Entergy Nuclear Northeast
Indian Point Energy Center
450 Broadway, GSB
Buchanan, NY 10511-0249

Robert Walpole
Licensing Manager
Tel (914) 734 6710

September 19, 2007

Re: Indian Point Unit 2
Docket No. 50-247
NL-07-103

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: **Supplement to Response to Request for Additional Information Regarding Relief Request RR-07, "Reactor Vessel Head Alternative Weld Repair Methods" (TAC No. MD4702)**

REFERENCES:

1. Entergy Letter dated February 28, 2007, P.W. Conroy to Document Control Desk, "4th Ten-Year Interval Inservice Inspection and Containment Inservice Inspection Program Plan at Indian Point Unit 2 (IP2)"

2. Entergy Letter dated August 15, 2007, Robert Walpole to Document Control Desk, "Reply to Request for Additional Information Regarding Relief Request RR-07, "Reactor Vessel Head Alternative Weld Repair Methods" (TAC No. MD4702)

Dear Sir or Madam:

By letter dated February 28, 2007 (Reference 1) Entergy Nuclear Operations, Inc. (ENO) submitted the 4th Ten-Year Interval Inservice Inspection and Containment Inservice Inspection Program Plan for the period March 1, 2007, through April 3, 2016, for Indian Point Unit 2. The NRC staff requested additional information via teleconference on June 19, 2007. In response to the teleconference, ENO submitted a revision to Relief Request RR-07 by letter dated August 15, 2007 (Reference 2) and requested NRC authorization to use alternative embedded flaw repair technique method (WCAP-15987-P-A) as a contingency in the event that flaws requiring repair are identified by inspections performed during the Indian Point Unit 2 Fourth Ten-Year ISI Interval.

The NRC staff requested additional information via teleconference on August 23, 2007 in order to complete its review of Relief Request RR-07. The purpose of this letter is to provide the responses to the questions discussed at the teleconference regarding Relief Request RR-07. Responses to NRC questions on RR-07 are provided in Attachment 1 to this letter with the revised RR-07, Revision 2, in Attachment 2.

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If you have any questions or require additional information, please contact Mr. Robert Walpole, Manager, Licensing at (914) 734-6710.

Sincerely,

Robert Walpole
Licensing Manager
Indian Point Energy Center

Attachments:
1. Response to RAI Regarding Relief Request RR-07, "Reactor Vessel Head Alternative Weld Repair Methods"
2. Revised Relief Request RR-07, Revision 2, "Reactor Vessel Head Alternative Weld Repair Methods"

cc: Mr. John P. Boska, Senior Project Manager, NRC NRR DORL
Mr. Samuel J. Collins, Regional Administrator, NRC Region I
NRC Resident Inspector's Office, Indian Point 2
Mr. Paul Eddy, New York State Dept. of Public Service

ATTACHMENT 1 TO NL-07-103

Supplement to Response to RAI Regarding Relief Request RR-07,
"Reactor Vessel Head Alternative Weld Repair Methods"

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

Supplement to Reply to RAI Regarding Relief Request RR-07, "Reactor Vessel Head Alternative Weld Repair Methods"

Responses to the questions discussed at August 23, 2007, teleconference request for additional information regarding relief request RR-07, "Reactor Vessel Head Alternative Weld Repair Methods" are as follows:

1. **The licensee's proposed revision to Relief Request RR-07 removed LTR-NRC-03-061 dated October 1, 2003 from J. S. Galembush (Westinghouse) to Terence Chan (NRC) and Bryan Benney (NRC) with the subject of "Inspection of Embedded Flaw Repair of a J-groove Weld" (Reference 3). Reference 3 was not reviewed as part of the topical report approval, and therefore, could not be referenced as an approved document. However, the staff recommends that the licensee include Reference 3 in Section E (Proposed Alternative and Basis for Use) of the submittal.**

   Response 1

   Section E, "Basis for Use" has been revised to provide the requested information. The revised relief request, RR-07 Revision 2, is provided in Attachment 2.

