ENT000028
Submitted: March 28, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos. 50-247-LR and 50-286-LR
ENTERGY NUCLEAR OPERATIONS, INC.	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	
	)	March 28, 2012

ENTERGY'S STATEMENT OF POSITION REGARDING CONTENTION RK-TC-2 (FLOW-ACCELERATED CORROSION)

William B. Glew, Esq.
William C. Dennis, Esq.
ENTERGY NUCLEAR OPERATIONS, INC.
440 Hamilton Avenue
White Plains, NY 10601
Phone: (914) 272-3202
Fax: (914) 272-3205
E-mail: wglew@entergy.com
E-mail: wdennis@entergy.com

Kathryn M. Sutton, Esq.
Paul M. Bessette, Esq.
Raphael P. Kuyler, Esq.
MORGAN, LEWIS & BOCKIUS LLP
1111 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
Phone: (202) 739-5738
E-mail: ksutton@morganlewis.com
E-mail: pbessette@morganlewis.com
E-mail: rkuyler@morganlewis.com

COUNSEL FOR ENTERGY NUCLEAR OPERATIONS, INC.

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Pursuant to 10 C.F.R. § 2.1207(a)(1) and the Atomic Safety and Licensing Board's ("Board") Order Granting NRC Staff's Unopposed Time Extension Motion and Directing Filing of Status Updates,[1] Entergy Nuclear Operations, Inc. ("Entergy") submits this Statement of Position ("Statement") on Riverkeeper, Inc.'s ("Intervenor's") flow-accelerated corrosion ("FAC") contention. This Statement is supported by the Testimony of Entergy Witnesses Ian D. Mew, Alan B. Cox, Nelson F. Azevedo, Jeffrey S. Horowitz and Robert M. Aleksick (ENT000029), and the exhibits thereto (ENT00015A-B, ENT000030 to ENT000089). For the reasons discussed below, RK-TC-2 lacks merit and should be resolved in Entergy's favor.

I. PRELIMINARY STATEMENT

RK-TC-2 is a safety contention, claiming that Entergy's aging management program ("AMP") for FAC (referred to as the FAC Program) set forth in the License Renewal Application ("LRA") for Indian Point Nuclear Generating Units 1 and 2 (respectively, "IP2" and "IP3," collectively "Indian Point Energy Center" or "IPEC") does not provide sufficient detail to demonstrate that the intended functions of applicable components will be maintained during the

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Order (Granting NRC Staff's Unopposed Time Extension Motion and Directing Filing of Status Updates) (Feb. 16, 2012) (unpublished).

period of extended operation ("PEO"), as required by 10 C.F.R. § 54.21(a)(3). The testimony of the Intervenor's witness, Dr. Hopenfeld, focuses on asserted deficiencies in the CHECWORKS computer software, which is used as part of Entergy's FAC Program at IPEC.

Entergy's testimony demonstrates that its FAC Program is consistent with the guidance for an acceptable AMP for FAC in NUREG-1801, notwithstanding Intervenors' claims to the contrary.[2] Specifically, the Entergy FAC Program incorporates all ten elements of the AMP set forth in NUREG-1801 and, as a result, provides reasonable assurance that, consistent with the current licensing basis ("CLB"), the effects of aging for FAC-susceptible components will be adequately managed throughout the period of extended operation ("PEO"), as required by 10 C.F.R. § 54.21(a)(3).

Although the Intervenors make numerous broad claims about Entergy's purported over-reliance on and deficiencies in the CHECWORKS model, Entergy's witnesses refute their unfounded assertions point-by-point. Dr. Hopenfeld's testimony,[3] *curriculum vitae*, and statements suggest that he is not a specialist in the management of aging due to FAC. Thus, while he and Riverkeeper proffer many criticisms of Entergy's FAC Program, Entergy's witnesses refute each of their claims and demonstrate that they lack merit.

Riverkeeper and Dr. Hopenfeld raise two basic criticisms of Entergy's FAC Program. The first is that the CHECWORKS computer code does not accurately predict FAC wear rates,

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[2] Entergy prepared its April 2007 LRA in accordance with the guidance in NUREG-1801, Revision 1. *See* NUREG-1801, Generic Aging Lessons Learned Report, Rev. 1 (Sept. 2005) ("NUREG-1801, Revision 1"). NUREG-1801, Revision 2 was issued in December 2010 ("NUREG-1801, Revision 2"). As explained further in Section III.A.3, below, because the IPEC FAC Program relies on NSAC-202L-R3, it also meets the intent of the new guidance in NUREG-1801, Revision 2.

