August 9, 2005

Mr. Joseph E. Venable
Vice President Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 (WATERFORD 3) - RE: REQUEST FOR RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND VESSEL CODE (CODE) (TAC NO. MC5787)

Dear Mr. Venable:

By letter dated January 31, 2005, as supplemented by letters dated March 8, March 28, March 29, March 31, and June 3, 2005, Entergy Operations Inc. (Entergy, the licensee) submitted a request for the use of alternatives to certain ASME Code Section XI requirements at Waterford 3. This relief request proposed an alternative to the temper bead welding requirements of the ASME Code, Section XI, IWA-4500 and IWA-4530.

The U. S. Nuclear Regulatory Commission (NRC) staff authorizes the alternative proposed by Entergy in accordance with 50.55a(a)(3)(i) of Title 10 of *Code of Federal Regulations* (10 CFR), which states that the proposed alternatives may be used when authorized by the Director of the Office of Nuclear Reactor Regulation if the applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety.

Due to the immediate need of this relief request, verbal authorization for the use of this relief request was granted by the NRC staff on April 20, 2005.

The staff's safety evaluation is enclosed.

Sincerely,

/RA/

David Terao, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure: Safety Evaluation

cc w/encl: See next page

August 9, 2005

Mr. Joseph E. Venable
Vice President Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 (WATERFORD 3) - RE: REQUEST FOR RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND VESSEL CODE (CODE) (TAC NO. MC5787)

Dear Mr. Venable:

By letter dated January 31, 2005, as supplemented by letters dated March 8, March 28, March 29, March 31, and June 3, 2005, Entergy Operations Inc. (Entergy, the licensee) submitted a request for the use of alternatives to certain ASME Code Section XI requirements at Waterford 3. This relief request proposed an alternative to the temper bead welding requirements of the ASME Code, Section XI, IWA-4500 and IWA-4530.

The U. S. Nuclear Regulatory Commission (NRC) staff authorizes the alternative proposed by Entergy in accordance with 50.55a(a)(3)(i) of Title 10 of *Code of Federal Regulations* (10 CFR), which states that the proposed alternatives may be used when authorized by the Director of the Office of Nuclear Reactor Regulation if the applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety.

Due to the immediate need of this relief request, verbal authorization for the use of this relief request was granted by the NRC staff on April 20, 2005.

The staff's safety evaluation is enclosed.

Sincerely,
/RA/
David Terao, Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure: Safety Evaluation

cc w/encl: See next page

DISTRIBUTION:
PUBLIC
RidsAcrsAcnwMailCenter
RidsNrrDlpmLpdiv1 (DTerao)
RidsRgn4MailCenter (DGraves)
RidsOgcRp
RidsNrrDlpmLpdiv (HBerkow)
JDixon-Herrity, RIV Plants
RidsNrrLADBaxley
PDIV-1 Reading
EAndruszkiewicz
RidsNrrPMNKalyanam

052230126 * Minor editorial changes made in staff supplied SE

OFFICE	PDIV-1/PM	PDIV-1/LA	EMCB/A*	OGC	PDIV-1/SC
NAME	NKalyanam	DBaxley	MMitchell	SUttal(NLO)	DTerao
DATE	7/21/05	7/22/05	6/8/05	8/3/05	8/9/05

OFFICIAL RECORD COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. W3-R&R-003

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NUMBER 50-382

1.0 INTRODUCTION

By letter dated January 31, 2005 (Reference 1), as supplemented by letters dated March 8 (Reference 2), March 28 (Reference 3), March 29 (Reference 4), March 31 (Reference 5), and June 3, 2005 (Reference 6), Entergy Operations, Inc. (Entergy or the licensee) submitted relief request number W3-R&R-003 for the Waterford Steam Electric Station, Unit 3 (Waterford 3). This relief request proposed an alternative to the temper bead welding requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section XI, IWA-4500 and IWA-4530. In the alternative, the licensee proposed a repair using a remotely operated, gas tungsten arc welding (GTAW) process. The GTAW process utilizes an ambient temperature temper bead method with a 50E F minimum preheat temperature and no post weld heat treatment (PWHT).

2.0 REGULATORY EVALUATION

Pursuant to 50.55a(g)(4) of Title 10 of *Code of Federal Regulations* (10 CFR), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” to the extent practical within the limitations of design, geometry, and materials of construction of the components. Paragraph IWA-4170(b) of ASME Section XI requires that repairs and installation of replacement items be performed in accordance with the Owner’s Design Specification and the original Code of Construction of the component or system. Later editions and addenda of the Construction Code or of Section III, either in their entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable requirements of IWA-4200, IWA-4400, or IWA-4500 may be used. The Code of Record for the Waterford 3 second 10-year inservice inspection (ISI) interval is the 1992 Edition with portions of the 1993 Addenda of ASME Section XI. The original Code of Construction for Waterford 3 is ASME Section III, 1971 Edition with the Addenda through Summer 1971.

The regulation at 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) of this section may be used, when authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

3.1 Components for which Relief is Requested:

Pressurizer Heater Sleeves
Pressurizer Upper and Lower Head Instrument Nozzles
Pressurizer Side Shell Nozzle

3.2 Background

The Waterford 3 pressurizer lower head, upper head, and side shell were manufactured from SA533, Grade B, Class 1 low alloy steel (P-Number 3, Group 3 material). The pressurizer heater sleeves, upper and lower head instrument nozzles, and side shell nozzle were originally manufactured from nickel-based Alloy 600 material. Alloy 600 has a demonstrated sensitivity to primary water stress corrosion cracking (PWSCC).

During previous refueling outages, the Waterford 3 pressurizer upper head instrument nozzles were repaired by replacing the original Alloy 600 nozzles with new Alloy 690 nozzles. In addition, one of the thirty heater sleeves was also plugged using Alloy 690. During Refueling Outage 13 in the spring 2005, Waterford 3 replaced all remaining Alloy 600 heater sleeves and instrument nozzles.

