UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos. 50-247-LR and 50-286-LR
ENTERGY NUCLEAR OPERATIONS, INC.	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	March 29, 2012

ENTERGY'S STATEMENT OF POSITION REGARDING CONTENTION NYS-26B/RK-TC-1B (METAL FATIGUE)

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Pursuant to 10 C.F.R. § 2.1207(a)(1) and the Atomic Safety and Licensing Board's ("Board") Order Granting NRC Staff's Unopposed Time Extension Motion and Directing Filing of Status Updates,[1] Entergy Nuclear Operations, Inc. ("Entergy") submits this Statement of Position ("Statement") on Consolidated Contention NYS-26B/RK-TC-1B ("NYS-26B/RK-TC-1B") regarding metal fatigue proffered by New York State ("NYS" or "the State") and Riverkeeper, Inc. ("Riverkeeper") (jointly "Intervenors"). This Statement is supported by the Testimony of Nelson F. Azevedo, Alan B. Cox, Jack R. Strosnider, Jr., Robert E. Nickell, and Mark A. Gray ("Entergy's Testimony") (Entergy Exhibit ENT000183), and the exhibits thereto (Entergy Exhibits ENT00015A-B, ENT000031, ENT000032, ENT000184 to ENT000231, and ENT000369). For the reasons discussed below, NYS-26B/RK-TC-1B lacks merit and should be resolved in Entergy's favor.

[1] Licensing Board Order Granting NRC Staff's Unopposed Time Extension Motion and Directing Filing of Status Updates (Feb. 16, 2012) (unpublished).

I. PRELIMINARY STATEMENT

NYS-26B/RK-TC-1B is a safety contention, asserting that Entergy's aging management program ("AMP") for metal fatigue (referred to as the fatigue management program or "FMP") set forth in the License Renewal Application ("LRA") for Indian Point Nuclear Generating Units 2 and 3 ("IP2" and "IP3," collectively "Indian Point Energy Center" or "IPEC") does not include an adequate plan to monitor and manage the effects of aging that may occur due to metal fatigue on key reactor components in violation of 10 C.F.R. § 54.21(c)(1)(iii). The testimony of the Intervenors' witnesses—Dr. Joram Hopenfeld for Riverkeeper and Dr. Richard T. Lahey for the State—focuses on purported deficiencies in the environmentally-assisted fatigue ("EAF") evaluations performed by Westinghouse Electric Company LLC ("Westinghouse") in support of Entergy's LRA for IPEC. Neither Dr. Hopenfeld nor Dr. Lahey is a specialist in fatigue analysis, and they seem to misunderstand the methodology used in the Westinghouse EAF analyses. Although the Intervenors make a host of claims about the details of the Westinghouse EAF evaluations, Entergy's witnesses refute their claims point-by-point, and show that none of them have merit.

Entergy's testimony shows that the IPEC LRA complies fully with 10 C.F.R. Parts 50 and 54 and is consistent with NRC Staff guidance for an acceptable Aging Management Program ("AMP") for fatigue in NUREG-1801, "Generic Aging Lessons Learned Report," Revision 1 (Sept. 2005) ("NUREG-1801, Revision 1") (NYS00146A-C), notwithstanding Intervenors' claims to the contrary. Specifically, the Entergy FMP provides reasonable assurance that, consistent with the current licensing basis ("CLB") *and* considering environmental effects, the cumulative usage factors ("CUFs") for components comprising the reactor coolant pressure boundary will not exceed the limit of 1.0, throughout the period of extended operation ("PEO"),

thereby assuring that those components will continue to perform their intended functions, as required by 10 C.F.R. §§ 54.21(a)(3) and (c)(1)(iii).

Entergy's witnesses explain that the environmentally-assisted CUF ("CUF_{en}") values calculated for all three reactor vessel locations (bottom head to shell; reactor vessel inlet nozzle; and reactor vessel outlet nozzle) identified in NUREG/CR-6260 "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components" (Feb. 1995) ("NUREG/CR-6260") (NYS000355) are within acceptable regulatory limits through the end of the PEO. For those representative components listed in NUREG/CR-6260 where the screening CUF_{en} values listed in the LRA were projected to exceed 1.0 during the PEO, Westinghouse conducted refined EAF analyses for Entergy, including analyses of the: (1) surge line hot leg and pressurizer surge line nozzles; (2) reactor coolant system ("RCS") piping charging system nozzles; (3) RCS piping safety injection nozzles ("boron injection tank nozzles"); and (4) residual heat removal Class 1 piping ("accumulator nozzles"). Consistent with the relevant NRC Staff-approved guidance, and with Entergy's commitments and established engineering methods, the refined EAF analyses demonstrate that the CUF_{en} values for the components specified in NUREG/CR-6260 do not exceed 1.0. In addition, Entergy has committed to monitor the actual number of accumulated plant transient cycles as compared to the number of cycles assumed in the EAF analyses and will take appropriate corrective actions, including repairs and/or replacements prior to exceeding the CUF limit of 1.0 should the rate of accumulated cycles increase as a result of future changes in plant operations. By committing to repair or replace the affected locations *before* their CUF_{en} values exceed 1.0, consistent with NUREG-1801, Revision 1, and 10 C.F.R. § 54.21(a)(3) and (c)(1)(iii), Entergy has demonstrated that it will adequately manage the effects of aging due to fatigue at the affected locations.

The Intervenors' Position Statement[2] claims that the LRA is deficient for three basic reasons:

> 1. The methodology [relied upon by Entergy] to determine whether CUFen for any particular component is > 1- i.e. the WESTEMs computer program – is technically deficient;
>
> 2. The input values chosen by Entergy for its use of WESTEMs are not technically defensible and understate the extent of metal fatigue;
>
> 3. The range of components for which the CUFen calculations are proposed to be conducted is too narrow.[3]

Entergy's Testimony refutes these three general criticisms—and the numerous ancillary and sub-issues raised in Dr. Hopenfeld's and Dr. Lahey's testimony.[4]

As to the first issue, the challenges to the WESTEMS™ software used in Westinghouse's EAF analyses, Entergy's witnesses demonstrate that Dr. Lahey and Dr. Hopenfeld's critiques are primarily based on misunderstandings of the WESTEMS™ software and the standard ASME Code Section III stress and fatigue analysis methodology used to perform the EAF analyses. In demanding *more precise* CUF_{en} calculations, Intervenors' experts' testimony does not account for the significant conservatisms and margin inherent in the analyses. Drs. Lahey and Hopenfeld also fail to recognize that the objective of an EAF analysis is to determine whether or not the CUF_{en} exceeds 1.0, not to calculate a precise CUF_{en} value.

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2 State of New York and Riverkeeper, Inc. Initial Statement of Position [on] Consolidated Contention NYS-26B/RK-TC-1B (NYSR00343) ("Intervenors' Statement").

3 Intervenors' Statement at 2-3 (NYSR00344).

4 Pre-Filed Written Testimony of Dr. Richard T. Lahey, Jr. Regarding Contention NYS-26B/RK-TC-1B (Dec. 22, 2011) ("Lahey Testimony") (NYSR00344); Report of Dr. Richard T. Lahey, Jr. in Support of Contentions NYS-25 and NYS-26B/RK-TC-1B (Dec. 20, 2011) ("Lahey Report") (NYS000296); Supplemental Report of Dr. Richard T. Lahey, Jr. in Support of Contention NYS-25 and NYS-26N/RK-TC-1B (Dec. 21, 2011) ("Supplemental Lahey Report") (NYS000297); Pre-Filed Written Testimony of Dr. Joram Hopenfeld Regarding Contention NYS-26B/RK-TC-1B – Metal Fatigue (Dec. 20, 2011) ("Hopenfeld Testimony") (RIV000034); Report of Dr. Joram Hopenfeld in Support of Contentions NYS-26B/RK-TC-1B – Metal Fatigue (Dec. 19, 2011) ("Hopenfeld Report") (RIV000035) (collectively "Intervenors' Testimony").

As to Intervenors' second issue, which addresses WESTEMS™ input values, Entergy's witnesses explain that the Intervenors' Testimony on these issues doesn't account for the substantial conservatisms in the selection of inputs to the EAF analysis, including heat transfer coefficients, dissolved oxygen values, and the number of analyzed transients. Dr. Lahey and Dr. Hopenfeld also do not address directly-relevant and readily-available information contained in the LRA, the refined EAF analyses, and the supporting documentation that Entergy disclosed to the Intervenors in this proceeding pertaining to these issues.

Third, the Intervenors' witnesses are incorrect when they assert that, because certain preliminary (but now superseded) CUF_{en} values listed in the original LRA exceeded 1.0, Entergy is somehow bound to those screening-level CUF_{en} values to determine whether additional EAF analyses or other corrective actions are necessary for the PEO. Under NUREG-1801, Revision 1 (NYS00146A-C), its companion document, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Rev. 1 (Sept. 2005) ("SRP-LR") (NYS000195), and the more recent revisions to both of these documents,[5] applicants may perform a more-refined fatigue analysis than the analysis used to determine the plant's design CUF by evaluating, for example, the number and severity of actual plant transient cycles rather than using assumed design cycles. This established practice yields a new CUF value (to which the environmental correction factor, or "F_{en}" is then applied) that maintains licensing basis design margins. Because Entergy has analyzed the set of limiting components identified in NUREG/CR-6260 and demonstrated through appropriate analysis that no CUF_{en} value exceeds

[5] NUREG-1801, "Generic Aging Lessons Learned Report," Rev. 2 (Dec. 2010) ("NUREG-1801, Revision 2") (NYS00147A-D), and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Rev. 2 (Dec. 2010) ("SRP-LR, Revision 2") (NYS000161).

1.0, there is no need to "broaden" the analyses beyond those components specified in the LRA based on preliminary screening results or otherwise.

Nonetheless, in response to additional NRC Staff RAIs issued on the IPEC and several other pending LRAs, Entergy has committed to conduct an additional review to confirm that the already-analyzed locations are, in fact, the limiting locations for the IPEC plant configurations, even though such a commitment is not necessary to comply with the FMP described in NUREG-1801, Revision 1. As explained further below, this commitment meets the intent of NUREG-1801, Revision 2. The NRC Staff approved this new commitment in its Supplemental Safety Evaluation Report for the IPEC license renewal.[6]

In short, the Intervenors have not met their burden of moving forward with sufficient evidence to show a deficiency in Entergy's FMP,[7] and Entergy's testimony fully refutes the Intervenors' claims. Entergy's LRA for IP2 and IP3 is fully compliant with the applicable criteria in NUREG-1801, Revision 1, and meets the intent of NUREG-1801, Revision 2. The Intervenors present no valid critique of the Westinghouse EAF evaluations, which Entergy shows are conservative calculations that adequately support the LRA. Accordingly, contrary to the Intervenors' contention, there is reasonable assurance that the aging effects of metal fatigue on the reactor coolant system ("RCS") pressure boundary will be managed during the period of extended operation, consistent with 10 C.F.R. §§ 54.21(a)(3), 54.21(c)(1)(iii) and 54.29(a).

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6 *See* NUREG-1930, Supp. 1, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, at 4-2 (Aug. 2011) ("SSER") (NYS000160).

7 *See AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-09-7, 69 NRC 235, 269 (2009), *aff'd sub nom. N.J. Envtl. Fed'n v. NRC*, 645 F.3d 220 (2011).

II. PROCEDURAL HISTORY OF CONTENTION NYS-26B/RK-TC-1B

A. Original Contention

On April 23, 2007, Entergy filed its application to renew the operating licenses for IP2 and IP3 for 20 years beyond their current expiration dates of September 28, 2013, and December 12, 2015, respectively. After a notice of opportunity for hearing was published in the *Federal Register* on August 1, 2007,[8] the State and Riverkeeper each filed separate petitions to intervene, proposing a number of contentions.[9]

In their petitions to intervene, NYS and Riverkeeper proffered contentions NYS-26 and TC-1, respectively.[10] Both contentions claimed that, because LRA Tables 4.3-13[11] and 4.3-14[12] indicated that the projected CUF_{en} values for certain IPEC components will exceed 1.0 during the PEO, Entergy must demonstrate that the effects of aging on the intended function(s) will be adequately managed for the PEO, as required by 10 C.F.R. § 54.21(c)(1)(iii).[13] Entergy opposed

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8 Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License Nos. DPR-26 and DPR-64 for an Additional 20-Year Period, 72 Fed. Reg. 42,134 (Aug. 1, 2007).

