide the RCS heatup limitations and cooldown limitations for Units 1 and 2, respectively, and are valid up to 15 EFPY. The licensee has proposed to replace Figures 3.4.3-1 for Unit 1, 3.4.3-1 for Unit 2, 3.4.3-2 for Unit 1, and 3.4.3-2 for Unit 2 in their entirety. The replaced figures would be valid up to 34 EFPY for Units 1 and 2. Because the figures are consistent with the supporting analyses and because the NRC staff found the analyses acceptable, the NRC staff finds the replacement of the existing figures with the revised figures that are valid up to 34 EFPY acceptable.

3.3.2 Changes to TS 3.4.6, TS 3.4.7, and TS 3.4.10

The licensee proposed to change the LTOP enable temperature listed in TS 3.4.6, "RCS Loops, MODE 4," TS 3.4.7, "RCS Loops, MODE 5, Loops Filled," and TS 3.4.10, "Pressurizer Safety Valves," from 285 °F to 210 °F. This proposed change is consistent with the supporting analysis that the NRC staff found acceptable. Therefore, the NRC staff finds the change of the LTOP enable temperature in TS 3.4.6, TS 3.4.7, and TS 3.4.10 to be acceptable.

3.3.3 Changes to TS 3.4.12

The significant changes to TS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," include allowing a maximum of two pumps capable of injecting into the RCS and allowing credit for two RHR suction relief valves as an alternative method of relieving pressure during LTOP conditions. The proposed changes are as follows:

1. The TS 3.4.12 LCO would allow a maximum of two pumps (instead of one pump) to be capable of injecting into the RCS to allow credit for RHR suction relief valves for pressure relieving capability, and the TS would allow crediting a combination of any one RHR suction relief valve and one PORV. The licensee has proposed to delete the option of using an RCS vent as a method for LTOP OPERABILITY since this case is no longer applicable when two pumps are capable of injecting into the RCS. They also revised the RCS cold leg temperature value from 65 °F to 70 °F. The revised LCO would state the following:

   "An LTOP System shall be OPERABLE with a maximum of two (charging pumps, safety injection pumps or charging and safety injection pumps) capable of injecting into the RCS, the accumulators isolated, RCP operation limited as specified in Table 3.4.12-1 and either a, b or c below:

   a. Two power operated relief valves (PORVs) with nominal lift setting = 400 psig (as left calibrated), allowable value $\leq$ 425 psig (as found), with RCS cold leg temperature $\geq$ 70°F; or

   b. Two residual heat removal (RHR) suction relief valves with lift settings $\geq$ 417 psig and $\leq$ 509 psig with an indicated RCS cold leg temperature $\geq$ 70 °F; or

c. A combination of any one PORV and one RHR suction relief valve, each with left settings as described above."

The addition of items b and c above support the condition of a maximum two pumps capable of injecting into the RCS, which the NRC staff found acceptable in Section 3.2 of this SE. Also, the change of the RCS cold leg temperature value from 65 °F to 70 °F is supported by the analysis that the staff found acceptable in Section 3.2 of this SE. Therefore, these changes are acceptable. Furthermore, the NRC staff notes that the proposed items b. and c. are similar to those in the Westinghouse STS in NUREG-1431. Although the STS does not allow a maximum of two pumps capable of injecting into the RCS, the STS does discuss, in brackets, the use of RHR suction relief valves and the combination of any one PORV and one RHR for pressure relieving capabilities. Therefore, there is precedent for the proposed changes to TS 3.4.12 LCO b and c.

2. The licensee proposed to modify TS 3.4.12 Applicability. The first line of the applicability statement will be revised to state, "MODE 4 when any RCS cold leg temperature is $\leq$ 210 °F."

Also in Section 3.2 of this SE, the NRC staff found the proposed change from 285 °F to 210 °F to be consistent with the supporting analysis. Therefore, the NRC staff finds the proposed change of the LTOP enable temperature in TS 3.4.12 to be acceptable.

To support the proposed changes to the LCO statement regarding a maximum of two pumps capable of injecting into the RCS, DEC proposed to replace Condition A in its entirety, delete the NOTE for Required Action A.1, and modify the required action statement in Required Action A.1. The revised Condition A and Required Action A.1 would state the following:

Condition A: "More than two pumps (charging, safety injection, or charging and safety injection) capable of injecting into the RCS."

Required Action A.1: "Initiate action to verify a maximum of two pumps are capable of injecting into the RCS."

The NOTE allowed two charging pumps to be capable of injecting into the RCS during pump swap operation for $\leq$ 15 minutes. This note is no longer applicable because the revised LCO allows a maximum of two pumps capable of injecting into the RCS during the MODES of applicability. The proposed changes to Condition A and Required Action A.1 support the revised LCO and, therefore, are acceptable.