[3] *See* Prefiled Written Testimony of Dr. Joram Hopenfeld Regarding Riverkeeper Contention TC-2 – Flow Accelerated Corrosion (Dec. 21, 2011) ("Hopenfeld Testimony") (RIV000003); Report of Dr. Joram Hopenfeld in Support of Riverkeeper Contention RK-TC-2 – Flow Accelerated Corrosion (Dec. 21, 2011) (RIV000005) ("Hopenfeld Report") (collectively "Intervenor's Testimony").

and the second is that CHECWORKS is the only tool in Entergy's FAC AMP at IPEC.[4] Based on these claims, Dr. Hopenfeld determines that the IPEC FAC Program is inadequate.[5]

Neither of these claims is true. As to the claim that CHECWORKS does not accurately predict FAC wear rates, as Entergy's witnesses demonstrate, the CHECWORKS program provides a screening and prioritization function to assist the program owner in focusing inspections on higher-susceptibility locations. In other words, CHECWORKS optimizes the selection process for uninspected components within the FAC Program (*i.e.*, components that have not previously been inspected under the FAC Program) by directing more attention towards components with the highest estimated rates of FAC and relatively less attention on components with lower rates of FAC or relatively less uncertainty. Many of Dr. Hopenfeld's examples of alleged inaccurate CHECWORKS predictions represent Analysis Lines (*i.e.*, groupings of components subject to similar operating conditions and water chemistry) where there is uncertainty in CHECWORKS' predictions, indicating the need for inspections, not any deficiency in CHECWORKS or the FAC Program. Entergy's witnesses show that CHECWORKS, as one of many elements in the FAC program, adequately performs its intended screening function.

As to the second claim, that CHECWORKS is the only tool in Entergy's FAC Program for IPEC, CHECWORKS is only one tool within a robust and multi-faceted FAC Program at IPEC, which complies with the guidelines in NSAC-202L-R3. For example, only 22% of FAC-susceptible components at IP2, and 20% of FAC-susceptible components at IP3 are even

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4 *See* Testimony of Entergy Witnesses Ian D. Mew, Alan B. Cox, Nelson F. Azevedo, Jeffrey S. Horowitz, and Robert M. Aleksick Regarding Contention RK-TC-2 (Flow-Accelerated Corrosion) at A36 (Mar. 28, 2012) ("Entergy Test.") (ENT000029) (*citing* Hopenfeld Report at 4-18, 21-23 (RIV000005)).

5 *See id.* (*citing* Hopenfeld Report at 25-26).

modeled in CHECWORKS. In other words, the majority of FAC-susceptible components are managed using other methods. As recent IPEC outage reports demonstrate, only about one-quarter to one-third of inspections in any given outage have been based on CHECWORKS results.

In conclusion, Riverkeeper has not met its burden of presenting sufficient evidence to show a deficiency in Entergy's FAC Program. Riverkeeper presents no valid critique of the CHECWORKS computer code, which is only one tool within the larger FAC Program. In contrast, Entergy's FAC Program for IP2 and IP3 is consistent with the applicable criteria in NUREG-1801, Revision 1, and meets the intent of NUREG-1801, Revision 2. Contrary to Riverkeeper's contention, there is reasonable assurance that the aging effects of FAC will be adequately managed during the period of extended operation, consistent with 10 C.F.R. §§ 54.21(a)(3) and 54.29(a).

II. PROCEDURAL HISTORY OF CONTENTION RK-TC-2

A. Original Contention

On April 23, 2007, Entergy filed its application to renew the operating licenses for IP2 and IP3 for 20 years beyond their current expiration dates of September 28, 2013, and December 12, 2015, respectively. After a notice of opportunity for hearing was published in the *Federal Register* on August 1, 2007,[6] Riverkeeper filed a petition to intervene and proffered a number of contentions.[7] Riverkeeper TC-2 claimed that the LRA violates 10 C.F.R. § 54.21(a)(3) because it does not demonstrate that the effects of aging will be managed for FAC-

[6] 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).

[7] *See* Riverkeeper Inc.'s Request for Hearing and Petition to Intervene in the License Renewal Proceeding for the Indian Point Nuclear Power Plant (Nov. 30, 2007) ("Petition"), *available at* ADAMS Accession No. ML073410093.

susceptible components.[8] Riverkeeper claimed that the FAC AMP lacked sufficient details and failed to address each of the elements identified in NUREG-1801.[9] Riverkeeper's critique of Entergy's FAC Program focused on CHECWORKS, claiming that it is unreliable at IPEC because it is not adequately benchmarked following stretch power uprates ("SPUs") at IP2 and IP3, and that the CHECWORKS program has no track record of success at IPEC or in the industry as a whole.[10] Entergy and the NRC Staff opposed the admission of the contention in its entirety under 10 C.F.R. § 2.309(f)(1).[11]

The Board admitted RK-TC-2 on July 31, 2008, stating:

> [T]he Board admits Riverkeeper's TC-2 which contends that (1) Entergy's AMP for components affected by FAC is deficient because it does not provide sufficient details (*e.g.*, inspection method and frequency, criteria for component repair or replacement) to demonstrate that the intended functions of the applicable components will be maintained during the extended period of operation; and (2) Entergy's program relies on the results from CHECWORKS without benchmarking or a track record of performance at IPEC's power uprate levels.[12]

The Board also noted that, while the 2004 and 2005 SPUs at IP2 and IP3 (3.26% and 4.85%, respectively) were "much smaller" than the 20% extended power uprate ("EPU") at the Vermont Yankee Nuclear Power Station ("Vermont Yankee"), Entergy had not "provided any

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8 *See id.* at 15.

9 *See id.* at 16.

10 *See id.* at 20-22.