9 *See Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3), LBP-08-13, 68 NRC 43, 68-160, 166-190 (2008).

10 *See* New York State Notice of Intention to Participate and Petition to Intervene at 227 (Nov. 30, 2007) ("NYS Petition"); Riverkeeper, Inc.'s Request for Hearing and Petition to Intervene in Indian Point License Renewal Proceeding for the Indian Point Nuclear Power Plant at 7 (Nov. 30, 2007) ("Riverkeeper Petition").

11 LRA at 4.3-24 ("IPEC Unit 2 Cumulative Usage Factors for NUREG/CR-6260 Limiting Locations") (ENT00015B).

12 *Id*. at 4.3-25 ("IPEC Unit 3 Cumulative Usage Factors for NUREG/CR-6260 Limiting Locations").

13 In RK-TC-1, Riverkeeper also alleged that Entergy must "broaden its TLAA analysis" beyond the scope of the representative components identified in Tables 4.3-13 and 4.3-14 to identify other components whose CUF may be greater than one, and take other steps to expand the scope of its fatigue analyses. *See* Riverkeeper Petition at 7-8.

the admission of NYS-26 and TC-1 in their entirety.[14] The NRC Staff opposed the admission of both contentions in part.[15]

Entergy subsequently amended the LRA to add Commitment 33 to the scope of the FMP, by stating that it will use that program to manage the effects of reactor water environment on fatigue life, in accordance with 10 C.F.R. § 54.21(c)(1)(iii).[16] Consistent with this regulation and with NUREG-1801, Revision 1, Commitment 33 specified that, at least two years prior to entering the PEO, Entergy would update the fatigue usage calculations in LRA Tables 4.3-13 and 4.3-14, including application of the appropriate F_{en} factor (or use the existing fatigue analysis if that analysis was valid for the PEO) or repair or replace the affected locations.[17]

NYS and Riverkeeper filed replies to Entergy's Answer in February 2008, in which they asserted that LRA Amendment 2 (Commitment 33) did not resolve their concerns.[18] On March 4, 2008, the Staff filed a letter apprising the Board that the LRA omissions asserted in NYS-26 and TC-1 had been cured by LRA Amendment 2, thereby rendering those contentions moot and inadmissible.[19]

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[14] Answer of Entergy Nuclear Operations, Inc. Opposing New York State Notice of Intention to Participate and Petition to Intervene at 141-49 (Jan. 22, 2008); Answer of Entergy Nuclear Operations, Inc. Opposing Riverkeeper, Inc.'s Request for Hearing and Petition to Intervene at 29-43 (Jan. 22, 2008).

[15] NRC Staff's Response to Petitions for Leave to Intervene Filed by [the State of New York and Riverkeeper, Inc.] at 77-78 (Jan. 22, 2008) ("NRC Staff Answer") (opposing NYS-26 insofar as it suggested that Entergy will use arbitrary assumptions in performing any refined analyses of the CUFs and contended that Entergy must immediately replace components with CUF_{en} values exceeding 1.0.); *Id.* at 117-18 (opposing TC-1 insofar as it alleged that the lists of components in LRA Tables 4.3-13 and 4.3-14 are incomplete, and that other components need to be considered beyond those listed.).

[16] *See* NL-08-021, Letter from Fred R. Dacimo, Entergy, to NRC, "License Renewal Application Amendment 2" Attach. 1, at 1 ("NL-08-021") (NYS000351).

[17] *See id*. at 1-2.

[18] New York State Reply in Support of Petition to Intervene at 124-30 (Feb. 22, 2008); Riverkeeper, Inc.'s Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene at 2-12 (Feb. 15, 2008).

[19] *See* Letter from David E. Roth & Kimberly A. Sexton, Counsel for NRC Staff, to Licensing Board at 2 (Mar. 4, 2008), *available at* ADAMS Accession No. ML080670286.

Thereafter, on March 5, 2008, and April 7, 2008, Riverkeeper and NYS filed amended contentions TC-1A and NYS-26A, respectively, and again asserted that LRA Amendment 2 did not cure the deficiencies previously alleged by those parties.[20] They contended that LRA Amendment 2 lacks sufficient details concerning the analytical methods that Entergy will use to calculate the refined CUF_{en} values and, by delaying the analyses, fails to meet NRC regulations.[21] NYS further asserted that "the most prudent way to manage aging for extended operation is to replace those affected components *now*."[22] Both Entergy and the Staff opposed the admission of amended contentions TC-1A and NYS-26A in their entirety, citing Entergy's explicit commitment to manage EAF under the FMP.[23]

The Board admitted NYS and Riverkeeper's initial and amended contentions, but limited admission to those aspects "relating to the calculation of the $CUF_{[en]}$s and the adequacy of the resulting AMP for those components with $CUF_{[en]}$s greater than 1.0."[24] Specifically, the Board admitted NYS-26/26A on the following narrow grounds:

> [T]his Board admits NYS-26/26A to the limited extent that it asserts that the LRA is incomplete without the calculations of the CUFs as *threshold* values necessary to assess the need for an AMP,

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20 Riverkeeper, Inc.'s Request for Admission of Amended Contention 6, at 2-3 (Mar. 5, 2008); Petitioner State of New York's Request for Admission of Supplemental Contention No. 26-A, 4 (Metal Fatigue) at 4-6 (Apr. 7, 2008) ("NYS-26A Request").

21 NYS-26A Request at 5.

22 *Id.* at 6. The Commission recently rejected a very similar theory. In reversing a Board's admission of a contention that sought to have the NRC require the applicant to "preclude" aging effects, the Commission held that this aspect of the contention sought to impose a burden greater than the regulatory requirement to "adequately manage" aging effects under 10 C.F.R. § 54.21(a)(3). *See NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC __, slip op. at 17 (March 8, 2012).

23 *See* Answer of Entergy Nuclear Operations, Inc. to Riverkeeper's Request for Admission of Amended Contention TC-1 (Concerning Environmentally Assisted Fatigue) (Mar. 31, 2008); Answer of Entergy Nuclear Operations, Inc. Opposing the State of New York's Request for Admission of Supplemental Contention 26-A (Metal Fatigue) (Apr. 21, 2008); NRC Staff's Response to Riverkeeper, Inc.'s Request for Admission of Amended Contention TC-1 ["TC-1A"] (Metal Fatigue) (Apr. 21, 2008); NRC Staff's Response to New York State's Request for Admission of Supplemental Contention 26-A (Metal Fatigue) (Apr. 21, 2008).

24 *See Indian Point*, LBP-08-13, 68 NRC at 137.

> that Entergy's AMP is inadequate *for lack of the final values*, and that the LRA must specify actions to be carried out by the Applicant during extended operations to manage the aging of key reactor components susceptible to metal fatigue.[25]

In this regard, the Board found that Entergy must include CUF_{en} calculations as part of its LRA to comply with the time-limited aging analysis ("TLAA") regulations (10 C.F.R. § 54.21(a)(3)), notwithstanding Entergy's stated reliance on an AMP pursuant to § 54.21(c)(1)(iii).[26] The Board, in other words, did not accept Entergy's commitment to perform the refined CUF_{en} analyses within two years of the PEO in accordance with its NUREG-1801-consistent Fatigue Monitoring Program.[27] The Board also admitted RK-TC-1/1A and consolidated it with NYS-26/26A.[28]

In view of the Board's admission of the Consolidated Contention and finding that Entergy must include its CUF calculations in the LRA,[29] and consistent with Commitment 33, Entergy retained Westinghouse in 2008 to prepare refined fatigue analyses to determine CUF_{en}s for the relevant IPEC-specific NUREG/CR-6260 critical component locations. The refined fatigue analyses were completed in late June 2010, and approved by Entergy on July 29, 2010.[30] The refined fatigue analyses showed that the CUF_{en} for components listed in LRA Tables 4.3-13 and 4.3-14 would not exceed 1.0 through the end of the PEO.[31] On August 9, 2010, Entergy

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25 *Id*. at 140 (emphasis added).

26 *See id*. at 137, 140. TLAAs are discussed further in Section III.A.1, below.

27 *See id.* at 138-39

28 *See id*. at 172, 219-20.

29 *See id*. at 137.

30 *See* Westinghouse, WCAP-17199-P, Environmental Fatigue Evaluation for Indian Point Unit 2, Rev. 0, at 1-1 (June 2010) ("WCAP-17199") (NYS000361); Westinghouse, WCAP-17200-P, Environmental Fatigue Evaluation for Indian Point Unit 3, Rev. 0, at 1-1 (June 2010) ("WCAP-17200") (NYS000362).

31 *See* WCAP-17199, at 6-1 (NYS000361); WCAP-17200, at 6-1 (NYS000362). The refined EAF analyses did *not* cover the reactor vessel inlet and outlet nozzles because the initial values in the LRA showed that the CUF_{en} for these components would not exceed 1.0.

notified the NRC Staff of the results of the refined EAF analyses; *i.e.*, the refined CUF_{en} values.[32]

B. Motion for Summary Disposition

Following Entergy's submittal of its refined EAF analyses, Entergy moved for summary disposition of NYS-26/26A/RK-TC-1/1A.[33] In its Motion for Summary Disposition, Entergy argued that, in view of the Commission's decision in *Vermont Yankee*,[34] Entergy's commitment (Commitment 33) to submit refined EAF evaluations for components where the CUF_{en} in the LRA exceeded 1.0 was legally sufficient under 10 C.F.R. § 54.21(c)(iii), and that its completion of Commitment 33 demonstrated there were no longer any material factual disputes regarding the admitted contention.[35] The NRC Staff supported Entergy's Motion for Summary Disposition, while Riverkeeper and the State opposed it.[36]

C. Amended Contention NYS-26B/RK-TC-1B

Shortly thereafter, the Intervenors submitted another amended contention, designated NYS-26B/RK-TC-1B.[37] The contention claimed that:

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[32] *See* NL-10-082, Letter from Fred R. Dacimo, Entergy, to NRC, "License Renewal Application – Completion of Commitment #33 Regarding the Fatigue Monitoring Program" (Aug. 9, 2010) ("NL-10-082") (NYS000352).

[33] *See* Applicant's Motion for Summary Disposition of New York State Contentions 26/26A and Riverkeeper Technical Contentions 1/1A (Metal Fatigue of Reactor Components) (Aug. 25, 2010) ("Motion for Summary Disposition"), *available at* ADAMS Accession No. ML102600058.

[34] *Vt. Yankee, LLC* (Vt. Yankee Nuclear Power Station), CLI-10-17, 72 NRC 1 (2010).

[35] *See generally* Motion for Summary Disposition.

[36] *See* NRC Staff's Answer to Applicant's Motion for Summary Disposition of New Yorn Contention 26/26A and Riverkeeper Contention TC-1/TC-1A – Metal Fatigue (Sept. 14, 2010), *available at* ADAMS Accession No. ML102571919; State of New York and Riverkeeper, Inc. Combined Response to Entergy Motion for Summary Disposition of Combined Contentions NYS 26/26A and RK TC-1/TC1-A (Metal Fatigue) (Sept. 14, 2010), *available at* ADAMS Accession No. ML103010518.

[37] *See* State of New York's and Riverkeeper's Motion for Leave to File a New and Amended Contention Concerning the August 9, 2010 Entergy Reanalysis of Metal Fatigue (Sept. 9, 2010), *available at* ADAMS Accession No. ML102670665.

