ENT000678
Submitted: August 10, 2015

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)	)	
	)	August 10, 2015

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

[redacted]

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TABLE OF CONTENTS

Page

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Pursuant to 10 C.F.R. § 2.1207(a)(1) and the Atomic Safety and Licensing Board's ("Board") Revised Scheduling Order,[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 "Revised Testimony of Entergy Witnesses Nelson F. Azevedo, Alan B. Cox, Jack R. Strosnider, Jr., Randy G. Lott, Mark A. Gray, and Barry M. Gordon Regarding Contention NYS-26B/RK-TC-1B (Metal Fatigue)" ("Entergy's Testimony") (ENT000679), and the exhibits thereto (ENTR15001, ENT00015A-B, ENTR00031, ENT000032, ENTR00184 through ENT000231, ENT000369, ENT000618, ENT000627, ENT000631, ENT000636, ENT000646, ENT000659, ENT000665, ENT000669, and ENT000680 through ENT000697). For the reasons discussed below, NYS-26B/RK-TC-1B lacks merit and should be resolved in Entergy's favor.

[1] Licensing Board Revised Scheduling Order at 2 (Dec. 9, 2014) (unpublished) ("Revised Scheduling Order").

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, Jr. 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. Although the Intervenors make a host of claims about the Westinghouse EAF evaluations and their purported inadequacies, Entergy's witnesses refute their claims point-by-point, and show that none of them have merit.

As a threshold matter, it is important to recognize that Intervenors' claims and testimony in NYS-26B/RK-TC-1B date back to 2011 or earlier and, as a result, are cumulative, overlapping, and redundant when considered along with their many filings on other contentions in this proceeding. Such an approach is not only undisciplined, but also contrary to the Commission's intent in requiring intervenors to bring forward well-defined and adequately-supported contentions so that other parties to the proceeding are given full and fair notice of the intervenors' actual claims.[2] In response to Intervenors' "kitchen sink" approach to NYS-26B/RK-TC-1B, Entergy's Testimony addresses the various claims set forth in the ten separate documents that constitute Dr.

[2] *Pub. Serv. Co. of N.H.* (Seabrook Station, Units 1 & 2), ALAB-899, 28 NRC 93, 97 (1988), *aff'd sub nom. Massachusetts v. NRC*, 924 F.2d 311 (D.C. Cir. 1991), *cert. denied*, 502 U.S. 899 (1991).

[redacted]

Hopenfeld's and Dr. Lahey's testimony on this contention, as submitted by Intervenors in December 2011,[3] June 2012[4], and June 2015[5] (collectively "Intervenors' Testimony"). Where there is an irreconcilable inconsistency, we focus on the most recent filings.

The Intervenors' Revised Statement of Position claims that the IPEC LRA is deficient for three basic reasons:

> (1) The methodology [relied upon by Entergy] to determine whether CUF_{en} 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; [and]
>
> (3) The range of components for which the CUF_{en} calculations are proposed to be conducted is too narrow.[6]

These claims lack merit. Entergy fully demonstrates in response that the EAF analyses Westinghouse performed for IPEC license renewal used well-established, standard ASME Code

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[3] Pre-Filed Written Testimony of Richard T. Lahey, Jr. Regarding Consolidated Contention NYS-26B/RK-TC-1B (Dec. 22, 2011) (revised Oct. 1, 2012) ("Lahey Testimony") (NYSR10344); 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 Contentions NYS-25 and NYS-26B/RK-TC-1B (Dec. 21, 2011) ("Supplemental Lahey Report") (NYS000297); Pre-Filed Written Testimony of Dr. Joram Hopenfeld Regarding NYS-26B/RK-TC-1B – Metal Fatigue (Dec. 20, 2011) ("Hopenfeld Testimony") (RIV000034); Report of Dr. Joram Hopenfeld in Support of Contention NYS-26B/RK-TC-1B – Metal Fatigue (Dec. 19, 2011) ("Hopenfeld Report") (RIV000035).

[4] Pre-Filed Written Reply Testimony of Richard T. Lahey, Jr. Regarding Consolidated Contention NYS-26B/RK-TC-1B (June 29, 2012) ("Lahey Rebuttal Testimony") (NYS000440); Prefiled Rebuttal Testimony of Dr. Joram Hopenfeld Regarding Contention NYS-26B/RK-TC-1B – Metal Fatigue (June 28, 2012) ("Hopenfeld Rebuttal Testimony") (RIV000114);.

[5] Revised Pre-Filed Written Testimony of Dr. Richard T. Lahey, Jr. Regarding Consolidated Contention NYS-26B/RK-TC-1B (June 9, 2015) ("Revised Lahey Testimony").(NYS000530); Supplemental Prefiled Written Testimony of Dr. Joram Hopenfeld Regarding Contention NYS-26B/RK-TC-1B (June 9, 2015) ("Supplemental Hopenfeld Testimony") (RIV000142); Supplemental Report of Dr. Joram Hopenfeld in Support of Contention NYS-26[B]/RK-TC-1B and Amended Contention NYS-38/RK-TC-5 (June 9, 2015) ("Supplemental Hopenfeld Report") (RIV000144).

[6] State of New York and Riverkeeper, Inc., Revised Statement of Position, Consolidated Contention NYS-26B/RK-TC-1B at 17 (June 9, 2015) ("Intervenors' Revised SOP") (NYS000529); *see also* State of New York and Riverkeeper, Inc., Initial Statement of Position, Consolidated Contention NYS-26B/RK-TC-1B at 2-3 (Dec. 22, 2011) ("Intervenors' Initial SOP") (NYSR00343).

[redacted]

methods, calculated fatigue usage with considerable margin and conservatism, and covered all primary plant components at IPEC with current licensing basis ("CLB") cumulative usage factor ("CUF") fatigue analyses.

There are several fatal flaws in NYS-26B/RK-TC-1B, and Intervenors' experts' attempts to breathe life into this stale contention are futile and, ultimately, in vain. From the outset, the Intervenors' criticisms of the EAF analyses and the IPEC FMP ignore the margin and conservatisms inherent in the ASME Code fatigue analysis methodology, thereby severely undercutting the merits of their claims. Next, and quite notably, neither Dr. Hopenfeld nor Dr. Lahey is a specialist in fatigue analysis—as this lack of familiarity evidences itself in their clear and apparent misunderstanding of standard fatigue analysis principles. The end result of these deficiencies is Intervenors' failure to meet their burden of moving forward with sufficient evidence to show a deficiency in Entergy's EAF evaluations or its FMP.[7] By fully refuting their claims in its Testimony, Entergy has met its burden of showing, by a preponderance of the evidence,[8] that NYS-26B/RK-TC-1B lacks merit and should be resolved in its favor. Now we turn to the details that drive and demand this result.

As to the first issue—the Intervenors' challenges to the WESTEMS™ software used in Westinghouse's EAF analyses—Entergy's witnesses fully 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

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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).

8 *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.

[redacted]

EAF analyses.[9] While demanding *more precise* CUF_{en} calculations, Intervenors curiously do not account for the significant conservatisms and margin already included and inherent in the analyses.[10] In fact, Drs. Lahey and Hopenfeld fail to recognize that the objective of an EAF analysis is binary—to determine *whether or not* the CUF_{en} will exceed 1.0 at any point during the period of extended operation ("PEO")—not to calculate a precise CUF_{en} value.[11] Ultimately, the Intervenors do not identify any deficiency in the Westinghouse fatigue analysis, so they clearly have not met their burden of going forward on Contention NYS-26B/RK-TC-1B.[12]

Turning next to Intervenors' second issue—the allegedly deficient or non-conservative fatigue analysis input values—Entergy's experts explain the invalidity of the claims, as Intervenors' experts do not 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.[13] Moreover, Dr. Lahey and Dr. Hopenfeld simply ignore and do not address directly-relevant and readily-available information contained in the LRA, the refined EAF analyses, and the substantial supporting documentation that Entergy disclosed to the Intervenors in this proceeding pertaining to these issues.[14] They have, therefore, once again failed to meet their burden of going forward.

Intervenors' third claim—that the range of components for which the CUF_{en} calculations are proposed to be conducted is too narrow—is unchanged since 2011.[15] Given the many

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9 *See* Entergy's Testimony § IV.A.1.(ENT000679)

10 *See id*. § IV.A.2.

11 *See id.* § IV.B.2.

12 *See Oyster Creek*, CLI-09-7, 69 NRC at 269.

13 *See* Entergy's Testimony § V.D. (ENT000679).

14 *See id.*

15 *Compare* Intervenor's Revised SOP at17 (NYS000529) *with* Intervenor's Initial SOP at 3 (NYSR00343).

[redacted]

intervening CUF_{en} analyses completed since 2012, this third claim is now clearly moot. Under Commitment 33, made in the original LRA consistent with then-current NRC Staff guidance, Entergy prepared refined EAF analyses for the IPEC components specified in NUREG/CR-6260[16]. Entergy completed those evaluations in 2010.[17] Since then, to meet the intent of updated guidance in NUREG-1801, Revision 2,[18] Entergy has made additional commitments. Specifically, in Commitment 43, Entergy committed to review its design basis fatigue evaluations to determine whether the previously-analyzed NUREG/CR-6260 locations are limiting for the IP2 and IP3 configurations.[19] In Commitment 49, Entergy clarified that the limiting locations review would include RVI components.[20] Entergy completed this review for IP2 in 2013 and for IP3 in 2015. It included reactor coolant pressure boundary locations and reactor vessel internals ("RVI") components.[21] And contrary to Intervenors' claims, there is no technical basis to require an additional correction factor to the fatigue analysis for RVIs to account for the effects of irradiation embrittlement on fatigue life.[22] Instead, the RVI AMP manages the combined effects of fatigue, irradiation embrittlement, and other aging mechanisms that may affect RVIs.[23]

Thus, the limiting locations review for IP2 and IP3 was a comprehensive, new evaluation of all non-NUREG/CR-6260 components with CLB CUF evaluations, including RVIs, and, consistent with NRC Staff guidance, it confirmed that CUF_{en} values for all limiting locations at

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16 NUREG/CR-6260, Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components (Feb. 1995) ("NUREG/CR-6260") (NYS000355).

17 *See* Entergy's Testimony § V.C (ENT000679).

18 The NRC Staff issued NUREG-1801, Revision 2 three years after the IPEC LRA was submitted.

19 *See* Entergy's Testimony § V.E (ENT000679).

20 *See id.*

21 *See id.* § V.E.2.

22 *See id*. at A76.

23 *See id*.

[redacted]

IPEC are not projected to exceed 1.0 during the PEO.[24] Intervenors have again ignored this development—opting instead to remain focused on the past. This decision renders their third claim moot in the present.

Despite the fact that Entergy has reviewed all primary plant components at IPEC with CLB CUF time-limited aging analyses ("TLAAs") for EAF, Intervenors' continue to argue that "the range of components for which the CUF_{en} calculations are proposed to be conducted is too narrow."[25] To the extent that Intervenors and their witnesses demand EAF evaluations of additional primary plant components, their claims are an impermissible challenge to the CLB for IP2 and IP3.[26] And to the extent that Dr. Hopenfeld and Dr. Lahey seek EAF evaluations of secondary plant components,[27] they entirely miss the point of CUF_{en}s, which is to evaluate certain components that are exposed to the reactor water environment.[28] NRC Staff guidance does not require such additional evaluations, and Intervenors have certainly identified no unusual circumstance necessary to overcome the special weight accorded to that guidance.[29]

In addition, Entergy has committed in the FMP 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

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24 *See id.* §§ V.D and V.E).

25 Intervenors' Revised SOP at 17 (NYS000529).

26 *See Fla. Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3,8-10; (2001); *see also Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3), CLI-15-6, 81 NRC __, slip op. at 8 (Mar. 9, 2015); 10 C.F.R. § 54.21(a)(1).

27 *See* Hopenfeld Report at 3 (RIV000035).]

28 *See* Entergy's Testimony § V.F (ENT000679).

29 *NextEra Energy Seabrook LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC 301, 314 n.78; *Indian Point*, CLI-15-6, 81 NRC __, slip op. at 21-22.

[redacted]

future changes in plant operations.[30] By committing to repair or replace the affected locations *before* their CUF_{en} values exceed 1.0, consistent with NUREG-1801, Revision 1, "Generic Aging Lessons Learned Report," Revision 1 (Sept. 2005) ("NUREG-1801, Revision 1") (NYS00146A-C), and 10 C.F.R. § 54.21(a)(3) and (c)(1)(iii), Entergy has fully demonstrated that it will adequately manage the effects of aging due to fatigue at the affected locations.