This request for alternative is specific to each of the following pressurizer repair welding activities that involve welding using a proposed ambient temperature temper bead technique:

- Heater Sleeve Mid-Wall Repair

In this repair, the new Alloy 690 heater sleeve is welded directly to the pressurizer bore using the proposed ambient temperature temper bead process.

- Heater Sleeve Repair Using an Outside Diameter Weld Pad

In this repair, an Inconel weld pad (Alloy 52) is welded to the outside diameter (OD) of the pressurizer lower head using the proposed ambient temperature temper bead process. The new Alloy 690 heater sleeve is welded to the Inconel weld pad (Alloy 52) using a non-temper bead welding process. This alternative repair option will only be used in the unlikely circumstance where the mid-wall repair cannot be implemented.

- OD Weld Pad Repair of Lower Head Instrument Nozzles

In this repair, an Inconel weld pad (Alloy 52) is welded to the OD of the pressurizer lower head using the proposed ambient temperature temper bead process. The new Alloy 690 nozzle is welded to the Inconel weld pad (Alloy 52) using a non-temper bead welding process.

- OD Weld Pad Repair of Side Shell Instrument Nozzle

In this repair, an Inconel weld pad (Alloy 52) is welded to the OD of the pressurizer side shell using the proposed ambient temperature temper bead process. The new Alloy 690 nozzle is welded to the Inconel weld pad (Alloy 52) using a non-temper bead welding process.

- OD Weld Pad Repair of Previously Repaired Upper Head Instrument Nozzles

Two Inconel 52 weld pads were previously welded to the OD of the pressurizer upper head using the temper bead process. Alloy 690 instrument nozzles were welded to the weld pads with Alloy 182 filler metal. In this repair, the existing nozzles and associated attachment welds will be removed by grinding and new Alloy 690 nozzles will be installed using Inconel 52 or 52 "Modified" (UNS N06054) filler metal. The Inconel 52 "Modified" filler metal has been approved for use by ASME via ASME Section IX Code Case 2142-2. In the unlikely event that grinding results in a repair cavity that is within 1/8-inch of the ferritic base materials, ambient temperature temper bead welding will be performed.

3.3 <u>Code Requirements for Which Relief is Requested</u>

The 1992 Edition of ASME Section XI, paragraph IWA-4170(b) states: "Repairs and installation of replacement items shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later editions and addenda of the Construction Code or of Section III, either in their entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4200 and IWA-4400, or IWA-4500 may be used."

IWA-4500 of ASME Section XI establishes alternative repair welding methods for performing temper bead welding. According to IWA-4500(a), "Repairs to base materials and welds identified in IWA-4510, IWA-4520, and IWA-4530 may be made by welding without the specified post weld heat treatment requirements of the Construction Code or Section III, provided the requirements of IWA-4500(a) through (e) and IWA-4510, IWA-4520, or IWA-4530, as applicable, are met."

3.4 <u>Licensee's Proposed Alternative</u> (As stated)

> Pursuant to 10 CFR 50.55a(a)(3)(i), Entergy proposes alternatives to the GTAW-machine temper bead welding requirements of IWA-4500 and IWA-4530 of ASME Section XI. Specifically, Entergy proposes to perform ambient temperature temper bead welding in accordance with Attachment 1 [to Reference 6], "Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique."
>
> Entergy will use this proposed alternative for mid-wall repairs of the pressurizer heater sleeves and OD weld pad repairs of the pressurizer instrument nozzles as described above. However, where mid-wall repairs for pressurizer heater sleeves cannot be performed, an alternative OD weld pad repair will be performed. Although a contingency, this alternative OD weld pad repair for the heater sleeves is unlikely. Entergy has reviewed the proposed ambient temperature temper bead welding techniques of Attachment 1 [to Reference 6] against the GTAW-machine temper bead welding requirements of IWA-4500 and IWA-4530. This review was performed to identify differences between Attachment 1 [to Reference 6] and IWA-4500 and

IWA-4530. Based upon this review, Entergy proposes alternatives to the following ASME Section XI requirements of IWA-4500 and IWA-4530:

1. IWA-4500(a) specifies that repairs to base materials and welds identified in IWA-4530 may be performed without the specified postweld heat treatment of the construction code or ASME Section III provided the requirements of IWA-4500 and IWA-4530 are met. IWA-4530 includes temper bead requirements applicable to the shielded metal arc welding (SMAW) and the machine or automatic GTAW processes. As an alternative, Entergy proposes to perform temper bead weld repairs using the ambient temperature temper bead technique described in Attachment 1 [to Reference 6]. Only the machine or automatic GTAW process can be used when performing ambient temperature temper bead welding in accordance with Attachment 1 [to Reference 6].

2. IWA-4500(d)(2) specifies that if repair welding is to be performed where physical obstructions impair the welder's ability to perform, the welder shall also demonstrate the ability to deposit sound weld metal in the positions, using the same parameters and simulated physical obstructions as are involved in the repair. This limited accessibility demonstration applies when manual temper bead welding is performed using the Shielded Metal Arc Welding (SMAW) process. It does not apply to "welding operators'' who perform machine or automatic GTAW-welding from a remote location. (This distinction is clearly made in IWA-4500 and IWA-4530.) Because the proposed ambient temperature temper bead technique described in Attachment 1 [to Reference 6] utilizes a machine GTAW process, limited access demonstrations of "welding operators" are not required. Therefore, the requirement of IWA-4500(d)(2) does not apply.

3. IWA-4500(e)(2) specifies that the weld area plus a band around the repair area of at least 1½ times the component thickness or 5 inches, whichever is less, shall be preheated and maintained at a minimum temperature of 300EF for the GTAW process during welding; maximum interpass temperature shall be 450EF. As an alternative, Entergy proposes that the weld area plus a band around the repair area of at least 1½ times the component thickness or 5 inches, whichever is less, shall be preheated and maintained at a minimum temperature of 50EF for the GTAW process during welding. The maximum interpass temperature shall be 350EF regardless of the interpass temperature during qualification.