> Entergy's License Renewal Application does not include an adequate plan to monitor and manage the effects of aging due to metal fatigue on key reactor components in violation of 10 C.F.R. § 54.21(c)(1)(iii).[38]

Specifically, NYS and Riverkeeper claimed that Entergy has inappropriately limited the number of component locations for which EAF analyses must be performed, failed to provide a propagation of error analysis for the WESTEMS™ fatigue analyses, improperly excluded reactor pressure vessel ("RPV") "in-core" structures and fittings from the scope of the EAF analyses, failed to disclose sufficient information about Westinghouse's thermal hydraulic analysis, relied on incorrect or undisclosed assumptions regarding F_{en} factors, dissolved oxygen levels, and numbers of transients, and failed to provide a "detailed, reliable, and prescriptive" AMP.[39]

Entergy and the NRC Staff opposed the admission of NYS-26B/RK-TC-1B.[40]

On November 4, 2010, the Board dismissed Intervenors' earlier consolidated metal fatigue contentions as moot, denied the Motion for Summary Disposition as Moot, and admitted NYS-26B/RK-TC-1B.[41] The Board held that, once an applicant has chosen to perform revised CUF_{en} analyses, the Intervenors may question "the adequacy, reliability, and breadth of these calculations when applied to Entergy's AMP under Section 54.21(c)(1)(iii)."[42] The Board also

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38 Petitioners State of New York and Riverkeeper, Inc. New and Amended Contention Concerning Metal Fatigue at 1 (Sept. 9, 2010) ("New and Amended Contention"), *available at* Accession No. ML102670665).

39 *See* New and Amended Contention at 6-13.

40 *See* Applicant's Answer to New and Amended Contention New York State 26B/Riverkeeper TC-1B (Metal Fatigue) (Oct. 4, 2010), *available at* ADAMS Accession No. ML102910142; NRC Staff's Answer to State of New York's and Riverkeeper's Motion for Leave to File a New and Amended Contention Concerning the August 9, 2010 Entergy Reanalysis of Metal Fatigue (New York State 26-B/Riverkeeper TC-1B (Metal Fatigue)) (Oct. 4, 2010), *available at* ADAMS Accession No. ML102780048.

41 Licensing Board Memorandum and Order (Ruling on Motion for Summary Disposition of NYS-26/26A/Riverkeeper TC-1/1A (Metal Fatigue of Reactor Components) and Motion for Leave to File New Contention NYS-26B/Riverkeeper TC-1B)) at 2 (Nov. 4, 2010) (unpublished) ("Order Admitting NYS-26B/RK-TC-1B").

42 *Id.* at 23-24.

held that NYS-26B/RK-TC-1B superseded the previous contentions (NYS-26/26A/RK-TC-1/1A), and therefore dismissed those earlier contentions.[43]

The Board identified the following bases for NYS-26B/RK-TC-1B, which focused on challenges to the Westinghouse EAF analyses:

> NYS-26B/RK-TC-1B characterizes Entergy's reanalyses as inadequate under NRC regulations and the GALL Report because these *reanalyses* (1) inappropriately limited the number of components subject to fatigue analyses, (2) neither explain the methodology used to conduct their CUF [cumulative usage factor] analyses nor include a detailed error analysis, (3) exclude "a fatigue evaluation of important structures and fittings within the" reactor pressure vessel (RPV), (4) exclude from evaluation "the potential failure of highly fatigued structures and fittings under" certain types of "large thermal/pressure shock-type loads," and (5) contain lower safety margins that create more risk because the *new* CUFs have been "reduced by more than an order of magnitude." The Intervenors also note that "Entergy has not committed to repair or replace components when the CUF approaches unity (1.0)."[44]

In addition to the EAF reanalyses, the admitted contention contested certain aspects of the FMP, including the "monitoring locations, trigger points, and proposed actions . . . for metal fatigue,"[45] and alleged inadequate corrective actions,[46] but these challenges are premised on the validity of Intervenors' critiques of the EAF analyses. Taking into account all of Intervenors' assertions, the fundamental factual issue in dispute is whether the EAF analyses are adequate to demonstrate that the CUF_{en}s for the analyzed components do not exceed 1.0.

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43 *See id*. at 29.

44 *Id*. at 8 (emphasis added) (*citing* New and Amended Contention at 9-11).

45 *Id*. at 14 (*citing* New and Amended Contention at 6-13).

46 *See* New and Amended Contention at 6.

D. Entergy's Motion in Limine

The Intervenors submitted their Testimony, Statement, and supporting exhibits on December 22, 2011.[47] On January 30, 2012, Entergy filed a motion in limine, arguing that Riverkeeper's expert, Dr. Hopenfeld, lacks expertise in certain areas covered by his testimony, and that Dr. Hopenfeld's critique of Entergy's design basis CUF calculations for the IP2 and IP3 reactor vessel inlet and outlet nozzles were outside the scope of this contention and proceeding.[48] The NRC Staff supported Entergy's Motion in Limine,[49] and Riverkeeper opposed it.[50]

As explained in Entergy's Motion for Limine, the Commission has held that Intervenors are not permitted to change the scope of a contention as admitted by the Board. In the *Vogtle* proceeding, the Commission upheld a Board ruling excluding testimony at hearing that strayed beyond the scope of the bases as pled and admitted, which "defined the scope of the . . . contention."[51] The Commission emphasized that the scope of a contention is limited to admitted issues of law and fact pled with particularity in the intervention petition, including its stated bases.[52]

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47 The State subsequently filed a revised Position Statement and a revised version of the Lahey Testimony on December 27, 2011, and Riverkeeper filed a revised version of the Hopenfeld Report on the same date.

48 *See* Entergy's Motion in Limine to Exclude Portions of Pre-Filed Direct Testimony, Expert Report, Exhibits, and Statement of Position for Contention NYS-26B/RK-TC-1B (Metal Fatigue) (Jan. 30, 2012) ("Motion in Limine").

49 *See* NRC Staff's Response in Support of Entergy's Motion in Limine to Exclude Portions of Pre-filed Direct Testimony, Expert Report, Exhibits, and Statement of Position for Contention NYS-26B/RK-TC-1B (Metal Fatigue) (Feb. 9, 2012) (not publicly available on ADAMS).

50 Riverkeeper, Inc. Opposition to Entergy's Motion in Limine to Exclude Portions of Pre-filed Testimony, Expert Report, Exhibits, and Statement of Position for Contention NYS-26B/RK-TC-1B (Metal Fatigue) (Feb. 17, 2012) (not publicly available on ADAMS).

51 *S. Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), CLI-10-5, 71 NRC 90, 101 (2010).

52 *Vogtle*, CLI-10-5, 71 NRC at 100; *see also Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 311 ("NRC adjudicatory proceedings would prove endless if parties were free . . . to introduce entirely new claims which they either originally opted not to make or which simply did not occur to them at the outset.") (*quoting La. Energy Servs*., *L.P.* (Nat'l Enrichment Facility), CLI-05-28, 62 NRC 721, 727-28 (2005)).

The Board denied Entergy's Motion in Limine on March 6, 2012, finding that Dr. Hopenfeld has sufficient background to assist the Board in the resolution of the questions raised in this contention,[53] and that Riverkeeper does not challenge any of the design basis CUF calculations.[54]

Shortly after the Board denied Entergy's Motion in Limine, the Commission issued an order in the *Seabrook* license renewal proceeding, where, consistent with Entergy's arguments in its Motion in Limine, the Commission "remind[ed]" Boards "of the need to specify each basis relied upon for admitting a contention."[55] Further, while the *Seabrook* Board had stated that it "admits contentions . . . and not their supporting bases,"[56] the Commission rejected this statement, because "an admitted contention *is defined by its bases*."[57]

III. APPLICABLE LEGAL AND REGULATORY STANDARDS

The Intervenors' Statement asserts that "[t]he legal issues raised by this contention have been essentially briefed and resolved by the Board's ruling in rejecting Entergy's Motion for Summary Disposition and admitting NYS-26B/RK-TC-1B."[58] This is incorrect for two reasons. First, the Board has issued no ruling on the merits of this contention, but has instead found that the Intervenors only have raised "material questions that warrant resolution at hearing,"[59] and

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53 *See* Licensing Board Order (Granting in Part and Denying in Part Applicant's Motions *in Limine*) at 15 (Mar. 6, 2012) (unpublished) ("Ruling on Motions in Limine").

54 *See id.* Entergy respectfully disagrees with the latter finding of the Board and addresses this issue further in Section IV.B.2.d, below.

55 *Seabrook*, CLI-12-05, slip op. at 11 n.50.

56 *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), LBP-11-02, 75 NRC __, slip op. at 31, (Feb. 15, 2011); *see also* Ruling on Motions in Limine at 6.

57 *Seabrook*, CLI-12-05, slip op. at 11 n.50 (emphasis added).

58 Intervenors' Statement at 33 (NYSR00343).

59 Order Admitting NYS-26B/RK-TC-1B at 19.

that there is a "genuine dispute of material fact or law" with respect to Entergy's AMP.[60] Second, the Intervenor's Testimony and Statement raise a number of novel and erroneous legal and regulatory theories that are refuted by Entergy's Testimony and in this Statement. The remainder of this section discusses the legal and regulatory standards governing the adjudication of this contention.

A. 10 C.F.R. Part 54 Requirements

1. Regulatory Requirements

Under the governing regulations in Part 54, the review of license renewal applications is confined to matters relevant to the period of extended operation requested by the applicant. The Commission has stated that "[a]djudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review, for our hearing process (like our Staff's review) necessarily examines only the questions our safety rules make pertinent."[61] The Commission has specifically limited its license renewal safety review to the matters specified in 10 C.F.R. §§ 54.21 and 54.29(a)(2), which focus on the management of aging of certain systems, structures, and components ("SSCs"), and the review of TLAAs.[62]

Certain in-scope components are subject to time-limited calculations or analyses that are part of the CLB, known as TLAAs. TLAAs must be evaluated for the PEO. In doing so, an applicant must: (i) show that the original TLAAs will remain valid for the extended operation

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60 *Id*. at 27.

61 *Fla. Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 10 (2001); *see also* Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,462 n.2 (May 8, 1995) ("1995 License Renewal SOC") (NYS000016).

62 *See Turkey Point*, CLI-01-17, 54 NRC at 7-8; *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-26, 56 NRC 358, 363 (2002). As explained in Section III.A.2, below, NRC guidance for the license renewal process is set forth in the General Aging Lessons Learned Report, Rev. 1 (NUREG-1801) ("NUREG-1801, Revision 1"), the Standard Review Plan for License Renewal (NUREG-1800), and Regulatory Guide ("RG") 1.188, Standard Format and Content for Applications to Renew Nuclear Power Plant Operating License (Sept. 2005).

period; (ii) revise and extend the TLAAs to be valid for a longer term, such as 60 years; *or* (iii) otherwise demonstrate that the effects of aging will be adequately managed during the renewal term.[63] As it relates to this contention, the Commission has held that CUF_{en} calculations are not TLAAs, because an EAF analysis is not part of the CLB.[64] Instead, the CLB CUFs are managed through the IPEC FMP—of which the CUF_{en} calculation is a part—pursuant to 10 C.F.R. § 54.21(c)(1)(iii).[65] Thus, under the Commission's decision in CLI-10-17, the completion of CUF_{en} calculations is not a prerequisite to the NRC's approval of license renewal,[66] and such analyses are not required to be completed in advance of any hearing on the adequacy of Entergy's LRA for IPEC, or in advance of the granting of the renewed license.[67]

2. NRC Staff Guidance

NUREG-1801, Revision 1, which provides the technical basis for the SRP-LR and contains the NRC Staff's generic evaluation of programs to manage the effects of aging during the PEO, to meet the requirements of 10 C.F.R. Part 54.[68] NUREG-1801, Revision 1 indicates that many existing, current-term programs are also adequate to manage the aging effects for particular structures or components for license renewal. Thus, programs that are consistent with

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63 *See* 10 C.F.R. § 54.21(c)(1).

64 *See Vt. Yankee*, CLI-10-17, 72 NRC at 18-20, 34 (explaining that a CUF calculation is evaluated as a TLAA, but that CUF_{en} calculations cannot be TLAAs because they are not contained in the CLB).

65 *See id.*; *see also* NUREG-1930, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, at 4-46 (Nov. 2009) ("SER") (NYS00326B).

66 *Vt. Yankee*, CLI-10-17, 72 NRC at 34 ("Because CUF_{en}s are not contained in Vermont Yankee's current licensing basis, they cannot be TLAAs and thereby a prerequisite to license renewal.").

67 *See infra* Section IV.B.2.b.ii.

