January 8, 2002

Mr. John T. Herron
Vice President Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 - ISSUANCE OF AMENDMENT RE: REVISION OF REACTOR COOLANT SYSTEM COOLDOWN REQUIREMENT (TAC NO. MB1732)

Dear Mr. Herron:

The Commission has issued the enclosed Amendment No. 177 to Facility Operating License No. NPF-38 for the Waterford Steam Electric Station, Unit 3. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated April 13, 2001.

The amendment relaxes the allowable cooldown rate in the Reactor Coolant System (RCS) TS 3.4.8.1, "Pressure/Temperature Limits." Specifically, the change eliminates the limitation of a 10 ^{o}F per hour cooldown rate when the RCS temperature is below 135 ^{o}F. The proposed limitations permit a 100 ^{o}F per hour cooldown rate to continue down to an RCS temperature of 110 ^{o}F, at which point the rate is reduced to 30 ^{o}F per hour.

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

Sincerely,

/RA/

N. Kalyanam, Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosures: 1. Amendment No. 177 to NPF-38
2. Safety Evaluation

cc w/encls: See next page

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ENTERGY OPERATIONS, INC.

DOCKET NO. 50-382

WATERFORD STEAM ELECTRIC STATION, UNIT 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 177
License No. NPF-38

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

   A. The application for amendment by Entergy Operations, Inc. (EOI) dated April 13, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations 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;

   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 amended by 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-38 is hereby amended to read as follows:

   2. Technical Specifications and Environmental Protection Plan

      The Technical Specifications contained in Appendix A, as revised through Amendment No. 177 , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. EOI shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: January 8, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 177

TO FACILITY OPERATING LICENSE NO. NPF-38

DOCKET NO. 50-382

Replace the following pages of the Appendix A Technical Specifications 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 4-28	3/4 4-28
3/4 4-29	3/4 4-29
3/4 4-31	3/4 4-31

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 177 TO

FACILITY OPERATING LICENSE NO. NPF-38

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By application dated April 13, 2001, Entergy Operations, Inc. (the licensee), submitted a request for changes to the Waterford Steam Electric Station, Unit 3, (Waterford 3) Technical Specifications (TSs). The requested changes would relax the allowable cooldown rate in TS 3.4.8.1, "Reactor Coolant System Pressure-Temperature Limits," by revising the reactor coolant system (RCS) cooldown limitations. Presently, the cooldown rates are 100 °F per hour at temperatures above 200 °F, 30 °F per hour at temperatures equal to or greater than 135 °F and equal to or less than 200 °F, and 10 °F per hour at temperatures below 135 °F. The new cooldown rate steps proposed are 100 °F per hour at RCS temperatures down to and including 110 °F, and 30 °F per hour at RCS temperatures below 110 °F. There are no changes proposed to either the applicability period for the curves or to the low temperature overpressure protection (LTOP) enable temperature of 272 °F.

2.0 BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC or the Commission) has established requirements in Appendix G of Part 50 to Title 10, *Code of Federal Regulations* (10 CFR Part 50, Appendix G), to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. Appendix G to 10 CFR Part 50 requires the Pressure-Temperature (P-T) limits for an operating plant to be at least as conservative as those that would be generated if the methods of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) were applied. The methodology of Appendix G to the ASME Code postulates the existence of a sharp surface flaw in the reactor pressure vessel (RPV) that is normal to the direction of the maximum applied stress. For materials in the beltline and upper and lower head regions of the RPV, the maximum flaw size is postulated to have a depth that is equal to one-fourth of the thickness and a length equal to 1.5 times the thickness. The basic parameter in Appendix G to the ASME Code for calculating P-T limit curves is the stress intensity factor, K_I, which is a function of the stress state and flaw configuration. The methodology requires that licensees determine the reference stress intensity (K_{Ia}) factors, which vary as a function of temperature, from the RCS operating temperatures, and from the adjusted reference temperatures (ARTs) for the limiting materials in the RPV. Thus, the critical locations in the RPV beltline and head regions are the 1/4-thickness

(1/4T) and 3/4-thickness (3/4T) locations, which correspond to the points of the crack tips if the flaws are initiated and grown from the inside and outside surfaces of the vessel, respectively. Regulatory Guide 1.99, Revision 2, provides an acceptable method of calculating ARTs for ferritic RPV materials, and the methods for adjusting the ARTs of materials in the beltline region of the RPV, where the effects of neutron irradiation may induce an increased level of embrittlement in the materials.