11 *See* Answer of Entergy Nuclear Operations, Inc. Opposing Riverkeeper Inc.'s Request for Hearing and Petition to Intervene (Jan. 22, 2008) ("Answer to Petition"), *available at* ADAMS Accession No. ML080300071; NRC Staff's Response to Petitions for Leave to Intervene Filed by (1) Connecticut Attorney General Richard Blumenthal, (2) Connecticut Residents Opposed to Relicensing of Indian Point, and Nancy Burton, (3) Hudson River Sloop Clearwater, Inc., (4) the State of New York, (5) Riverkeeper, Inc., (6) the Town of Cortlandt, and (7) Westchester County (Jan. 22. 2008) ("NRC Staff Answer to Petition"), *available at* ADAMS Accession No. ML080230649.

12 *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3), LBP-08-13, 68 NRC 43, 176-77 (2008).

information to explain what percent change in plant operating parameters would be small enough not to have a material effect on the CHECWORKS results."[13]

B. Motion for Summary Disposition

On August 25, 2010, Entergy filed a motion for summary disposition of RK-TC-2.[14] Entergy contended that, since the admission of RK-TC-2, Entergy and the Staff had provided substantial additional information about the FAC Program at IPEC which refuted Riverkeeper's claims.[15] Entergy also maintained that the CHECWORKS model had been updated with information from several post-uprate outages, and that a review of the computer code outputs during the post-uprate period indicated that the level of correlations between CHECWORKS predictions and measured wear values was consistent with industry and IPEC expectations.[16]

In its Opposition to Summary Disposition, Riverkeeper largely repeated the claims in its Petition. Once again, Riverkeeper asserted the inadequacy of CHECWORKS and the lack of any other "meaningful" tools in the IPEC FAC Program.[17]

On November 4, 2010, the Board denied Entergy's motion for summary disposition.[18] In doing so, the Board held that the 2010 Hopenfeld Declaration raised genuine issues of material fact which remained in dispute. The Board identified these questions to be whether:

> (1) Entergy's AMP for components affected by FAC is deficient because it does not provide sufficient details to demonstrate that

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13 *Id.* at 177.

14 *See* Applicant's Motion for Summary Disposition of Riverkeeper Technical Contention 2 (Flow-Accelerated Corrosion) (July 26, 2010), *available at* ADAM Accession No ML102140430.

15 *See id.* at 8-10.

16 *See id.* at 13.

17 *See generally* Riverkeeper Opposition to Entergy's Motion for Summary Disposition of Riverkeeper Technical Contention 2 (Flow-Accelerated Corrosion) (Aug. 16, 2010) ("Opposition"), *available at* ADAMS Accession No. ML102371214.

18 *See* Licensing Board Order (Ruling on Entergy's Motion for Summary Disposition of Riverkeeper TC-2 (Flow-Accelerated Corrosion)) at 9 (Nov. 4, 2010) ("Ruling on Summary Disposition").

> the intended functions of the applicable components will be maintained during the extended period of operation; and (2) Entergy's program relies on the results from CHECWORKS without adequate benchmarking or a track record of performance at IPEC's power uprate levels.[19]

C. Entergy's Motion in Limine

Riverkeeper submitted its Testimony, Statement, and supporting exhibits on December 22, 2011. Riverkeeper's testimony and principal claims are summarized in Section IV.A below. On January 30, 2012, Entergy filed a motion in limine, arguing that Riverkeeper's filings raised four new issues that were not reasonably inferred from the stated and admitted bases for RK-TC-2.[20] The NRC Staff supported Entergy's Motion in Limine,[21] and Riverkeeper opposed it.[22]

The Board denied Entergy's Motion in Limine on March 6, 2012, finding that although these four issues "were not central to Riverkeeper's claims in its petition, they are related and relevant to whether FAC will be adequately managed during the period of extended operations."[23] Entergy respectfully disagrees with the Board's Ruling on Motions in Limine, but fully addresses the disputed issues in its Testimony, as discussed in Section IV.B.2.h, below.[24]

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19 *Id.* at 8.

20 *See* Entergy's Motion in Limine to Exclude Portions of Pre-Filed Direct Testimony, Expert Report, Exhibits, and Statement of Position for Contention RK-TC-2 (Flow-Accelerated Corrosion) at 7 (Jan. 30, 2012) ("Motion in Limine"). Those four new issues alleged that *undetected* FAC: (1) poses a risk of loss-of-coolant accidents ("LOCAs") and associated alleged deficiencies in the IPEC probabilistic risk assessments ("PRAs"); (2) could affect the integrity of components under seismic loads; (3) could affect the integrity of components under station blackout ("SBO") loads; and (4) could affect the likelihood of components succumbing to the effects of metal fatigue. *See* Hopenfeld Report at 24-25 (RIV000005).

21 *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 Riverkeeper TC-2 (Flow-Accelerated Corrosion) (Feb. 9, 2012), *available at* ADAMS Accession No. ML12040A348.

22 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 Riverkeeper TC-2 (Flow-Accelerated Corrosion) ("Riverkeeper Answer") (Feb. 17, 2012), *available at* ADAMS Accession No. ML12048B483.

23 Licensing Board Order (Granting in Part and Denying in Part Applicant's Motions in Limine) at 23 (Mar. 6, 2012) (unpublished) ("Ruling on Motions in Limine").