68 *See* NUREG-1801, Rev. 1, at 3-4.

NUREG-1801, Revision 1 are generally accepted by the Staff as adequate to meet the license renewal rule.[69]

NUREG-1801, Revision 1, Section X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," defines the program attributes for an aging management program that monitors and tracks the number of critical thermal and pressure transients and addresses the effects of the reactor coolant environment on fatigue life.[70] The NRC Staff has found this program to be an acceptable option for managing the effects of metal fatigue for reactor coolant pressure boundary components, including environmental effects, under 10 C.F.R. § 54.21(c)(1)(iii).[71]

A license renewal applicant's use of the guidance in NUREG-1801, Revision 1 satisfies regulatory requirements under 10 C.F.R. Part 54.[72] As the Commission very recently held, "Where the NRC develops a guidance document to assist in compliance with applicable regulations, it is entitled to special weight."[73] In particular, for license renewal safety issues, a "license renewal applicant's use of an aging management program identified in the GALL Report [*i.e.*, NUREG-1801, Revision 1] *constitutes reasonable assurance* that it will manage the targeted aging effect during the renewal period."[74] The Commission recently reiterated this

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69 *See id.* at 3. In December 2010, the NRC Staff issued NUREG-1801, Revision 2. As explained further below, the IPEC FMP meets the intent of NUREG-1801, Revision 2 because the relevant substantive changes to the Staff's guidance are addressed in the FMP.

70 *See id.* at X M-1 to -2 (NYS00146C).

71 *Id.* at X M-1.

72 *See*, *e.g.*, *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-08-23, 68 NRC 461, 468 (2008).

73 *Seabrook*, CLI-12-05, slip op. at 16 n.78 (*quoting Private Fuel Storage, L.L.C.* (Indep. Spent Fuel Storage Installation), CLI-01-22, 54 NRC 255, 264 (2001)); *see also id.* ("We recognize, of course, that guidance documents do not have the force and effect of law. Nonetheless, guidance is at least implicitly endorsed by the Commission and therefore is entitled to correspondingly special weight") (*quoting Yankee Atomic Elec. Co.* (Yankee Nuclear Power Station), CLI-05-15, 61 NRC 365, 375 n.26 (2005).

74 *See Oyster Creek*, CLI-08-23, 68 NRC at 468 (2008) (emphasis added).

principle, holding that "a commitment to implement an AMP that the NRC finds is consistent with the GALL Report [*i.e.*, NUREG-1801, Revision 1] constitutes one acceptable method for compliance with 10 C.F.R. § 54.21(c)(1)(iii)."[75] To challenge the adequacy of an NRC-approved guidance document, an intervenor must provide specificity and substantial support,[76] to overcome the "special weight" accorded to a guidance document—such as NUREG-1801, Revision 1—that has been implicitly endorsed by the Commission.[77]

Based on this case law, a finding that an applicant's AMP is consistent with NUREG-1801, Revision 1 carries special weight[78] and constitutes a finding of reasonable assurance under 10 C.F.R. §§ 54.21(a), 54.21(c)(1)(iii), and 54.29(a).[79] In November 2009, the NRC Staff issued its SER, finding Entergy's LRA to be consistent with NUREG-1801, Revision 1 and acceptable.[80]

3. NUREG-1801, Revision 2

In December 2010, the NRC Staff issued NUREG-1801, Revision 2. This revision was issued more than three years after the IPEC LRA was submitted, and more than a year after the NRC staff issued its original SER on the IPEC LRA in August 2009. The IPEC LRA is consistent with the guidance in NUREG-1801, Revision 1.

As explained in Section IV.B of Entergy's Testimony, NUREG-1801, Revision 2 contains two significant changes that are relevant the issues raised in this contention. The first is

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75 *Vt. Yankee*, CLI-10-17, 72 NRC at 36.

76 *See id.* at 33 n.185, 37.

77 *Seabrook*, CLI-12-05, slip op. at 16 n.78.

78 *Id.*

79 *Vt. Yankee*, CLI-10-17, 72 NRC at 36.

80 *See* SER at 3-79 (NYS00326B).

a change to the discussion of the critical components identified in NUREG/CR-6260.[81] NUREG/CR-6260 identified a set of representative components for environmental fatigue analysis purposes based on high fatigue usage and risk importance.[82] In NUREG-1801, Revision 1, the Staff specified that the sample of components to be evaluated by a license renewal applicant for EAF "is to include the locations identified in NUREG/CR-6260, as minimum, or [the applicant should] propose alternatives based on plant configuration."[83] The new guidance in NUREG-1801, Revision 2 now states that "This sample set should include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the [RCS] pressure boundary if they may be more limiting than those considered in NUREG/CR-6260."[84]

After the issuance of the SER, in response to additional NRC Staff RAIs issued on the IPEC and several other pending LRAs, Entergy committed to review the design basis ASME Code fatigue evaluations to determine whether the locations that had been evaluated as part of the LRA are the limiting locations for the IPEC plant configurations.[85] Entergy also committed that, if more limiting locations are identified, then it would evaluate the effects of the reactor coolant environment on fatigue for the most limiting location prior to the PEO.[86] Thus, with this additional commitment (Commitment 43), the IPEC FMP meets the intent of the new guidance in NUREG-1801, Revision 2.[87]

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81 *See* NRC Regulatory Issue Summary 2011-05, Information on Revision 2 to the Generic Aging Lessons Learned Report for License Renewal of Nuclear Power Plants, at 4 (July 1, 2011) ("RIS 2011-05") (ENT000192).

82 *See* NUREG/CR-6260 at xx-xxi (NYS000355).

83 NUREG-1801, Rev. 1 at X M-1 (NYS00146C).

84 NUREG-1801, Rev. 2 at X M1-2 (NYS00147C).

85 *See* NL-11-032, Letter from F. Dacimo to NRC, "Response to Request for Additional Information (RAI) Aging Management Programs" Attach. 1, at 26 (Mar. 28, 2011) ("NL-11-032") (NYS000151).

86 *See id.*

87 As explained further below, Commitment 43 is also consistent with the Commission's decision in CLI-10-17.

The second significant change to fatigue monitoring in NUREG-1801, Revision 2 is to the set of approved formulae for evaluation of environmental effects on fatigue. In NUREG-1801, Revision 1, the NRC Staff approved the use of the formulae in NUREG/CR-6583, (at 68-69 (NYS000356)), for carbon and low alloy steels and NUREG/CR-5704, (§ 7 (NYS000354)), for austenitic stainless steels. In NUREG-1801, Revision 2, it approved the use of *either* the formulae in NUREG/CR-6583 for carbon and low-alloy steels or NUREG/CR-5704 for stainless steels *or* NUREG/CR-6909 (NYS000357) for either material, *or* a Staff-approved alternative.[88]

In the IPEC EAF analyses, Westinghouse applied formulae calculated as described in NUREG/CR-6583 and NUREG/CR-5704, as applicable. Therefore, the IPEC LRA is consistent with the guidance in NUREG-1801, Revision 1 *and* meets the intent of Revision 2.

B. Burden of Proof

At the hearing stage, an intervenor has the initial "burden of going forward"; that is, it must provide sufficient, probative evidence to establish a *prima facie* case for the claims made in the admitted contention.[89] The mere admission of a contention does not satisfy this burden.[90] If the Intervenors do establish a *prima facie* case on a particular claim, then the burden shifts to

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88 *See* NUREG-1801, Rev. 2 at X M1-1 (NYS00147C)

89 *Oyster Creek*, CLI-09-07, 69 NRC at 269 (*quoting Consumers Power Co*. (Midland Plant, Units 1 & 2), ALAB-123, 6 AEC 331, 345 (1973) ("The ultimate burden of proof on the question of whether the permit or license should be issued is . . . upon the applicant. But where . . . one of the other parties contends that, for a specific reason . . . the permit or license should be denied, that party has the *burden of going forward* with evidence to buttress that contention. Once he has introduced sufficient evidence to establish a *prima facie* case, the burden then shifts to the applicant who, as part of his overall burden of proof, must provide a sufficient rebuttal to satisfy the Board that it should reject the contention as a basis for denial of the permit or license.") (emphasis in original)); *see also Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council*, 435 U.S. 519, 554 (1978) (upholding this threshold test for intervenor participation in licensing proceedings); *Phila. Elec. Co.* (Limerick Generating Station, Units 1 & 2), ALAB-262, 1 NRC 163, 191 (1975) (holding that the intervenors had the burden of introducing evidence to demonstrate that the basis for their contention was more than theoretical).

90 *See Oyster Creek*, CLI-09-07, 69 NRC at 268-70.

Applicant to provide sufficient evidence to rebut the intervenor's contention.[91]

To prevail, the Applicant's position must be supported by a preponderance of the evidence.[92]

C. The Reasonable Assurance Standard

For safety issues, pursuant to Section 54.29(a), the NRC will issue a renewed license if it finds that actions have been identified and have been or will be taken by the applicant, such that there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB.[93]

Longstanding precedent makes clear that the reasonable assurance standard does not require an applicant to meet an "absolute" or "beyond a reasonable doubt" standard.[94] Rather, the Commission takes a case-by-case approach, applying sound technical judgment and verifying the applicant's compliance with Commission regulations.[95]

D. Enforceability of Commitments

Licensee commitments are a well-established and essential mechanism for ensuring that licensees implement their AMPs in a timely and effective manner.[96] Part 54 specifically

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91 *See, e.g.*, *id*. at 269; *La. Power & Light Co.* (Waterford Steam Electric Station, Unit 3), ALAB-732, 17 NRC 1076, 1093 (1983) (citing *Midland*, ALAB-123, 6 AEC at 345); *see also* 10 C.F.R. § 2.325.

92 *See Pac. Gas & Elec. Co.* (Diablo Canyon Nuclear Power Plant, Units 1 & 2), ALAB-763, 19 NRC 571, 577 (1984); *Oyster Creek*, CLI-09-07, 69 NRC at 263.

93 10 C.F.R. § 54.29(a). This regulation also requires any applicable environmental requirements of 10 C.F.R. Part 51, Subpart A, to be satisfied.

94 *Oyster Creek*, CLI-09-07, 69 NRC at 262 n.142; *Commonwealth Edison Co.* (Zion Station, Units 1 & 2), ALAB-616, 12 NRC 419, 421 (1980); *N. Anna Envtl. Coal. v. NRC*, 533 F.2d 655, 667-68 (D.C. Cir. 1976) (rejecting the argument that reasonable assurance requires proof beyond a reasonable doubt and noting that the licensing board equated "reasonable assurance" with "a clear preponderance of the evidence").

95 *See Oyster Creek*, CLI-09-7, 69 NRC at 262 n.143, 263; *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-10-14, 71 NRC 449, 465-66 (2010).

96 *See Vt. Yankee*, CLI-10-17, 72 NRC at 37 ("An applicant may commit to implement an AMP that is consistent with [NUREG-1801] and that *will* adequately manage aging.").

authorizes licensees to demonstrate compliance with its requirements via prospective actions to be taken after the NRC issues the renewed license. This method of compliance is a well-established part of NRC regulatory practice.[97] This principle dates back to the original license renewal rule in 1991, when the Commission accepted the use of new commitments to monitor, manage, and correct age-related degradation unique to license renewal. It stated:

> The licensing basis for a nuclear power plant during the renewal term will consist of the current licensing basis and *new commitments* to monitor, manage, and correct age-related degradation unique to license renewal, as appropriate. The current licensing basis includes all applicable NRC requirements and licensee commitments, as defined in the rule.[98]

In its 1995 revised rule, the Commission reiterated that such commitments are acceptable.[99]

More recently, the Commission again affirmed these important principles in the *Vermont Yankee* license renewal proceeding. In CLI-10-17, the Commission held:

> [I]n Oyster Creek, we expressly interpreted section 54.21(c)(1) to permit a demonstration *after* the issuance of a renewed license: "an applicant's use of an aging management program identified in the GALL Report [*i.e.* NUREG-1801] constitutes reasonable assurance that it *will* manage the targeted aging effect during the renewal period." We reiterate here that a commitment to implement an AMP that the NRC finds is consistent with the GALL Report

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[97] *See, e.g.*, 10 C.F.R. § 54.29(a) (stating "actions have been identified and have been *or will be taken*" with respect to managing the effects of aging and TLAAs) (emphasis supplied); *see also Turkey Point*, CLI-01-17, 54 NRC at 8 ("Part 54 requires renewal applicants to demonstrate how their programs *will be effective in managing the effects of aging during the proposed period of extended operation. . . .* Applicants must identify any *additional actions*, *i.e.*, maintenance, replacement of parts, etc., *that will need to be taken* to manage adequately the detrimental effects of aging.") (citations omitted) (emphasis added).