The methodology of Appendix G to the ASME Code requires that P-T curves must satisfy a safety factor of 2.0 on stress intensities arising from primary membrane and bending stresses during normal plant operations (including heatups, cooldowns, and transient operating conditions), and a safety factor of 1.5 on stress intensities arising from primary membrane and bending stresses when leak rate or hydrostatic pressure tests are performed on the RCS. Table 1 to 10 CFR Part 50, Appendix G provides the staff's criteria for meeting the P-T limit requirements of Appendix G to the ASME Code and the minimum temperature requirements of the rule for bolting up the vessel during normal and pressure testing operations.

3.0 EVALUATION

3.1 Licensee Evaluation

The basis for the acceptability of the minimum cooldown rate in this assessment is that the conservatively-determined peak transient pressure must be less than the bounding pressure established for the applicable cooldown rate. This bounding pressure is that calculated minimum acceptable pressure for the limiting materials at the minimum boltup temperature, i.e., 72 °F (indicated). The analysis utilizes the existing data that serves as the basis for the current P-T limits. The data is adjusted to present actual rather than indicated pressure and temperature limit information referenced to the pressurizer pressure. This actual data is then used to assess whether the cooldown limits can be made less restrictive.

An attachment to the report also describes the most accurate methodology for monitoring reactor vessel beltline temperatures during various plant conditions. During reactor coolant pump (RCP) operation, the lowest cold leg temperature associated with an operating RCP is used to monitor P-T limits. When one or more of the RCPs is running, cold leg temperature indication is representative of the coolant temperature entering the reactor vessel beltline. Following coast down of the last RCP, the segments of reactor coolant piping upstream of shutdown cooling injection are no longer indicative of reactor beltline temperature. Therefore, shutdown cooling temperature is used to monitor P-T limits. Changes to the TS 3/4.4.8 Bases section are proposed to describe this method of monitoring reactor vessel beltline temperature.

The bounding pressure is typically that at the minimum boltup temperature. In order to eliminate the 10 °F per hour cooldown rate and extend the applicability of 30 °F per hour cooldown rate to the minimum boltup temperature (46.40 °F actual), the peak transient pressure cannot exceed the most limiting (lowest) pressure on the 30 °F per hour cooldown curve within the LTOP temperature range. The LTOP temperature range is between the minimum boltup temperature and the LTOP enable temperature. This pressure must also be less than the minimum pressure of 554 pounds per square inch (psi) absolute (psia). This pressure is established from the existing uncorrected value for the minimum pressure of 625 psia. The minimum pressure limit is defined as 20% of the pre-operational hydrostatic test pressure which is 625 uncorrected. Applying the same actual pressure correction factor of

71 psi, as that used for the beltline limits, the minimum pressure in terms of actual pressurizer pressure is 554 psia (= 625 psia - 71 psi). This value will be compared with the applicable beltline limits to determine the limiting (lowest) value. The actual pressurizer pressure for 30 °F per hour cooldown at the minimum boltup temperature of 46.4 °F (72 °F - 25.6 °F, temperature uncertainty) is 513.9 psia. As this value is less than the minimum pressure of 554 psia, the 513.9 psia can be considered as a bounding value for the bounding peak pressure. To provide a margin, a value of 510 psia is selected as the bounding peak pressure.

The data is further evaluated to determine the lowest temperature at which the 100 °F per hour cooldown rate would be acceptable. The peak transient pressure of 465 psia is less than the actual pressurizer pressure limit at an actual RCS temperature of 70 °F. Thus, this cooldown rate, which is currently restricted by the TS to use above RCS temperatures of 135 °F (indicated), may be used down to an RCS temperature of 70 °F (actual). However, the TS limit is being conservatively established at 110 °F (indicated), to account for instrument uncertainty.

