UNITED STATES
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In re:	Docket Nos. 50-247-LR; 50-286-LR
License Renewal Application Submitted by	ASLBP No. 07-858-03-LR-BD01
Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc.	DPR-26, DPR-64 December 22, 2011

STATE OF NEW YORK
INITIAL STATEMENT OF POSITION
CONTENTION NYS-25

Office of the Attorney General
for the State of New York
The Capitol
State Street
Albany, New York 12224

PRELIMINARY STATEMENT

In accordance with 10 C.F.R. § 2.1207(a)(1) and the Atomic Safety and Licensing Board's ("Board") July 1, 2010 Memorandum and Order, the State of New York (the "State") hereby submits its Initial Statement of Position on the State's admitted Contention 25 ("NYS-25") concerning the integrity of Indian Point's embrittled reactor pressure vessels and their internal components. Embrittlement of reactor pressure vessels and their internal components is one of the most important age-related phenomena that NRC must consider in its review of Entergy's application to extend the operating life of the Indian Point reactors for an additional twenty years. Failure to consider the effects of embrittlement and the synergistic effects of embrittlement and other age related degradation mechanisms could prevent the maintenance of a coolable core geometry which in turn, could result in a meltdown of the core, a release of radiation, and profound safety consequences for the State and its citizens.

In this proceeding, the State of New York has satisfied the standards contained in 10 C.F.R. § 2.309 governing contention admissibility – standards that NRC and Entergy have described as "strict by design." The State now submits the accompanying December 20, 2011 Report of Dr. Richard T. Lahey, Jr., Edward S. Hood Professor Emeritus of Engineering, Rensselaer Polytechnic Institute (Exh. NYS000296), and Supplemental Report by Dr. Lahey concerning Entergy's use of the WESTEMS computer code as a tool to analyze the cumulative fatigue condition of important reactor components (Exh. NYS000297), Dr. Lahey's prefiled written testimony (Exh. NYS 000294), and related evidence to show that Entergy's license

renewal application ("LRA") should be denied because the application does not demonstrate that the reactor pressure vessel internals will remain functional during various design basis events as required by 10 C.F.R. §§ 50.54, 50.46, 54.3, 54.4, 54.21, 54.29, 54.33(a) , and because the application does not provide an adequate program to monitor and manage the effects of aging degradation of the reactor pressure vessel internals as required by 10 C.F.R. §§ 54.21(a)(3), 54.21(c)(iii) and 54.29(a)(1).[1]

PROCEDURAL HISTORY

The State of New York's Petition to Intervene and Contention 25

On November 30, 2007, the State submitted a Petition to Intervene, which Petition included proposed contentions regarding critical deficiencies in Entergy's Indian Point relicensing application with respect to public safety, health, and the environment. *State of New York Notice of Intention to Participate and Petition to Intervene*, (Nov. 30, 2007) ("NYS Petition") ML073400187. Among those proposed contentions was Contention NYS-25 that challenged Entergy's approach to the embrittlement of the reactor pressure vessel and their internal components. NYS Petition at 223-27. NYS-25, asserted:

> Entergy's License Renewal Application Does Not Include An Adequate Plan To Monitor And Manage The Effects Of Aging Due To Embrittlement Of The Reactor Pressure Vessels ("RPVs") And The Associated Internals.

[1] Any attempt by Entergy to remedy this deficiency in its license renewal application by amending it previous submissions should be filed with the Board and all parties should be given a reasonable opportunity to file, with the Board, new contentions based on Entergy's revised submittals.

NYS Petition at 223. NYS-25 contended that the LRA fails to include an adequate plan to monitor and manage the effects of aging due to embrittlement of the reactor pressure vessels ("RPV") and the associated internals as required by 10 C.F.R. § 54.21(a), and does not comply with 10 C.F.R. § 54.21(c). *Id*. The State further contended that the LRA does not document "that Entergy performed any age-related accident analyses, or that it took embrittlement into account when it assessed the effect of transient loads or the loss of coolant accident ("LOCA")." NYS Petition at 224.