4. IWA-4500(e)(2) specifies that thermocouples and recording instruments shall be used to monitor process temperatures. Entergy will use thermocouples and associated recording instruments when performing an OD pad repair. However, Entergy cannot use thermocouples and recording instrumentation when performing a mid-wall repair. Because the inside diameter of the new sleeve is only 1.30 inches (approximately) and welding is being performed internally, there is insufficient space and accessibility along the inside diameter of the heater sleeve to use thermocouples. As an alternative, Entergy will verify the preheat temperature with a pyrometer or temperature indicating crayon prior to welding. With respect to interpass temperature, Entergy will implement a five (5) minute hold time between passes to ensure that the interpass temperature will not approach 350EF. Mock-up testing and supporting engineering analysis [...] have

been performed to demonstrate that the 350EF interpass temperature limitation of the code case will not be exceeded.

5. IWA-4500(e)(2) specifies that thermocouple attachment and removal shall be performed in accordance with ASME Section III. The thermocouple attachment and removal requirements of IWA-4500(e)(2) do not apply to either the OD pad repair or the mid-wall repair for the following reasons:

    a. The thermocouples utilized when performing the OD pad repairs will be magnetically attached to the ferritic base material of the pressurizer in the vicinity of the nozzle being repaired rather than being attached by welding. With no weld removal required, the thermocouple attachment and removal requirements of IWA-4500(e)(2) do not apply to the OD pad repairs.

    b. For reasons discussed in [Section 3.4, bullet 4 above], Entergy will not use thermocouples and recording equipment when performing a mid-wall repair. Therefore, the thermocouple attachment and removal requirements of IWA-4500(e)(2) do not apply to the mid-wall repairs.

6. IWA-4532.1 establishes procedure technique requirements that apply when using the SMAW process. Because the proposed ambient temperature temper bead technique of Attachment 1 [to Reference 6] utilizes the machine or automatic GTAW welding process, the SMAW temper bead technique requirements of paragraph IWA-4532.1 do not apply.

7. IWA-4532.2(c) specifies that the repair cavity shall be buttered with six layers of weld metal in which the heat input of each layer is controlled to within +/-10% of that used in the procedure qualification test, and heat input control for subsequent layers shall be deposited with a heat input equal to or less than that used for layers beyond the sixth in the procedure qualification. As an alternative, Entergy proposes to deposit the weld area with a minimum of three layers of weld metal to obtain a minimum thickness of 1/8-inch. The heat input of each weld layer in the 1/8-inch thick section shall be controlled to within +/-10% of that used in the procedure qualification test. The heat input for subsequent weld layers shall not exceed the heat input used for layers beyond the 1/8-inch thick buttered section (first three weld layers) in the procedure qualification.

8. IWA-4532.2(c) specifies that the completed weld shall have at least one layer of weld reinforcement deposited. Once the weld is completed, this reinforcement shall be removed by mechanical means. As an alternative, Entergy's proposed ambient temperature temper bead technique does not include a reinforcement layer.

9. IWA-4532.2(d) specifies that, after at least 3/16-inch of weld metal has been deposited, the weld area shall be maintained at a temperature of 450EF - 550EF for a minimum of four (4) hours (for P-No. 3 materials). As an alternative, Entergy's proposed ambient temperature temper bead technique does not include a postweld soak.

10. IWA-4532.2(e) specifies that after depositing at least 3/16-inch of weld metal and performing a postweld soak 450EF - 550EF, the balance of welding may be performed at an interpass temperature of 350EF. As an alternative, Entergy proposes that an interpass temperature of 350EF may be used throughout the welding process without a postweld soak.

11. IWA-4533 specifies the following examinations shall be performed after the completed repair weld has been at ambient temperature for at least 48 hours: (a) the repair weld and preheated band shall be examined by the liquid penetrant method; (b) the repaired region shall be volumetrically examined by the radiographic method, and if practical, by the ultrasonic method. As an alternative to the IWA-4533, Entergy proposes to perform the following examinations of the new mid-wall repair weld and OD weld pad after the completed repair weld has been at ambient temperature for 48 hours:

    a. A liquid penetrant examination of the completed repair weld shall be performed in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5350.

    b. The completed repair weld shall be ultrasonically examined in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5330.

3.5 <u>Licensee's Basis for Proposed Alternative</u> (As Stated)

The pressurizer upper and lower heads and side shell were manufactured from P-No. 3, Group 3 low alloy steel. If repairs were to be performed in accordance with ASME Section III, Entergy would have two options:

1. Perform a weld repair that includes a postweld heat treatment at 1,100EF - 1,250EF in accordance with NB-4622.1; or

2. Perform a temper bead repair using the SMAW process in accordance with NB-4622.11.

Each option is discussed below.

1. <u>Postweld Heat Treatment</u>
   NB-4600 requires the postweld heat treatment (PWHT) to be performed at 1,100EF - 1,250EF. PWHT of the pressurizer head is impractical as it could cause ovalization and misalignment of heater sleeves, which would permanently damage the head including the heater support assembly.

2. <u>Temper Bead Repair using SMAW</u>

   NB-4622.11 provides temper bead rules for repair welding dissimilar materials using the SMAW process. Because NB-4622.11 does not include temper bead rules for the machine or automatic GTAW process, a manual SMAW temper bead process must be used. However, a manual SMAW temper bead repair is not a desirable option due to radiological considerations. First, resistance heating blankets, thermocouples, and insulation must be installed. Secondly, the manual SMAW temper bead process is a time and dose intensive process. Each weld layer is manually deposited in a high dose and high temperature (350EF) environment. The manual SMAW process also requires the weld crown of the first weld layer to be mechanically removed by grinding. Upon completing repair welding, the resistance heating blankets, thermocouples, and insulation must be removed. Thermocouples and heating blanket-mounting pins must be removed by grinding. The ground areas must be subsequently examined by either magnetic particle or liquid penetrant examination techniques.