In summary, the Intervenors have not met their burden of moving forward with sufficient evidence to show a deficiency in Entergy's FMP,[31] and Entergy's testimony fully refutes the Intervenors' claims in NYS 26B/RK-TC-1B. 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 AMP for fatigue in NUREG-1801, Revision 1, notwithstanding Intervenors' claims to the contrary. It also meets the intent of NUREG-1801, Revision 2. The Intervenors also present no valid critique of the Westinghouse EAF evaluations. Accordingly, consistent with the CLB *and* considering environmental effects, the CUFs for components comprising the reactor coolant pressure boundary will not exceed the limit of 1.0, throughout the ("PEO"). Contrary to the Intervenors' contention, there is reasonable assurance that the aging effects of metal fatigue on the reactor coolant system ("RCS") will be managed during the PEO, consistent with 10 C.F.R. §§ 54.21(a)(3), 54.21(c)(1)(iii) and 54.29(a).

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

As noted above, the claims in NYS-26B/RK-TC-1B are cumulative, dated, and overlapping with other contentions. Specifically, they substantially overlap with claims set forth in contentions NYS-25 (the "embrittlement" contention) and NYS-38/RK-TC-5 (the "safety

[30] *See* Entergy's Testimony § V.D.2 (ENT000679).

[31] *See Oyster Creek*, CLI-09-7, 69 NRC at 269.

[redacted]

commitments" contention).[32] Indeed, Dr. Lahey's testimony regarding RVIs across the three contentions is substantively identical,[33] and Dr. Hopenfeld's report on this contention and NYS-38/RK-TC-5 is the same document.[34] Despite the significant developments and new information that has emerged over the past three years or more, the Intervenors have not updated the contention and replaced their earlier SOP, testimony, or reports with substantively new materials, despite the fact that several prior positions and claims have been superseded by more recent developments and, accordingly, the contention must be rejected on the merits.[35]

A. Original Contention

In April 2007, Entergy filed its application to renew the operating licenses for IP2 and IP3 for 20 years beyond their initial 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,[36] the State and Riverkeeper each filed separate petitions to intervene, each proposing several contentions.[37]

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32 In objecting to the proposed amendments to NYS-25 and NYS-38/RK-TC-5 earlier this year, Entergy noted there was "no discernible distinction" between the two amended contentions, and asked the Board to separate the various claims in the interest of adjudicatory economy. Entergy's Consolidated Answer Opposing Intervenors' Motions. to Amend Contentions NYS-25 and NYS-38/RK-TC-5, at 13 (Mar. 10, 2015), *available at* ADAMS Accession No. ML15069A677. The Board "acknowledged that there is significant overlap," but found the State's actions "permissible." Memorandum and Order (Granting Motions. for Leave to File Amendments. to Contentions NYS-25 and NYS-38/RK-TC-5), at 14 (Mar. 31, 2015) ("Second Order Amending NYS-25"), *available at* ADAMS Accession No. ML15090A771.

33 *Compare* Lahey Testimony (NYSR10344) *with* Revised Lahey Testimony (NYS000530) *and* Revised Pre-filed Written Testimony of Dr. Richard T. Lahey, Jr. Regarding Joint Contention NYS-38/RK-TC-5, (June 9, 2015) (NYS000562), *available at* ADAMS Accession No. ML 15161A311.

34 *See* Supplemental Hopenfeld Report (RIV000144).

35 *See* Entergy's Testimony at § II (ENT000679).

36 Entergy Nuclear Operations, Inc., Indian Point Nuclear Generating Unit Nos. 2 and 3; 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).

37 *See Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 & 3), LBP-08-13, 68 NRC 43, 68-161, 166-191 (2008).

[redacted]

In their petitions to intervene, NYS and Riverkeeper proffered contentions NYS-26 and TC-1, respectively.[38] Both contentions claimed that because LRA Tables 4.3-13[39] and 4.3-14[40] 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).[41] Entergy opposed the admission of NYS-26 and TC-1 in their entirety.[42] The NRC Staff opposed the admission of both contentions in part.[43]

Entergy subsequently amended the LRA ("LRA Amendment 2") 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).[44] Consistent with that regulation and with NUREG-1801, Revision 1, Commitment 33 specified that at least two years prior to entering the PEO, Entergy would take one or more of the following actions: (1) refine the fatigue analyses, at least two years before entering the PEO, to determine valid CUF_{en}

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38 *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").

39 LRA at 4.3-24 ("IP2 Cumulative Usage Factors for NUREG/CR-6260 Limiting Locations") (ENT00015B).

40 *Id*. at 4.3-25 ("IP3 Cumulative Usage Factors for NUREG/CR-6260 Limiting Locations").

41 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.

42 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).

43 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.).

44 *See* NL-08-021, Letter from Fred R. Dacimo, Entergy, to NRC, "License Renewal Application Amendment 2" Attach. 1, at 1 (Jan. 22, 2008) ("NL-08-021") (NYS000351).

values below the limit; (2) manage the effects of aging due to fatigue at the affected locations by an inspection program that has been reviewed and approved by the NRC; or (3) repair or replace the affected locations before exceeding CUF of 1.0.[45] 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 Commitment 33, thereby rendering those contentions moot and inadmissible.[46]

Thereafter, on March 5, 2008, and April 7, 2008, Riverkeeper and NYS filed amended contentions TC-1A and NYS-26A, respectively, arguing that LRA Amendment 2 did not cure the deficiencies previously alleged by those parties.[47] 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.[48] NYS further asserted that "the most prudent way to manage aging for extended operation is to replace those affected components *now*."[49] 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.[50]

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45 *See id*. at 1-2.

46 *See* Letter from D. Roth & K. Sexton, Counsel for NRC Staff, to Licensing Board at 2 (Mar. 4, 2008), *available at* ADAMS Accession No. ML080670286. The Board took no direct action in response to this letter.

47 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").

48 NYS-26A Request at 5.

49 *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 301, 314-15 (2012).

50 *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

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The Board admitted and consolidated 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."[51] 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, 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.[52]

In this regard, the Board found that Entergy must include CUF$_{en}$ calculations as part of its LRA to comply with the 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).[53]

In view of the Board's admission of the Consolidated Contention and finding that Entergy must include its CUF$_{en}$ calculations in the LRA,[54] 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 June 2010, and approved by Entergy on July 29, 2010.[55] The refined fatigue analyses showed that the CUF$_{en}$ for components listed in LRA Tables 4.3-13 and 4.3-14

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).

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

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

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

54 *See id*. at 137.

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

[redacted]

would not exceed 1.0 through the end of the PEO.[56] On August 9, 2010, Entergy notified the NRC Staff of the results of the refined EAF analyses; *i.e.*, the refined CUF_{en} values.[57]

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.[58] In its Motion for Summary Disposition, Entergy argued that, in view of the Commission's decision in *Vermont Yankee* in which the Commission held that EAF evaluations are not required as a condition precedent to the renewal of an operating license.[59] Entergy's 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.[60] The NRC Staff supported Entergy's Motion for Summary Disposition,[61] while Riverkeeper and the State opposed it arguing that its "contention covers the full gamut of the AMP for metal fatigue of key reactor components and is neither limited to TLAA

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56 *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.

57 *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).

58 *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.

59 *Entergy Nuclear Vt. Yankee, LLC & Entergy Nuclear Operations, Inc.* (Vt. Yankee Nuclear Power Station), CLI-10-17, 72 NRC 1, 33-41, (2010). The Commission held that "[n]one of our regulations requires that a license renewal applicant calculate CUF_{en} — *that is, adjust the CUF by applying the environmental adjustment factor* — prior to the issuance of a renewed license." *Id.* at 39 (emphasis in original). *See also id.* at 41 ("We see nothing in our regulations to suggest that 'baseline' CUF_{en} calculations are *prerequisites* to establish the 'parameters' of the AMP.") (emphasis in original)..

60 *See generally* Motion for Summary Disposition.

61 *See* NRC Staff's Answer to Applicant's Motion for Summary Disposition of New York Contention 26/26A and Riverkeeper Contention TC-1/TC-1A – Metal Fatigue (Sept. 14, 2010), *available at* ADAMS Accession No. ML102571919.

[redacted]

calculations or CUF_{en} calculations [which] challenges, on the merits, the adequacy of what Entergy has proposed to do to meet its obligations under 10 C.F.R. § 54.21(c)(1)(iii).[62]

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

Shortly thereafter, Intervenors submitted another amended contention, designated NYS-26B/RK-TC-1B.[63] The contention claimed that Entergy's LRA 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).[64] Specifically, Intervenors 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.[65] Entergy and the Staff opposed the admission of NYS-26B/RK-TC-1B on the grounds that it raised issues beyond the scope of this proceeding, lacked adequate factual and legal support, failed to raise a genuine dispute on a material issue of law or fact, and belatedly

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62 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 [sic] (Metal Fatigue), at 2 (Sept. 14, 2010), *available at* ADAMS Accession No. ML103010518.

63 *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.

64 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).

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

[redacted]

asserted that Entergy must consider reactor pressure vessel "in-core" structures and certain accident loads as part of its fatigue analyses.[66]

On November 4, 2010, the Board denied the Motion for Summary Disposition as moot, and admitted NYS-26B/RK-TC-1B.[67] 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)."[68] The Board also held that NYS-26B/RK-TC-1B superseded the previous contentions (NYS-26/26A/RK-TC-1/1A), and therefore dismissed those earlier contentions.[69]

The Board identified the following bases for NYS-26B/RK-TC-1B, which focused on challenges to the Westinghouse EAF analyses.[70] According to the Board, 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,"[71] and alleged inadequate corrective actions,[72] but these challenges are premised on the validity of Intervenors' critiques of the EAF analyses. Taking into account all of Intervenors' assertions, the fundamental

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66 *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.

67 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").

68 *Id*. at 22-23.

69 *See id*. at 2, 29.

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

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

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

[redacted]

factual issue in dispute is whether the EAF analyses are adequate to demonstrate that the CUF_{en} values for the analyzed components do not exceed 1.0.

D. Intervenors' 2011 Direct Testimony and Entergy's Motion in Limine on Direct

Intervenors submitted their Testimony, Statement, and supporting exhibits on December 22, 2011.[73] 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.[74] The NRC Staff supported Entergy's Motion in Limine,[75] and Riverkeeper opposed it.[76] 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,[77] and that Riverkeeper does not challenge any of the design basis CUF calculations.[78]

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73 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.

74 *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") (not publicly available on ADAMS).

75 *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).

76 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) ("Riverkeeper Answer") (not publicly available on ADAMS).

77 *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").

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

[redacted]

E. Entergy's 2012 Testimony

On March 29, 2012, in accordance with a Board Order issued on February 16, 2012, [79] Entergy filed its Statement of Position, prefiled testimony, and supporting exhibits with respect to NYS-26B/RK-TC-1B.[80] The NRC Staff made its corresponding evidentiary submissions on that on March 30 and 31, 2012.[81]

F. Intervenors' 2012 Rebuttal Testimony and Entergy's Motion in Limine on Rebuttal

In response to Entergy's and the NRC Staff's March 2012 evidentiary submissions, New York and Riverkeeper filed a Revised Statement of Position, prefiled rebuttal testimony from Dr. Lahey and Dr. Hopenfeld, and additional exhibits on June 29, 2012.[82] On July 30, 2012, in accordance with the Board's Order dated May 16, 2012,[83] Entergy filed a motion in limine seeking to strike portions of Intervenors Revised Position Statement, and to exclude portions of the Hopenfeld Rebuttal Testimony and several other supporting Intervenor exhibits (RIV000103, RIV000104, RIV000105, and RIV000106).[84] Entergy argued, in principal part, that Intervenors'

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

80 *See* Entergy's Statement of Position Regarding Contention NYS-26B/RK-TC-1B (Metal Fatigue) (Mar. 29, 2012) (ENT000182); Testimony of Entergy Witnesses Nelson F. Azevedo, Alan B. Cox, Jack R. Strosnider, Robert E. Nickell, and Mark A. Gray Regarding Contention NYS-26B/RK-TC-1B (Metal Fatigue) (Mar. 29, 2012) (ENT000183); Entergy Exhibits ENT00015A-B, ENT000031, ENT000032, ENT000184 to ENT000231, and ENT000369.

81 *See* NRC Staff's Statement of Position Regarding NYS-26B/RK-TC-1B (Mar. 31, 2012) (NRC000101); NRC Staff Testimony of Allen Hiser, Ching Ng, and On Yee Concerning NYS-26B/Riverkeeper TC-1B (Metal Fatigue of Reactor Components) (Mar. 31, 2012) (NRC000102); NRC Exhibits NRC000103 to NRC000119, NRC000123 to NRC000124.

82 *See* State of New York and Riverkeeper Inc.'s Revised Statement of Position Regarding Consolidated Contention NYS-26B/RK-TC-1B (July [sic] 29, 2012) (NYS000439); Lahey Rebuttal Testimony (NYS000440); Hopenfeld Rebuttal Testimony (RIV000114); Riverkeeper Exhibits RIV000103 to RIV000106, RIV000115 to RIV000119, and RIV000135 to RIV000141.