3. DEC proposed to change the condition statements in Conditions E, F, and G from "PORV" to "required RCS relief valve," to support the changes to the LCO. Required Actions E.1 and F.1 have also be modified to reflect the proposed change. The revised Conditions and Required Actions would state the following:

Condition E: "One required RCS relief valve inoperable in MODE 4."

Required Action E.1: "Restore required RCS relief valve to OPERABLE status."

Condition F: "One required RCS relief valve inoperable in MODE 5 or 6."

Required Action F.1: "Restore required RCS relief valve to OPERABLE status."

Condition G: "Two required RCS relief valves inoperable."

These proposed changes support the revised LCO that allows credit for the use of RHR suction relief valves or a combination of one PORV and one RHR suction relief valve. Therefore, the NRC staff finds the proposed changes to Conditions E, F, and G, and Required Actions E.1 and F.1 to be acceptable. Furthermore, the proposed wording change in Conditions E, F, and G, and Required Actions E.1 and F.1 are consistent with NUREG-1431.

4. DEC also proposed changes to Required Actions and Completion Times of Condition G. The licensee would enter Condition G if two required RCS relief valves are inoperable, or if the Required Action and associated Completion Time of Condition A, D, E, or F are not met, or if the LTOP System is inoperable for any reason other than Condition A, C, D, E, or F. Required Actions G.1 and G.3 are new actions to support the revised LCO. All of the Required Actions must be performed whenever Condition G is entered. Required Actions G.1, G.2, and G.3, and the associated Completion Times will state the following:

   Required Action G.1: "Initiate ACTION to ensure a maximum of one charging pump or one safety injection pump is capable of injecting into the RCS."

   Completion Time: Immediately.

   Required Action G.2: "Depressurize RCS and establish RCS vent of $\geq$ 4.5 square inches."

   Completion Time: 12 hours

   Required Action G.3: "Verify RCS vent > 4.5 square inches open."

   Completion Time: "Once per 12 hours for unlocked valves AND once per 31 days for locked open vent valve(s)."

Since the revised LCO allows a maximum of two pumps capable of injecting into the RCS, it is necessary to limit pump injection capability when the required pressure relief capability is not available. The NRC staff concludes that the appropriate action is to ensure that only one pump is capable of injecting into the RCS when the conditions of Condition G are met. Therefore, the NRC staff finds the proposed Required Action G.1 and the associated Completion Time to be acceptable.

The licensee changed the existing Required Action G.1 to Required Action G.2. DEC also extended the associated Completion Time from 8 hours to 12 hours. The NRC staff notes that the 12 hour completion time is consistent with NUREG-1431. The licensee stated that the increase in completion time provides operator flexibility for a more controlled depressurization and establishment of an RCS vent. In addition, the change in completion time does not represent a significant increase in risk during shutdown operations. On this basis, the NRC staff finds the proposed increase in completion time from 8 hours to 12 hours to be acceptable.

Once the RCS vent $\geq$ 4.5 square inches is established, it is necessary to verify that the RCS vent is maintained open. The proposed Required Action G.3 in addition to the associated

Completion Times provides for the verification and is reasonable for this task. Therefore, the NRC staff finds the proposed Required Action G.3 and the associated Completion Time to be acceptable.

5. DEC proposed changing the existing SR to support the revised LCO and LTOP enable temperature. The licensee revised SR 3.4.12.3 due to the deletion of the required RCS vent in the LCO. The licensee also proposed a new SR that supports the revised LCO. The revised and new SRs and their associated frequencies are as follows:

   The licensee proposed modifying SR 3.4.12.1 to state, "Verify a maximum of two pumps (charging, safety injection, or charging and safety injection) are capable of injecting into the RCS." The original SR required verifying a maximum of one charging or SI pump being capable of injection. This change supports the revised LCO, therefore, the NRC staff finds it acceptable.

   The licensee proposed deleting the existing SR 3.4.12.3 in its entirety, including the associated NOTE and frequency. The revised SR 3.4.12.3 will state, "Verify RHR suction isolation valves are open for each required RHR suction relief valve." As noted in the associated TS Bases, this SR would be applicable when LCO b or c was entered. The associated Frequency is 12 hours. This frequency is sufficient to verify that the RHR suction isolation valves remain open when required. Therefore, the staff finds the proposed changes to SR 3.4.12.3 to be acceptable.

   Additionally, DEC modified SR 3.4.12.5 NOTE to account for the revised LTOP enable temperature. The revised NOTE will state, "Not required to be met until 12 hours after decreasing RCS cold leg temperature to $\leq$ 210 °F." The propose change from 285 °F to 210 °F is consistent with the supporting analysis. Therefore, the NRC staff finds the proposed change of the LTOP enable temperature in SR 3.4.12.5 to be acceptable.