Entergy is not requesting an alternative to NB-4600; rather this request proposes an alternative to IWA-4500 and IWA-4530. Owners are allowed by ASME Section XI, IWA-4170(b) and IWA-4500(a) to perform temper bead repairs of dissimilar materials. IWA-4170(b) and IWA-4500(a) provide requirements and controls for performing such repairs. For clarification, Entergy will meet applicable requirements of IWA-4000 except as otherwise approved by the NRC in accordance with this request.

IWA-4500 and IWA-4530 of ASME Section XI establish requirements for performing temper bead welding of "dissimilar materials." According to IWA-4530, either the automatic or machine GTAW process or SMAW process may be used. When using the machine GTAW process, a minimum preheat temperature of 300EF must be established and maintained throughout the welding process while the interpass temperature is limited to 450EF. Upon completion of welding, a postweld soak is performed at 450EF - 550EF for a minimum of 4 hours.

The IWA-4500 and IWA-4530 temper bead welding process is a time and dose intensive process. Resistance heating blankets are attached to the pressurizer base material; typically a capacitor discharge stud welding process is used. Thermocouples must also be attached to the pressurizer base material using a capacitor discharge welding process to monitor preheat, interpass, and postweld soak temperatures. Prior to heatup, thermal insulation is also installed. Upon completion of repair welding (including the postweld soak), the insulation, heating blankets, studs, and thermocouples must be removed from the pressurizer base material. Thermocouples and stud welds are removed by grinding. Ground removal areas are subsequently examined by the liquid penetrant or magnetic particle method. A significant reduction in dose could be realized by utilizing an ambient temperature temper bead process. Therefore, Entergy proposes an alternative welding technique based on the methodology of ASME Code Case N-638.

<u>Suitability of Proposed Temperature Temper Bead Technique</u>

A. <u>Evaluation of the Ambient Temperature Temper Bead Technique</u>

Research by the Electric Power Research Institute (EPRI) and other organizations on the use of an ambient temperature temper bead operation using the machine GTAW process is documented in EPRI Report GC-111050 ["Ambient Temperature Preheat for Machine GTAW Temper Bead Applications," dated November 1998]. According to the EPRI report, repair welds performed with an ambient temperature temper bead procedure utilizing the machine GTAW welding process exhibit mechanical properties equivalent to or better than those of the surrounding base material. Laboratory testing, analysis, successful procedure qualifications, and successful repairs have all demonstrated the effectiveness of this process.

The effects of the ambient temperature temper bead welding process of Attachment 1 [to Reference 6] on mechanical properties of repair welds, hydrogen cracking, and restraint cracking are addressed below.

1. <u>Mechanical Properties</u>

The principal reasons to preheat a component prior to repair welding is to minimize the potential for cold cracking. The two cold cracking mechanisms are hydrogen cracking and restraint cracking. Both of these mechanisms occur at ambient temperature. Preheating slows down the cooling rate resulting in a ductile, less brittle microstructure thereby lowering susceptibility to cold cracking. Preheat also increases the diffusion rate of monatomic hydrogen that may have been trapped in the weld during solidification. As an alternative to preheat, the ambient temperature temper bead welding process utilizes the tempering action of the welding procedure to produce tough and ductile microstructures. Because precision bead placement and heat input control is characteristic of the machine GTAW process, effective tempering of weld heat affected zones is possible without the application of preheat. According to Section 2-1 of EPRI Report GC-111050, "[T]he temper bead process is carefully designed and controlled such that successive weld beads supply the appropriate quantity of heat to the untempered heat affected zone such that the desired degree of carbide precipitation (tempering) is achieved. The resulting microstructure is very tough and ductile."

The IWA-4530 temper bead process also includes a postweld soak requirement. Performed at 450EF - 550EF for 4 hours (P-No. 3 base materials), this postweld soak assists diffusion of any remaining hydrogen from the repair weld. As such, the postweld soak is a hydrogen bake-out and not a postweld heat treatment as defined by the ASME Code. At 450EF - 550EF, the postweld soak does not stress relieve, temper, or alter the mechanical properties of the weldment in any manner.

Section 2.1 of Attachment 1 [to Reference 6] establishes detailed welding procedure qualification requirements for base materials, filler metals, restrain, impact properties, and other procedure variables. The qualification requirements of Section 2.1 provide assurance that the mechanical properties of repair welds will be equivalent to or superior to those of the surrounding base material.

2. <u>Hydrogen Cracking</u>

Hydrogen cracking is a form of cold cracking. It is produced by the action of internal tensile stresses acting on low toughness heat affected zones. The internal stresses are produced from localized build-ups of monatomic hydrogen. Monatomic hydrogen forms when moisture or hydrocarbons interact with the welding arc and molten weld pool. The monatomic hydrogen can be entrapped during weld solidification and tends to migrate to transformation boundaries or other microstructure defect locations. As concentrations build, the monatomic hydrogen will recombine to form molecular hydrogen - thus generating localized internal stresses at these internal defect locations. If these stresses exceed the fracture toughness of the material, hydrogen induced cracking will occur. This form of cracking requires the presence of hydrogen and low toughness materials. It is manifested by intergranular cracking of susceptible materials and normally occurs within 48 hours of welding.

IWA-4500 establishes elevated preheat and postweld soak requirements. The elevated preheat temperature of 300EF increases the diffusion rate of hydrogen from the weld. The postweld soak at 450EF - 550EF was also established to bake-out or facilitate diffusion of any remaining hydrogen from the weldment. However, while hydrogen cracking is a concern for SMAW, which uses flux covered electrodes, the potential for hydrogen cracking is significantly reduced when using the machine GTAW welding.