[98] Final Rule: Nuclear Power Plant License Renewal, 56 Fed. Reg. 64,943, 64,946 (Dec. 13, 1991) (emphasis added).

[99] *See* Final Rule: Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. at 22,473 (stating that, for the license renewal review, consideration of *written commitments* only need encompass those commitments that concern the capability of systems structures and components, identified in § 54.21(a), integrated plant assessment and §54.21(c) time-limited aging analyses, to perform their intended functions, as delineated in § 54.4(b)).

constitutes one acceptable method for compliance with 10 C.F.R. § 54.21(c)(1)(iii).[100]

Accordingly, it is permissible for an applicant to incorporate commitments in its LRA, and for the Staff to review and rely on such commitments in making its reasonable assurance determination under Section 54.29(a).

Importantly, the NRC Staff reviews these implementation activities to be performed in connection with commitments as part of its ongoing regulatory oversight process—"separate and apart" from its review of the LRA.[101] The adequacy of Entergy's ongoing AMP implementation and commitment-fulfillment activities should not be within the scope of this hearing. Instead, the focus of this hearing must be on the adequacy of Entergy's LRA, including the TLAAs, AMPs, and commitments contained therein.

IV. ARGUMENT

A. Intervenor's Witnesses and Position

The party sponsoring a witness has the burden of demonstrating that the witness is qualified.[102] "A witness may qualify as an expert by knowledge, skill, experience, training, or education to testify if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue."[103]

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100 *Vt. Yankee*, CLI-10-17, slip op. at 44 (citing *AmerGen Energy Co., LLC* (License Renewal for Oyster Creek Nuclear Generating Station), CLI-08-23, 68 NRC 461, 468 (2008)).

101 *Oyster Creek*, CLI-09-07, 69 NRC at 248-49 (holding that that review of the applicant's compliance with a commitment to perform a finite element structural analysis of the drywell was not a precondition for granting the renewed operating license); *see also id.* at 284 ("review and enforcement of license conditions is a normal part of the Staff's oversight function rather than an adjudicatory matter"); NRC Inspection Manual, Temporary Instruction 2516/001, Review of License Renewal Activities at 1 (Mar. 30, 2011), *available at* ADAMS Accession No. ML110620255 (governing NRC Staff inspections on the "implementation of license renewal commitments, license conditions, and selected aging management programs").

102 *See*, *e.g.*, *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 & 2), CLI-04-21, 60 NRC 21, 27, 30 (2004) (alteration in original omitted) (internal quotation marks omitted).

103 *Id.* at 27-28 (alteration in original omitted) (internal quotation marks omitted).

1. Dr. Richard T. Lahey

As noted previously, NYS's testimony is sponsored by Dr. Richard T. Lahey, Professor of Engineering at RPI. According to his *curriculum vitae*, Dr. Lahey holds a Ph.D. in Mechanical Engineering and has experience in the field of nuclear engineering. Dr. Lahey's 60-page *curriculum vitae* is silent on the topic of fatigue analysis. It shows that the focus of his research appears to have been in the fields of thermal hydraulics and heat transfer, but does not appear to show experience in fatigue analysis, or in applying thermal hydraulic and heat transfer analyses in support of fatigue calculations.

a. Dr. Lahey's Testimony

Dr. Lahey's testimony asserts that the Westinghouse EAF analyses did not include an "error analysis," which, he claims, one would normally expect to see, particularly given that "many" of the results showed CUF_{en} values close to 1.0.[104] He criticizes the use of "engineering judgment" in the EAF evaluations, stating that the results are "strongly influenced by the code user's [*i.e.*, the analyst's] assumptions, manipulations, and interventions."[105] Dr. Lahey identifies a number of purported "possible sources of error" in the WESTEMS™ model used by Westinghouse to conduct the EAF evaluations, such as asserted imprecision in the application of heat transfer coefficients, the use of thermocouple data,[106] the use of a modified heat transfer coefficient to account for the effects of thermal sleeves,[107] the use of a one-dimensional thermal-hydraulics model rather than a more complex three-dimensional model,[108] an asserted failure to

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104 Supplemental Lahey Report at 8 (NYS000297).

105 *Id.*.

106 *See id.* at 2-3.

107 *See id.* at 3..

108 *Id.*

account for the onset of nucleate boiling at certain component locations during depressurization transients,[109] and several other issues related to the calculations for individual components. In addition, Dr. Lahey claims that the EAF evaluations do not address the possibility that the analyzed components "may have experienced significant corrosion and irradiation-induced embrittlement, and thus can experience early fatigue-induced failures,"[110] and may be become vulnerable to design basis loads.[111] Finally, Dr. Lahey asserts that there is a need to conduct fatigue analyses of the reactor vessel internals.[112]

b. Dr. Lahey's Testimony Should Be Accorded Little Weight

Dr. Lahey's credentials focus on thermal hydraulic and heat transfer analyses applications in areas other than fatigue calculations. As a result, the State does not show that Dr. Lahey's testimony is probative on the specific issues raised in this contention. Indeed, as Entergy's witnesses show, Dr. Lahey's Report, Supplemental Report, and Testimony seem to reveal a number of basic misunderstandings on the specialized subject of fatigue analysis. For example, Dr. Lahey focuses on the alleged lack of precision and "uncertainties" in the EAF analyses. As Entergy's witnesses show, however, the actual objective of an EAF analysis is to determine whether or not the CUF_{en} exceeds 1.0,[113] not to calculate a precise CUF_{en} value. Westinghouse's analyses provide sufficient refinement and conservatism to accomplish the actual objective. Entergy's witnesses refute Dr. Lahey's errors point-by-point in their testimony.

Thus, the Board should accord Dr. Lahey's testimony little weight.

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109 *Id.* at 6 n.1

110 Lahey Report at 25 (NYS000296).

111 *See* Lahey Supplemental Report at 4 (NYS000297).

112 *See* Lahey Report at 30 (NYS000296).

113 *See* Entergy Test. at A33, A91, A114.

2. Dr. Joram Hopenfeld

As noted previously, Riverkeeper's testimony is sponsored by Dr. Joram Hopenfeld, the CEO of Noverflo, Inc.

a. Dr. Hopenfeld's Testimony

Dr. Hopenfeld, like Dr. Lahey, makes general claims that there is a wide margin of error in the EAF analyses. According to Dr. Hopenfeld, Westinghouse has "grossly" underestimated the calculated CUF_{en} values.[114] In particular, Dr Hopenfeld points to various uncertainties described in NUREG/CR-6909, which he asserts must be accounted for using bounding F_{en} values specified in that document.[115] The application of these bounding F_{en} values, he claims, would yield CUF_{en} values that exceed the regulatory limit of 1.0.[116] His claims about the EAF analyses include claims that Westinghouse used improper values for dissolved oxygen (DO) content during transients,[117] used unrealistically-low heat transfer coefficients,[118] and used an unjustifiable number of transients.[119] Dr. Hopenfeld also claims that once the "initial CUF_{en} findings" in the LRA showed various components exceeding a CUF_{en} value of 1.0, that Entergy was obligated to identify additional locations for EAF analyses, beyond those locations specified in NUREG/CR-6260. Finally, Dr. Hopenfeld asserts that, given all of the deficiencies he claims to have identified in the IPEC EAF analyses, Entergy has not otherwise provided a sufficiently detailed AMP to ensure that the degradation effects of metal fatigue will be adequately handled during the proposed PEO.

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114 Hopenfeld Report at 4 (RIV000035).

115 *See id.* at 4-9.

116 *See id.* at 8.

117 *See id.* at 10-13.

118 *See id.* at 15-18.

119 *See id.* at 18-20.

b. Dr. Hopenfeld's Testimony Should Be Accorded Little or No Weight

While Entergy recognizes that the Board has held that Dr. Hopenfeld has sufficient background to assist the Board in the resolution of the questions raised in this contention,[120] Entergy continues to believe that Riverkeeper has not carried its burden of demonstrating that Dr. Hopenfeld holds specialized knowledge in the field of metal fatigue analysis.[121] This is consistent with the Board's recognition that Dr. Hopenfeld "might have limited experience with the inner workings of the specific codes addressed in his testimony – the ASME Code Section III, and WESTEMS."[122] Further, the Board noted that Dr. Hopenfeld "was not commenting on the validity of the codes, nor was he challenging the algorithms used in the codes to model the solution to the equations used to calculate stress and fatigue analysis."[123] Accordingly, the Board should accord little or no weight to Dr. Hopenfeld's testimony on those topics.

Notably, despite Dr. Hopenfeld's apparent minimal experience with metal fatigue issues, he expresses his conclusions stridently, but without sufficient evidentiary support. For example, the conclusions of his Report include the following statement: "As the foregoing *unequivocally* demonstrates, Entergy has *demonstrably* failed to properly account for all relevant uncertainties,"[124] when, as Entergy's witnesses show, the Westinghouse EAF analyses do account for the specific uncertainties he has identified. He goes on to speculate that the

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120 *See* Ruling on Motions in Limine at 15.

121 *See Catawba*, CLI-04-21, 60 NRC at 27-28.

122 Ruling on Motions in Limine at 14; *accord Curriculum Vitae* of Joram Hopenfeld (Dec. 22, 2011) ("Hopenfeld CV") (RIV000004); *Entergy Nuclear Vt. Yankee* (Vt. Yankee Nuclear Power Station), Docket No. 50-271-LR, Hearing Transcript at 832-33 (Jul. 21, 2008), *available at* ADAMS Accession No. ML082320362 (ENT000369) (recording Dr. Hopenfeld's admission that he lacks expertise in "stress numerical analysis").

123 Ruling on Motions in Limine at 15.

124 Hopenfeld Report at 21 (RIV000035) (emphasis added).

predicted fatigue life of IPEC components has been "*grossly* underestimated,"[125] when, as even Dr. Hopenfeld admits, there is "no correlation between the degree to which the CUFen exceeds unity and fatigue life."[126] The certainty with which Dr. Hopenfeld expresses his opinions, despite substantial evidence contradicting his opinions, further tends to reduce the probative value of his testimony.

Indeed, Dr. Hopenfeld has, in another context, already described the problems with his own testimony on this contention. In a Declaration he submitted in the *Vermont Yankee* license renewal proceeding—a document related to a number of contentions, including one very similar to this one—he asserted that the presiding Board in that case lacked the requisite specific expertise, stating as follows: "the issues in this case involve very specific and not broadly understood materials, mechanics, energy, and plant operations phenomena beyond the depth of most generalists."[127] Dr. Hopenfeld's statement speaks directly to the deficiencies in his own testimony, which reflects a lack of specialized expertise in the field of fatigue analysis.

B. Entergy's Witnesses and Position

Entergy's testimony on NYS-26B/RK-TC-1B is sponsored by the witnesses identified below. The testimony, opinions, and evidence presented by these Entergy witnesses are based on their technical and regulatory expertise, professional experience, and personal knowledge of the issues raised in NYS-26B/RK-TC-1B. Collectively, these witnesses will demonstrate that NYS-26B/RK-TC-1B lacks merit.

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125 *Id.* (emphasis added)

126 Hopenfeld Report at 3 n.2 (RIV000035).

127 Declaration of Dr. Joram Hopenfeld in Support of New England Coalition's Motion for Reconsideration at 5, ¶ 3 (Dec. 15, 2008) ("2008 Vermont Yankee Hopenfeld Decl.") (ENT000089), *available at* ADAMS Accession No. ML090160358.