83 Licensing Board Order (Granting Unopposed Extension of Time) (May 16, 2012) (unpublished).

84 *See* Entergy's Motion to Strike Portions of Intervenor's Revised Statement of Position and Motion in Limine to Exclude Portions of the Pre-Filed Rebuttal Testimony and Exhibits for Contention NYS-26B/RK-TC-1B (Metal Fatigue) (July 30, 2012) (not publicly available on ADAMS).

[redacted]

arguments challenging the enforceability of Entergy's commitments were not reasonably inferred from the bases of the admitted contention, and that Intervenors' continued challenges to IPEC design basis fatigue calculations were outside of the scope of the contention and the proceeding.[85]

The Board denied Entergy's motion in limine from the bench, with no further explanation.[86]

G. Deferral of the Evidentiary Hearings on NYS-26B/RK-TC-1B

In early 2012, NRC Staff notified the Board and the parties that it could not then prepare a response on a related contention concerning embrittlement (NYS-25) due to pending Staff reviews of related issues, and that it also intended to issue SSER 2, which would issues related to embrittlement and metal fatigue.[87] The Board ultimately moved NYS-26B/RK-TC-1B to the Track 2 deferred hearing.[88]

H. Intervenors' 2015 Revised Evidentiary Submissions

On November 6, 2014, the Staff issued Supplement 2 to its Safety Evaluation Report ("SER") related to IPEC license renewal.[89] The Board provided Intervenors with an opportunity to file new contentions or amend their existing Track 2 safety contentions following the publication of SSER 2.[90] On February 13, 2015, Intervenors sought to supplement the bases for

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85 *See id*.

86 *See* Hearing Transcript, *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3) at 1266 (Oct. 15, 2012).

87 Letter from S. Turk, Counsel for NRC Staff, to Administrative Judges, at 1-2 (Jan. 27, 2012), *available at* ADAMS Accession No. ML12027A115.

88 Licensing Board Order (Evidentiary Hearing Administrative Matters) (Sept. 14, 2012) (unpublished).

89 NUREG-1930, Supp. 2, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Plant, Units. 2 and 3 (Nov. 2014) ("SSER 2"), *available at* ADAMS Accession No. ML15188A383.

90 *See* Revised Scheduling Order at 2.

[redacted]

NYS-25 and NYS-38/RK-TC-5.[91] Intervenors did not seek to amend NYS-26B/RK-TC-1B.

In accordance with the Board's Revised Scheduling Order of December 9, 2014,[92] as modified on May 27, 2015,[93] New York and Riverkeeper filed revised statements of position, written testimony with affidavits, and exhibits on June 9, 2015.

III. APPLICABLE LEGAL AND REGULATORY STANDARDS

As demonstrated below, Entergy's FMP and EAF evaluations fully meet the applicable requirements in 10 C.F.R. Part 54. In addition to lacking technical merit, Intervenors' arguments in NYS-26B/RK-TC-1B are legally deficient, insofar as they stray beyond the limited scope of the license renewal rule, and seek actions beyond those required to fully satisfy the NRC's reasonable assurance standard in Part 54. Intervenors' arguments also fail to: (1) overcome the special weight accorded to NRC Staff guidance documents, (2) carry the Intervenors' burden of going forward on their contention, and (3) recognize that the use of commitments is an established part of the license renewal process.

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

1. The License Renewal Review Is a Limited One

Under 10 C.F.R. Part 54, the NRC Staff's license renewal review is limited in scope; *i.e.*, it focuses on actions taken or proposed by the applicant to manage the effects of aging on passive, long-lived components during the PEO—not on the adequacy of a plant's CLB.[94] The

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91 State of New York's Motion for Leave to Supplement Previously-Admitted Contention NYS-25 (Feb. 13, 2015) ("Second Motion to Amend"), *available at* ADAMS Accession No. ML15044A498; State of New York and Riverkeeper's Joint Motion for Leave to Supplement Previously-Admitted Joint Contention NYS-38/RK-TC-5 (Feb. 13, 2015), *available at* ADAMS Accession No. ML15044A500.

92 Revised Scheduling Order, at 2.

93 Order (Granting New York's Motion for an Eight-Day Extension of the Filing Deadline) (May 27, 2015).

94 *See Turkey Point*, CLI-01-17, 54 NRC at 7-9; *see also Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3), CLI-15-6, 81 NRC __, slip op. at 8-9 (Mar. 9, 2015); 10 C.F.R. § 54.21(a)(1).

[redacted]

Commission's license renewal regulations reflect this long-standing, deliberate distinction between 10 C.F.R. Part 54 aging management issues on the one hand, and ongoing 10 C.F.R. Part 50 regulatory process (*e.g.*, the adequacy of the plant's design basis) on the other.[95] This limited review is premised on the notion that, with the exception of aging management issues, ongoing NRC regulatory processes are adequate to ensure that the CLB of an operating plant provides and maintains an acceptable level of safety.[96] Thus, any challenges to the adequacy of the IP2 and IP3 CLBs or the Staff's regulatory oversight processes must be rejected on legal grounds.[97]

Although Intervenors' arguments are often vague, their evidentiary submissions raise certain issues that are clearly outside the limited scope of this license renewal proceeding. For example, the alleged need to consider "shock loads" in fatigue analyses, as cited by Dr. Lahey in his testimony on all three pending Track 2 contentions, involves concerns about "postulated" accidents or events that are beyond the IP2 and IP3 design bases.[98] This is only one example of Intervenors' impermissible, out-of-scope arguments.

Additionally, to the extent that Intervenors claim that EAF analyses of primary plant components beyond those with existing CLB cumulative usage factor evaluations are necessary, such claims, in effect, challenge the CLBs for IP2 and IP3, as the review of TLAAs for license renewal is limited to consideration of components with *existing* TLAAs.[99] That is, certain in-scope plant components are subject to time-limited calculations or analyses that are part of the

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95 *See Turkey Point*, CLI-01-17, 54 NRC at 7; *see also id*. at 9 ("The current licensing basis . . . includes the plant-specific design basis information documented in the plant's most recent Final Safety Analysis Report and any orders, exemptions, and licensee commitments that are part of the docket for the plant's license . . . .").

96 *See* Final Rule, Nuclear Power Plant License Renewal, 56 Fed. Reg. 64,943, 64,946 (Dec. 13, 1991).

97 *See Indian Point*, CLI-15-6, 81 NRC __, slip op. at 8; 10 C.F.R. § 54.21(a)(1).

98 *See*, *e.g.*, Intervenors' Revised SOP at 26, 28 (NYS000529).

99 *See Vt. Yankee*, CLI-10-17, 72 NRC at 39 ("TLAAs are *existing* analyses that are part of the plant's [current licensing basis] . . . They are not new analyses . . . .") (emphasis in original).

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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 PEO; (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.[100] Therefore, as relevant to NYS-26/RK-TC-1, the EAF evaluations prepared by Westinghouse for IPEC appropriately address all those components with existing CLB cumulative usage factor TLAAs.

In a similar vein, the EAF evaluations are part of the FMP, the program that Entergy is using to resolve the cumulative usage factor TLAAs under 10 C.F.R. § 54.21(c)(iii). Contrary to Intervenors' belief, the CUF analysis is a fatigue analysis, not a general analysis of all aging effects. Therefore, to the extent that Intervenors argue that irradiation embrittlement or other degradation mechanisms (which they claim act "synergistically" with metal fatigue) must be considered in EAF evaluations, their claims are challenges to the CLB and the license renewal rule, as implemented through NRC-approved AMPs—like the FMP—in NUREG-1801. In short, Intervenors are not permitted to expand the scope of Entergy's EAF evaluations to include any components and any aging mechanisms and effects that Intervenors deem relevant.[101]

2. The Reasonable Assurance Standard

Pursuant to 10 C.F.R. § 54.29(a), the NRC will issue a renewed license if it finds that the applicant has identified actions that have been taken or will be taken such that there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in

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100 *See* 10 C.F.R. § 54.21(c)(1).

101 *See* Testimony of Entergy Witnesses Nelson F. Azevedo, Robert J. Dolansky, Alan B. Cox, Jack R. Strosnider, Timothy J. Griesbach, Randy G. Lott, and Mark A. Gray Regarding Contention NYS-25 (Embrittlement) § V.B (Aug. 10, 2015) ("Entergy's NYS-25 Testimony") (ENT000619). In the case of RVI internals, Entergy relies on the RVI AMP to manage the effects of aging on RVI components caused by all pertinent aging mechanisms, including the effects of fatigue, embrittlement, and stress corrosion cracking. *See id.*

[redacted]

accordance with the CLB.[102] Longstanding precedent makes clear that the reasonable assurance standard does not require an applicant to meet an "absolute" or "beyond a reasonable doubt" standard.[103] Rather, the Commission takes a case-by-case approach, applying sound technical judgment and verifying the applicant's compliance with Commission regulations.[104] Those regulations are "not intended to demonstrate absolute assurance that structures and components will not fail, but rather that there is reasonable assurance" that they will continue to perform their intended functions consistent with the CLB during the PEO.[105]

Intervenors seem to advocate a new, more stringent legal standard than the reasonable assurance standard codified in 10 C.F.R. Part 54. For example, Dr. Lahey claims that Entergy is obligated to maintain its present day "licensing basis safety margins" throughout the proposed 20-year PEO.[106] He also objects to the acceptability of CUF_{en} values that are "just below unity."[107] Dr. Hopenfeld similarly asserts that certain components with CUF_{en} values near 1.0 "can be expected to fail under design basis accidents."[108]

For component design purposes, ASME Code Section III requires that the CUF not exceed unity or 1.0; *i.e.*, the total number of assumed cycles for design is not to exceed the allowable

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102 10 C.F.R. § 54.29(a).

103 *Oyster Creek*, CLI-09-7, 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").

104 *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).

105 NUREG-1800, Rev. 1, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Appx. A, at A.1-1 (Sept. 2005) ("SRP-LR, Rev. 1") (NYS000195); NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Rev. 2, Appx. A at A.1-1(Dec. 2010) ("SRP-LR, Rev. 2") (NYS000161).

106 Lahey Rebuttal Testimony at 11 (NYS000440).

107 Revised Lahey Testimony at 66 (NYS000530).

108 Supplemental Hopenfeld Report at 2 (RIV00144).

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number of stress cycles, consistent with the fatigue design criteria. A CUF of less than one provides reasonable assurance that the component will not fail by fatigue cracking during its operation. Under 10 C.F.R. § 50.55a, the NRC has established that maintaining a CUF less than the ASME Code design limit of 1.0, in accordance with ASME Code design rules, provides reasonable assurance of public health and safety.[109] Thus, the notion that, in order to preserve design basis margin, the CUF_{en} cannot be "just below unity" when projected to the end of the PEO is tantamount to changing the established design limit in the CLB to a lower value.[110] This is neither part of the license renewal process nor necessary to the NRC's reasonable assurance determination under 10 C.F.R. Part 54.

Moreover, the design CUF value is not indicative of the current condition of any component, or of any potential for fatigue cracking at the present time. Instead, it represents a calculation of the condition at the end of life, assuming that every postulated transient included in the EAF analysis has taken place. A CUF value greater than 1.0 indicates that, after all of the postulated transients have taken place, there is a potential for cracking at the affected location. However, exceeding the criterion does not necessarily mean—as Intervenors suggest—that the component will exhibit fatigue cracking, given the well-known, proven margins and conservatisms in the analytical process—which Intervenors' witnesses fail to acknowledge. Thus, Intervenors' arguments are inconsistent with the NRC's reasonable assurance standard.

B. <u>License Renewal Guidance</u>

Intervenors argue that due to the alleged absence of comprehensive, accurate metal fatigue calculations, "Entergy has failed to define specific criteria to assure that susceptible components

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109 *See* Entergy's Testimony at A74 (ENT000679).

110 *See id.*

[redacted]

are inspected, monitored, repaired, or replaced in a timely manner."[111] They further assert that once components with "high" CUF_{en} 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."[112]

In making those arguments, Intervenors ignore the fact that Entergy's FMP is based on, and has been found by the NRC Staff to be consistent with, the relevant recommendations in the NRC's two primary license renewal guidance documents—NUREG-1801, the "Generic Aging Lessons Learned Report" or "GALL Report,"[113] and NUREG-1800, the "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," or "SRP-LR."[114] Programs that are consistent with NUREG-1801 are accepted by the Staff as adequate to meet the license renewal rule.[115] The Commission, in fact, has held that a license renewal applicant's use of the guidance in NUREG-1801 satisfies regulatory requirements under 10 C.F.R. Part 54;[116] *i.e.*, an applicant's use of an AMP identified in NUREG-1801 "constitutes *reasonable assurance* that it

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111 Intervenors' Revised SOP at 48 (NYS000529).