The machine GTAW welding process is inherently free of hydrogen. Unlike the SMAW process, GTAW welding filler metals do not rely on flux coverings that may be susceptible to moisture absorption from the environment. Conversely, the GTAW process utilizes dry inert shielding gases that cover the molten weld pool from oxidizing atmospheres. Any moisture on the surface of the component being welded will be vaporized ahead of the welding torch. The vapor is prevented from being mixed with the molten weld pool by the inert shielding gas that blows the vapor away before it can be mixed. Furthermore, modern filler metal manufacturers produce wires having very low residual hydrogen. This is important because filler metals and base materials are the most realistic sources of hydrogen for the automatic or machine GTAW temper bead welding. Therefore, the potential for hydrogen-induced cracking is greatly reduced by using the machine GTAW process.

3. <u>Cold Restraint Cracking</u>

Cold restraint cracking generally occurs during cooling at temperatures approaching ambient temperature. As stresses build under a high degree of restraint, cracking may occur at defect locations. Brittle microstructures with low ductility are subject to cold restraint cracking.

However, the ambient temperature temper bead process is designed to provide a sufficient heat inventory so as to produce the desired tempering for high toughness. Because the machine GTAW temper bead process provides precision bead placement and control of heat, the toughness and ductility of the heat affected zone will typically be superior to the base material. Therefore, the resulting structure will be appropriately tempered to exhibit toughness sufficient to resist cold cracking.

In conclusion, no elevated preheat or postweld soak above ambient temperature is required to achieve sound and tough repair welds when performing ambient temperature temper bead welding using the machine GTAW process. This conclusion is based upon strong evidence that hydrogen cracking will not occur with the GTAW process. In addition, automatic or machine temper bead welding procedures without preheat will produce satisfactory toughness and ductility properties both in the weld and weld heat affected zones. The results of previous industry qualifications and repairs further support this conclusion. The use of an ambient temperature temper bead welding procedure will improve the feasibility of performing localized weld repairs with a significant reduction in radiological exposure.

B. <u>Evaluation of Proposed Alternatives to IWA-4500 and IWA-4530</u>

1. According to IWA-4500(a), repairs may be performed to dissimilar base materials and welds without the specified postweld heat treatment of ASME Section III provided the requirements of IWA-4500 and IWA-4530 are met. The temper bead rules of IWA-4500 and IWA-4530 apply to dissimilar materials such as P-No. 43 to P-No. 3 base materials welded with F-No. 43 filler metals. When using the GTAW-machine process, the IWA-4500 and IWA-4530 temper bead process is based fundamentally on an elevated preheat temperature of 300EF, a maximum interpass temperature of 450EF, and a postweld soak of 450EF to 550EF. The proposed alternative of Attachment 1 [to Reference 6] also establishes requirements to perform temper bead welding on dissimilar material welds that join P-No. 43 to P-No. 3 base materials using F-No. 43 filler metals. However, the temper bead process of Attachment 1 [to Reference 6] is an ambient temperature technique that only utilizes the GTAW-machine or GTAW automatic process. The suitability of the proposed ambient temperature temper bead technique is evaluated in this section. The results of this evaluation demonstrate that the proposed ambient temperature temper bead technique provides an acceptable level of quality and safety.

2. According to IWA-4500(e)(2), the weld area plus a band around the repair area of at least 1½ times the component thickness or 5 inches, whichever is less, shall be preheated and maintained at a minimum temperature of 300EF for the GTAW process during welding while the maximum interpass temperature is limited to 450EF. The ambient temperature temper bead technique of Attachment 1 [to Reference 6] also establishes a preheat band of at least 1½ times the component

thickness or 5 inches, whichever is less. However, the ambient temperature temper bead technique requires a minimum preheat temperature of 50EF and a maximum interpass temperature of 350EF. The suitability of an ambient temperature temper bead technique with reduced preheat and interpass temperatures is addressed in Section [3.5.1].

3. According to IWA-4500(e)(2), thermocouples and recording instruments shall be used to monitor process temperatures. As explained in Section [3.4], Entergy will use thermocouples and associated recording instruments when performing an OD pad repair. However, Entergy cannot use thermocouples and recording instrumentation while performing a mid-wall repair. Because the inside diameter of the new sleeve is only 1.30 inches (approximately) and welding is being performed internally, there is insufficient space and accessibility along the inside diameter of the heater sleeve to use thermocouples. As an alternative, Entergy will verify the preheat temperature with a pyrometer or temperature indicating crayon prior to welding. With respect to interpass temperature, Entergy will implement a five (5) minute hold time between passes to ensure that the interpass temperature will not approach 350EF. Because of the large heat sink of the pressurizer shell and the five-minute hold time between passes, the 350EF interpass limitation of the welding procedure will not be exceeded. Mock-up testing and supporting engineering analysis [...] have been performed by Welding Services, Inc. and Structural Integrity Associates to support this position. This alternative approach for controlling interpass temperature has been approved by the NRC for performing mid-wall repairs of reactor pressure vessel head nozzles at Arkansas Nuclear One Unit 1, Calvert Cliffs Units 1 and 2, Millstone Unit 2, Oconee Units 1 and 2, Palisades, and Point Beach Units 1 and 2.

4. According to IWA-4532.2(c), the repair cavity shall be buttered with six layers of weld metal in which the heat input of each layer is controlled to within +/-10% of that used in the procedure qualification test, and heat input control for subsequent layers shall be deposited with a heat input equal to or less than that used for layers beyond the sixth in the procedure qualification. As an alternative to IWA-4532.2, Entergy proposes to butter the ferritic base material with at least three layers of weld metal to obtain a minimum butter thickness of 1/8-inch. The heat input of each layer in the 1/8-inch thick buttered section shall be controlled to within +/-10% of that used in the procedure qualification test. The heat input for subsequent weld layers shall not exceed the heat input used for layers beyond the 1/8-inch thick buttered section (first three weld layers) in the procedure qualification. When using the ambient temperature temper bead technique of Attachment 1 [to Reference 6], the machine GTAW process is used. Machine GTAW is a low heat input process that produces consistent small volume heat affected zones. Subsequent GTAW weld layers introduce heat into the heat affected zone produced by the initial weld layer. The heat penetration of

subsequent weld layers is carefully applied to produce overlapping thermal profiles that develop a correct degree of tempering in the underlying heat affected zone. When welding dissimilar materials with nonferritic weld metal, the area requiring tempering is limited to the weld heat affected zone of the ferritic base material along the ferritic fusion line.