24 In doing so, Entergy does not waive its rights with regard to the scope of the admitted contention, particularly given the Commission's recent decision in *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-

III. APPLICABLE LEGAL AND REGULATORY STANDARDS

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

1. Regulatory Requirements

Under the governing regulations in Part 54, the review of license renewal applications is confined to matters relevant to the period of extended operation requested by the applicant. The Commission has stated that "[a]djudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review, for our hearing process (like our Staff's review) necessarily examines only the questions our safety rules make pertinent."[25] The Commission has specifically limited its license renewal safety review to the matters specified in 10 C.F.R. §§ 54.21 and 54.29(a)(2), which focus on the management of aging of certain systems, structures, and components ("SSCs"), and the review of time-limited aging analyses ("TLAAs").[26]

2. NRC Staff Guidance

NUREG-1801, Revision 1 provides the technical basis for the SRP-LR and contains the NRC Staff's generic evaluation of programs used to manage the effects of aging during the PEO, to meet the requirements of 10 C.F.R. Part 54. NUREG-1801, Revision 1 indicates that many

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05, 75 NRC __, slip op. (Mar. 8, 2012). In that decision, the Commission specifically rejected the theory that a Board "admits contentions . . . and not their supporting bases." *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), LBP-11-02, 73 NRC __, slip op. at 31 (Feb. 15, 2011). Instead, the Commission explained that "an admitted contention *is defined by its bases*." *Seabrook*, CLI-12-05, slip op. at 11 n.50 (emphasis added).

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

[26] *See Turkey Point*, CLI-01-17, 54 NRC at 7-8; *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-26, 56 NRC 358, 363 (2002). As explained in Section III.A.2, below, NRC guidance for the license renewal process is set forth in NUREG-1801, Revision 1, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Revision 1 (Sept. 2005) ("SRP-LR") (NYS000195), and Regulatory Guide ("RG") 1.188, Standard Format and Content for Applications to Renew Nuclear Power Plant Operating License (Sept. 2005).

existing, current-term programs are also adequate to manage the aging effects for particular structures or components for license renewal. It also contains recommendations concerning specific areas for which existing licensee programs should be augmented for license renewal.[27] Thus, programs that are consistent with NUREG-1801, Revision 1 are generally accepted by the Staff as adequate to meet the license renewal rule.[28]

NUREG-1801 describes an acceptable FAC program based on the EPRI guidance document NSAC-202L-R2.[29] Although NUREG-1801, Revision 1 references NSAC-202L-R2, Entergy relies upon the more recent update to EPRI's guidance, NSAC-202L-R3, for its fleet-wide FAC Program.[30] Entergy's use of NSAC-202L-R3 has been reviewed and approved by the NRC Staff.[31]

A license renewal applicant's use of the guidance in NUREG-1801, Revision 1 satisfies regulatory requirements under 10 C.F.R. Part 54.[32] As the Commission recently held, "Where the NRC develops a guidance document to assist in compliance with applicable regulations, it is entitled to special weight."[33] In particular, for license renewal safety issues, a "license renewal

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27 *See* NUREG-1801, Rev. 1, at 4 (NYS00146A).

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

29 *See* NUREG-1801, Rev. 1, at XI M-61 (NYS00146C).

30 *See* Nuclear Safety Analysis Center (NSAC)-202L, Recommendations for an Effective Flow-Accelerated Corrosion Program, Rev. 3 (May 2006) ("NSAC-202L-R3") (RIV000012).

31 *See* NUREG-1930, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3, at 3-24 (Nov. 2009) ("SER") (NYS00326B). As explained below, the use of NSAC-202L-R3 is also consistent with the NRC Staff's new guidance in NUREG-1801, Revision 2.

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

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

applicant's use of an aging management program identified in the GALL Report [*i.e.*, NUREG-1801, Revision 1] *constitutes reasonable assurance* that it will manage the targeted aging effect during the renewal period."[34] The Commission recently reiterated this principle, holding that "a commitment to implement an AMP that the NRC finds is consistent with the GALL Report [*i.e.*, NUREG-1801, Revision 1] constitutes one acceptable method for compliance with 10 C.F.R. § 54.21(c)(1)(iii)."[35] To challenge the adequacy of an NRC-approved guidance document, an intervenor must provide specificity and substantial support for such a challenge,[36] in order to overcome the "special weight" accorded to a guidance document—such as NUREG-1801, Revision 1—that has been implicitly endorsed by the Commission.[37]

Based on this case law, a finding that an applicant's AMP is consistent with NUREG-1801, Revision 1 carries special weight and constitutes a finding of reasonable assurance under 10 C.F.R. §§ 54.21(a), 54.21(c)(1)(iii), and 54.29(a). In November 2009, the NRC Staff issued its SER, finding Entergy's LRA to be consistent with NUREG-1801, Revision 1 and acceptable.[38]

3. NUREG-1801, Revision 2

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

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

35 *Vt. Yankee, LLC* (Vt. Yankee Nuclear Power Station), CLI-10-17, 72 NRC 1, 36 (2010).

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

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

38 *See* SER at 3-30 (NYS00326B).