Dr. Richard Lahey, a Professor of Engineering at Rensselaer Polytechnic Institute with extensive experience in the design, operations, safety, and aging of nuclear power plants, submitted a declaration in support of various contentions presented by the State including NYS-25. Declaration of Dr. Richard T. Lahey, Jr., at ¶¶ 6-18 (Nov. 2008) (*included in* ML073400193) (Exh. NYS000298). Dr. Lahey stated that embrittlement of the RPVs and their associated internal components is one of the most important age-related phenomena, and that failure to carefully consider the effects of embrittlement could result in a meltdown of the core. *Id*. at ¶¶ 6, 9. Furthermore, Entergy failed to document in its LRA any experiments or analysis to justify that the embrittled RPV internal structures will not fail and that a coolable core geometry will be maintained subsequent to a Design Basis Accident Loss of Coolant Accident. *Id*. at ¶¶ 14-16. According to Dr. Lahey "[t]his is a serious and unacceptable omission by Entergy because embrittled structures are known not to tolerate shock loads well." *Id*. at ¶ 16.

Entergy and NRC Staff opposed the admission of the State's contention.[2] Among other things, Entergy argued that the Board should not admit NYS-25 because "The core barrel, thermal shield, baffle plates and baffle former plates (including bolts) are, however, made of stainless steel and are not susceptible to a decrease in fracture toughness as a result of neutron embrittlement." Entergy Answer at 137. On February 22, 2008, the State submitted a reply in further support of Contention 25.[3] On March 11, 2008, the Board heard oral argument concerning the admission of Contention 25.[4]

On July 31, 2008, the Board issued a memorandum and order rejecting Entergy's and NRC Staff's arguments and admitting contention NYS-25. *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), LBP-08-13, 68 N.R.C. 43 (July 31, 2008) ML082130436. The decision reviewed the State's contention and Dr. Lahey's supporting declaration. 68 N.R.C. at 129-131. The Board recognized Dr. Lahey's opinion that components in the Indian Point reactors have serious embrittlement issues that are not adequately addressed in Entergy's LRA.

---

[2] *Answer of Entergy Nuclear Operations Inc. Opposing New York State Notice of Intention to Participate and Petition to Intervene* (Jan. 22, 2008) (ML080300149) ("Entergy Answer"); *NRC Staff's Response to Petitions for Leave to Intervene* (Jan. 22, 2008) (ML080230543).

[3] *State of New York Reply in Support of Petition to Intervene* (Feb. 22, 2008) (ML080600444).

[4] Transcript of Proceedings, at 401-410 (Mar. 11, 2008) (ML080740257). The parties submitted an errata sheet, which the Board subsequently accepted, for the transcript of the three day oral argument.

Id. at 131. The Board noted:

> Dr. Lahey states that Entergy fails to document in its LRA "any experiments or analysis to justify that the embrittled RPV internal structures will not fail and that a coolable core geometry will be maintain subsequent to a [Design Basis Accident] LOCA." According to Dr. Lahey "[t]his is a serious and unacceptable omission by Entergy because embrittled structures are known not to tolerate shock loads well."

Id. (citations omitted).

Entergy's Revised LRA and
the State's Additional Bases Regarding Reactor Vessel Internals

On July 15, 2010, Entergy submitted to the Board an amendment to the LRA. *See* Entergy Letter to ASLB enclosing Entergy Communication NL-10-063 (LRA Amendment No. 9) (Exh. NYS000313) (ML102030120). NL-10-063 forwarded to NRC Staff a document entitled "Reactor Vessel Internals Program" or RVI Program. Entergy stated that "[t]he RVI Program will implement the EPRI Pressurized Water Reactor Internals Inspection and Evaluation Guidelines, MRP-227." NL-10-063, Attachment 1, p. 8. On September 15, 2010, the State submitted a motion for leave to file additional bases to NYS Contention 25. *State of New York's Motion for Leave to File Additional Bases for Previously-Admitted Contention NYS-25, etc*., (Sept. 15, 2010) (ML103050402). Dr. Lahey submitted a declaration in support of the additional bases, and identifying concerns with Entergy's NL-10-063 RVI Program. Declaration of Richard T. Lahey, Jr. (Sept. 15. 2010) (Exh. NYS000301)(included in ML103050402). Among other things, that declaration discussed the synergistic effects of embrittlement and fatigue. Lahey Sept. 15, 2010 Decl. at ¶¶ 13, 14, 15. In the September 15, 2010 declaration, Dr.