2. **Clarify the applicable code requirements in Section C.I.**

   Response 2

   Section C.I, "Applicable Code Requirements, ASME Section XI, 2001 Edition, w/2003 Addenda Code", has been revised to provide the requested information. The revised relief request, RR-07 Revision 2, is provided in Attachment 2.

ATTACHMENT 2 TO NL-07-103

Revised Relief Request RR-07, Revision 2
"Reactor Vessel Head Alternative Weld Repair Methods"

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

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Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

A. ASME Code Component(s) Affected

The reactor pressure vessel head (RPVH), which includes control rod drive mechanism (CRDM) penetrations (90), In-Core Instrumentation (ICI) penetrations (7), and one head vent penetration, is an American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Class 1 component.

B. Applicable Code Edition and Addenda

The Code of Record for Indian Point Unit 2 Inservice Inspection Fourth Interval is the ASME Section XI Code, 2001 Edition including the 2003 Addenda.

The Reactor Vessel Construction Code is ASME Section III, 1965 Edition, through Summer 1965 Addenda, including Code Cases 1332, 1335, 1339, and 1359.

C. Applicable Code Requirements

I. ASME Section XI, 2001 Edition, w/2003 Addenda Code:

- **ASME Code Section XI 2001 Edition with 2003 Addenda, IWA-4221, "Construction Code and Owner's Requirements,"** states
  (a) An item to be used for repair /replacement activities shall meet the Owner's Requirements. Owner's Requirements may be revised, provided they are reconciled in accordance with IWA-4222. Reconciliation documentation shall be prepared.
  (b) An item to be used for repair/replacement activities shall meet the Construction Code specified in accordance with (1), (2), or (3) below.
    (1) When replacing an existing item, the new item shall meet the Construction Code to which the original item was constructed.
    (2) When adding a new item to an existing system, the Owner shall specify a Construction Code that is no earlier than the earliest Construction Code used for construction of any system of any originally installed item in that system.

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(3) When adding a new system, the Owner shall specify a Construction Code that is no earlier than the earliest Construction Code used for other systems that perform a similar function.

(c) As an alternative to (b) above, the item may meet all or portions of the requirements of different Editions and Addenda of the Construction Code, or Section III when the Construction Code was not Section III, provided the requirements of IWA-4222 through IWA-4226, as applicable, are met. Construction Code Cases may also be used. Reconciliation required by this article shall be documented....."

- ASME Section XI, IWA-4420 "Defect Removal Requirements"

  IWA-4421 General Requirements

  Defects shall be removed or mitigated in accordance with the following requirements:
  (a) Defect removal by mechanical processing[4] shall be in accordance with IWA-4462.
  (b) Defect removal by thermal methods shall be in accordance with IWA-4461.
  (c) Defect removal or mitigation by welding or brazing shall be in accordance with IWA-4411
  (d) Defect removal or mitigation by modification shall be in accordance with IWA-4340.

[4] Mechanical processing refers to metal removal by mechanical means, e.g., grinding, machining, chipping.

II. Applicable Construction Code

- The applicable Construction Code is ASME Section III, 1965 Edition, through Summer 1965 Addenda, including Code Cases 1332, 1335, 1339, and 1359.

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BASE METAL DEFECT REPAIRS

ASME Section III, 1965 Edition, Summer 1965 Addenda Requirements

N-320 Nondestructive Examination and Repairs of Materials

Materials shall be examined by nondestructive methods applicable to the material and product form as required by the following rules:

N-321 Nondestructive Examination of Plates

N-321.1 Nondestructive Examination
(a) Ultrasonic Inspection - All plates for reactor vessels as defined N-131*(a)* and all plates 4 in. and over in nominal thickness for all other Class A vessels shall be ultrasonically examined in accordance with Specification SA-435. In the case of clad plates conforming to SA-263 or SA-264, this examination shall include inspection of the bond between the cladding and the base plate.
(b) Reference Specimens - A reference specimen shall be used to calibrate the test equipment. The reference specimen shall be of the same nominal thickness and composition as the plate being examined, and it shall have a flat-bottom hole 1/2 in. in diameter and a depth of 10 percent of the material thickness for thicknesses over 2 in. and a depth of 25 per cent of the material thickness for thicknesses of 2 in. or less.
(c) Acceptance Standards - A defect from which one or more ultrasonic indications cause a loss of back reflection greater than the reference defect which is monitored during movement of the transducer 2 in. in any direction is unacceptable unless the defects are removed and the plate is repaired.

N-321.2 Repair of Plates by Welding - The materials manufacturer may repair defects in plates by welding provided the following requirements are met:
(a) Prior approval is obtained from the vessel manufacturer.
(b) The depth of the defect does not exceed ¼ of the nominal thickness.
(c) The welding procedure and the welders or welding operators are qualified in accordance with Section IX of the Code.
(d) The defect is removed and the area prepared for repair is examined by a magnetic particle method in accordance with N-626 or by a liquid penetrant method in accordance with N-627.
(e) The material is heat treated after repair as required by N-532.
(f) The repaired area is examined by radiography in accordance with N-624 and

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by a magnetic particle method in accordance with N-626 or a liquid method in accordance N-627, except that for defects whose depth did not exceed the lesser of 3/8 in. or 10 percent of the nominal thickness, no radiographic examination need be made.
(g) The location and extent of the weld repair together with the repair procedure and examination results are recorded and transmitted as a part of the certification for purposes of N-514.2.
(h) The procedure qualification test plate receives a heat treatment which will duplicate the heating rate, the total time at maximum temperature, and the cooling rate to be employed in fabrication in accordance with the general procedure outlined in N-313.1.

ASME Section III, 2001 Edition, w/2003 Addenda Requirements

NB-4131 Elimination and Repair of Defects
Material originally accepted on delivery in which defects exceeding the limits of NB-2500 are known or discovered during the process of fabrication or installation is unacceptable. The material may be used provided the condition is corrected in accordance with the requirements of NB-2500 for the applicable product form except:
(a) the limitation on the depth of the weld repair does not apply;
(b) the time of examination of the weld repairs to weld edge preparations shall be in accordance with NB-5130;
(c) radiographic examination is not required for weld repairs to seal membrane material when the material thickness is 1/4 in. (6 mm) or less.

NB-2538 Elimination of Surface Defects
Surface defects shall be removed by grinding or machining, provided the requirements of (a) through (d) below are met.
(a) The depression, after defect elimination, is blended uniformly into the surrounding surface.
(b) After defect elimination, the area is examined by the magnetic particle method in accordance with NB-2545 or the liquid penetrant method in accordance with NB-2546 to ensure that the defect has been removed or reduced to an imperfection of acceptable size.
(c) Areas ground to remove oxide scale or other mechanically caused impressions for appearance or to facilitate proper ultrasonic testing need not be examined by the magnetic particle or liquid penetrant test method.
(d) When the elimination of the defect reduces the thickness of the section below

the minimum required to satisfy NB-3000, the product shall be repaired in accordance with NB-2539.

NB-2539.1 Defect Removal. The defect shall be removed or reduced to an imperfection of acceptable size by suitable mechanical or thermal cutting or gouging methods and the cavity prepared for repair.

NB-2539.4 Examination of Repair Welds. Each repair weld shall be examined by the magnetic particle method (NB-2545) or by the liquid penetrant method (NB-2546). In addition, when the depth of the repair cavity exceeds the lesser of 3/8 in. (10 mm) or 10% of the section thickness, the repair weld shall be radiographed after repair in accordance with NB-5110 and to the acceptance standards of NB-5520. The penetrameter and the acceptance standards for radiographic examination of repair welds shall be based on the section thickness at the repair area.

Analysis of the 1965 Edition, Summer 1965 Addenda and the 2001 Edition, w/2003 Addenda: there is no significant difference in the Code requirements.