After welding the ferritic base material to Alloy 690 with at least 1/8-inch of weld metal (first 3 weld layers), subsequent weld layers should not provide any additional tempering to the weld heat affected zone in the ferritic base material. Therefore, less restrictive heat input controls are adequate after depositing the 1/8-inch thick weld section.

5. According to IWA-4532.2(c), at least one layer of weld reinforcement shall be deposited on the completed weld and with this reinforcement being subsequently removed by mechanical means. In the proposed alternative of Attachment 1 [to Reference 6], the deposition and removal of a reinforcement layer is not required. A reinforcement layer is required when a weld repair is performed to a ferritic base material or ferritic weld using a ferritic weld metal. On ferritic materials, the weld reinforcement layer is deposited to temper the last layer of untempered weld metal of the completed repair weld. Because the weld reinforcement layer is untempered (and unnecessary), it is removed. However, when repairs are performed to dissimilar materials using nonferritic weld metal, a weld reinforcement layer is not required because nonferritic weld metal does not require tempering. When performing a dissimilar material weld with a nonferritic filler metal, the only location requiring tempering is the weld heat affected zone in the ferritic base material along the weld fusion line. However, the three weld layers of the 1/8-inch thick weld section are designed to provide the required tempering to the weld heat affected zone in the ferritic base material. Therefore, a weld reinforcement layer is not required.

   While Entergy recognizes that IWA-4532.2(c) does require the deposition and removal of a reinforcement layer on repair welds in dissimilar materials, Entergy does not believe that it is necessary for repair using a nonferritic filler material. This position is supported by the fact that ASME Code Case N-638 only requires the deposition and removal of a reinforcement layer of a similar filler material (ferritic) when performing repair welds on similar (ferritic) materials. Repair welds on dissimilar materials using nonferritic filler materials are exempt from this requirement in Code Case N-638.

6. According to IWA-4532.2(d), the weld area shall be maintained at a temperature of 450EF - 550EF for a minimum of 4 hours (for P-No. 3 materials) after at least 3/16-inch of weld metal has been deposited. In the proposed alternative of Attachment 1 [to Reference 6], a postweld soak is not required. The suitability of an ambient temperature temper bead technique without a postweld soak is addressed in Section [3.5.1].

7. According to IWA-4532.2(e), after depositing at least 3/16-inch of weld metal and performing a postweld soak at 450EF - 550EF, the balance of welding may be performed at an interpass temperature of 350EF. As an alternative, Entergy proposes that an interpass temperature of 350EF may be used throughout the welding process without a postweld soak. The proposed ambient temperature temper bead process of Attachment 1 [to Reference 6] is carefully designed and controlled such that successive weld beads supply the appropriate quantity of heat to the untempered heat affected zone such that the desired degree of carbide precipitation (tempering) is achieved. The resulting microstructure is very tough and ductile. This point is validated during weld procedure qualification. Based on Charpy V-notch testing of the procedure qualification test coupon, impact properties in weld heat affected zone will be demonstrated to be equal to or better than those of the unaffected base material. The suitability of an ambient temperature temper bead technique without a postweld soak is addressed in Section [3.5.1].

8. IWA-4533 specifies that (a) the repair weld and preheated band shall be examined by the liquid penetrant method; (b) the repaired region shall be volumetrically examined by the radiographic method, and if practical, by the ultrasonic method. As an alternative to IWA-4533, Entergy proposes to perform the following examinations after the completed repair weld has been at ambient temperature for 48 hours:

    a. Liquid penetrant examination shall be performed in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5350.

       Suitability: When using an ambient temperature temper bead technique, an elevated preheat temperature is not used. As a result, there is no preheated band. Therefore, the proposed alternative to only examine the new mid-wall repair weld and OD weld pad [after the completed repair weld] (including weld heat affected zones) is acceptable.

    b. The completed repair weld shall be ultrasonically examined in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5330.

       Suitability: Radiographic examination is impractical since the pressurizer vessel inside diameter is inaccessible for positioning the gamma source. As an alternative to radiographic examination, an ultrasonic examination of the new mid-wall repair weld and OD weld pad will be performed. Ultrasonic examination of temper bead repair welds is an acceptable option according to ASME Section XI, IWA-4630 in the 1995 Edition, 1996 Addenda and later (approved by NRC through the 2001 Edition, 2003 Addenda). Ultrasonic examination of repair welds is also required in Code Case N-638. The proposed ultrasonic examination will be performed in accordance with ASME Section III, NB-5000 which includes acceptance criteria that is appropriate for fabrication type flaws.

Conclusion

Entergy believes that compliance with the repair rules as stated in ASME Section XI and as described in Section [3.3] of this request would result in unwarranted damage to the pressurizer head assembly. Additionally, the work required to meet the current Code repair method, automatic or machine GTAW temper bead with 300EF minimum preheat and 450EF - 550EF postweld hydrogen bake-out, would be extremely difficult and personnel radiation exposure resulting from set-up, monitoring, and removing the required equipment is not justified.

Entergy also believes that the proposed alternative provides an acceptable level of quality and safety without exposing the pressurizer to potential distortion of the sleeves and heater support structure, as discussed in Section [3.5.1]. Therefore, Entergy requests that the NRC staff authorize the proposed alternative in accordance with 10 CFR 50.55a(a)(3)(i).