Lahey referenced another declaration that he had then recently submitted in connection with NYS-26B. *Id*. at ¶ 13 (referencing Declaration of Richard T. Lahey, Jr. (Sept. 8, 2010) (Redacted, Public Version) (Exh. NYS000300) (included in ML102670665) There, Dr. Lahey noted note that in-core fatigue failures of irradiated baffle-to-former bolts have been observed in operating PWRs.; Lahey Sept. 8, 2010 Decl. at ¶ 12.

Entergy and NRC Staff opposed the admission of the State's proposed additional bases.[5] On October 22, 2010, the State submitted a reply in further support of the additional bases for Contention NYS-25.[6]

On April 29, 2011, the State submitted to the Board additional information that reflected concerns by NRC Staff about deficiencies in the visual and remote examination techniques that Entergy and industry had proposed to employ as part of the aging management program for the embrittlement of reactor internals. Letter from AAG J. Sipos to ASLB (Apr. 29, 2011) (enclosing two memoranda documenting non-concurrences by NRC Staff members about a safety evaluation of EPRI MRP-227) (ML11133A288). In those documents, two NRC Staffers recognized that two types of examination methodologies (EVT-1 and UT) were superior to an alternative examination methodology (VT-3) recommended by EPRI in MRP-227-Rev. 0. R.L. Tregoning, & M. J. Case Memoranda (Exh. NYS000370).

---

[5] *NRC Staff's Answer to State of New York's Motion for Leave to File Additional Bases for Previously-Admitted Contention NYS-25* (Oct. 12, 2010) (ML102850764); *Applicant's Answer to Amended Contention NYS 25 Concerning Aging Management of Reactor Pressure Vessel Internal*s (Oct. 12, 2010)(ML103010104).

[6] *State of New York's Joint Reply to Entergy and NRC Staff's Separate Answers to the State's Additional Bases for Previously Admitted Contention NYS-25* (Oct. 22, 2010)

On July 6, 2011, the Atomic Safety and Licensing Board issued a memorandum and order that, among other things, admitted the State's amended bases for Contention NYS-25 and rejected Entergy's and NRC Staff's arguments opposing the State's submission. *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), Memorandum and Order Ruling on Pending Motions for Leave to File New and Amended Contentions (July 6, 2011) (ML111870344).

NRC Staff's Supplemental Safety Evaluation Report

On July 27, 2011, NRC Staff notified the Board that the Staff had completed a Safety Evaluation Report on EPRI's MRP-227 document. Letter from NRC Counsel S. Turk to ASLB, (July 27, 2011) ML11208C309 (*enclosing* NRC RIS 2011-07, License Renewal Submittal Information For Pressurized Water Reactor Internals Aging Management ML111990086) (Exhs. NYS000310). . RIS 2011-07 stated in part, "LRAs for pressurized water reactor (PWR) plants have identified that an aging management program (AMP) is needed to manage the effects of aging for reactor vessel internal (RVI) components that are within the scope of license renewal, in accordance with 10 CFR Part 54, 'Requirements for Renewal of Operating Licenses for Nuclear Power Plants.'"[7]

On August 31, 2011, NRC Staff informed the Board and the parties that Staff had issued a supplement to the Safety Evaluation Report concerning the application to renew the operating

---

(ML103000060).

[7] In June 2011, Staff prepared a Safety Evaluation of EPRI's MRP-227-Rev 0. Exh. NYS000309. EPRI had previously withdrawn a confidentiality designation for MRP-227. EPRI

licenses for Indian Point Unit 2 and Indian Point Unit 3. Letter from NRC Staff Counsel S. Turk to ASLB (ML11243A109) (enclosing NUREG-1930, Supplement 1 (SSER)) (Exh. NYS 000130).

The State and Riverkeeper's Joint Contention NYS-38/RK-TC-5

On September 30, 2011, the State and Riverkeeper jointly filed a contention challenging the failure of various proposed Aging Management Programs to provide sufficient details about their contents and methods. *State of New York and Riverkeeper Joint Contention NYS-38/RK-TC-5* (Sept. 30, 2011) (ML11273A196). Entergy and NRC Staff opposed the admission of the proposed contention. On November 1, 2011, the State and Riverkeeper submitted a reply in further support of Contention 38. On November 10, 2011, the Atomic Safety and Licensing Board issued a decision and order admitting Contention 38 and rejecting Entergy's and NRC Staff's arguments opposing the contention. *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), Memorandum and Order Ruling (admitting New Contention NYS-38/RK-TC-5) (ML11314A211).