WELD METAL DEFECT REPAIRS

ASME Section III, 1965 Edition, Summer 1965 Addenda Requirements

N-528 Repair of Weld Defects

N-528.1 Unacceptable defects detected visually or by the examination described in N-624, N-625, N-626, and N-627 and defects detected by leakage tests shall be removed by mechanical means or by thermal gouging processes, and appropriate nondestructive tests shall be performed to show to the satisfaction of the Inspector that the defect has been completely and satisfactorily removed.

N-528.2 The areas to be repaired shall be rewelded using qualified welding procedures and welders and the rewelded area shall he reexamined by the methods specified for the examination of the original weld to ensure that it has been satisfactorily repaired, except that if the depth of the deposit removed does not exceed the lesser 3/8 in. or 10 percent of the weld thickness, the examination

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may be made by a magnetic particle method in accordance with N-626 or a liquid penetrant method in accordance with N-627. The post-weld heat-treating rules in N-532 shall apply to all weld repairs.

ASME Section III, 2001 Edition, w/2003 Addenda Requirements

NB-4451 General Requirements
Defects in weld metal detected by the examinations required by NB-5000, or by the tests of NB-6000, shall be eliminated and repaired when necessary.

NB-4452 Elimination of Surface Defects
Weld metal surface defects may be removed by grinding or machining, and need not be repaired by welding, provided that the requirements of (a) through (c) below are met.
(a) The remaining thickness of the section is not reduced below that required by NB-3000.
(b) The depression, after defect elimination, is blended uniformly into the surrounding surface.
(c) The area is examined by a magnetic particle or liquid penetrant method in accordance with NB-5110 after blending and meets the acceptance standards of NB-5300 to ensure that the defect has been removed or reduced to an imperfection of acceptable limit. Defects detected by visual or volumetric method and located on an interior surface need only be reexamined by the method which initially detected the defect when the interior surface is inaccessible for surface examination.

NB-4453.1 Defect Removal. Defects may be removed by mechanical means or by thermal gouging processes. The area prepared for repair shall be examined by a liquid penetrant or magnetic particle method in accordance with NB-5110, and meet the acceptance standards of NB-5340 or NB-5350. This examination is not required where defect elimination removes the full thickness of the weld and where the backside of the weld joint is not accessible for removal of examination materials.

Analysis of the 1965 Edition, Summer 1965 Addenda and the 2001 Edition, w/2003 Addenda: there is no significant difference in the Code requirements.

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D. Reason for Request

Entergy will be performing RPVH inspections during future refueling outages to meet the requirements of the NRC First Revised Order EA-03-009 (Reference 1). Entergy is requesting this relief as a contingency in the event that flaws requiring repair are identified during these inspections. The proposed embedded flaw process as described in WCAP-15987-P-A (Reference 2), which incorporates the NRC Safety Evaluation (SE), provides an acceptable alternative to repair reactor vessel head penetrations.

E. Proposed Alternative and Basis for Use

Entergy proposes that the embedded flaw process as described in WCAP-15987-P-A (Reference 2), which incorporates the NRC Safety Evaluation (SE), be used as an alternative to repair reactor vessel head penetrations in lieu of the original construction code requirements, ASME Section III, 1965 Edition, Summer 1965 Addenda, Subsections N-320 and N-528, and the requirements of ASME Section III, 2001 Edition, 2003 Addenda, Subsections NB-4131, NB-2538, NB-2539.1, NB-2539.4, NB-4451, NB-4452 and 4453.1 to eliminate base metal and weld metal defects prior to repair welding.

Basis for Use:

In the NRC SE, incorporated in Reference 2, the NRC staff concluded that, subject to the specified conditions and limitations, the embedded flaw process proposed in the WCAP provides an acceptable level of quality and safety. The staff also concluded that the WCAP is acceptable for referencing in licensing applications.