4.0 STAFF EVALUATION

According to IWA-4500(a), repairs may be performed to dissimilar base materials and welds without the specified PWHT of ASME Section III provided the requirements of IWA-4500 and IWA-4530 are met. The temper bead rules of IWA-4500 and IWA-4530 apply to dissimilar materials such as P-No. 43 to P-No. 3 base materials welded with F-No. 43 filler metals. When using the GTAW machine process, the IWA-4500 and IWA-4530 temper bead process is based fundamentally on an elevated preheat temperature of 300E F, a maximum interpass temperature of 450E F, and a 450E F to 550E F postweld hydrogen bake-out. The proposed alternative in Attachment 1 to Reference 6, also establishes requirements to perform temper bead welding on dissimilar metal welds that join P-No. 43 to P-No. 3 base metals using F-No. 43 filler metals. However, the temper bead process in Attachment 1 to Reference 6, is an ambient temperature technique which only utilizes the GTAW machine or GTAW automatic process.

According to IWA-4500(e)(2), the weld area plus a band around the repair area of at least 1½ times the component thickness or 5 inches, whichever is less, shall be preheated and maintained at a minimum temperature of 300E F for the GTAW process during welding while the maximum interpass temperature is limited to 450E F. The ambient temperature temper bead technique in Attachment 1 to Reference 6, also establishes a preheat band of at least 1½ times the component thickness or 5 inches, whichever is less. However, the proposed ambient temperature temper bead technique requires a minimum preheat temperature of 50E F and a maximum interpass temperature of 350E F for the balance of welding. This is suitable because the heat penetration of subsequent weld layers is carefully applied to produce overlapping thermal profiles that develop an acceptable degree of tempering in the underlying heat affected zone. This is further developed in EPRI report GC-111050, wherein repair welds performed with an ambient temperature temper bead procedure utilizing the machine GTAW process exhibit mechanical properties equivalent to or better than those of the surrounding base material. As stated in this EPRI report, laboratory testing, analysis, successful procedure qualifications, and successful repairs have all demonstrated the effectiveness of this process.

Also, according to IWA-4500(e)(2), thermocouples and recording instruments shall be used to monitor process temperatures. Entergy will use thermocouples and associated recording instruments to monitor process temperatures when performing an OD pad repair. However, Entergy cannot use thermocouples and recording instrumentation while performing a mid-wall repair. The licensee states that they cannot use thermocouples and recording instruments to monitor process temperatures during the performance of the heater sleeve mid-wall repair because the ID of the new sleeve is only 1.30 inches and welding is being performed internally, thus there is insufficient space and accessibility along the ID of the heater sleeve to use thermocouples. As an alternative, the licensee will verify the preheat temperature with a pyrometer or temperature indicating crayon prior to welding. This method will provide an accurate measure of preheat temperature. With respect to interpass temperature, Entergy will implement a five-minute hold time between passes to ensure that the interpass temperature will not approach 350E F. The licensee states that because of the large heat sink of the pressurizer and the five minute hold time between passes, the 350E F interpass limitation of the welding procedure will not be exceeded. The licensee has performed mock-up testing and supporting engineering analysis to support this position. Therefore, this type of temperature control is acceptable.

According to IWA-4532.2(c), the repair cavity shall be buttered with six layers of weld metal in which the heat input of each layer is controlled to within +/-10 percent of that used in the procedure qualification test, and heat input control for subsequent layers shall be deposited with a heat input equal to or less than that used for layers beyond the sixth in the procedure qualification. As an alternative to IWA-4532.2, the licensee proposes to butter the repair cavity or weld area with at least three layers of weld metal to obtain a minimum butter thickness of 1/8-inch. The heat input of each layer in the 1/8-inch thick buttered section shall be controlled to within +/-10 percent of that used in the procedure qualification test. The heat input for subsequent weld layers shall not exceed the heat input used for layers beyond the 1/8-inch thick buttered section (first three weld layers) in the procedure qualification. When using the ambient temperature temper bead technique as stated in Attachment 1 to Reference 6, the machine GTAW process is used. Machine GTAW is a low heat input process that produces consistent small volume heat affected zones. Subsequent GTAW weld layers introduce heat into the heat affected zone produced by the initial weld layer. The heat penetration of subsequent weld layers is carefully applied to produce overlapping thermal profiles that develop a correct degree of tempering in the underlying heat affected zone. When welding dissimilar materials with nonferritic weld metal, the area requiring tempering is limited to the weld heat affected zone of the ferritic base material along the ferritic fusion line. After buttering the ferritic base material with at least 1/8-inch of weld metal (first 3 weld layers), subsequent weld layers should not provide any additional tempering to the weld heat affected zone in the ferritic base material. Therefore, less restrictive heat input controls are adequate after depositing the 1/8-inch thick buttered section. This alternative is acceptable to the staff.

According to IWA-4532.2(c), at least one layer of weld reinforcement shall be deposited on the completed weld with this reinforcement being subsequently removed by mechanical means. In the proposed alternative in Attachment 1 to Reference 6, the deposition and removal of a reinforcement layer is not required. A reinforcement layer is required when a weld repair is performed to a ferritic base material or ferritic weld using a ferritic weld metal. On ferritic materials, the weld reinforcement layer is deposited to temper the last layer of untempered weld metal of the completed repair weld. Because the weld reinforcement layer is untempered (and unnecessary), it is removed. However, when repairs are performed to dissimilar materials using nonferritic weld metal, a weld reinforcement layer is not required because nonferritic weld metal does not require tempering. When performing a dissimilar material weld with a nonferritic filler metal, the only location requiring tempering is the weld heat affected zone in the ferritic base material along the weld fusion line. However, the three weld layers of the 1/8-inch thick butter section are designed to provide the required tempering to the weld heat affected zone in the ferritic base material. Therefore, a weld reinforcement layer is not required. This position is supported by the fact that ASME Code Case N-638 only requires the deposition and removal of a reinforcement layer when performing repair welds on similar (ferritic) materials. Repair welds on dissimilar materials are exempt from this requirement. Non-ferritic filler metals, such as, the P-No. 43 filler metal do not undergo a phase change at elevated temperature and therefore do not require a PWHT. Since the last layer of weld metal is a non-ferritic metal being deposited over two previous non-ferritic weld filler metal layers, the need for a tempering layer is unnecessary and its removal is unnecessary. Therefore, deletion of this requirement is acceptable.