Over the last three years, the State and Entergy have disclosed various documents concerning the aging of reactor vessel internals. NRC Staff has provided limited disclosures concerning documents within the possession of NRC concerning aging of reactor internals. Further, the State has identified documents reflecting recently acknowledged concerns on the part of NRC and industry about age-related degradation of reactor pressure vessel internals caused by embrittlement, fatigue, and corrosion. For example, at a recent conference in Indian,

---

MRP 2010-016 letter (Mar. 2, 2010) (Exh NYS 000308).

NRC Staff highlighted concerns over aging management of reactor pressure vessel internals and other components. Slides, NRC Aging Management Program Including Long Term Operation (LTO), Workshop on Challenges on the Long Term Operation, vg5, 10, 21, New Delhi, India (ML111801154) (Nov. 8-11, 2011) (Exh. NYS000305).

SUMMARY OF ARGUMENT

Contention 25 is based on (i) 10 C.F.R. § 54.4(a)(1), which requires that the applicant have an aging management plan ("AMP") that will ensure the following functions:

> (i) The integrity of the reactor coolant pressure boundary;
>
> (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; [and]
>
> (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), §50.67(b)(2), or § 100.11 of this chapter, as applicable;

(ii) 10 C.F.R. § 54.21(a)(3), which requires that the applicant "demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis ("CLB") for the period of extended operation;" and (iii) 10 C.F.R. § 54.21(c) (iii), which specifically requires that "the applicant [Entergy] shall demonstrate that . . . (iii) [t]he effects of aging on the intended function(s) will be adequately managed for the period of extended operation." Entergy has failed to make the required demonstrations and, thus, the Board cannot find, pursuant to 10 C.F.R. § 54.29(a)(1), that:

> there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB . . . [including] (1) managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under §54.21(a)(1)

The focus of Contention 25 is reactor pressure vessel internals ("RPVI") and Entergy's deficient AMP for RPVIs. The principal support for Contention 25 is the report and prefiled testimony of Dr. Richard T. Lahey, Jr., the Edward E. Hood Professor Emeritus of Engineering at Rensselaer Polytechnic Institute (RPI) in Troy, New York, and numerous documents, all of which demonstrate that: (i) Entergy's AMP for RPVIs is not based on an analysis that addresses the critical issue of the synergistic degradation of RPVIs caused by the combination of embrittlement, metal fatigue, irradiation-assisted stress corrosion cracking ("IASCC"), and primarily water assisted stress corrosion cracking ("PWSCC"); (ii) Entergy's analysis fails to adequately consider the full range of transient shock loads (thermal and decompression) to which RPVIs will be subjected in the event of various postulated accidents, such as a design basis accident ("DBA"), and thus fails to develop a plan which considers those shock loads, and their resultant impact on core coolability, in setting either inspection, acceptance or corrective action criteria; (iii) the AMP lacks sufficient detail regarding the timing and nature of the inspections to be conducted, or proposes to conduct such inspections too late, both with regard to baseline inspections, and inspections during proposed extended operation, to allow Entergy to demonstrate that it has an effective inspection program; and () the AMP does not include a commitment to take preventative actions or to implement corrective actions, nor does it provide

specific, enforceable acceptance criteria for many components and contains no criteria to determine when to repair or replace embrittled components. Report of Dr. Richard T. Lahey, Jr. (Exh. NYS000296). The State also relies on Dr. Lahey's previous declarations that have been filed in this proceeding, as well as NRC, Entergy, and industry documents (Exhs. NYS000300, 301). .

Dr. Lahey demonstrates the importance of RPVI and explains how the failure of RPVIs during a DBA may result in the loss of a coolable geometry and thus core meltdown and a catastrophic release of radiation to the environment. Many of the RPVIs hold critical reactor components in place and their failure, during an accident, can cause those components, such as baffles, former plates, core support plates, thermal shields, control rods, guide tubes, plates and welds to either deform and/or create core blockages within the RPV pressure boundary. *See* NYS000296 at ¶¶ 12-13, 16-28, 38-40.