The primary difference between Revisions 1 and 2 of NUREG-1801 is that Revision 2 permits an applicant to rely on either NSAC-202-L-R2 or -R3 as the basis for its FAC program, while Revision 1 only references NSAC-202L-R2.[39] In the IPEC LRA, Entergy took an exception to the guidance in NUREG-1801, Revision 1, to rely upon the more recent guidance in NSAC-202L-R3 for the FAC Program.[40] Because it relies on NSAC-202L-R3, the IPEC FAC Program not only is consistent with NUREG-1801, Revision 1, but also meets the intent of the new guidance in NUREG-1801, Revision 2.

B. Burden of Proof

At the hearing stage, an intervenor has the initial "burden of going forward"; that is, it must provide sufficient, probative evidence to establish a *prima facie* case for the claims made in the admitted contention.[41] The mere admission of a contention does not satisfy this burden.[42] 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.[43]

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39 *See* NUREG-1801, Rev. 2, at IX-31 (NYS00147C); NUREG-1801, Rev. 1, at IX-30 (NYS00146C).

40 *See* NL-07-153, Letter from Fred R. Dacimo, Entergy, to NRC, "Amendment 1 to License Renewal Application (LRA)," Attach. 1, at 46-48 (Dec. 18, 2007) (NYS000159).

41 *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-09-07, 69 NRC 235, 269 (2009), (*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).

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

43 *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.

To prevail, the Applicant's position must be supported by a preponderance of the evidence.[44]

C. The Reasonable Assurance Standard

For safety issues, pursuant to Section 54.29(a), the NRC will issue a renewed license if it finds that actions have been identified and have been or will be taken by the applicant, such that there is *reasonable assurance* that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB.[45]

Longstanding precedent makes clear that the reasonable assurance standard does not require an applicant to meet an "absolute" or "beyond a reasonable doubt" standard.[46] Rather, the Commission takes a case-by-case approach, applying sound technical judgment and verifying the applicant's compliance with Commission regulations.[47]

IV. ARGUMENT

A. Intervenor's Witness and Position

The party sponsoring a witness has the burden of demonstrating that the witness is qualified.[48] "A witness may qualify as an expert by knowledge, skill, experience, training, or

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44 *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.

45 10 C.F.R. § 54.29(a). This regulation also requires any applicable environmental requirements of 10 C.F.R. Part 51,Subpart A, to be satisfied.

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

47 *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).

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

education to testify if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue."[49]

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

1. Dr. Hopenfeld's Testimony

Ultimately, Dr. Hopenfeld's testimony makes two main claims. First, he asserts that CHECWORKS does not accurately predict FAC wear rates.[50] To support this claim, Dr. Hopenfeld asserts that there are inaccurate IPEC CHECWORKS predictions, that there is a need for further benchmarking of the CHECWORKS computer program, that IPEC corrective action program reports, primarily documenting the results of FAC program inspections, revealed "unacceptable" wall thinning, and that there are examples of CHECWORKS "failures" at other facilities.[51] Dr. Hopenfeld's second claim is that CHECWORKS is the only tool in Entergy's FAC Program at IPEC.[52] Based on these claims, Dr. Hopenfeld concludes that the Energy FAC Program is inadequate. [53]

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

Dr. Hopenfeld's *curriculum vitae* does not show that he has worked directly on FAC program issues, as a member of the NRC Staff or at any other time.[54] His publications are similarly silent on FAC-related issues.[55]

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

50 *See* Hopenfeld Report at 4-18 (RIV000005).

51 *See id.*at 14.

52 *See id.* at 21-23.

53 *See id.* at 25-26.

54 *See Curriculum Vitae* of Joram Hopenfeld ("Hopenfeld CV") (Dec. 22, 2011) (RIV000004).

Based on a review of his *curriculum vitae*, Dr. Hopenfeld's only experience with FAC was appearing as a witness in *Vermont Yankee*,[56] where the Board reviewed Dr. Hopenfeld's various FAC and CHECWORKS-related theories—many of which are repeated in his testimony in this proceeding—and uniformly rejected them.[57] As Entergy's experts show, Dr. Hopenfeld's testimony does not accurately reflect certain basic concepts about FAC, CHECWORKS, and the FAC program. Further, during the *Vermont Yankee* hearing, Dr. Hopenfeld admitted his unfamiliarity with the corrosion process involved in FAC, stating that he was "not an expert on the corrosion process."[58] Thus, by his own admission, Dr. Hopenfeld lacks expertise on an issue central to this contention, and on which he has submitted extensive testimony in this proceeding—the physical process associated with FAC.

Notably, despite Dr. Hopenfeld's apparent minimal experience with FAC issues, he expresses his conclusions stridently, but without sufficient evidentiary support. For example, at the end of his Report, he recites his primary claims as follows: "Since CHECWORKS is *woefully* inaccurate, and *clearly* far from properly benchmarked, Entergy's FAC management program is inadequate,"[59] when, as Entergy's witnesses show, Dr. Hopenfeld does not acknowledge that CHECWORKS is performing its intended screening function as one of many tools within the IPEC FAC Program. The certainty with which Dr. Hopenfeld expresses his opinions, despite

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55 *See id*. at 4-5 (Dr. Hopenfeld's CV does not include page numbers, so Entergy's reference is to the sequential page number in the exhibit file).