The proposed changes to TS 3.4.8.1 will allow more operating flexibility during cooldown by permitting a higher cooldown rate at RCS temperatures below 135 °F. They have been demonstrated to be acceptable based on the comparison of the allowable pressurizer pressure limit over a range of RCS temperatures and ensuring that the minimum allowable pressure exceeds the conservatively calculated peak transient pressure condition.

3.2 Staff Evaluation

The existing P-T limit curves for normal operation, including heatup and cooldown are valid up to 16 effective full power years (EFPY).

The basis for the acceptability of the proposed changes is that the data is adjusted to present actual rather than indicated pressure and temperature limit information referenced to the pressurizer pressure. This actual data is then used to show that the cooldown limits can be made less restrictive. There are no changes proposed to either the applicability period for the curves or to the LTOP enable temperature of 272 °F.

For Waterford 3 RPV, the licensee provided the P-T limit cooldown curves for normal operating conditions effective to 16 EFPY. To test the validity of the licensee's proposed curve, the staff performed an independent assessment of the licensee's submittal. The staff applied the methodologies of Appendix G to the ASME Code and 10 CFR Part 50, Appendix G as the bases for its independent assessment.

The staff independently determined that the cooldown curve met the requirements of Appendix G to the ASME Code. The staff also confirmed that this P-T limit curve included appropriate minimum temperature requirements that were at least as conservative as those required in Table 1 to 10 CFR Part 50, Appendix G.

At vessel pressures less than 20% of the preservice system hydrostatic test pressure, Table 1 to 10 CFR Part 50, Appendix G, requires the temperature to be equal or greater than the value calculated using the methodology in Appendix G to Section XI of the ASME Code and the highest reference temperature of the material in the flange region that is highly stressed by bolt preload. Appendix G to the ASME Code specifies the minimum boltup temperature as the highest reference temperature of the material in the flange region that is highly stressed by bolt

preload. The licensee indicates that the highest reference temperature of the material in the flange region is 20 ºF. This value would increase to 45.6 ºF when temperature uncertainties (25.6 ºF) resulting from instrument error is included in the evaluation.

In its assessment, the staff verified that 20% of the pre-operational hydrostatic test pressure corresponds to a pressure of 625 psia. Applying a pressure correction (ΔP due to elevation of head, hot leg flow induced pressure drop, and reactor vessel flow induced pressure drop) of 71 psi, reduces the minimum pressure from 625 psia to 554 psia. At pressures below 554 psia, the P-T limits require the temperature to be greater than or equal to 72 ºF, which exceeds the value required by Appendix G to the ASME Code for minimum boltup temperature and by 10 CFR Part 50, Appendix G, for the flange region. At 554 psia the staff has determined that the minimum boltup temperature (72 ºF) is greater than the temperature limit using the margins specified in Appendix G to the ASME Code when the reactor vessel cooldown is at rates of 100 °F per hour or 30 °F per hour. Since the minimum boltup temperature is more limiting than the P-T limits using 30 °F per hour and 100 °F per hour cooldown rates, the reactor vessel P-T limits will meet the requirements in Appendix G to Section XI of the ASME Code at 100 °F per hour until the indicated RCS temperature is 110 °F.

4.0 SUMMARY

The staff concludes that the proposed change of cooldown rate for the P-T limit curves for the RCS satisfies the requirements of Appendix G to Section XI of the ASME Code, and Appendix G to 10 CFR Part 50. Hence, the proposed P-T limit curves, as amended, are acceptable for incorporation in the TS for Waterford 3.

5.0 STATE CONSULTATION

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

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement 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 amendment involves 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 amendment involves no significant hazards consideration and there has been no public comment on such finding (66 FR 22029, published May 2, 2001). Accordingly, the amendment meets 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 amendment.

7.0 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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: E. Andruszkiewicz

Date: January 8, 2002

Waterford Generating Station 3

cc:

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