112 *Id.*

113 *See generally* NUREG-1801, Rev. 1 (NYS00146A-C); NUREG-1801, Rev. 2 (NYS00147A-D).

114 *See generally* SRP-LR, Rev. 1 (NYS000195); SRP-LR, Rev. 2 (NYS000161). The SRP-LR provides guidance to NRC staff for conducting their review of LRAs and provides acceptance criteria for determining whether the applicant has met the regulatory requirements for license renewal. *See* SRP-LR, Rev. 2 at 1-3 (NYS00161). NUREG-1801 provides the technical basis for the SRP-LR and contains the NRC Staff's generic evaluation of programs that manage the effects of aging during the PEO in accordance with Part 54's requirements. *See* NUREG-1801, Rev. 1, at 3-4 (NYS00146A).

115 *See* NUREG-1800, Rev. 1 at 3 (NYS000161). The Commission has endorsed NUREG-1801 because it is based on extensive research and evaluation of operating experience derived from a comprehensive set of sources. *See* NUREG-1801, Rev. 2, at 2-3 (NYS00147A). NUREG-1801 was also subject to extensive stakeholder review and comment. *See id*. Neither NYS nor Riverkeeper, however, submitted comments to the NRC for consideration in NUREG-1801, Rev. 2. *See* NUREG-1950, Disposition of Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG-1801 and NUREG-1800, at IV-1 to IV-21 (Apr. 2011) (ENT000528) (listing public comments on changes to NUREG-1801 and NUREG-1800).

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

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will manage the targeted aging effect during the renewal period."[117] When the NRC develops a guidance document to facilitate compliance with NRC regulations, that document is "entitled to 'special weight'" in NRC proceedings,[118] Intervenors have provided no reason to set aside the special weight to be accorded NUREG-1801, or to question the consistency of Entergy's FMP with the recommendations in NUREG-1801.

C. 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.[119] The mere admission of a contention does not satisfy this burden.[120] If the Intervenors do establish a *prima facie* case on a particular claim, then the burden shifts to Applicant to provide sufficient evidence to rebut the intervenor's contention.[121]

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117 *See id.* (emphasis added); *see also Seabrook*, CLI-12-05, 75 NRC at 314 ("If the NRC concludes that an aging management program (AMP) is consistent with the GALL Report, then it accepts the applicant's commitment to implement that AMP, finding the commitment itself to be an adequate demonstration of reasonable assurance under section 54.29(a)."); *Vt. Yankee*, CLI-10-17, 72 NRC at 36 (holding that a commitment to implement an AMP that the NRC finds is consistent with NUREG-1801 constitutes an "acceptable method for compliance with 10 C.F.R. § 54.21(c)(1)(iii).").

118 *Indian Point*, CLI-15-6, 81 NRC __, slip op. at 19; *Seabrook*, CLI-12-05, 75 NRC 314 n.78.

119 *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).

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

121 *See, e.g.*, *id*. at 269; *La. Power & Light Co.* (Waterford Steam Elec. 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.

[redacted]

At the admissibility stage, the petitioner has the "ironclad obligation" to examine the available documentation with sufficient care to support the foundation for a contention.[122] This obligation applies with equal, if not greater force, at the hearing stage.[123] As will be further explained below, the Intervenors and their witnesses often disregard or misconstrue key documents (many of which have been proffered by Intervenors themselves) demonstrating the adequacy of Entergy's FMP. Intervenors, therefore, have failed to meet their burden of going forward with evidence to support NYS-26B/RK-TC-1B.

To prevail, the Applicant's position must be supported by a preponderance of the evidence.[124] Through its expert testimony and supporting evidence, Entergy has done so here.

IV. ENTERGY'S WITNESSES

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. In contrast, Intervenors' experts, Drs. Lahey and Hopenfeld, do not appear to have experience in fatigue analysis, under the ASME Code or otherwise. Indeed, the Board has recognized that Dr. Hopenfeld has "limited experience" in ASME Code Section III fatigue analysis.[125]

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122 *See Duke Power Co.* (Catawba Nuclear Station, Units 1 & 2), ALAB-687, 16 NRC 460, 468 (1982), *vacated in part on other grounds*, CLI-83-19, 17 NRC 1041 (1983).

123 *See Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 & 3), LBP-13-13, 78 NRC 246, 301 & 301 n.308 (2013) (rejecting an expert's claims based on "some averages" and a "gut feeling," rather than a thorough review of available documentation).

124 *See Diablo Canyon*, ALAB-763, 19 NRC at 577; *Oyster Creek*, CLI-09-07, 69 NRC at 262.

125 *See* Ruling on Motions in Limine at14-15; *accord Entergy Nuclear Vt. Yankee LLC and Entergy Nuclear Operations, Inc.* (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").

[redacted]

Collectively, Entergy's witnesses will demonstrate that NYS-26B/RK-TC-1B lacks merit.

A. Mr. Nelson F. Azevedo

Nelson Azevedo's professional and educational qualifications are summarized in his *curriculum vitae*.[126] 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 knowledge, skill,

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

[redacted]

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*.[127] 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 a consultant to Entergy, but before retiring in 2015 from Entergy he was 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.

[127] *See Curriculum Vitae* for Alan B. Cox (ENTR00031).

[redacted]

C. Mr. Jack R. Strosnider, Jr.

Jack Strosnider's professional and educational qualifications are summarized in his *curriculum vitae*.[128] 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 and Licensing 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.

[128] *See Curriculum Vitae* for Jack R. Strosnider, Jr (ENTR00184).

[redacted]

D. Dr. Randy G. Lott

Randy Lott's professional and educational qualifications are summarized in his *curriculum vitae*.[129] In brief, he holds a Bachelor of Science in Engineering degree in nuclear engineering from the University of Michigan, and Master of Science and Doctor of Philosophy degrees in nuclear engineering from the University of Wisconsin. Currently, he is a Consulting Engineer at Westinghouse Electric Co and has more than 35 years of experience in nuclear materials and radiation effects.

Dr. Lott has extensive experience with post-irradiation evaluation of reactor components, and has been actively involved in the design and implementation of aging management programs for reactor internals. His work on aging management strategies was incorporated into MRP-227-A, which was in turn incorporated into the GALL Report. Thus, Dr. Lott is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on RVI fatigue analysis in support of the IPEC license renewal application.

E. Mr. Mark A. Gray

Mark Gray's professional and educational qualifications are summarized in his *curriculum vitae*.[130] Mr. Gray is a Principal Engineer in the Primary Systems Design and Repair group at Westinghouse. He holds Master of Science and Bachelor of Science degrees in Mechanical Engineering from the University of Pittsburgh and has over 30 years of experience in the nuclear power industry. His 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

[129] *See Curriculum Vitae* for Randy G. Lott (ENT00168).

[130] *See Curriculum Vitae* for Mark A. Gray (ENTR00186).

[redacted]

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, contributed to a similar report covering RCS 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™ in support of the IPEC license renewal application.

F. Mr. Barry M. Gordon

Barry Gordon's professional and educational qualifications are summarized in his *curriculum vitae*.[131] In brief, he holds a Master of Science degree in Metallurgy and Material Science from Carnegie Mellon University. Currently, he is an Associate at Structural Integrity Associates, Inc., and has more than 45 years of experience and expertise in materials corrosion behavior in nuclear power plant environments. Mr. Gordon is a Corrosion Specialist and Fellow at the National Association of Corrosion Engineers ("NACE") International, and has taught a class on "Corrosion and Corrosion Control in LWRs" at the NRC for over a decade.

[131] *See Curriculum Vitae* for Barry M. Gordon (ENT000680).

[redacted]

Prior to joining Structural Integrity Associates, he spent 23 years at GE Nuclear Energy focusing on intergranular stress corrosion cracking ("IGSCC") of austenitic stainless steels and nickel base alloys. Thus, Mr. Gordon is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on the metallurgical and corrosion aspects of Entergy's FMP in support of the IPEC LRA.

V. ENTERGY'S EVIDENCE AND ARGUMENTS

A. General Overview of Entergy's Testimony

In their prefiled testimony, Entergy's expert witnesses explain why the FMP set forth in Entergy's LRA for IP2 and IP3 provides reasonable assurance that, consistent with the CLB *and* considering environmental effects, the CUFs for components comprising the reactor coolant pressure boundary and the RVIs will not exceed 1.0 at any time during the PEO, thereby providing reasonable assurance that those components will continue to perform their intended functions. Specifically, Entergy's experts provide testimony on metal fatigue and the relevant NRC regulations and guidance.[132] They also provide an overview of the LRA as it relates to the issue of metal fatigue,[133] a summary of the NRC Staff's review of the LRA on this topic,[134] and an overview of the EAF analyses conducted by Westinghouse in support of the IPEC LRA and Entergy's FMP.[135] Entergy's experts show that the FMP is consistent with NUREG-1801, Revision 1, and that is also meets the intent of NUREG-1801, Revision 2.[136] These facts carry

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132 *See* Entergy Testimony § IV (ENT000679).

133 *See id*. § V.A.

134 *See id*. § V.B.

135 *See id*. § V.C.

136 *See id*. at A46, A48, A52, A93, A101, A105, A122, A234.

[redacted]

special weight in support of the NRC's determination that Entergy's FMP meets the requirements of 10 C.F.R. Part 54.[137]

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. Most critically, 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 during the PEO and not to calculate a precise value below 1.0.[138] Dr. Hopenfeld and Dr. Lahey further conflate the margin required in ASME Code fatigue evaluations with conservatisms that remain at the discretion of the analyst.[139] They also conflate analytical simplification or uncertainty with non-conservatism.[140] However, Entergy's experts demonstrate that the refined EAF analyses—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 analyses.[141] Entergy's witnesses demonstrate that the refined IPEC EAF

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137 *See, e.g., Indian Point*, CLI-15-6, slip op. at 19; *Seabrook*, CLI-12-05, 75 NRC 314 n.78.

138 *See*, *e.g.*, Entergy Testimony at A157 (ENT000679) ("An EAF analysis is intended to demonstrate, with conservatism, whether the CUF_{en} of each analyzed component exceeds 1.0. The WESTEMS™ model is biased, by design, toward conservative evaluation parameters, not "accurate" evaluation parameters."); *id.* at A206 ("Under the GALL Report, the acceptance criterion for the Fatigue Monitoring AMP is that the CUF_{en} values, calculated using an acceptable methods provided in the GALL Report, remain below the fatigue design limit of 1.0 specified in the ASME Code and the regulations.").

139 *See* Entergy's Testimony § IV.A.2 (ENT000679).

140 The Commission itself has acknowledged this distinction. *See FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-8, 75 NRC 393, 416 (2012) ("As 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.'"). In this case, Intervenors speculate, that "WESTEMS "may be nonconservative." Revised Lahey Testimony at 73 (NYS000530). However, as Entergy's experts explain, the WESTEMS™ software uses standard ASME Code stress and fatigue analysis methods, which contain considerable margin and conservatisms. *See* Entergy's Testimony at A50 (ENT000679).

141 *See* Entergy Testimony, § IV.A.2 ((ENT000679).

[redacted]

analyses are sufficiently conservative to address the "uncertainties" that Drs. Lahey and Hopenfeld speculate have been unaddressed and therefore provide reasonable assurance that each analyzed component will not experience fatigue crack initiation during the PEO for each IPEC unit.

B. The Scope of Entergy's Limiting Locations Review and EAF Evaluations Is Comprehensive and Consistent with NRC Regulations and Guidance

In Section V.C of their testimony, Entergy's witnesses provide an overview of the EAF evaluations conducted in support of the IPEC LRA and FMP. As they explain, Entergy first prepared an initial fatigue screening evaluation in its 2007 LRA.[142] To satisfy Commitment 33, Entergy retained Westinghouse to perform comprehensive *refined* EAF analyses for all locations identified in NUREG/CR-6260. Those analyses were completed in 2010.[143]

Additionally, to address the subsequent Commitments 43 and 49 and to meet the intent of NUREG-1801, Revision 2, Entergy retained Westinghouse to review its design basis ASME Code fatigue evaluations to determine whether the NUREG/CR-6260 locations are the limiting locations for IPEC. This limiting locations review was a comprehensive new evaluation of all non-NUREG/CR-6260 IP2 and IP3 components with CLB CUF evaluations, including RVIs, and it confirmed that CUF_{en} values for all limiting locations at IPEC are not projected to exceed 1.0 at any time during the PEO.[144] This review further supports the comprehensive scope and adequacy of the Entergy FMP, by providing additional assurance that the CLB will be maintained throughout the PEO.[145]

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142 *See* Entergy's Testimony at A122 (ENT000679).