56 *See* Riverkeeper Initial Statement of Position Regarding Contentio RK-TC-2 (Flow Accelerated Corrosion) at 8 (Dec. 22, 2011) ("RK Statement of Position"); *see also Entergy Nuclear Vt. Yankee* (Vt. Yankee Nuclear Power Station), LBP-08-25, 68 NRC 763 (2008).

57 *See Vt. Yankee*, LBP-08-25, 68 NRC at 891 ("NEC's experts may be misunderstanding the purpose of CHECWORKS in the FAC program in their attempt to use continuous benchmarking of the model to predict absolute wear. As confirmed by Entergy and the NRC Staff, this is an impossible goal, which is recognized by the guidance documents for implementing this model.").

58 *Id.* at 862.

59 Hopenfeld Report at 25 (RIV000005) (emphasis added).

substantial evidence contradicting his opinions, further reduces the probative value of his testimony.

Indeed, Dr. Hopenfeld has, in another context, already described the problems with his own testimony on this contention. In a Declaration he submitted in the *Vermont Yankee* license renewal proceeding—a document related to a number of contentions, including one very similar to this one—he asserted that the presiding Board in that case lacked the requisite specific expertise, stating as follows: "the issues in this case involve very specific and not broadly understood materials, mechanics, energy, and plant operations phenomena beyond the depth of most generalists."[60] Dr. Hopenfeld's statement speaks directly to the deficiencies in his own testimony, which reflects a lack of specialized expertise in the field of FAC.

For these reasons, the Board should accord little or no weight to Dr. Hopenfeld's testimony on this contention.

B. Entergy's Witnesses and Position

1. Entergy's Witnesses

Entergy's testimony on RK-TC-2 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 RK-TC-2. Collectively, these witnesses will demonstrate that RK-TC-2 lacks merit.

a. Mr. Ian D. Mew

Ian Mew's professional and educational qualifications are summarized in his *curriculum vitae*.[61] Mr. Mew is employed by Entergy as a Senior Engineer in Programs and Components

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[60] Declaration of Dr. Joram Hopenfeld in Support of New England Coalition's Motion for Reconsideration ¶13, at 5 (Dec. 15, 2008) ("2008 Vermont Yankee Hopenfeld Decl.") (ENT000089).

[61] *See Curriculum Vitae* for Ian D. Mew (ENT000030).

Engineering at IPEC. He holds a Bachelor of Science degree in mechanical engineering from the Polytechnic Institute of New York and has more than 30 years of experience in the nuclear power industry. For the last 16 years, Mr. Mew has been heavily involved in FAC and steam generator program development and inspection. Mr. Mew has participated in several industry FAC working groups and industry-wide efforts to model and assess the effects of this aging mechanism.

As the program owner, Mr. Mew has extensive experience with the implementation of the FAC AMP at IPEC, including the CHECWORKS system and how, and to what extent it, is used to manage aging. His testimony focuses on the Entergy fleet-wide FAC Program, as set forth in EN-DC-315, Rev. 6[62] and its implementation at IPEC. For these reasons, Mr. Mew is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on FAC issues and the Entergy FAC Program at IPEC.

b. Mr. Alan B. Cox

Alan Cox's professional and educational qualifications are summarized in his *curriculum vitae*.[63] In brief, he holds a Bachelor of Science degree in Nuclear Engineering from the University of Oklahoma and a Master of Business Administration (M.B.A.) from the University of Arkansas at Little Rock. He is currently the Technical Manager for License Renewal at Entergy. Mr. Cox has more than 34 years of experience in the nuclear power industry, having served in various positions related to engineering and operations of nuclear power plants, including several years as a licensed reactor operator and a senior reactor operator. Since 2001, he has worked full-time on license renewal matters, supporting the integrated plant

62 EN-DC-315, Rev. 6, Flow Accelerated Corrosion Program (Mar. 1, 2010) (ENT000038).

63 *See Curriculum Vitae* for Alan B. Cox (ENT000031).

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 FAC Program. 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 matters discussed in his testimony that relate to implementation of the IPEC FAC Program, 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 FAC Program at IPEC.

c. Mr. Nelson F. Azevedo

Nelson Azevedo's professional and educational qualifications are summarized in his curriculum vitae.[64] Mr. Azevedo is employed by Entergy as the Supervisor of Code Programs at Indian Point Energy Center. He holds a Bachelor of Science degree in mechanical and materials engineering from the University of Connecticut, a Master of Science in mechanical engineering and a Master of Business Administration (M.B.A.) 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 FAC, inservice inspection, inservice testing, snubber testing, boric acid corrosion control, non-destructive examination, fatigue monitoring, steam generators, buried piping, alloy 600

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

cracking, reactor vessel embrittlement, welding, and 10 C.F.R. Part 50, Appendix J containment leakage programs. In addition to those duties he represents IPEC before industry organizations, including the pressurized water reactor ("PWR") Owners Group Management Committee.