Entergy's response to New York State's Contention 25 has evolved from an initial LRA that contained no AMP for RPVIs, to the current proposal that mostly includes adoption of the Electric Power Research Institutes ("EPRI") MRP-227 (Exh. NYS00307A-D)inspection plan with a representation that, in the future, it would endeavor to develop some modifications to MRP-227 that are required to comply with concerns raised by the NRC. *See* LRA at 3.1.2.1.2. (which does not list an AMP for RPVIs); NL-10-063, Attachment 1 at 7 (which includes an AMP for RPVIs) (Exh. NYS000313); NL-11-107 Attachment 1 (which purports to include the inspection plan for RPVIs)(Exh. NYS000314); and NL-11-101, Attachment 1 at 4 ("This

inspection plan will include the inspections specified in MRP-227, as modified by the conditions and limitations and applicant/licensee action items in the NRC SER on MRP-227, Revision 0. . . . Following issuance of MRP-227-A, Entergy will review the inspection plan to determine the need for revision, and will modify the inspection plan to include the necessary revisions, if any").

Entergy's evolving position fails to definitively commit to a precise program to address the problem of embrittlement of RPVIs and lacks analyses of some of the most important aspects of RPVI degradation, including the absence of any assessment of the synergistic affects of embrittlement, metal fatigue and stress corrosion cracking and the absence of specific criteria for acceptance, prevention and corrective actions. Rather, Entergy frequently asserts that its programs will be "consistent" with various more detailed programs, and avoids making a specific commitment to follow a specific requirement of any of those programs. *See e.g.* NL-11-107, Attachment 1, Indian Point Energy Center Reactor Vessel Internals Inspection Plan at 21("Equipment, techniques, procedures and personnel used to perform examinations required under this program will be *consistent* with the requirements of MRP-228" (emphasis added)). Given the enormous importance of retaining the structural integrity of RPVIs in the event of an accident, such as a DBA LOCA, this lack of definitive plans and definitive commitments to specific programs is unacceptable and should be cause for concern. As the Commission has held, when it comes to reactor safety requirements, "[w]e do not simply take the applicant at its word." *Entergy Nuclear Vt. Yankee, LLC* (Vt. Yankee Nuclear Power Station), CLI-10-17, 72 N.R.C. __, slip op. at 45 (July 8, 2010).

RELEVANT FACTS

The RPVI AMP that is currently before the Board for review consists of the general plan described in NL-10-063 and the inspection plan portion of that AMP described in NL-11-107, as supplemented by NL-11-101. The latter reference relates to Entergy's commitment to include any modifications contained in MRP-227A that it believes are relevant to Indian Point, in the inspection program for Indian Point. Thus, the adequacy of the AMP for RPVIs must stand or fall on the adequacy of these documents.

With regard to the issues that are relevant here the following facts are established by Dr. Lahey's Report, (Exh. NYS 000296), his Prefiled Direct Testimony, (Exh. NYS000294) and numerous exhibits:

1. Neutron fluence is a substantial degradation phenomena, known as embrittlement, that will increasingly affect Indian Point if it operates beyond its original 40 year life (Lahey Report at ¶ 17) (Exh. NYS 000296);

2. Entergy has provided no analysis in support of its AMPs that addresses the synergistic affects of embrittlement, metal fatigue, stress corrosion, and unique RPVI material on the degradation of RPVIs during the period of extended operation (Lahey Report at ¶ 16);

3. In NL-10-063 Entergy states that its RPVI AMP consists of its agreement to follow MRP-227 and, when available and if applicable, the modifications to MRP-227 identified in MRP-227A (Exh. NYS000313);

4. MRP-227 purports to be an internals inspection and evaluation guide for PWR RPVIs that requires individual plant development to create a true plant-specific AMP (MRP-227 at v);

5. Entergy, in NL-11-107 provides its plant-specific AMP for RPVIs;

6. The plant specific AMP for Indian Point's RPVIs contains numerous instances in which no actual acceptance criteria are provided or the criteria are wholly subjective. *See, e.g.,* NL-11-107 (Exh. NYS000314), Physical Measurements Examination Acceptance Criteria (NL-11-107, Attachment 1 at 25("Specific acceptance criteria will be developed as required, and thus are not provided generically in this plan"); Control Rod Guide Tube Assembly, *id*. at 47 ("The specific relevant condition is wear that could lead to loss of control rod alignment and impede control assembly insertion"); Baffle Former Assembly (Baffle Former Bolts), *id*. at 49 ("The examination acceptance criteria for the UT of the baffle-former bolts shall be established as part of the examination technical justification"),[8] Thermal Shield Assembly, *id*. at 51 (The specific relevant conditions for thermal shield flexures are excessive wear, fracture, or complete separation"). MRP-227 is similarly vague when it comes to enforceable and objective standards for corrective actions and acceptance criteria. MRP-227 is replete with phrases such as "should," "could," "may," and "assumed." These terms render MRP-227, which