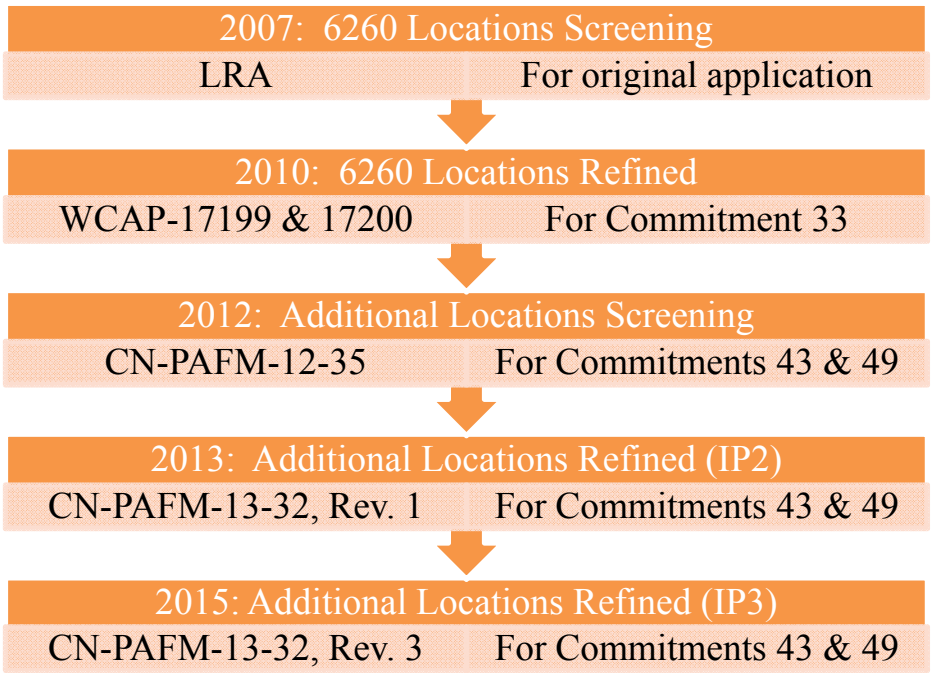
143 *See id.* (citing WCAP-17199, Rev. 1 (ENT000681); WCAP-17200, Rev. 1 (ENT000682)).

144 *See id.* at A48.

145 *See id.* at A234.

[redacted]

The limiting locations review included an initial screening review, completed in 2012,[146] following by *refined* evaluations of the non-NUREG/CR-6260 locations and RVIs that were identified as potentially leading locations in the 2012 CN-PAFM-12-35 screening analysis.[147] These evaluations were completed in 2013 for IP2, and 2015 for IP3.[148] The sequence and primary supporting analyses for the major evaluations discussed above are summarized in the chart below.



Thus, insofar as Intervenors' witnesses generally claim that Entergy was required to expand the scope of components reviewed for EAF once the LRA showed a CUF_{en} value greater than 1.0, their claim is moot.[149] Consistent with Commitments 43 and 49, Entergy expanded the

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146 *See id.* (citing Westinghouse Calculation Note CN-PAFM-12-35, Rev. 1, "Indian Point Unit2 and Unit 3 EAF Screening Evaluations" (Nov. 26, 2012) ("Westinghouse Calculation Note NC-PAFM-12-35") (NYS000510)).

147 *See id.* at A53 (citing Westinghouse, Calculation Note CN-PAFM-13-32, Rev. 3, "Indian Point Unit 2 (IP2) and Unit 3 (IP3) Refined EAF Analyses and EAF Screening Evaluations" (June 25, 2015) ("Westinghouse Calculation Note CN-PAFM-13-32, Rev. 3") (ENT000683)).

148 *See id.*

149 *See, e.g.*, Lahey Report at 25-26 (NYS000296), Hopenfeld Report at 24 (RIV000035).

[redacted]

scope of its EAF evaluations to cover all design basis ASME Code Class 1 fatigue evaluations and all RVI components with CLB CUF analyses.[150]

Dr. Hopenfeld's claim that Entergy must reconsider the CLB for IP2 and IP3 and prepare CUF (or CUF_{en}) evaluations for *additional* non-CLB CUF locations[151] is a challenge to the license renewal rule and the CLB.[152] Under 10 C.F.R. § 54.21(c)(1)(iii), the FMP is intended to manage the effects of aging addressed by fatigue TLAAs that are part of the CLB for IP2 and IP3.[153] Thus, any argument that Entergy must perform EAF evaluations for non-CLB CUF locations is impermissible.[154]

Moreover, to the extent that Dr. Hopenfeld and Dr. Lahey seek EAF evaluations of secondary plant components,[155] such components are not part of the reactor coolant pressure boundary and are not exposed to the reactor water environment.[156] Therefore, an EAF evaluation of secondary components is not required, necessary, or even logical.[157] In any event, aging effects applicable to those steam generator secondary side components, for example, are managed under the Water Chemistry Control – Primary and Secondary Program and the Steam Generator Integrity

150 *See* Entergy's Testimony at A124 (ENT000679).

151 Hopenfeld Report at 24 (RIV000035).

152 *See Pilgrim*, CLI-10-14, 71 NRC at 461; *Oyster Creek*, CLI-09-7, 69 NRC at 270; *see also* NUREG-1801, Rev. 1 at X M-1 (NYS00146C) ("In order not to exceed the *design limit* on fatigue usage . . . .") (emphasis added).

153 *See Vt. Yankee*, CLI-10-17, 72 NRC at 39 (explaining that TLAAs are existing analyses that are part of the plant's CLB); NUREG-1801, Rev. 1 at X M-1 (NYS00146C).

154 In any event, Entergy's witnesses also explain why, as a technical matter, there is no reason why the set of CLB CUF locations needs to be reconsidered for license renewal. *See* Revised Testimony of Entergy Witnesses Nelson F. Azevedo, Robert J. Dolansky, Alan B. Cox, Jack R. Strosnider, Timothy J. Griesbach, Barry M. Gordon, Randy G. Lott, and Mark A. Gray Regarding Contention NYS-38/RK-TC-5 (Safety Commitments) at A119 (Aug. 10, 2015) ("Entergy's Testimony on NYS-38/RK-TC-5") (ENT000699).

155 Hopenfeld Report at 24 (RIV000035).

156 *See* Entergy's Testimony at A124 (ENT000679) (citing GSI-190 Closeout Memorandum, Attach. 2, at 1 (ENT000190)).

157 *See id.* (citing GSI-190 Closeout Memorandum Attach. 2, at 1 (ENT000190); NUREG-1801, Revision 1, at X.M1 ("Thus, no further evaluation is recommended for license renewal if the applicant selects this option under 10 CFR 54.21(c)(1)(iii) to evaluate metal fatigue for the reactor coolant pressure boundary") (NYS00146C)).

[redacted]

Program.[158] The Steam Generator Integrity Program includes processes for monitoring and maintaining secondary side components, through visual inspections of feedwater rings for evidence of degradation from corrosion phenomena (*e.g.*, primary water stress corrosion cracking ("PWSCC")) and other mechanically-induced phenomena (*e.g.*, fatigue) performed by qualified personnel using approved non-destructive examination processes and procedures.[159] The adequacy of these programs is unchallenged in this contention.

C. The 2010 EAF Analyses for NUREG/CR-6260 Locations Conservatively Demonstrate that the CUF_{en} Values for the NUREG/CR-6260 Locations at IPEC Do Not Exceed 1.0

Intervenors claim that (1) the WESTEMS™ methodology is "technically deficient", (2) the input values chosen by Entergy for use in the WESTEMS™ computer program are technically indefensible and understate the extent of metal fatigue; and (3) the range of components for which the CUF_{en} calculations are proposed to be conducted is too narrow.[160] In Section V.D. of its prefiled testimony, Entergy's witnesses refute these claims, and show, among other things, that the WESTEMS™ methodology is consistent with standard ASME Code analysis methods and contains substantial margin and conservatisms in input values and other aspects of the analysis.

[redacted]

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

159 *See id.* App. B at B-118 (ENT00015B); SER at 3-115 to 3-116 (NYS00326B).

160 Intervenors' Revised SOP at 17 (NYS000529).

[redacted] The major documents supporting the 2010 Westinghouse EAF analyses for IPEC components are summarized in Tables 1 and 2 of Entergy's prefiled testimony.[170]

161 [redacted]

162 *See* Entergy's Testimony at A130 (ENT000679).

163 *See id.*

164 *See id*.

165 *See id*.

166 *See id*.

167 NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels" (Mar. 1998) ("NUREG/CR-6583") (NYS000356).

168 NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels" (Apr. 1999) ("NUREG/CR-5704") (NYS000354)

169 *See* Entergy's Testimony at A130 (ENT00679).

170 *See id.* at A132 (ENT000679).

[redacted]

The 60-year fatigue results for the critical component locations are provided in Tables 5-8 through 5-14 of WCAP-17199 and WCAP-17200.[171] Westinghouse determined that, for IP2 and IP3, the refined CUF_{en} values for pressurizer surge line piping, RCS piping charging system nozzle, RCS piping safety injection nozzle, and RHR Class 1 piping all are below 1.0 when projected to the end of the PEO.[172] The refined CUF_{en} values supersede the screening values contained in the April 2007 LRA. As discussed in the sections that follow, Intervenors and their witness fail to identify any deficiencies, much less material errors, in the methods and assumptions used in the IPEC EAF analyses.

1. Intervenors' Critique of the IPEC EAF Evaluations Lacks Merit

a. Entergy and Westinghouse Conservatively Estimated the Number of Past and Future Transients for Each Analyzed Component

Intervenors' first critique of the EAF evaluations is that "Entergy has not adequately considered either past or future transients at Indian Point."[173] That argument finds no support in the record evidence. On the contrary, the Westinghouse EAF evaluations provide ample documentation on the past transients used in the EAF analyses. In general, Westinghouse reviewed the IP2 and IP3 plant operating records to determine when the plant was at power operation and when the plant was shut down.[174] Available plant computer data were used to

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171 *See* WCAP-17199, Rev. 1 at 5-26, 5-28, 5-32, 5-35, 5-39, 5-41, 5-45 (ENT000681); WCAP-17200, Rev. 1 at 5-26, 5-28, 5-32, 5-35, 5-39, 5-41, 5-45 (ENT000682)).

172 *See* NL-10-082, Attach. 1 at 2-4 (NYS000352).

173 Intervenors' Revised SOP at 36 (NYS000529).

174 *See generally* WCAP-12191, Rev. 4, Transient and Fatigue Cycle Monitoring Program Transient History Evaluation Report for Indian Point Unit 2 (Dec. 2014) (ENT000689); WCAP-16898, Rev. 1, Transient and Fatigue Cycle Monitoring Program Transient History Evaluation for Indian Point Unit 3 (May 2015) (ENT000690).

characterize plant cycles.[175] When sufficient data were not available, appropriate alternatives were used, based on a review of plant history and operating procedures.[176]

i. *Past Transients Have Been Appropriately Considered for IPEC*

With respect to past transients for the IP3 pressurizer surge line in particular, Dr. Hopenfeld claims that "Entergy has completely failed to show or justify that the number of past transients were developed appropriately" based on data from IPEC and other plants.[181] He is incorrect. It is true that, for IP3, there were no available plant computer data to represent

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175 *See id.*

176 *See*, *e.g.*, Westinghouse Calculation Note CN-PAFM-09-64 at 6 (RIV000055).

177

181 Hopenfeld Report at 19 (RIV000035).

[redacted]

pressurizer surge line transients early in plant life.[182] However, Westinghouse reasonably addressed that issue, as documented in Westinghouse Calculation Note CN-PAFM-09-64 (RIV000055).[183]

[redacted] Dr. Hopenfeld's statements do not directly take issue with this process, and certainly do not undermine the validity of and conservatism in this process.

ii. *Future Transients Have Been Appropriately Considered for IPEC*

Dr. Hopenfeld also objects to the straight-line extrapolation of the number of plant transients from 40 to 60 years, claiming that the "bathtub curve" better represents the number of transients that will be experienced during the PEO.[187] As a threshold matter, Entergy's experts note that there is no logical basis to conclude that IP2 or IP3 would be subjected to an increasing number of cycles as the units approach 60 years of operation.[188] Regardless, as they further explain, Entergy's FMP for IPEC does not simply rely on "straight-line extrapolation" of

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182 *See* Entergy's Testimony at A140 (ENT000679).

183 *See id.*

184 *See id.* (citing [redacted]

187 *See* Hopenfeld Report at 19-20 (RIV000035).

188 *See* Entergy's Testimony at A141 (ENT000679).