Prior to becoming a Manager at Northeast Utilities, Mr. Azevedo was an Engineer for more than ten years and an Engineering Supervisor for another five at Northeast Utilities, which owned and operated the Connecticut Yankee and Millstone Stations. He was responsible for, among other duties, developing the Northeast Utilities' FAC program for the Connecticut Yankee and Millstone Stations and implementing the FAC program for Connecticut Yankee in the early 1990s. This included both working with EPRI to develop the initial program and managing the field activities to implement the required inspections and repairs/replacements. The Northeast Utilities FAC program was one of the first comprehensive FAC programs developed following several pipe failures, and this program later became one of the models used to upgrade FAC programs throughout the industry. As a Department Manager with Northeast Utilities, Mr. Azevedo managed five engineering sections responsible for implementing numerous engineering programs at the Millstone Nuclear Power Station, including the FAC programs for the three Millstone plants.

As Supervisor of Code Programs at IPEC, he has been responsible for FAC-related issues since January 2001. These activities include the supervision of the IPEC FAC Program, as well as refueling outage-related activities, including inspection location selection, field inspections, evaluation of inspection results, and any necessary repairs and/or replacements. Accordingly, Mr. Azevedo is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on the Entergy FAC Program at IPEC.

d. Dr. Jeffrey S. Horowitz

Jeffrey Horowitz's professional and educational qualifications are summarized in his *curriculum vitae*.[65] Dr. Horowitz holds four degrees in mechanical engineering, including a doctor of science degree from the Massachusetts Institute of Technology. Dr. Horowitz has been retained as an independent consultant by Entergy. Dr. Horowitz has more than 40 years of experience in the field of nuclear energy and related disciplines. For over 25 years he has been an independent consultant specializing in FAC and nuclear safety analysis. His primary client during this time has been the Electric Power Research Institute ("EPRI"), but he has also consulted on FAC-related issues for several U.S. and foreign utilities that operate nuclear power plants. In all, Dr. Horowitz has also participated in audits of the FAC programs at about 60 nuclear units in the United States and Canada.

Dr. Horowitz was the co-developer of the computer program CHEC (Chexal-Horowitz Erosion Corrosion) and demonstrated and released it to U.S. utilities in 1987. Later, he led the development of new and revised CHEC-related codes– CHECMATE and, ultimately, CHECWORKS (Chexal-Horowitz Engineering Corrosion Workstation)–which expanded on CHEC's capabilities. In sum, Dr. Horowitz possesses extensive knowledge of the CHECWORKS model and has extensive experience assessing and auditing FAC programs at IPEC and at industry facilities in general. Dr. Horowitz also played a key role in drafting NSAC-202L and its subsequent revisions. This NRC-approved guidance document is relied upon by Entergy at IPEC and by utilities throughout the U.S. nuclear industry. Dr. Horowitz has also conducted an audit of the IPEC FAC Program.[66] Thus, Dr. Horowitz is qualified through

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[65] *See Curriculum Vitae* for Jeffrey S. Horowitz (ENT000033).

[66] *See* Entergy Test. at A8 (ENT000029); Horowitz Audit of the IPEC FAC Program (Mar. 2012) (ENT000034).

knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on CHECWORKS, FAC issues and the industry's efforts to manage this phenomenon.

e. Mr. Robert M. Aleksick

Robert Aleksick's professional and educational qualifications are summarized in his *curriculum vitae*.[67] Mr. Aleksick is the President and founder of CSI Technologies, Inc., which specializes in FAC services and software development, and has assisted IPEC and other Entergy sites with numerous FAC-related projects for over two decades. CSI Technologies employs approximately 15 FAC Engineers. Mr. Aleksick has worked on or managed nearly 1,000 FAC-related projects at over 100 nuclear units. His clients include EPRI, INPO, and approximately 75% of the US nuclear power plants. He has participated in numerous industry initiatives and working groups.

As discussed in his Testimony[68] and *curriculum vitae*, Mr. Aleksick has extensive knowledge of the matters discussed herein that relate to the industry experience with FAC and the development of programs to predict which plant components may be susceptible to FAC. Moreover, Mr. Aleksick has direct knowledge of the Entergy FAC Program as implemented at IPEC as he has managed the CHECWORKS model and other key FAC Program documents at IPEC since 1992. Thus, Mr. Aleksick is qualified through knowledge, skill, directly-relevant experience, training, and education to provide expert witness testimony on FAC issues, the use of CHECWORKS, the industry's efforts to manage FAC and the Entergy FAC Program at IPEC.

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67 *See Curriculum Vitae* for Robert M. Aleksick (ENT000037).

68 *See* Entergy Test. at A22-A23 (ENT000029).

2. Entergy's Statement of Position

In their testimony, Entergy's experts explain why the FAC Program set forth in Entergy's LRA for IP2 and IP3 provides reasonable assurance that, the effects of aging due to FAC will be adequately managed such that the intended functions of FAC-susceptible components will be maintained consistent with the CLB during the PEO, as required by 10 C.F.R. §§ 54.21(a)(3) and 54.29(a). Specifically, they provide technical background testimony on FAC and the relevant NRC regulations and guidance.[69] They also provide an overview of the LRA as it relates to FAC and a summary of the NRC Staff's review of the LRA on this topic,[70] a discussion of the key attributes of the IPEC FAC Program,[71] an overview of how the CHECWORKS computer code functions,[72] and a summary of the impact of the SPUs at IP2 and IP3 on FAC Program activities.[73] As summarized below, Entergy's experts refute the Intervenor's claims point-by point, thereby demonstrating that the issues raised in RK-TC-2 and the Intervenor's associated evidentiary submissions lack merit.

a. CHECWORKS is Only One Aspect of the IPEC FAC Program

In Section VI.A of its prefiled testimony, Entergy's witnesses explain the role of the CHECWORKS program within the larger FAC Program at IPEC.[74] In his testimony, Dr. Hopenfeld repeatedly asserts that CHECWORKS is the "predominant feature" of Entergy's FAC

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69 *See id.* §§ IV, V.A.