1. Entergy's Witnesses

a. Mr. Nelson F. Azevedo

Nelson Azevedo's professional and educational qualifications are summarized in his *curriculum vitae*.[128] Mr. Azevedo is employed by Entergy as the Supervisor of Code Programs at IPEC. He holds a Bachelor of Science degree in Mechanical and Materials Engineering from the University of Connecticut, and a Master of Science in Mechanical Engineering and Master of Business Administration (M.B.A.) degrees from the Rensselaer Polytechnic Institute ("RPI") in Troy, New York. Mr. Azevedo has 30 years of professional experience in the nuclear power industry. In his current position, he oversees the IPEC engineering section responsible for implementing American Society of Mechanical Engineers ("ASME") Code programs, including the fatigue monitoring, inservice inspection, inservice testing, flow-accelerated corrosion, snubber testing, boric acid corrosion control, non-destructive examination, steam generators, buried piping, alloy 600 cracking, reactor vessel embrittlement, reactor vessel internals, welding, and 10 C.F.R. Part 50, Appendix J containment leakrate programs. In addition to those duties he is responsible for ensuring compliance with the ASME Code, Section XI requirements for repair and replacement activities at IPEC and represents IPEC before industry organizations, including the pressurized water reactor ("PWR") Owners Group Management Committee.

During his career, Mr. Azevedo has performed pipe stress analyses, finite element analysis of large components, ASME Code Section XI flaw evaluations, and ASME Code Section III, Class 1 fatigue analyses. He reviewed Westinghouse's draft environmental fatigue evaluations for IP2 and IP3 discussed below. Accordingly, Mr. Azevedo is qualified through

[128] *See Curriculum Vitae* for Nelson F. Azevedo (ENT000032).

knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on the Entergy FMP and fatigue analyses.

b. Mr. Alan B. Cox

Alan Cox's professional and educational qualifications are summarized in his *curriculum vitae*.[129] In brief, he holds a Bachelor of Science degree in Nuclear Engineering from the University of Oklahoma and a Master of Business Administration (M.B.A.) from the University of Arkansas at Little Rock. He is currently the Technical Manager for License Renewal at Entergy. Mr. Cox has more than 34 years of experience in the nuclear power industry, having served in various positions related to engineering and operations of nuclear power plants, including several years as a licensed reactor operator and a senior reactor operator. Since 2001, he has worked full-time on license renewal matters, supporting the integrated plant assessment and LRA development for Entergy license renewal projects, as well as projects for other utilities.

As Technical Manager, Mr. Cox was directly involved in preparing the LRA and developing or reviewing AMP descriptions for IP2 and IP3, including the FMP for IPEC. He has also been directly involved in developing or reviewing Entergy responses to NRC Staff Requests for Additional Information ("RAI") concerning the LRA and necessary amendments or revisions to the application. Accordingly, he has extensive knowledge of the IPEC FMP, including the description of that program in the LRA and other related documentation discussed below. Thus, Mr. Cox is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on the Entergy FMP.

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[129] *See Curriculum Vitae* for Alan B. Cox (ENT000031).

c. Mr. Jack R. Strosnider, Jr.

Jack Strosnider's professional and educational qualifications are summarized in his *curriculum vitae*.[130] Mr. Strosnider holds a Bachelor of Science degree and a Master of Science degree, both in Engineering Mechanics from the University of Missouri at Rolla, and an M.B.A. degree from the University of Maryland. Mr. Strosnider is a Senior Nuclear Safety Consultant with Talisman International, LLC. Prior to April 2007, he was employed for 31 years by the NRC. During that time, he held numerous senior management positions at the NRC, including Director of the Office of Nuclear Material Safety and Safeguards, Deputy Director of the Office of Nuclear Regulatory Research, and Director of the Division of Engineering in the Office of Nuclear Reactor Regulation ("NRR").

Mr. Strosnider has extensive experience in developing and applying NRC regulations and programs addressing the aging of nuclear power plant structures and components. He has directed engineering reviews and the preparation of SERs for license renewal and was also responsible for research programs related to environmental effects on reactor component cracking; licensing reviews associated with resolution of Generic Safety Issue (GSI) 190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life;" and the evaluation of the effects of fatigue on reactor components. Thus, Mr. Strosnider is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on the NRC regulatory requirements relating to fatigue and criteria necessary to satisfy those requirements.

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[130] *See Curriculum Vitae* for Jack R. Strosnider, Jr (ENT000184).

d. Dr. Robert E. Nickell

Robert Nickell's professional and educational qualifications are summarized in his *curriculum vitae*.[131] Dr. Nickell is the President and founder of an engineering consulting firm, Applied Science & Technology, which has provided specialty engineering consulting services to the industry and government for over 30 years. Dr. Nickell holds a Bachelor of Science degree, a Master of Science degree, and a Doctor of Philosophy degree, all in engineering science, from the University of California at Berkeley. In addition to his over 30 years of engineering consulting practice, Dr. Nickell has been employed by the Electric Power Research Institute ("EPRI"), the Sandia National Laboratories, and Bell Telephone Laboratories.

Dr. Nickell has been extensively involved in the development of ASME Code standards and in licenses renewal related activities. He has authored or co-authored more than 100 technical publications, and was the principal author of License Renewal Industry Reports on topics such as fatigue and fracture resistant design concepts and the evaluation of fatigue data accounting for environmental effects for carbon and low-alloy steel components. Thus, Dr. Nickell is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on fatigue analysis and management.

e. Mr. Mark A. Gray

Mark Gray's professional and educational qualifications are summarized in his *curriculum vitae*.[132] Mr. Gray is a Principal Engineer in the Primary Systems Design and Repair group at Westinghouse. He holds a Bachelor of Science in Mechanical Engineering from the University of Pittsburgh and has over 30 years of experience in the nuclear power industry. His

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131 *See Curriculum Vitae* for Robert E. Nickell (ENT000185).

132 *See Curriculum Vitae* for Mark A. Gray (ENT000186).

principal work activities include the evaluation of the structural integrity of primary system piping and components, including the development of plant life extension and monitoring programs and analysis. He participated in the development and application of transient and fatigue monitoring algorithms and software for the WESTEMS™ Transient and Fatigue Monitoring System, and collaborated with vendors outside Westinghouse in the development of transient and fatigue monitoring systems.

He co-authored the Westinghouse Owners Group ("WOG") Generic Technical Report on Aging Management for Pressurizers, and contributed to a similar report covering Reactor Coolant System Piping, and represented Westinghouse before the NRC in their review of the generic reports. He has contributed to development of transient and fatigue monitoring programs for more than ten U.S. operating facilities. During the preparation of the EAF analyses for IPEC license renewal, Mr. Gray provided general technical direction for the engineers performing the EAF analyses, and either co-authored or reviewed the resulting Westinghouse environmental fatigue reports, referred to as "WCAP" reports. For these reasons, Mr. Gray is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on fatigue analysis and management issues, including the revised EAF analyses and the use of WESTEMS^{TM} in support of the IPEC license renewal application.

2. Entergy's Statement of Position

In their testimony, Entergy's experts explain why the FMP set forth in Entergy's LRA for IP2 and IP3 provides reasonable assurance that, consistent with the current licensing basis ("CLB") *and* considering environmental effects, the CUFs for components comprising the reactor coolant pressure boundary will not exceed 1.0, throughout the period of extended operation ("PEO"), thereby providing reasonable assurance that those components will continue to perform their intended functions, as required by 10 C.F.R. §§ 54.21(a)(3), 54.21(c)(1)(iii), and

54.29(a). Specifically, Entergy's experts provide technical background testimony on metal fatigue and the relevant NRC regulations and guidance.[133] They also provide an overview of the LRA as it relates to the issue of metal fatigue,[134] a summary of the NRC Staff's review of the LRA on this topic,[135] and an overview of the environmentally-assisted fatigue ("EAF") analyses conducted by Westinghouse in support of the IPEC LRA and Entergy's FMP.[136] Entergy's witnesses show that the FMP is consistent with NUREG-1801, Revision 1, and meets the intent of NUREG-1801, Revision 2.[137] These facts carry special weight in support of the NRC's determination that Entergy's FMP meets the requirements of 10 C.F.R. Part 54.[138] Finally, as summarized below, Entergy's experts refute the Intervenors' evidence point by point, thereby demonstrating that the issues raised in NYS-26B/RK-TC-1B and the Intervenors' associated evidentiary submissions lack factual and technical merit.

a. Drs. Hopenfeld and Lahey Misconstrue Certain Fundamental Principles of Fatigue Analysis

In Section V.D.1 of its prefiled testimony, Entergy's witnesses explain that Dr. Hopenfeld and Dr. Lahey misconstrue certain fundamental principles of fatigue analysis, such as the objective of a CUF_{en} calculation, which is to determine whether or not the CUF_{en} exceeds 1.0, not to calculate a precise CUF_{en} value. In their testimony, Dr. Hopenfeld and Dr. Lahey appear to conflate uncertainty with non-conservatism.[139] However, the refined EAF analyses—

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133 *See* Entergy Test. § IV (ENT000183).

134 *See id.* § V.A.

135 *See id.* § V.B.

136 *See id.* § V.C.

137 *See id.* at A52, A121.

138 *See supra* Sections III.A.2, III.A.3.

139 The Commission itself recently acknowledged this distinction. *See FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-08, 75 NRC __, slip op. at 30-31 (Mar. 27, 2012) ("As

consistent with established engineering standards and practices—contain considerable conservatisms and design margin, both in the selection of input parameters and in the conduct of the analysis. Entergy's witnesses demonstrate that the refined IPEC EAF analyses are sufficiently conservative to address the "uncertainties" identified by Drs. Lahey and Hopenfeld and therefore provide reasonable assurance that each analyzed component will not experience fatigue crack initiation during the PEO.

b. Entergy is Permitted to Refine its EAF Analyses

In Section V.D.2 of its prefiled testimony, Entergy's witnesses demonstrate that Entergy is permitted, under NRC regulations, Commission precedent, and established guidance, to refine the initial CUF_{en} values provided in the LRA through an EAF analysis.

(i) **The Refined Westinghouse EAF Analyses Supersede Prior Calculations**

As the Commission ruled in the Vermont Yankee license renewal proceeding, an applicant may perform refined fatigue analyses that supersede prior analyses.[140] As Entergy's witnesses explain, this Commission decision is fully consistent with well-established NRC Staff and industry guidance.[141]

Entergy's witnesses also explain that, in the preparation of the LRA, the existing CLB CUF values were simply multiplied by a bounding environmental correction factor ("F_{en}") to determine a CUF_{en}.[142] This screening exercise was intended to identify locations needing a more

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Judge Trikouros stated at the prehearing conference, merely because a computer model may be simpler does not mean that it would be less conservative . . . because 'sometimes the simpler model gives higher doses than the more complex model.'").

140 *See Vt. Yankee*, CLI-10-17, 72 NRC at 21 n.99 ("The ASME Code allows performance of a more detailed analysis as a way to demonstrate code compliance.").

141 Entergy Test. at A90 (ENT000183) (*citing* NUREG-1801, Revision 1 at X M-2 (NYS00146C); MRP-47 at 3-7 (NYS000350)).

142 Entergy Test. at A91 (ENT000183).

refined CUF_{en} evaluation (*i.e.*, identify locations where the estimated CUF_{en} exceeded 1.0)—*not* to determine an exact CUF_{en} value. The purpose of the refined EAF calculations, then, was to recalculate a CUF_{en} to determine whether or not the CUF_{en} actually exceeds 1.0 during the PEO. The results from the refined Westinghouse EAF analyses demonstrate that none of the NUREG/CR-6260 locations have CUF_{en} values in excess of 1.0.[143] Therefore, there is no need to expand the fatigue analysis to additional components. Thus, Entergy has evaluated EAF effects on the six critical reactor coolant system pressure boundary component locations identified in NUREG/CR-6260, an approach that is fully consistent with NUREG-1801, Revision 1.