[8] NYS-RK Contention 38 challenges the practice of postponing development of AMP plan components until after the hearing. Here, Contention 25 challenges the absence of any acceptance criteria and thus the inability of Entergy to demonstrate compliance with AMP requirements.

is itself only a guideline, unenforceable. *See, e.g.*, MRP-227 at 6-9; 6-1 ("various options … are available for the disposition of conditions detected during examinations … that are unable to satisfy the examination acceptance criteria"). *See also* Lahey Report Exh. NYS000296 at ¶ 16.

7. Entergy's AMP does not specify what actions will take place when inspections reveal that acceptance criteria has not been achieved. For example, under Examination Acceptance Criteria for Visual (VT-3) Examination, Entergy merely states, "The disposition can include a supplementary examination to further characterize the relevant condition, an engineering evaluation to show that the component is capable of continued operation with a known relevant condition, or repair/replacement to remediate the relevant condition." NL-11-107 at 23.

8. Entergy's AMP does not include any preventative action measures. NL-10-063, Attachment 1 at 86 ("The Reactor Vessel Internals Program is a condition monitoring program that does not include preventive actions").

9. Although Entergy has agreed to do some baseline inspections for the baffle former assembly, the timing of those inspections is potentially well-beyond the date on which extended operation would commence. NL-11-107, Attachment 1 at 36-38 indicating that baseline inspections will occur in a range of 20-40 EFPY.

10. RPVIs are more susceptible to embrittlement than the RPV, for which Entergy has already had to seek an exemption from ASME End of Life Charpy impact

Upper Shelf Energy limits (Lahey Report at ¶¶ 19-20);

11. As the RPVIs age, embrittlement causes the nil ductility temperature (NDT) to rise thus expanding the temperature range at which RPVIs lose ductility (Lahey Report at ¶ 18);

12. There are factors other than embrittlement degrading the structural integrity of RPVIs including metal fatigue and stress corrosion cracking (Lahey Report at ¶¶ 17 and 19);

13. Embrittled components are more prone to crack propagation (Lahey Report at ¶ 19);

14. The control rod drives and their associated guide tubes, plates, pins, and welds have been identified as particularly susceptible to stress corrosion cracking which cracking is made more severe by embrittlement (Lahey Report at ¶¶ 25-27);

15. Entergy's AMP for RPVI is inadequate with respect to the embrittlement of the control rod drives and their associated guide tubes, plates, pins, and welds (Lahey Report at ¶¶ 25-27, n. 5; MRP-227 at v);

16. In the event of a DBA LOCA, RPVIs can be subjected to substantial external forces from thermal shock transients and decompression shock loads (Lahey Report at ¶ 23);

17. Entergy's AMP for RPVIs is not based upon an analysis that considers the combined degradation affects of embrittlement, metal fatigue and stress corrosion cracking in determining the frequency of inspections, the criteria for acceptance of

components after inspections, the criteria for when to expand inspections, the criteria for preventative actions and the criteria for when and how to repair or replace RPVI components (Lahey Report at ¶ 16);

18. Entergy intends to rely extensively on Visual (VT-3) Examination although there is substantial evidence that this inspection methodology is often subjective and ineffectual (NL-10-063 at 87; MRP-227 at 4-4, 4-5 and 4-14 to 4-16);

19. Without timely and properly conducted baseline inspections of RPVIs, it is not possible to accurately measure the progression of degradation of components over the period of extended operation and to take timely action to prevent failure of the component (Lahey Report at ¶¶ 28-29).

ARGUMENT

ENTERGY HAS NOT DEMONSTRATED THAT THE EFFECTS OF AGING ON CERTAIN INTENDED FUNCTIONS WILL BE ADEQUATELY MANAGED FOR THE PERIOD OF EXTENDED OPERATION.