   Finally, the licensee added a new SR 3.4.12.7 to support the revised LCO. SR 3.4.12.7 states, "Verify associated RHR suction isolation valves are open, with operator power removed and locked in removed position, for each required RHR suction relief valve." The proposed frequency is 31 days. As noted in the associated TS Bases, this SR would be applicable when LCO b or c was entered. The proposed SR provides additional requirements to verify that the required RHR suction isolation valves are locked in the power removed position every 31 days. This frequency is sufficient to verify that the RHR suction isolation valves remain open when required. Therefore, the NRC staff finds the proposed SR 3.4.12.7 to be acceptable. In addition, the NRC staff notes that the proposed SR 3.4.12.7 is consistent with NUREG-1431.

6. DEC proposed changing TS Tables 3.4.12-1 to reflect the new LTOP requirements.

   For Unit 1, the licensee removed the minimum RCS cold leg temperature limit for a maximum of one pump in operation. Therefore, with one pump in operation, the maximum of two pumps in operation temperature limit would apply. This change is conservative, since the new requirement is more limiting. Also, for a maximum of two pumps in operation, the licensee raised the minimum RCS cold leg temperature requirement from 68 °F to 70 °F, and for a maximum of 4 pumps in operation, the licensee raised the minimum temperature

requirement from 73 ^{o}F to 126 ^{o}F. These changes are consistent with the supporting analyses.

For Unit 2, the licensee removed the minimum RCS cold leg temperature limit for a maximum of two pumps in operation. Therefore, with two pumps in operation, the maximum of four pumps in operation temperature limit would apply. This change is conservative, since the new requirement is more limiting. Also, for a maximum of one pump in operation, the licensee raised the minimum RCS cold leg temperature requirement from 67 ^{o}F to 70 ^{o}F, and for a maximum of 4 pumps in operation, the licensee raised the minimum temperature requirement from 95 ^{o}F to 140 ^{o}F. These changes are consistent with the supporting analyses.

Because the NRC staff found the supporting analyses acceptable, the NRC staff finds the changes to TS Tables 3.4.12-1 to be acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the South 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 and change surveillance requirements. 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 (68 FR 74264). 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.

7.0 REFERENCES

1. Letter from G. R. Peterson, Duke Energy Corporation, to USNRC, "Catawba Nuclear Station, Units 1 and 2, Proposed Technical Specification (TS) Amendment TS 3.4.3 - Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits, TS 3.4.6, RCS Loops - MODE 4, TS 3.4.7, RCS Loops - MODE 5, Loops Filled, TS 3.4.10, Pressurizer

Safety Valves, TS 3.4.11, Pressurizer Power Operated Relief Valves (PORVs), TS 3.4.12, Low Temperature Overpressure Protection (LTOP) System," March 20, 2003.

2. Letter from G. R. Peterson, Duke Energy Corporation, to USNRC, "Catawba Nuclear Station, Units 1 and 2, Response to Request for Additional Information (RAI) for Proposed Technical Specification Amendment TS 3.4.3 - Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits, TS 3.4.6, RCS Loops - MODE 4, TS 3.4.7, RCS Loops - MODE 5, Loops Filled, TS 3.4.10, Pressurizer Safety Valves, TS 3.4.11, Pressurizer Power Operated Relief Valves (PORVs), TS 3.4.12, Low Temperature Overpressure Protection (LTOP) System," June 10, 2003.

3. Letter from D. M. Jamil, Duke Energy Corporation, to USNRC, "Catawba Nuclear Station, Units 1 and 2, Response to Request for Additional Information (RAI) for Proposed Technical Specification Amendment TS 3.4.3 - Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits, TS 3.4.6, RCS Loops - MODE 4, TS 3.4.7, RCS Loops - MODE 5, Loops Filled, TS 3.4.10, Pressurizer Safety Valves, TS 3.4.11, Pressurizer Power Operated Relief Valves (PORVs), TS 3.4.12, Low Temperature Overpressure Protection (LTOP) System," September 30, 2003.

4. Letter from D. M. Jamil, Duke Energy Corporation, to USNRC, "Catawba Nuclear Station, Units 1 and 2, Response to Request for Additional Information (RAI) for Proposed Technical Specification Amendment TS 3.4.3 - Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits, TS 3.4.6, RCS Loops - MODE 4, TS 3.4.7, RCS Loops - MODE 5, Loops Filled, TS 3.4.10, Pressurizer Safety Valves, TS 3.4.11, Pressurizer Power Operated Relief Valves (PORVs), TS 3.4.12, Low Temperature Overpressure Protection (LTOP) System," October 22, 2003.

5. Letter from D. M. Jamil, Duke Energy Corporation, to USNRC, "Catawba Nuclear Station, Units 1 and 2, Withdrawal of Exemption Requests for Proposed Technical Specification Amendment Concerning Reactor Coolant System Pressure and Temperature Limits and Low Pressure Overtemperature Protection System," December 4, 2003.

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