According to IWA-4532.2(d), the weld area shall be maintained at a temperature of 450E F to 550E F for a minimum of 4 hours (for P-No. 3 materials) after at least 3/16-inch of weld metal has been deposited. In the proposed alternative of Attachment 1 to Reference 6 a postweld soak is not required. According to IWA-4532.2(e), after depositing at least 3/16-inch of weld metal and performing a postweld soak at 450E F to 550E F, the balance of welding may be performed at an interpass temperature of 350E F. As an alternative, the licensee proposes that an interpass temperature of 350E F may be used throughout the welding process without a postweld soak. The proposed ambient temperature temper bead process in Attachment 1 to Reference 6 is carefully designed and controlled such that successive weld beads supply the appropriate quantity of heat to the untempered heat affected zone such that the desired degree of carbide precipitation (tempering) is achieved. The resulting microstructure is very tough and ductile. This point is validated during weld procedure qualification. Also, based on Charpy V-notch testing of the procedure qualification test coupon, impact properties in the weld heat affected zone will be demonstrated to be equal to or better than those of the unaffected base material. Therefore, the proposed alternative is acceptable. The suitability of this proposal has also been explained above in the evaluation of IWA-4500(e)(2).

IWA-4533 specifies that the repair weld and preheated band shall be examined by the liquid penetrant method and the repaired region shall be volumetrically examined by the radiographic method, and if practical, by the ultrasonic method. As an alternative to IWA-4533, the licensee proposes to perform the following examinations after the completed repair weld has been at ambient temperature for at least 48 hours. Liquid penetrant examination shall be performed in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5350. The completed repair weld shall be ultrasonically examined in accordance with NB-5000 of ASME Section III, 1989 Edition. Acceptance criteria shall comply with NB-5350. When using an ambient temperature temper bead technique, an elevated preheat temperature is not used. As a result, there is no preheated band. Therefore, the proposed alternative to only examine the new mid-wall repair weld and OD weld pad after the completed repair weld (including weld heat affected zones), when performing the liquid penetrant examination is acceptable. Radiographic examination is impractical since the pressurizer vessel ID is inaccessible for positioning the gamma source. Also, the geometry of the pressurizer lower head and the orientation of the pressurizer to heater sleeve weld, make effective radiographic examination impractical. As an alternative to radiographic examination, an ultrasonic examination of the new mid-wall repair weld will be performed. Ultrasonic examination of temper bead repair welds is an acceptable option according to ASME Section XI, IWA-4630 in the 1995 Edition, 1996 Addenda and later. Ultrasonic examination of repair welds is also required in Code Case N-638. The proposed ultrasonic examination will be performed in accordance with ASME Section III, NB-5000 which includes acceptance criteria that is appropriate for fabrication type flaws.

The use of a GTAW temper bead technique to avoid the need for PWHT is based on research that has been performed by EPRI (Report GC-111050) and other organizations. The research demonstrates that carefully controlled heat input and bead placement allow subsequent welding passes to relieve stress and temper the heat affected zone of the base material and preceding weld passes. The temper bead process has been shown effective by research, successful procedure qualifications, and many successful repairs performed since the technique was developed. Many acceptable Procedure Qualification Records and Welding Procedure Specifications presently exist and have been utilized to perform numerous successful repairs. The use of the automatic or machine GTAW process for temper bead welding allows more precise control of heat input, bead placement, and bead size and contour than the manual SMAW process. The very precise control over these factors afforded by the alternative provides more effective tempering and will provide an acceptable level of quality and safety.

5.0 CONCLUSION

The staff concludes that the licensee’s proposed alternative to use ambient temperature temper bead welding for repairs in the pressurizer heater sleeves and nozzles as discussed in Relief Request No. W3-R&R-003, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for use at Waterford 3. The alternative is authorized for the second 10-year ISI interval through the end of the refueling outage scheduled for the spring of 2005.

All other requirements of the ASME Code, Section III and XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Due to the immediate need of this relief request, verbal authorization for the use of this relief request was granted by the NRC staff on April 20, 2005.

6.0 REFERENCES

1. Letter dated January 31, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Proposed Alternative to ASME Requirements for Weld Repairs, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (Agencywide Documents Access and Management System (ADAMS) Accession Number ML050390283)

2. Letter dated March 8, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Proposed Alternative to ASME

Requirements for Weld Repairs, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (ADAMS Accession No. ML050740451)

3. Letter dated March 28, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Response to NRC Request for Additional Information, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (ADAMS Accession No. ML050890322)

4. Letter dated March 29, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Proposed Alternative to ASME Requirements for Weld Repairs, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (ADAMS Accession No. ML050900304)

5. Letter dated March 31, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Proposed Alternative to ASME Requirements for Weld Repairs, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (ADAMS Accession No. ML050970079)

6. Letter dated June 3, 2005, from F. G. Burford (Entergy) to U. S. Nuclear Regulatory Commission, Request for Alternatives W3-R&R-003 - Proposed Alternative to ASME Requirements for Weld Repairs, Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38. (ADAMS Accession No. ML051600331)

Principal Contributor: E. Andruszkiewicz

Date: August 9, 2005

cc:

Mr. Michael E. Henry, State Liaison Officer
Department of Environmental Quality
Permits Division
P.O. Box 4313
Baton Rouge, Louisiana 70821-4313

Vice President Operations Support
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Director
Nuclear Safety Assurance
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Wise, Carter, Child & Caraway
P. O. Box 651
Jackson, MS 39205

General Manager Plant Operations
Waterford 3 SES
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Licensing Manager
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Winston & Strawn
1700 K Street, N.W.
Washington, DC 20006-3817

Resident Inspector/Waterford NPS
P. O. Box 822
Killona, LA 70066-0751

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

Parish President Council
St. Charles Parish
P. O. Box 302
Hahnville, LA 70057

Executive Vice President
& Chief Operating Officer
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Chairman
Louisiana Public Services Commission
P. O. Box 91154
Baton Rouge, LA 70825-1697