Pursuant to 10 C.F.R. § 54.33(a), all license renewals require the holder of the license to be subject to 10 C.F.R. § 50.54 which includes, *inter alia*, the obligation to comply with "all rules, regulations, and orders of the Commission". *Id.* § 50.54(h). Among those rules and regulations is 10 C.F.R. § 50.46(b)(4), which requires that following a LOCA "[c]alculated changes in core geometry shall be such that the core remains amenable to cooling." The obligation to maintain a coolable core geometry following a DBA LOCA has been described as

one of the requirements that is "fundamental to providing reasonable assurance that [a proposed action] will not endanger the health and safety of the public." *Duke Energy Corporation* (Catawba Nuclear Station, Units 1 and 2) 60 N.R.C. 713, 724, LBP-04-32 (2004).

The purpose of an AMP is to assure that the "effects of aging on [certain] intended function(s) will be adequately managed for the period of extended operation." 10 C.F.R. § 54.21(c)(iii). Maintaining a coolable core geometry is one of the functions that must be maintained throughout the period of extended operation. 10 C.F.R. §§ 54.33(a), 54.4(a)(i)(ii)(iii) and 54.4(b). An applicant must demonstrate that:

> there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB . . . [including] (1) managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under §54.21(a)(1)

10 C.F.R. § 54.29(a)(1). Here, Entergy must prove that its AMP for components whose continued integrity following a DBA LOCA is essential to maintaining a coolable core geometry will achieve the regulation's objective. Entergy has failed to meet that obligation.

First, maintaining the integrity of RPVIs following postulated accidents, such as a DBA LOCA, is essential to maintaining a coolable core geometry. Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, NUREG-1930 ("SER"), Vol. 1 at 2-41 (November 2009)("if certain reactor vessel internals failed, they could potentially inhibit core coolability during an accident"); Lahey Report at ¶23 (Exh. NYS000296)..

Second, integrity of the RPVIs is directly dependent upon how well the RPVI withstands

the hostile environment inside the reactor over an extended period of time including the synergistic effects of embrittlement, metal fatigue and stress corrosion cracking. However, in conducting its analysis of various accident conditions, and in developing its AMP, Entergy does not provide evidence of the ability of the RPVIs to withstand accident-induced shock loads given all these degradation mechanisms to which they have been and will be subjected. Thus, Entergy has not demonstrated that its AMP for RPVIs will detect and correct problems with RPVIs that could cause them to fail in the event of accident-induced decompression and/or thermal shock loads.

Third, Entergy does not have an adequate AMP to manage and monitor the aging degradation of control rods and their associated guide tubes, plates, pins, and welds, even though these components are particularly vulnerable to stress corrosion cracking and embrittlement makes such stress corrosion more severe. Without any explanation in either MRP-227 or in NL-11-107, these RPVIs are given limited consideration in the inspection program being offered by Entergy. MRP-227 at v., NRC Regulatory Issue Summary 2011-07 License Renewal Submittal Information For Pressurized Water Reactor Internals Aging Management ("RIS-2011-07"), an internal NRC guidance document, asserts:

> The scope of the program does not include consumable items such as fuel assemblies, reactivity control assemblies, and nuclear instrumentation because these components are not subject to an AMR, as defined in 10 CFR 54.21(a)(1).

Id. at 3. However, this statement is demonstrably inaccurate. First, the control rods and their associated guide tubes, plates, pins, and welds are not consumables, at least not in the normal

sense of that word. In fact, Dr. Lahey has urged that Entergy be required to make them consumable – *i.e.*, to be replaced frequently to account for the embrittlement, stress corrosion and metal fatigue degradation to which they are being subjected. Second, 10 C.F.R. §54.21(a)(1) excludes "control rod drives," not control rods and their associated guide tubes, plates, pins, and welds. The control rod drives are more akin to pumps because they have moving parts and thus are not passive. But, like pumps, the non-moving parts of the system remain subject to AMR and AMP, where appropriate. Thus, for example, while the Commission makes clear that internal parts of components that move are exempt from aging management, the housing of the component is not included if it is part of the pressure boundary of the containment:

> the Commission determined that structures and components that perform active functions are not subject to an aging management review (e.g., pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies). However, pressure-retaining boundaries (e.g., pump casings, valve bodies, fluid system piping) and structural supports (e.g., diesel generator structural supports) that are necessary for the structure or component to perform its intended function meet the description of passive, and will be subject to an aging management review.