(ii) **Entergy's New Commitment Meets the Intent of NUREG-1801, Rev. 2**

Entergy's witnesses also explain that the FMP meets the intent of NUREG-1801, Revision 2.[144] Specifically, in response to an RAI from the NRC Staff, Entergy committed to review its design basis ASME Code fatigue evaluations to determine whether the NUREG/CR-6260 locations that have been evaluated for the effects of the reactor coolant environment on fatigue are the limiting locations for IPEC.[145] As the NRC Staff found in its Supplemental SER, this commitment further supports the conclusion that the LRA satisfies 10 C.F.R. § 54.21(a) (3) and (c)(1)(iii).[146]

Under the Commission's decision in CLI-10-17, the completion of CUF_{en} calculations is not a prerequisite to NRC approval of license renewal, because CUF_{en} calculations are not

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143 *See* Westinghouse, WCAP-17199-P, Environmental Fatigue Evaluation for Indian Point Unit 2, Rev. 0, at 6-1 (June 2010) ("WCAP-17199") (NYS000361); Westinghouse, WCAP-17200-P, Environmental Fatigue Evaluation for Indian Point Unit 3, Rev. 0, at 6-1 (June 2010) ("WCAP-17200") (NYS000362).

144 *See* Entergy Test. at A52, A91 (ENT000183).

145 *See* NL-11-032, attach. 1, at 26 (NYS000151).

146 *See* Entergy Test. at A92 (ENT000183).

TLAAs.[147] Similarly, the review specified in Commitment 43 is not a TLAA, but is an activity conducted under an AMP—the FMP. Because the completion of the review specified in Commitment 43 is an AMP implementation activity, the analyses are not required to be completed in advance of any hearing on the adequacy of Entergy's LRA for IPEC, or in advance of the granting of a renewed license.[148]

Therefore, the existing FMP, further bolstered by the already-completed EAF evaluations, fully meets the intent of NUREG-1801, Revision 2. As a result, there is sufficient evidence in the record now for the NRC to make its required regulatory findings under 10 C.F.R. §§ 54.21(a)(3), 54.21(c)(1)(iii) and 54.29(a).

c. Westinghouse's EAF Analysis Methodology is Technically Sound and Fully Supported

In Section V.D.3 of its prefiled testimony, Entergy's witnesses show that the WESTEMS™ methodology is consistent with standard ASME Code analysis methods and contains substantial conservatisms in input values and other aspects of the analysis, so no "propagation of error" analysis is required or necessary. This section refutes Dr. Lahey's and Dr. Hopenfeld's critiques of the EAF analyses in detail, showing that they lack merit. In general, Dr. Lahey and Dr. Hopenfeld do not acknowledge that the EAF analyses include assumptions that conservatively represent the complex conditions that the Intervenors' experts incorrectly describe as unaccounted-for uncertainties. Entergy's witnesses show that the Westinghouse EAF evaluations used conservative and appropriate input values, including heat transfer coefficients,

147 *See Vt. Yankee*, CLI-10-17, 72 NRC at 34 ("Because CUF_{en}s are not contained in Vermont Yankee's current licensing basis, they cannot be TLAAs and thereby a prerequisite to license renewal.").

148 *See id.* at 41. Entergy recognizes that this issue is the subject of a different contention, NYS-38/RK-TC-5, and therefore does not address it further here.

dissolved oxygen values, and transient data, such that the EAF evaluations conservatively calculate the CUF_{en} for the analyzed components.[149]

With respect to the heat transfer coefficients used as inputs into the EAF evaluation, Westinghouse used conservative (*i.e.*, large) heat transfer coefficients to maximize the postulated analyzed temperature gradient ("ΔT") across each component, and thereby conservatively calculated the stresses as part of the ASME Code Section III stress and fatigue analysis.[150]

With respect to the environmental correction factor, instead of F_{en} values specified in the NRC Staff-approved NUREG/CR-5704 and NUREG/CR-6583, Dr. Hopenfeld advocates for the use of the very large, bounding F_{en}s specified in NUREG/CR-6909.[151] Entergy's witnesses explain that there is no technical basis for Riverkeeper's claim that Entergy must use only the bounding F_{en} values identified in NUREG/CR-6909.[152] Indeed, Dr. Hopenfeld appears to be alone in his recommendation to apply the NUREG/CR-6909 F_{en} factors to results developed using the ASME Code design fatigue curves, instead of the NUREG/CR-6909 fatigue curves. The NRC Staff recommends the use of *either* methodology, not this hybrid combination of the F_{en} factors from NUREG/CR-6909 and the ASME Code—as opposed to the NUREG/CR-6909—fatigue curves.[153] Dr. Hopenfeld raised a very similar claim in the *Vermont Yankee* proceeding, but the Board in that case rejected his theory that such a hybrid was required.[154]

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149 *See* Entergy Test. § V.D.3 (ENT000183).

150 *See id.* § V.D.3.a.

151 *See* Hopenfeld Report at 7 (RIV000035).

152 Entergy Test. § V.D.3.c (ENT000183).

153 *See id.* at A52, A119 (citing NUREG-1801, Rev. 1 at X M-1 (NYS00146C); NUREG-1801, Rev. 2, at X M1-1 (NYS00147C)), A121.

154 *See Vt. Yankee, LLC.* (Vt. Yankee Nuclear Generating Station) LBP-08-25, 68 NRC 763, 805-06 (2008), *rev'd & remanded on other grounds*, CLI-10-17, 72 NRC 1 (2010).

Further, the dissolved oxygen values used as inputs in the determination of the environmental correction factor ("F_{en}") were fully consistent with NRC Staff-approved guidance in NUREG-CR-5704 and NUREG-CR-6583.[155] The F_{en}s specified in those documents appropriately reflect plant conditions for a PWR, such as IP2 or IP3, where dissolved oxygen concentration is maintained below 0.005 ppm except in shutdown plant conditions when the temperature is well below 150º C, such that any adverse environmental effects of the reactor coolant environment are substantially reduced.[156]

In Section V.D.3.e, Entergy's witnesses also explain that the EAF analyses include an appropriately conservative number of transients. If, for some reason, the number of projected transients begins to increase over time, then corrective action will be required under the FMP, including repair or replacement of components, as appropriate, before the analyzed number of transients is reached.[157]

Dr. Lahey's critiques also assert the need for "a lot of 'engineering judgment'" in the EAF analyses, and the potential for the exercise of such judgment to lead to errors and uncertainties.[158] Westinghouse, however, prepared the EAF analyses consistent with longstanding and long-accepted engineering practices in the field of ASME Code stress and fatigue analysis, using qualified analysts who conducted the evaluations consistent with Westinghouse's NRC-approved quality assurance program.[159] The EAF analyses are

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155 *See* Entergy Test. § V.D.3.d (ENT000183).

156 *See id.* at A125, A126.

157 *See Vt. Yankee*, LBP-08-25, 68 NRC at 813 (holding that even if an increased number of transients "appears later in the operational life of the facility, this will be detected and addressed by Entergy's continued tracking of transients").

158 Lahey Report at 28 (NYS000296); *see also* Supplemental Lahey Report at 3, 4, 7, 8 (NYS000297).

159 *See* Entergy Test. at A111 (ENT000183).

conservative evaluations intended to determine whether or not the CUF_{en} exceeds 1.0, not to precisely determine the value of the CUF_{en}, and engineering judgment is appropriately exercised within the context of those analyses.[160] As explained in Section IV.D.3 of Entergy's Testimony, the Intervenors do not identify any areas where Westinghouse's assumptions were non-conservative.

For all of the aforementioned reasons, no propagation of error analysis, as advocated by Dr. Lahey and Dr. Hopenfeld, is required or necessary.[161] An intervenor in the *Vermont Yankee* license renewal proceeding raised essentially the same claim—supported by testimony from Dr. Hopenfeld—and the Board in that proceeding found the claim lacked technical merit, ruling that the lack of an error analysis in the CUF_{en} analyses does *not* render the analyses inadequate.[162] The technical bases for the Board's finding included the well-known conservatisms and design margin provided in the ASME design fatigue curves for carbon steel and stainless steel.[163] The *Vermont Yankee* Board also cited Entergy testimony to the effect that further "error analysis" is unnecessary because refined CUF_{en} analyses apply very conservative input parameters to maximize stresses.[164] Entergy's witnesses explain that this conclusion applies with equal force to the IPEC EAF analyses.[165]

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160 *See id.* § V.D.3.b.

161 *See id.* § V.D.3.f.

162 *See Vt. Yankee*, LBP-08-25, 68 NRC at 804, 814.

163 *See id*. at 814.

164 *Id*.

165 *See* Entergy Test. at A139 (ENT000183).

d. Design CUF Calculations for the Reactor Vessel Inlet and Outlet Nozzles

Section D.5 of Entergy's prefiled testimony addresses Dr. Hopenfeld's critique of the design CUF calculation prepared by Combustion Engineering during the original design of IP2 and IP3. As Entergy's witnesses explain, contrary to Riverkeeper's claims in its Answer to Entergy's Motion in Limine,[166] these calculations: (1) are part of the original design basis of IP2 and IP3; (2) are part of the CLB for IP2 and IP3; (3) cover the reactor vessel inlet and outlet nozzles, components that were *not* the subject of any refined EAF analysis during the course of this license renewal proceeding, and do *not* relate to the evaluation of similar refined calculations that might be conducted in the future as part of the FMP; and (4) *are* nevertheless critiqued by Dr. Hopenfeld in his testimony.[167]

In particular, in opposing Entergy's Motion in Limine, Riverkeeper stated:

> Dr. Hopenfeld's testimony does not challenge any original design basis CUF calculations. As Dr. Hopenfeld explains, Entergy provided such calculations in response to Riverkeeper's repeated inquiries about heat transfer coefficients that were applied to the 2010 "refined" EAF reanalysis.[168]

Riverkeeper's statement that Dr. Hopenfeld does not challenge these calculations is directly contradicted by Dr. Hopenfeld's testimony itself. First, on page 17 of Dr. Hopenfeld's Report, he asserts there are deficiencies in the "40-year old Combustion Engineering calculations" of CUFs for the reactor vessel inlet and outlet nozzles, *i.e.*, the design basis CUF

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166 Riverkeeper, Inc. Opposition to Entergy's Motion in Limine to Exclude Portions of Pre-filed Testimony, Expert Report, Exhibits, and Statement of Position for Contention NYS-26B/RK-TC-1B (Metal Fatigue) at 10 (Feb. 17, 2012) ("Riverkeeper Answer").

167 *See* Entergy Test. at A142 (ENT000183).

168 Riverkeeper Answer at 10 (citation omitted).

calculations.[169] As Entergy's witnesses explain, the Westinghouse refined EAF analyses did not cover the reactor vessel inlet and outlet nozzles, because the CLB CUF calculations, when corrected for environmental effects and projected through the PEO, continued to show a CUF_{en} below 1.0.[170]

Second, Entergy did not provide the design CUF calculations in response to "*repeated* inquiries about heat transfer coefficients that were *applied to the 2010 'refined' EAF reanalysis*."[171] As is clear on the face of Exhibit RIV000054, Entergy promptly provided the design CUF calculations to Riverkeeper in response to its *first* request, on September 26, 2011, asking "whether comparable information/documents [*i.e.*, documents addressing heat transfer coefficients] exist for other components, including but not limited to the other components listed in Tables 4.3-13 and 4.3-14 of Entergy's License Renewal Application . . . ."[172] As Riverkeeper should be aware, Riverkeeper had *not* previously requested documents relating to components that Westinghouse did *not* analyze for EAF in 2010, such as the reactor vessel inlet and outlet nozzles.[173] These statements from Riverkeeper may have led the Board to conclude that Riverkeeper's testimony "does not challenge any of the design basis CUF calculations."[174]

In addition, while Riverkeeper asserts that Dr. Hopenfeld's testimony on the design CUF calculations is "testimony about the deficiencies with Entergy's 'refined' fatigue analyses," it is

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169 Hopenfeld Report at 17.

170 *See* Entergy Test. at A142 (ENT000183).

171 Riverkeeper Answer at 10 (emphasis in original).

172 Letter from P. Bessette & K. Sutton, Morgan Lewis, to D. Brancato, Riverkeeper, "Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generation Units 2 and 3), Docket Nos. 50-247-LR and 50-286-LR" at 2 (Oct. 18, 2011) (RIV000054). Entergy's response also explained that by providing these documents, Entergy was not conceding their relevance to the admitted contention. *See id.*

173 Thus, there is absolutely no basis for Riverkeeper's assertion that Entergy's statements in its Motion in Limine were "highly disingenuous." Riverkeeper Answer at 10 n.46.