[redacted]

transients. As part of the FMP, Entergy tracks all operating cycles used to calculate the CUF_{en} and, by doing so, ensures that the numbers of actual cycles through 60 years do not exceed the numbers of cycles assumed in the fatigue analysis.[189]

Dr. Hopenfeld postulates that future plant operating changes could result in increased numbers of cycles.[190] If that occurs, or if the analyzed number of cycles is approached for some other reason (such that actual cycles are expected to exceed the number analyzed), then under the FMP, Entergy will reevaluate in advance the fatigue analysis for the affected components to ensure that the CUF_{en} does not exceed 1.0.[191] Consistent with 10 C.F.R. §§ 54.21(a)(3) and (c)(1)(iii), those components which cannot be demonstrated to comply with a CUF of 1.0 based on such a re-analysis will be repaired or replaced to ensure they meet required structural capabilities.[192] Thus, Dr. Hopenfeld's speculation about the "bathtub curve" is irrelevant.

b. Entergy and Westinghouse Used Conservatively Large Heat Transfer Coefficients to Maximize the Postulated Analyzed Temperature Gradient Across Each Analyzed Component

Intervenors' experts also allege deficiencies in the heat transfer coefficients used in the EAF analyses.[193] As a threshold matter, Entergy's experts explain that though heat transfer is a factor in the calculation of transient thermal stress, the major factor controlling thermal fatigue

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189 *See* LRA, App. B at B-44 (ENT00015B).

190 *See* Hopenfeld Report at 19-20 (RIV000035).

191 *See* Entergy's Testimony at A141 (ENT000679) (citing SER at 3-79, 4-44 (NYS00326B, NYS00326E); NL-08-084, 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)).

192 *See id.* Pursuant to Commitment 33, if Entergy does not demonstrate valid projected CUF_{en} values below 1.0 via refined CUFen analyses (Option 1), then Entergy must "repair or replace the affected locations before exceeding a CUF of 1.0." Repair or replacement of a component, if necessary, also would be accomplished in accordance with established plant procedures that are governed by Entergy's QA program, as credited in the SER. See SER at 3-216 (NYS00326C). As required by 10 C.F.R. § 50.55a, repair and replacement will be accomplished in accordance with the applicable requirements of ASME Code Section XI, "Inservice Inspection of Nuclear Power Plant Components." See NL-08-084, Attach. 1 at 4 (ENT000194); SER at 3-173 to -189 (NYS000326C).

193 See, e.g., Hopenfeld Report at 13, 17 (RIV000035); Supplemental Lahey Report at 6 (NYS000297).

[redacted]

damage is the magnitude of the variation in temperature.[194] In any event, for the reasons detailed in Entergy's testimony and summarized below, Dr. Hopenfeld's and Dr. Lahey's statements regarding heat transfer coefficients are not supported by the record or general engineering principles.

Dr. Hopenfeld suggests that "Entergy has not provided sufficient information to allow for meaningful comment on the heat transfer calculations," including "actual equations" employed to determine the heat transfer coefficients.[195] Dr. Hopenfeld is mistaken.

[redacted]

194 *See* Entergy's Testimony at A143 (ENT000679).

195 Hopenfeld Report at 17 (RIV000035).

196 *See* Entergy's Testimony at A144 (ENT000679).

197 *See id.*

198 *See id.*

199 *See id.* Entergy's testimony discusses the heat transfer components used for specific components (*i.e.*, the surge line hot leg nozzles, pressurizer surge nozzles, boron injection tank, and the accumulator nozzles) in detail. *See id*.

[redacted]

Neither concern, however, calls into question the adequacy of the EAF analyses. It is well known to experts in the field that single-phase heat transfer coefficients are approximate and empirical.[203] [redacted]

200 *See* Lahey Rebuttal at 15-16 (NYS000440).

201 *See* Entergy's Testimony at A147 (ENT000679).

202 Supplemental Lahey Report at 4 (NYS000297).

203 *See* Entergy's Testimony at A154 (ENT000679) (citing F. Kreith, PRINCIPLES OF HEAT TRANSFER at 396 (3rd ed. 1973) (ENT000208)).

204 *See id.*

205 [redacted]

206 *See* Entergy's Testimony at A156 (ENT000679). [redacted]

[redacted]

c. ***The Westinghouse EAF Calculations Conservatively Consider Flow Rates and Bulk Liquid Temperatures***

In a related vein, Dr. Hopenfeld contends that information on "flow velocities" also is necessary to assess the uncertainty of the heat transfer coefficients used, but alleges that this information was not specified by Entergy or Westinghouse.[207] Here, again, Dr. Hopenfeld fails to acknowledge the relevant, available information. In actuality, the Westinghouse EAF calculations specify—and conservatively consider—flow rates and bulk liquid temperatures.[208] Dr. Hopenfeld does not discuss this information or explain why any of the information in the EAF evaluations on this topic is incorrect.

d. ***The Westinghouse EAF Evaluations Fully Account for Thermal Stratification in the Pressurizer Surge Line***

In 2011, 2012, and 2013, Dr. Hopenfeld provided several iterations of testimony on the phenomena of "thermal stratification" and "thermal striping," suggesting that they have not been properly accounted for in the EAF evaluations.[209] In addition to confusing these two separate phenomena throughout his testimony,[210] Dr. Hopenfeld again overlooks or misunderstands information in the record that directly addresses his concerns.

Thermal stratification refers to transient fluid temperature differences across the piping, such as a layer of warmer water lying above a layer of colder water.[211] Dr. Hopenfeld asserts that stratified flow in the pressurizer surge line is a non-uniform heat load that must be addressed in the

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207 Hopenfeld Report at 18 (RIV000035).

208 *See* Entergy's Testimony at A161 (ENT000679).

209 *See*, *e.g.,* Supplemental Hopenfeld Report at 22 (RIV000144); *see also* Hopenfeld Report at 24 (RIV000035); Hopenfeld Rebuttal Testimony at 18 (RIV000114).

210 *See*, *e.g.,* Supplemental Hopenfeld Report at 22 (RIV000144) (citing to studies of thermal *stratification* in the pressurizer surge line as the basis an assertion that "[t]he pressurizer surge line is most vulnerable to fatigue failure from thermal *striping*."); *see also* Hopenfeld Rebuttal Testimony at 18 (RIV000114) (faulting Entergy's witness for failing to properly consider stratification in response to a question about thermal striping).

211 *See* Entergy's Testimony at A163 (ENT000679).

[redacted]

fatigue evaluation.[212] As Westinghouse Principal Engineer and EAF analyst Mr. Gray explains,

[redacted]

Dr. Hopenfeld also raises the issue of "high frequency temperature fluctuations on the surface of the component."[216] As Mr. Gray explains, Dr. Hopenfeld appears to be referring to the phenomenon of thermal striping in feedwater nozzles, although it is not entirely clear.[217] [redacted]

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212 See Hopenfeld Report at 15 (RIV000035).

213 *See* Entergy's Testimony at A163 (citing [redacted]

214 *See id.* at A162.

215 *See*, *e.g.*, [redacted]

216 *See* Hopenfeld Report at 15 (RIV000035).

217 *See* Entergy's Testimony at A164 (ENT000679).

218 *See id.*

[redacted]

Thus, as Mr. Gray explains, [redacted]

Thus, the Westinghouse EAF evaluations appropriately considered potential thermal stratification in its EAF analyses of surge line components at IP2 and IP3. Dr. Hopenfeld's

219 [redacted]

221 *See* Entergy's Testimony at A165 (ENT000679) (citing [redacted]

222 [redacted]

223 *See* Entergy's Testimony at A165 (ENT000679).

[redacted]

primary claim on this topic appears to be based on his confusion regarding potential thermal striping on pressurizer surge line components, which does not exist.[224]

e. The Westinghouse EAF Evaluations Used Appropriate Environmental Correction Values That Are Based on NRC Guidance

Dr. Hopenfeld argues that the IPEC EAF evaluations should use very large, "bounding" environmental correction factor (F_{en}) values that would significantly increase the CUF_{en} for all components at IPEC.[225] In Section V.D.6 of their testimony, Entergy's expert witnesses explain that this approach is contrary to NRC guidance and technically baseless.

Consistent with NRC guidance,[226] [redacted]

As an alternative approach, Dr. Hopenfeld proposes that, due to alleged uncertainties "inherent" in the determination of CUF_{en} values, the "appropriate bounding F_{en} values [are] 12 and 17 for stainless steel and carbon and low alloy steel, respectively."[230] Dr. Hopenfeld's proposed

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224 *See id.*

225 *See* Hopenfeld Report at 4-9 (RIV000035).

226 *See* NUREG-1801, Revision 2 at X M1-1 (NYS00147C).

227 [redacted]).

230 Hopenfeld Report at 5, 7 (RIV000035).

[redacted]

approach would use only the *bounding* F_{en} factors mentioned in NUREG/CR-6909, while disregarding the recommendation in NUREG/CR-6909 to calculate more specific F_{en} values when possible, and he would then use those bounding correction factors in combination with values derived from the ASME Code design air curves for carbon steel and low-alloy steels contained in NUREG/CR-6583 and NUREG/CR-5704.[231] The values that would be derived from this approach are unrealistic, unnecessarily high, and inconsistent with the guidance in those three documents.[232] Indeed, another licensing board rejected a very similar argument made by Dr. Hopenfeld in the *Vermont Yankee* license renewal proceeding.[233]

Furthermore, Dr. Hopenfeld's proposed methodology is inconsistent with NRC Staff guidance in NUREG-1801. As noted above, the Staff has found the use of NUREG/CR-6583 and NUREG/CR-5704 to be acceptable.[234] Absent compelling and unusual circumstances, the Staff's guidance on this issue is entitled to special weight and should not be casually dismissed.[235] Dr. Hopenfeld identifies no unusual circumstances at IPEC that would justify the disregard of Staff guidance.

To support his contrary point of view, Dr. Hopenfeld relies on the alleged statements of Dr. Omesh Chopra of the Argonne National Laboratory ("ANL") before the Advisory Committee on Reactor Safeguards ("ACRS") for the propositions that "it is the responsibility of the operator

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231 *See* Entergy's Testimony at A174 (ENT000679).

232 *See id*. at A176.

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

234 *See* NUREG-1801, Rev. 1, at X M-1 (NYS00146C) ("Formulae for calculating the environmental life correction factors are contained in NUREG/CR-6583 for carbon and low-alloy steels and in NUREG/CR- 5704 for austenitic stainless steels."); NUREG-1801, Rev. 2, at X M1-1 (NYS00147C) (allowing licensees to use the formulae provided in NUREG/CR-6583 or NUREG/CR-6909 for carbon and low alloy steels, and those provided in NUREG/CR-5704 or NUREG/CR-6909 for stainless steels).

235 *Seabrook*, CLI-12-05, 75 NRC at 314 n.78; *Indian Point*, CLI-15-6, 81 NRC __, slip op. at 21-22.

[redacted]

to account for the differences between lab and plant environments when applying the results," and that "the ANL results may not be conservative."[236] Although Dr. Hopenfeld attributes these statements to Dr. Chopra, the principal investigator of the ANL research, these are not quotations from Dr. Chopra.[237] Rather, they reflect Dr. Hopenfeld's selective interpretation of Dr. Chopra's actual statements before the ACRS.[238]

Based on his incorrect characterization of Dr. Chopra's statements, Dr. Hopenfeld asserts that Entergy must use the general form of the F_{en} equation presented early in NUREG/CR-6909 (NYS000357) and asserts, with no support, that the designer must use this general equation for each location analyzed.[239] However, as Entergy's experts point out, Dr. Hopenfeld disregards that fact that NUREG/CR-6909: (1) develops applications of test data for different materials; (2) develops methods and margins to account for the various factors to be considered in evaluations; and (3) presents final equations for specific material types, with the ranges and limits specified for each input variable.[240] In other words, contrary to Dr. Hopenfeld's belief, the ANL results discussed in NUREG/CR-6909 (and the correction factors specified in other NRC guidance documents) *already* account for the differences between lab and plant environments.[241]

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236 *See* Supplemental Hopenfeld Report at 7 (RIV000144) (citing Transcript, Advisory Committee on Reactor Safeguards, Subcommittee on Materials, Metallurgy and Reactor Fuels at 22 and generally (Dec. 6, 2006) (RIV000037)).

237 *See* Entergy's Testimony at A178 (ENT000679)

238 *See id.*

239 *See* Supplemental Hopenfeld Report at 7 (RIV000144).

240 *See* NUREG/CR-6909, App. A (NYS000357).

241 *See* Entergy's Testimony at A179 (ENT000679).