The Westinghouse topical report WCAP-15987-P-A is based on the ASME Code 1989 Edition of Section XI. The generic relief, as documented in the WCAP report, was based on the 1989 Edition of the ASME Code because the requirements of this edition are the most limiting of all the allowable editions now in effect (e.g.: ASME Section III, 1965 Edition, Summer 1965 Addenda through 2001 Edition, 2003 Addenda). The considerations mentioned in the generic relief are essentially independent of any particular code edition, since they stand alone. For these reasons, it is not necessary to reconcile to any other code edition. Also, it is important to mention that the use of the generic relief has already been approved for several plants.

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The embedded flaw repair process is considered a permanent repair that will last through the useful life of the RPVH. As long as a primary water stress corrosion cracking (PWSCC) flaw remains isolated from the primary water environment the only known mechanism for any further potential propagation is fatigue. The calculated fatigue usage in this region is very low because the reactor vessel head region is isolated from the transients that affect the hot leg or cold leg piping.

The thickness of the weld used to embed the flaw has been designed to provide a permanent embedment of the flaw. The embedded flaw process imparts less residual stresses than would a weld repair following the complete removal of the flaw.

Since Alloy 52/152 (690) weldment is considered highly resistant to PWSCC, a new PWSCC crack should not initiate and grow through the Alloy 52/152 overlay to reconnect the primary water environment with the embedded flaw. The resistance of the alloy 690 material has been demonstrated by laboratory testing, and in over 12 years of operational service in steam generator tubes, where no PWSCC has been found.

The design, implementation of repairs, and inspections will be consistent with the information contained in Reference 2.

The embedded flaw repair overlay welds on the penetration J-groove welds will consist of a minimum of 3 deposited layers. The embedded flaw repair overlay welds on the inside diameter (ID) and the outside diameter (OD) of the penetration tube material will consist of a minimum of 2 deposited layers of weld, consistent with Reference 2 to minimize welding induced residual stresses and material distortion. In the case of repairs on the ID surface, the 2 layer approach results in a reduced inlay excavation depth.

Flaw identification methods include eddy-current and ultrasonic examination (EC/UT) of the penetration tube and UT of the J-groove weld from the penetration tube ID side and EC of the J-groove weld from the J-groove weld surface. These are currently the best techniques available for the inspection of the J-groove welds. The embedded flaw repairs for J-groove welds will be inspected manually or remotely by qualified NDE personnel using qualified dye penetrant inspection procedures. Inspection methodology for embedded flaw repairs will be consistent with letter LTR-NRC-03-61, dated October 1, 2003 "Inspection of Embedded Flaw Repair of a J-Groove Weld".

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Therefore, the embedded flaw repair process is considered to be an acceptable alternative to the Code requirements: ASME Section III, 1965 Edition, Summer 1965 Addenda, Subsections N-320 and N-528, and ASME Section III, 2001 Edition, 2003 Addenda, Subsections NB-4131, NB-2538, NB-2539.1, NB-2539.4, NB-4451, NB-4452 and 4453.1, and provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).

F. Duration of Proposed Alternative

Relief is requested for the Fourth Ten-Year interval (effective from March 1, 2007 through April 3, 2016). ENO is in the process of license renewal application. The end date of the 4th Interval will be controlled by the ISI/CISI Program Plan, commensurate with the Operating License Renewal Application.

G. Precedents

1. Relief was approved for IP2 & IP3 during the 3rd ISI Interval, dated 10/05/2004, NRC Safety Evaluation (TAC NOS. MC3281 AND MC3282) (Reference 3).

H. References

1. U. S. Nuclear Regulatory Commission (NRC) Order EA-03-009, "Issuance of First Revised Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004.

2. Westinghouse Topical Report, WCAP-15987-P, Revision 2-P-A, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations", dated December 2003.

3. NRC letter to Entergy Nuclear Operations, Inc; regarding Approval of Relief Request Nos. 62 Rev. 1 and 3-32 Rev. 1 for IP2 and IP3, dated October 5, 2004,