Statement of Considerations Regarding License Renewal Regulations, 60 Fed. Reg. 22461, 22464, 22,477 (May 8, 1995). If the control rods or their associated guide tubes, plates, pins, and welds fail due to embrittlement, stress corrosion cracking and metal fatigue, in the event of an accident, the control rod drives will not be able to perform their function of controlling core reactivity. *See also* Lahey Report at ¶¶ 25-27NYS 000296 .

Fourth, even had Entergy provided a basic analysis to justify the limited AMP inspection

program it has offered for RPVIs, the program is deficient in several respects. Entergy's limited RPVI inspection program does not fully provide criteria for determining when the status of the RPVIs is acceptable or when the inspection should be expanded, nor does does it provide any criteria for determining what actions should be taken when a RPVI is found to be "unacceptable." Similarly, it does not provide any criteria for a program that defines repair and replacement actions, lacks any preventative action measures for RPVI embrittlement and, while in certain instances provides for baseline inspections, the schedule for those baseline inspections allows postponement of the inspections until well into the period of extended operation..

Fifth, the inspection program offered relies substantially on Visual (VT-3) Examination (NL-10-063 at 87; EPRI MRP-227 at 4-4 to 4-5, 4-14 to 4-16), although there is serious doubt that this method will accurately or reliably detect RPVI degradation in all critical situations. The problem is that the MRP-227-approved VT-3 methodology is incapable of detecting substantial cracks in RPVI that do not exhibit as gross deformation of the component, and that use of other methodologies such as UT, EV-1 and VT-1, also recommended by MRP-227, are more reliable and better able to detect stress corrosion cracking. Reasons for Non-concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'" R.L. Tregoning RES/DE, ML110770169; Comments for the Document Sponsor to Consider Pertaining to Non-Concurrence on "Draft Safety Evaluation for the Electric Power Research Institute's Topical

Report (TR) Materials Reliability Program (MRP) Report 1016596 (MRP-227), Revision 0, 'Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines.'" Michael J. Case RES/DE, ML110810787. Reliance on the assumption that there will be a grossly visible defect before the component reaches critical degradation is a hypothesis that has not been tested and as to which Entergy offers no supporting evidence.

Notably, MRP-227 also contains text that raises question about how Entergy will inspect for and manage RPVI embrittlement. While MRP-227 and NL-10-063 seem to imply that a licensee will examine RPVIs for signs of embrittlement, footnote 1 to MRP-227 Table 3-3 states as follows:

> The significance of thermal and irradiation embrittlement is directly related to the probability of a flaw existing in the component. *There are no recommendations for inspection to determine embrittlement level because these mechanisms cannot be directly observed*. However, potential embrittlement must be considered in flaw tolerance evaluations.

MRP-227, p. 3-23 – 3-24, Table 3-3, "Final Disposition of Category B and C Westinghouse internals," note 1 (emphasis added). The recognition that embrittlement mechanisms "cannot be directly observed" further supports the concerns about the effectiveness of visual exams.

Even MRP-227 recognizes that EV-1 and VT-1 have detection capabilities that are superior to VT-3. MRP-227 at 4-4 ("Unlike the detection of general degradation conditions by visual (VT-3) examination, visual (VT-1) and enhanced visual (EVT-1) examinations are conducted to detect discontinuities and imperfections on the surface of components, including such conditions as cracks, wear, corrosion, or erosion. Specifically, VT-1 is used for the detection of surface discontinuities such as gaps, while EVT-1 is used for the detection of surface

breaking flaws"). However, neither MRP-227 nor NL-11-107 given any rational justification for the widespread approval of the use of VT-3 for such critical components as baffle-former bolt assemblies.

In summary, Entergy recognizes that it is obligated to provide an AMP for RPVIs. However, the AMP offered is deficient in several fundamental ways which make it impossible for Entergy to demonstrate the adequacy of the RPVI AMP to assure the coolability of the core geometry following accidents, such as a DBA LOCA. Thus, license renewal must be denied because the Board does not have a basis upon which it can find that there is reasonable assurance that the core will retain a coolable geometry in the event of a DBA LOCA. 10 C.F.R. § 54.29(a)(1).

CONCLUSION

For the above reasons Entergy's application to renew the operating licenses for Indian Point Unit 2 and Indian Point Unit 3 should be denied.

Respectfully submitted,

Signed (electronically) by

John J. Sipos
Assistant Attorney General
Office of the Attorney General
for the State of New York
The Capitol
Albany, New York 12227
(518) 402-2251

Dated: December 22, 2011