[redacted]

Thus, overall, the methodologies and formulae set forth in NUREG/CR-6583 and NUREG/CR-5704, which Westinghouse used in its IPEC EAF evaluations, appropriately account for the uncertainties identified in NUREG/CR-6909 and recited by Dr. Hopenfeld.[242]

f. The Westinghouse EAF Evaluations Contain Appropriate Assumptions Regarding Water Chemistry and Dissolved Oxygen Concentrations

In yet another series of unsubstantiated attacks on Entergy's EAF evaluations, Dr. Hopenfeld contends that the F_{en} values used by Entergy and Westinghouse do not adequately reflect operating plant conditions for a PWR such as IP2 or IP3, including the water chemistry and dissolved oxygen ("DO") concentrations.[243] In Section V.D.7 of their testimony, Entergy's experts address each of Dr. Hopenfeld's claims and demonstrate that they have no technical basis. As such, Dr. Hopenfeld again fails to identify any error or deficiency in the IPEC EAF evaluations.

By way of background, the decrease in fatigue life due to environmental factors "is significant *only* when four conditions are satisfied simultaneously, *viz.*, when the strain amplitude, temperature, and DO in water are above certain threshold values, and the strain rate is below a threshold value."[244] Thus, in addition to strain rate and strain amplitude, temperature must be high and oxygen must be high *at the same time* for there to be a significant environmental effect.[245]

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242 *See id.*.

243 Hopenfeld Report at 7 (RIV000035).

244 NUREG/CR-6815, Review of the Margins for ASME Code Fatigue Design Curve – Effects of Surface Roughness and Material Variability at 10 (Sept. 2003) ("NUREG/CR-6815") (emphasis added) (ENT000225). *See also* ANL-LWRS-47, Report on Assessment of Environmentally-Assisted Fatigue for LWR Extended Service Conditions, at 27 (Sept. 2011) (RIV000150) ("[E]nvironmental effects on fatigue life are significant only when critical parameters (temperature, strain rate, DO level, and strain amplitude) meet certain threshold values. Environmental effects are moderate, e.g., less than a factor of 2 decrease in life, when *any one* of the threshold conditions is not satisfied.") (RIV000150) (emphasis added)).

245 *See* Entergy's Testimony at A184 (ENT000679) (citing NUREG/CR-6815 at 10).

[redacted]

Therefore, as explained in Sections 5.1 and 5.2 of WCAP-17199 and WCAP-17200, and following the approach in both NUREG/CR-5704 (stainless steels) and NUREG/CR-6583 (carbon steels), the F_{en} factor to be used is in part dependent on the product of three values: transformed oxygen ("O*"), which represents the impact of DO concentration on the F_{en}, transformed temperature ("T*"), which represents the impact of fluid temperature on the F_{en}, and transformed strain rate ("ε'"), which represents the impact of the rate of change of the strain in the material during the transient. If either O* or T* (or ε') equals zero, then the product of this portion of either F_{en} formula also equals zero and the F_{en} value is determined by other empirically-derived constants.[247] These formulas were developed by the Argonne National Laboratory ("ANL") based on experimental data and are approved by the NRC in NUREG-1801, Revisions 1 and 2.[248]

[redacted]

246 *See* Entergy's Testimony at A185 (ENT000679).

247 *See* Entergy's Testimony at A181 (ENT000679).

248 *See* NUREG-1801, Rev. 1, at X M-1 (NYS00146C); NUREG-1801, Rev. 2, at XM1-1 (NYS00147C).

249 *See* WCAP-17199, Rev. 1 at 5-24 (ENT000681); *see also* NUREG/CR-6583 at 60 (NYS000356).

250 *See id.*

[redacted]

Indeed, IPEC chemistry specifications require DO concentration to be an order of magnitude lower than 0.05 ppm during operations. [254] Only during the short periods of time when the service temperature is less than 150 ºC can DO concentrations be greater.[255] This is confirmed by plant chemistry records, which show that during the startup following the most recent refueling outage, DO was measured to be below 0.05 ppm (50 ppb) before the plants heated up above 200 ºF (93 ºC), which is consistent with the assumptions made by Westinghouse.[256]

Dr. Hopenfeld's claim that oxygen dissolved in the coolant will increase significantly during shutdown transients is unfounded.[257] For transients involving the shutdown and cooldown

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251 [redacted]

252 Hopenfeld Report at 7 (RIV000035) (citing NUREG/CR-6909 at 26-28 (NYS000357)).

253 [redacted]

254 *See* Entergy's Testimony at A186 (ENT000679) (citing Entergy, 0-CY-2310, Rev. 24, Reactor Coolant System Specification and Frequencies at 11 (Jan. 16, 2015) (ENT000692)).

255 *See id.*

256 *See* IPEC, Unit 3 Chemistry Data at 2 (Mar. 21-22, 2015) (ENT000693) (showing DO < 2.5 ppb prior to heatup above 188 ºF). DO levels in the RCS at IP2 and IP3 are measured approximately three times per week and the normal values are < 0.0025 PPM. This value is 20 times lower than the conservative lower bound of 0.05 ppm used in the EAF evaluations. Dr. Hopenfeld's claim that actual plant measurements must be used instead of Westinghouse's conservative assumptions appears to be based on BWR practices and lacks basis for IPEC. See Hopenfeld Rebuttal Testimony at 38-40 (RIV000114); Supplemental Hopenfeld Report at 14 (RIV000144).

257 *See* Hopenfeld Report at 10-11 (RIV000035).

[redacted]

of the plant, this is not an issue of concern for PWRs like IP2 and IP3, because the temperature term in the F_{en} equation is zero at temperatures less than 150°C.[258] With regard to transients that can occur while the plant temperature is above 150ºC, the issue also is not of concern because the IPEC units are operated in a manner that precludes a ready source of DO.[259]

Finally, Entergy's witnesses address Dr. Hopenfeld's related assertion that there is no "evidence that Entergy considered the presence of trace impurities on water conductivity, which reduces fatigue life," or that the EAF evaluations considered the "potential synergistic interaction between fatigue" and stress corrosion cracking ("SCC") caused by chlorides.[260] As Mr. Gordon and Mr. Azevedo explain, the potential for trace impurities in the reactor coolant to contribute to SCC is addressed through the Water Chemistry Control – Primary and Secondary Program.[261] This approach consistent with that described in NUREG/CR-6909.[262]

Moreover, to the extent Intervenors' concern regards SCC, as opposed to fatigue, Entergy does not rely on the FMP to manage the effects of SCC. Consistent with NRC Staff guidance in NUREG-1801, Entergy relies on several other inspection programs to manage the effects of aging due to cracking caused by SCC or other mechanisms through inspections of primary plant components, including the ISI Program, the Nickel Alloy Inspection Program, the Reactor Vessel Head Penetration Inspection Program, the Steam Generator Integrity Program, and the RVI

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258 *See* Entergy's Testimony at A186 (ENT000679).

259 *See id.*

260 Hopenfeld Report at 7 (RIV000035).

261 *See* Entergy's Testimony at A196 (ENT000679) (citing NUREG-1801, Rev. 1, at XI M-10 (NYS00146C); LRA App. B at B-137 to -39 (ENT00015B)).

262 *See id.* (citing NUREG/CR-6909 at 30 (NYS000357) ("Normally, plants are unlikely to accumulate many fatigue cycles under off-normal conditions. Thus, effects of water conductivity on fatigue life have not been considered in the determination of F_{en}.")).

[redacted]

AMP.[263] To the extent Intervenors demand that Entergy use the FMP to address mechanisms other than fatigue, they have failed to address or carry their burden of identifying "unusual circumstances" at IPEC that would justify the disregard of the special weight accorded to Staff guidance.[264]

2. Contrary to Intervenors' Claim, No Propagation of Error Analysis Is Required In Connection With the Westinghouse EAF Evaluations

In response to the claims of Intervenors' witnesses, Entergy's experts explain that there is no need to precisely quantify uncertainties arising from the use of engineering judgment because the EAF analyses are, by design, conservative, bounding analyses. While Dr. Lahey argues that modeling and input assumptions lead to results that are highly uncertain and unreliable,[265] engineering analyses require assumptions and inputs.[266] He further asserts a CUF_{en} that is close to, but does not exceed 1.0, means that "virtually any error would put some of the calculated values of CUF_{en} over the $CUF_{en} = 1.0$ fatigue failure limit," such that Entergy must conduct a "propagation of error" analysis.[267] Dr. Hopenfeld makes similar claims.[268] But as Entergy's experts demonstrate throughout their testimony, conservative modeling and input assumptions have been used at each step of the fatigue analyses, thereby providing confidence that the results are reliable for managing the effects of fatigue throughout the PEO for IP2 and IP3.

The ASME Code long has recognized that there are uncertainties associated with both analytical inputs and modeling techniques—a recognition that Dr. Lahey and Dr. Hopenfeld do

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263 *See* Entergy's Testimony at A66 (ENT000679); *see also* LRA App. B at B-63, B-74, B-109, B-118 (ENT00015B); NL-12-037, Attach. 1 (NYS000496).

264 *Seabrook*, CLI-12-05, 75 NRC at 314 n.78; *Indian Point*, CLI-15-6, slip op. at 21-22.

265 *See* Supplemental Lahey Report at 8 (NYS000297).

266 *See* Entergy's Testimony at A198 (ENT000679).

267 Revised Lahey Report at 67 (NYS000530); see also Lahey Report at 27 (NYS000296).

268 *See* Hopenfeld Report at 21 (RIV000035).

[redacted]

not acknowledge. Those uncertainties are addressed through the design margin factors discussed in Section IV.A.2 of Entergy's Testimony,[269] rather than through "error analyses" suggested by Dr. Lahey.[270] As Entergy's testimony makes clear, the IPEC EAF evaluations have been prepared with variables purposefully chosen to reasonably bound expected values.[271] Because the inputs are not best-estimate values of a normal distribution, a propagation of error analysis is inappropriate.[272]

Indeed, for that reason, NUREG-1801, Revision 1 and the acceptance criteria for fatigue analysis in the SRP-LR do not specify any need for uncertainty analyses to validate ASME Code or ANSI B31.1 fatigue analyses.[273] In addition, the ASME Code fatigue analysis methods endorsed by NRC in 10 C.F.R. § 50.55a do not establish any requirements for "propagation of error" analyses.[274] In short, Dr. Lahey has provided no regulatory or technical basis demonstrating the need to perform uncertainty analyses for ASME Code Section III or ANSI B31.1 fatigue analyses.[275]

Drs. Lahey and Hopenfeld only speculate that there are "many possible sources of error" in the EAF analyses,[276] which "*could* lead to a violation" of the 1.0 limit.[277] They fail altogether to

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269 Those design margins are the adjustment factors in the design fatigue curves and the design margin in the stress allowables.

270 *See* Entergy's Testimony at A200 (ENT000679).

271 *See id.*

272 *See id.* Thus, Dr. Lahey's reliance on the Vardeman & Jobe engineering textbook is misplaced. *See* Lahey Report at 27 (NYS000296) (citing S. Vardeman and J.M. Jobe, *Basic Engineering Data Collection and Analysis*, at 310-11 (2001) (NYS000347)); *see also* Revised Lahey Testimony at 70 (NYS000530).

273 *See* NUREG-1801, Revision 1, § X.M1 (NYS00146C); SRP-LR, § 4.3 (NYS000195).

274 *See generally* ASME Code, Section III, Article NB-3000 (NYS000349).

275 *See* Entergy's Testimony at A200 (ENT000679).

276 Supplemental Lahey Report at 2 (NYS000297),

substantiate or quantify the postulated errors or uncertainties. If anything, the detrimental effects of the environment are likely overestimated due to the conservative bias applied to the analyses.[278]

due to the substantial margin and conservatisms in the EAF analyses.

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277 Lahey Report at 27 (NYS000296) (emphasis added). *See also* Hopenfeld Report at 21 (RIV000035) ("Given the large uncertainties . . . the detrimental effects of the environment on fatigue strength, and resulting predicted fatigue life, of the components evaluated are *likely* grossly underestimated.") (emphasis added)).

278 *See* Entergy's Testimony at A200 (ENT000679).

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280 Lahey Report at 26-27 (NYS000296).

281 *See* Entergy's Testimony at A205 (ENT000679).

[redacted] In fact, to the extent that the environmental adjustment introduces additional conservatism, the conservatisms in the analysis are increased.[283]

In short, Dr. Lahey's and Dr. Hopenfeld's demands for an "error analysis" lack regulatory and technical basis. The IPEC EAF evaluations, like any ASME Code fatigue evaluation, are bounding, conservative analyses, with considerable margin. Nothing in the regulations, ASME Code, or NRC Staff guidance suggests the need for an additional error analysis and, as a technical matter, there is no such need.