174 Ruling on Motions in Limine at 15.

not.[175] As Entergy's witnesses explain, the Westinghouse EAF analyses do not rely on the design CUF calculations, nor do they cover the components that are the subject of Section IV.C.ii.2 of Dr. Hopenfeld's Report; *i.e.*, the reactor vessel inlet and outlet nozzles.[176] Again, apparently based on Riverkeeper's incorrect statement, the Board concluded that "these specific CLB analyses define the current practices of the Applicant that relate to similar calculations that will be performed as part of Entergy's AMP for metal fatigue."[177] There is, however, no evidence in the record whatsoever to suggest that, if Entergy needed to perform additional refined EAF analyses in the future, it would revert to the methodology used in the 1960s rather than using WESTEMS™, for example. Because the design CUF calculations are part of the CLB and do not define practices to be used in any calculations that might be performed in the future under the FMP, Entergy continues to assert that any question of the adequacy of the design CUF calculations remains outside the scope of this license renewal proceeding.[178]

The adequacy of these original design calculations is also outside the scope of the admitted contention. As explained in Entergy's Motion in Limine, Dr. Hopenfeld's critique of the design CUF calculations is an entirely new issue, as there was no discussion of them—much less a suggestion of any related deficiency—in the bases for this contention.[179] Riverkeeper characterizes its contention as including "a broad criticism pertaining to Entergy's failure to demonstrate an adequate program to manage metal fatigue during the proposed period of

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175 Riverkeeper Answer at 11.

176 *See* Entergy Test. at A142 (ENT000183).

177 Ruling on Motions in Limine at 16.

178 *See id.* at 15 ("We find that Riverkeeper's testimony and corresponding evidentiary submission on this contention does not challenge any of the design basis CUF calculations"); *see also* 1995 License Renewal SOC, 60 Fed. Reg. at 22,473 ("The regulatory process is the means by which the Commission continually assesses the adequacy of and compliance with the CLB.").

179 There are no criticisms of the adequacy of the design basis reactor vessel inlet and outlet nozzles in the New and Amended Contention or its superseded prior versions.

extended operation."[180] But as the Commission recently confirmed, a contention cannot be interpreted to include new claims that are outside of the admitted bases for that contention.[181] As explained above, the Commission made this clear in its very recent decision in the *Seabrook* proceeding.[182] Contrary to Riverkeeper's assertions, no contention can be construed to include bases that were not pled. For NYS-26B/RK-TC-1B, the bases submitted (and admitted) at the contention admissibility stage did not even mention the design CUF calculations, much less include a challenge to them.[183]

Without waiving its arguments regarding the scope of the proceeding and the admitted contention, Entergy's witnesses explain in Section V.D.4 of their testimony that Dr. Hopenfeld's criticisms of the design basis CUF calculations for the reactor vessel inlet and outlet nozzles also lack technical merit. Specifically, Dr. Hopenfeld's observations that these calculations used a simplified model and that heat transfer conditions may vary with geometry do not reveal any deficiency in the calculations.[184] Dr. Hopenfeld does not explain why the conservative values used in these analyses do not account for the variability he assumes.[185] Nor is there any concern with potential flow-accelerated corrosion of components within the scope of the fatigue management program, because none of the reactor coolant pressure boundary components within the scope of the FMP are susceptible to FAC.[186] Entergy's witnesses also show that the effects

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180 Riverkeeper Answer at 4.

181 The Board's Ruling on Motions in Limine found Dr. Hopenfeld's critique of the design CUF calculations to be within scope, but this decision appears to rest on the assumption that the design CUF calculations somehow fed into the Westinghouse EAF analyses, as Riverkeeper incorrectly argued in its Answer. *See* Ruling on Motion in Limine at 16. Therefore, Entergy respectfully disagrees with the Board's finding on this issue.

182 *See Seabrook*, CLI-12-05, slip op. at 11 n.50 ("an admitted contention is defined by its bases").

183 *See supra note* 178.

184 *See* Entergy Test. at A143 (ENT000183).

185 *See id.*

186 *See id*. at A144.

of the stainless steel cladding were properly accounted for in the design basis CUF calculations, and in the application of the environmental correction factor to the CLB CUFs in the LRA.[187]

e. Non-Pressure Boundary Components

In Section V.D.5 of its prefiled testimony, Entergy's witnesses show that an EAF analysis is not required for components that are not part of the reactor coolant pressure boundary.

As to the effects of aging on steam generator tubes, they are managed under the Water Chemistry Control – Primary and Secondary Program and the Steam Generator Integrity Programs.[188] The adequacy of these programs is unchallenged in this contention.[189] Moreover, historic issues with failures of feedwater distribution components in steam generators are due to *erosion*—not fatigue, as Dr. Hopenfeld suggests—and have been addressed in response to generic industry communications.[190] Thus, to the extent Intervenors claim that non-pressure boundary components should have been analyzed in the Westinghouse EAF analyses, they are incorrect and outside the scope of this contention.

As to the effects of aging on reactor vessel internals—including fatigue and any other aging mechanisms—they are managed under a separate AMP, the Reactor Vessel Internals Program, which manages the effects of aging on reactor vessel internals using the guidance from EPRI Materials Reliability Program.[191] That AMP is the subject of a separate admitted contention (NYS-25), and the Intervenors' claims regarding the effects of aging on reactor vessel internals will be fully addressed in Entergy's testimony on that contention.

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187 *See id*. at A145.

188 *See id.* at A149 (citing LRA Tbls. 3.1.2-4-IP2 and 3.1.2-4-IP3 (ENT00015A); LRA, App. B at B-118, B-137 (ENT00015B)).

189 Another admitted contention—NYS-38/RK-TC-5—raises issues related to these two programs, but any such issues will be addressed in Entergy's testimony on that contention.

190 *See* Entergy Test. at A149 (ENT000183).

191 *See id*. at A147-48.

f. Combined Effects of Fatigue and Other Aging Mechanisms, Including Accident Loads

In Section V.D.6 of its prefiled testimony, Entergy's witnesses show that the EAF analyses (and other AMPs, the adequacy of which are not challenged in this contention) appropriately consider the combined effects of fatigue and other aging mechanisms, notwithstanding Intervenors' claims to the contrary. First, the interaction between corrosion and fatigue is fundamentally the focus of the environmentally-assisted fatigue analysis.[192] Second, none of the reactor coolant pressure boundary components exceed the threshold of 1.0×10^{17} neutrons/cm^2 for irradiation damage set forth in 10 C.F.R. Part 50, Appendix G, including the reactor vessel inlet and outlet nozzles.[193] Therefore, the Intervenors' concerns about the interaction of fatigue, corrosion, and neutron-irradiation embrittlement are appropriately accounted for in the EAF evaluations.

g. The Balance of Entergy's FMP is Robust and Provides Reasonable Assurance that the Effects of Fatigue Will be Adequately Managed

In Section V.D.6 of its prefiled testimony, Entergy's witnesses show that Intervenors' claims that Entergy's FMP lacks sufficient detail are based on faulty critiques of the EAF analyses and otherwise do not account for relevant information in the record. Entergy's witnesses show that the FMP is fully consistent with NUREG-1801, Revision 1 and meets the intent of NUREG-1801, Revision 2. This showing constitutes a finding of reasonable assurance under 10 C.F.R. §§ 54.21(a), 54.21(c)(1)(iii), and 54.29(a).[194] Any challenges to a program that is consistent with Staff guidance that has been implicitly endorsed by the Commission—such as

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192 *See id*. at A150.

193 *See id.*

194 *See Vt. Yankee*, CLI-10-17, 72 NRC at 36; *see also Seabrook*, CLI-12-05, slip op. at 16 n.78.

NUREG-1801—must be specifically and substantially supported in order to overcome the special weight accorded to such documents.[195]

Contrary to Intervenors' claims, Entergy has done considerably more than merely provide, in its LRA, "a bare assertion that it will comply with GALL."[196] Under its FMP, Entergy will track the numbers of actual plant transients and evaluate those numbers against the analyzed numbers of cycles.[197] The plant transient counts are required to be updated periodically to ensure that the CUF_{en} limit of 1.0 is not exceeded and to ensure that appropriate corrective actions are implemented, if necessary, prior to reaching the limit.[198] There also is no uncertainty about the timing or scope of repair and replacement activities under the FMP—the program requires that corrective action be implemented *before* the plant exceeds the analyzed number of transient cycles.[199] The Staff has reviewed and approved Entergy's FMP.[200]

For the reasons set forth in Entergy's testimony and in this Statement of Position, the Intervenors have not met their burden to demonstrate that Entergy's program is inconsistent with NUREG-1801, Revision 1 or Revision 2. Nor have they set forth any specific and substantial reason why compliance with NUREG-1801, Revision 1 or Revision 2, is insufficient to show compliance with the license renewal regulations.[201]

The Intervenors conclude their Statement of Position with the following set of demands:

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195 *See Seabrook*, CLI-12-05, slip op. at 16 n.78.

196 Intervenors' Statement at 33 (NYSR00343).

197 *See* Entergy Test. at A153 (ENT000183) (*citing* Letter from Fred R. Dacimo, Entergy, to NRC, "Reply to Request for Additional Information Regarding License Renewal Application – Time-Limited Aging Analyses and Boraflex" Attach. 1, at 4 (May 16, 2008) ("NL-08-084") (ENT000194); SER at 4-45 (NYS000160)).

198 *See id*. (citing NL-08-084, at 4 (ENT000194); SER at 3-79, 4-44 (NYS000160)).

199 *See* Entergy Test. at A153 (citing NL-08-084, encl. 1 at 4 (ENT000194); SER at 4-44, 4-45 (NYS000160)).

200 *See* SER at 4-44 to 4-45 (NYS000160).

201 *Vt. Yankee*, CLI-10-17, 72 NRC at 33 n.185.

> In light of the absence of comprehensive, accurate metal fatigue calculations to properly guide Entergy's aging management efforts, Entergy has failed to define specific criteria to assure that susceptible components are inspected, monitored, repaired, or replaced in a timely manner. Once components with high CUFen values have been properly identified, Entergy must describe a fatigue management plan for each such component that should, at a minimum, rank components with respect to their consequences of failure, establish criteria for repair versus defect monitoring, and establish criteria for the frequency of the inspection (considering, for example defect size changes and uncertainties in the stress analysis and instrumentation), and allow for independent and impartial reviews of scope and frequency of inspection. Entergy has failed to do this.[202]

This statement presupposes that the EAF evaluations are deficient (*i.e.*, an "absence of comprehensive and accurate metal fatigue calculations"), which Entergy's witnesses show is incorrect.[203] To the extent this statement includes a demand for a continuing oversight role for Intervenors after the issuance of the renewed license for IPEC, such a demand lacks foundation in law, regulation or legal precedent. On the contrary, the Atomic Energy Act vests that authority in the NRC.[204]

V. CONCLUSION

For the foregoing reasons, Entergy's FMP is consistent with NUREG-1801, Revision 1, and meets the intent of the guidance in NUREG-1801, Revision 2. Therefore, Entergy's LRA provides reasonable assurance that the effects of aging due to metal fatigue will be adequately managed throughout the PEO. The Intervenors have not carried their burden of providing

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202 Intervenors' Statement at 30-31.

203 *See supra* Sections IV.B.2.a-c & f.

204 *See Oyster Creek*, CLI-09-07, 69 NRC at 282 ("the NRC's oversight does not end once the license is renewed — we continue to exercise oversight during operation as required under our regulations and the AEA, just as we have since the plant was originally licensed"); *id*. at 284 ("review and enforcement of license conditions is a normal part of the Staff's oversight function rather than an adjudicatory matter"), *aff'd N.J. Envt'l Fed. v. NRC*, 645 F.3d 220 (3d Cir. 2011).

sufficient evidence to support the claims made in NYS-26B/RK-TC-1B. Accordingly, NYS-26B/RK-TC-1B should be resolved in Entergy's favor.

Respectfully submitted,

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