D. The 2013 and 2015 EAF Analyses for Non-NUREG/CR-6260 Locations Conservatively Demonstrated that the CUF_{en}s for Limiting Locations Do Not Exceed 1.0

As stated above, in Westinghouse Calculation Note CN-PAFM-12-35 (NYS000510), issued in 2012, Westinghouse "review[ed the] design basis ASME Code Class 1 fatigue evaluations to determine whether the NUREG/CR-6260 locations that have been evaluated for the effects of the reactor coolant environment on fatigue usage are the limiting locations for the IP2 and IP3 configurations," as Entergy committed to do in the first part of Commitment 43.[284] Since more potential limiting locations were identified, Westinghouse evaluated the most limiting locations for the effects of the reactor coolant environment on fatigue usage, as Entergy committed to do in the second part of Commitment 43.[285] Those evaluations are documented in Calculation Notes CN-PAFM-13-32, Rev. 3 (ENT000683) and CN-PAFM-13-40 (ENT000688). Additionally, Westinghouse used the NUREG/CR-6909 methodology in the evaluation of the

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282 *See id.*

283 *See id.*

284 *See* NL-11-032, Attach. 2 at 17; *see also* Entergy's Testimony at A212 (ENT000679).

285 *See generally* Westinghouse Calculation Note CN-PAFM-13-40 (ENT000688).

limiting locations consisting of nickel alloy.[286] These evaluations included recalculations of limiting RVI locations as well, consistent with Entergy's Commitment 49.[287]

For the remaining locations,

[286] NL-11-032, Attach. 2 at 17; Westinghouse Calculation Note CN-PAFM-12-35 (NYS000510) ("For the IP2/IP3 EAF screening . . . NUREG/CR-6909 is used for nickel alloy steels"); *see also generally* Westinghouse Calculation Note CN-PAFM-13-32, Rev. 3 (ENT000683).

[287] *See* Entergy's Testimony A212 (ENT000679).

[288] *See id.* at A210 (ENT000679) (citing).

[289] *See id.*

[290] *See id.*

[291] *See id.* (citing Westinghouse Calculation Note CN-PAFM-13-32, Rev. 3 (ENT000683)).

[292] *See id.*

[redacted]

The Westinghouse calculations found that all CUF_{en} values for RVI locations and potentially limiting equipment locations were less than 1.0.[293] These results indicate that further refined analysis (such as a WESTEMS™ analysis, as performed for the 6260 locations) would result in *even lower* CUF_{en} values; therefore, the analyses demonstrated that the NUREG/CR-6260 locations originally evaluated were in fact limiting locations for fatigue at IP2 and IP3, and that the CUF_{en} does not exceed 1.0 for all RVI components with CLB CUFs.[294]

1. Contrary to Intervenors' Claim, Entergy Has Not "Systematically Removed Conservatisms" Built Into the EAF Calculations

Intervenors accuse Entergy and Westinghouse of "systematically remov[ing] conservatisms built into the CUF_{en} calculation[s] in order to obtain a result below the 1.0 threshold."[295] For example, Dr. Lahey has characterized the EAF analyses performed after submission of the LRA as selectively removing conservatisms to "reach a manipulated and predetermined result."[296] In his Supplemental Report, he states that "the thermal stress results for CUF_{en} are strongly influenced by the code user's assumptions, manipulations and interventions, and that "[t]here is a lot of 'engineering judgment' implicit in the CUF_{en} results," such that their credibility is questionable.[297] And, most recently, he describes Westinghouse's refined EAF analyses as improperly relying on "reductions of conservatism."[298]

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293 *See* Westinghouse Calculation Note CN-PAFM-13-32, Rev. 3 at 7-8 (ENT000683); Westinghouse Calculation Note CN-PAFM-13-40 at 11 (ENT000688).

294 *See* Entergy's Testimony at A211 (ENT000679).

295 Intervenors' Revised SOP at 21 (NYS000529).

296 Declaration of Dr. Richard T. Lahey, Jr. in Support of the State of New York's Supplemental Contention 26-A ¶ 5 (Apr. 7, 2008) (NYS000299).

297 Supplemental Lahey Report at 8 (NYS000297).

298 Intervenors' Revised SOP at 22 (NYS000529) (citing Revised Lahey Testimony at 66-67 (NYS000530)).

[redacted]

Intervenors' allegations are factually and legally baseless. It is well established that an applicant may perform more rigorous, refined fatigue analyses that account for excess conservatisms in the original fatigue analyses.[299] The elimination of unnecessary conservatisms through re-analysis yields a new CUF value (to which the F_{en} is then applied).[300] Consistent with NRC regulations and guidance, the refined EAF analyses conducted by Westinghouse showed the CUF_{en} to be less than or equal to 1.0, and these new evaluations supersede any corresponding prior initial screening evaluations.[301]

As explained throughout Entergy's testimony, Westinghouse prepared the EAF analyses—both the WESTEMS™ calculations and the limiting locations reviews—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.[302] This is not a simple defense of "standard industry practice," as Dr. Lahey broadly asserts. The margin and conservatism in ASME fatigue calculations is well-documented, and Westinghouse's documentation of the IPEC EAF evaluations is transparent with regard to the assumptions and methods used.[303] Intervenors

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299 *See* Entergy's Testimony at A123 (ENT000679).

300 *See* MRP-47 at 4-4 (NYS000350) (stating that techniques for removing excess conservatisms from the input (stress) values of CUF calculations are "generally well understood by engineers performing these assessments throughout the industry").

301 *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."); *see also* Entergy's Testimony at A123 (ENT000679) (citing NUREG-1801, Revision 1 at X M-2 (NYS00146C) (allowing a "more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded during the extended period of operation")); *see also* MRP-47 at 3-7 (NYS000350) ("Possible reasons for updating the fatigue analysis could include . . . [e]xcess conservatism in original fatigue analysis with respect to modeling, transient definition, transient grouping and/or use of an early edition of the ASME Code.")

302 *See* Entergy Testimony at A198 (ENT000679); Westinghouse Level 2 Policy/Procedures, NSNP 3.2.6, Design Analysis at 5-6 (Mar. 2011) (ENT000196).

303 *See id.* at A125 (ENT000679.

[redacted]

have failed to identify any Westinghouse assumption that could reasonably be viewed as non-conservative.

2. There Is No Technical Basis Supporting Intervenors' Asserted Need to Apply an Additional Correction Factor for the Effects of Irradiation Embrittlement

Drs. Lahey and Hopenfeld assert that, in evaluating environmental effects on RVI components, is it necessary to apply an additional correction factor for the effects of irradiation embrittlement.[304] However, they fail to recognize that fatigue and irradiation embrittlement do not interact "synergistically."[305] Specifically, irradiation may have a positive or negative effect on the load carrying capability of the material, depending on the circumstances.[306]

As Entergy's expert witnesses explain, fatigue crack propagation depends on a number of factors; however, increased strength generally tends to increase the resistance to fatigue crack growth.[307] Similarly, irradiation effects also increase the material strength and fatigue resistance but decrease the ductility and fracture toughness (*i.e.*, the ability of the material to resist fast fracture) of the material.[308] These mixed effects can be offsetting, and the results have been demonstrated experimentally. For example, as explained in MRP-175, "[t]he work of several researchers suggest that neutron irradiation does not result in a further reduction in fatigue

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304 *See*, *e.g.*, Revised Lahey Testimony at 15 (NYS000530) (arguing that "synergistic interactions" have not been considered for RVIs); *see also* Supplemental Hopenfeld Report at 23-25 (RIV000144).

305 *See* Entergy's Testimony at A215 (ENT000679).

306 *See id.* at A76 (explaining that one example of a positive effect on fatigue is provided in the work of P. Shahinian et al, [NRL Report 7446, Effect of Neutron Irradiation on Fatigue Crack Propagation in Types 304 and 316 Stainless Steels at High Temperature at 10-12 (July 21, 1972) (ENT000697)], which reported a reduction in fatigue crack growth rates in type 304 and 316 stainless steels irradiated under fast reactor conditions at temperatures up to 800°F).

307 *See id.* (citing G. Was, FUNDAMENTALS OF RADIATION MATERIALS SCIENCE: METALS AND ALLOYS; PART III: MECHANICAL EFFECTS OF RADIATION DAMAGE at 689-90 (2007) ("Was Text") (ENT000627)).

308 *See id*.

properties and in some cases suggests an improvement."[309] While MRP-175 acknowledges that there is limited literature addressing this topic, Draft NUREG/CR-6909 concludes that, although, the data in this area are inconclusive, the EAF methodology is appropriate for materials exposed to significant levels of irradiation.[310] Therefore, there is no basis, at this time, to conclude that an additional correction factor is necessary to account for the effects of irradiation embrittlement on fatigue life.[311]

It bears emphasis again that fatigue analyses are not the only methods used to manage the effects of irradiation or fatigue on RVIs. The RVI AMP, which is discussed in detail in Entergy's prefiled testimony on Contention NYS-25, is a risk-prioritized inspection program that inspects high-susceptibility RVI components for cracking and other aging effects, regardless of the underlying aging mechanisms.[312] The RVI and FMP together provide reasonable assurance that the effects of aging on RVIs will be adequately managed throughout the PEO.[313]

E. The Balance of Entergy's FMP Is Robust and Provides Reasonable Assurance that the Effects of Fatigue Will Be Adequately Managed

In Section V.F 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.

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309 MRP-175 at D-3 (ENT000631).

310 *See* Draft NUREG/CR-6909, Rev. 1 at 9 (NYS000490).

311 *See* Entergy's Testimony at A76 (ENT000679).

312 *See* Entergy's Testimony on NYS-25 § VII.A.3 (ENT000616).

313 *See* Entergy's Testimony at A219 (ENT000679).

[redacted]

§§ 54.21(a), 54.21(c)(1)(iii), and 54.29(a).[314] Any challenges to a program that is consistent with Staff guidance that has been implicitly endorsed by the Commission—such as NUREG-1801—must be specifically and substantially supported in order to overcome the special weight accorded to such documents.[315]

1. Intervenors' Critique of Design Basis CUF Calculations Lacks Merit

Finally, Entergy's witnesses address Dr. Hopenfeld's critique of the design CUF calculations 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,[316] these fatigue calculations cover the reactor vessel inlet and outlet nozzles, and are part of the CLB for IP2 and IP3, 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.[317] Any question of the adequacy of these original design calculations is therefore an impermissible challenge to the CLB.[318]

Intervenors' challenge is also outside the scope of the admitted contention, as there are no criticisms of the adequacy of the design basis reactor vessel inlet and outlet nozzles in the Intervenors' pleadings on this contention at the admissibility stage.[319] As the Commission has

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314 *See Vt. Yankee*, CLI-10-17, 72 NRC at 36; *see also Seabrook*, CLI-12-05, 75 NRC at 314 n.78.

315 *See id.*

316 Riverkeeper Answer at 10.

317 *See* Entergy's Testimony at A228 (ENT000679) (citing C.R. Crockrell and J. C. Lowry, Combustion Engineering, Inc., C.E. CENC-1110, Analytical Report for Indian Point Reactor Vessel Unit No. 2, (Apr. 22, 1968) (RIV000052A-D); C.R. Crockrell and J. C. Lowry, Combustion Engineering, Inc., CENC-1122, Analytical Report for Indian Point Reactor Vessel Unit No. 3 (June 1969) (RIV000053A-O)).

318 *See Vt. Yankee*, CLI-10-17, 72 NRC at 20 ("the adequacy of the code of record relating to metal fatigue is a potential safety issue to be addressed by the current regulatory process for operating reactors").

319 *See also* Motion in Limine at 10-12.

[redacted]

confirmed, a contention cannot be interpreted to include new claims that are outside of the admitted bases for that contention.[320]

Nevertheless, 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.[321] Dr. Hopenfeld does not explain why the conservative values used in these analyses do not account for the variability he assumes.[322]

2. Intervenors' Legal Arguments Regarding the FMP Lack Merit

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.[323]

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

> 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

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320 *See Seabrook*, CLI-12-05, 75 NRC at 310 n.50 ("an admitted contention is defined by its bases"). 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 Motions in Limine at 16. Therefore, Entergy respectfully disagrees with the Board's finding on this issue.

321 *See* Entergy's Testimony at A228 (ENT000679).

322 *See id.*

323 *Vt. Yankee*, CLI-10-17, 72 NRC at 32 n.185.

[redacted]

> replaced in a timely manner. Once components with high CUF_{en} 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.[324]

This statement presupposes that the EAF evaluations are deficient (*i.e.*, an "absence of comprehensive [and] accurate metal fatigue calculations"), which Entergy's witnesses have shown is incorrect. 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.[325]

VI. 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 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.

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[324] Intervenors' Revised SOP at 48.

[325] *See Oyster Creek*, CLI-09-07, 69 NRC at 282 ("[T]he 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 ("[R]eview 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).

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Respectfully submitted,

Executed in Accord with 10 C.F.R. § 2.304(d)

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