70 *See id.* § V.B.

71 *See id.* § V.C.

72 *See id.* § V.D.

73 *See id.* § V.E.

74 *See id.* § VI.A.

Program.[75] However, Entergy's experts demonstrate that CHECWORKS is neither the only method nor the predominant method used at IPEC to select inspection locations.[76] At IP2, 22%, and at IP3, 20% of susceptible Analysis Lines are currently modeled in CHECWORKS.[77] For the vast majority of FAC-susceptible components at IPEC, inspection locations are selected through methods other than CHECWORKS. Those methods include: (1) calculations of a component's predicted wall thickness using pipe wall thicknesses data collected from ultrasonic testing (called "trending"); (2) industry experience related to FAC; (3) results from other plant inspection programs, such as the valve maintenance program; (4) engineering judgment; and (5) the susceptible non-modeled rankings, which are calculated based on operating conditions, consequence of failure, maintenance history, and industry experience.[78]

Even for those components that are modeled by CHECWORKS, the first four of these other tools play significant roles in the selection of inspection locations.[79] In fact, once a CHECWORKS-modeled component is inspected, the resulting measurements are trended in an identical manner as data from a non-modeled component.[80] Thus, reinspections of CHECWORKS-modeled locations are based on trending, *not* CHECWORKS.[81] As a result, Dr. Hopenfeld's statement that FAC-related industry and plant operating experience are merely

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75 Hopenfeld Report at 23 (RIV000005); *id* at 4 (stating that the FAC Program is "largely based on the computer program CHECWORKS"); *id*. (stating that Entergy "primarily" selects inspection locations based on CHECWORKS); *id* at 20 (stating that the FAC Program relies "integrally" on CHECWORKS to determine inspection locations).

76 *See* Entergy Test. at A77, A94 (ENT000029).

77 *See id.* at A76, A94.

78 *See id.*. at A95.

79 *See id*.

80 *See id.* at A80, A84, A95.

81 *See id.*; EPRI, CHECWORKS Steam/Feedwater Application Guidelines for Plant Modeling and Evaluation or Component Inspection Data at 2-1, 2-2 (Nov. 2009) (ENT000071).

additional "types of information that feed directly into CHECWORKS"[82] is simply incorrect.[83] Industry and plant operating experience *directly* inform the selection of inspection locations, and are not filtered through CHECWORKS.[84] This is obviously true for components that are not modeled in CHECWORKS, but it also holds true for modeled lines.[85]

Entergy's experts, using data from recent outages, demonstrate that the FAC Program uses multiple independent tools to determine inspection locations.[86] First-time inspections based on predictions from CHECWORKS normally comprise between one-quarter and one-third of FAC inspections in a given outage.[87] This is true for both IP2 and IP3, and in general throughout the U.S. nuclear fleet.[88] For example, during the recent 2R19 outage at IP2 in 2010, new CHECWORKS locations comprised 26% of the total number of inspections.[89] Reinspections based on trending accounted for 46%, inspections based on operating experience accounted for 7%, and the remaining 21% were inspections of previously uninspected Susceptible Non-Modeled ("SNM") components.[90] Similarly, at IP3, in the 3R14 outage in 2007, shortly after the SPU, CHECWORKS locations comprised 36% of the total number of inspections.[91] Reinspections based on trending accounted for 31%, operating experience (including locations

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82 Hopenfeld Report at 21 (RIV000005).

83 *See* Entergy Test. at A98 (ENT000029).

84 *See id*. at A77, A98.

85 *See id*. at A98.

86 *See id*. at A77.

87 *See id.*

88 *See id.*

89 *See id.*; Scope of Flow-Accelerated Corrosion Inspection Points for 2R19 Outage (Apr. 4, 2010) (ENT000057).

90 *See* Entergy Test. at A77 (ENT000029); Scope of Flow-Accelerated Corrosion Inspection Points for 2R19 Outage (Apr. 4, 2010) (ENT000057).

91 *See* Entergy Test. at A77 (ENT000029); Scope of Flow-Accelerated Corrosion Inspection Points for 3R14 Outage (Apr. 2, 2007) (ENT000061).

selected specifically due to the power uprate) accounted for 33%, and the remaining 1% were inspections of previously uninspected SNM components.[92] Figures 1 and 2 below illustrate the inspection distributions from the five most recent outages for IP2 and IP3, respectively. These data show that Dr. Hopenfeld is incorrect when he states that "Entergy's method of selecting components for wall measurements and determining the time between successive thickness measurements is primarily based on predictions generated from the computer code, CHECWORKS."[93]

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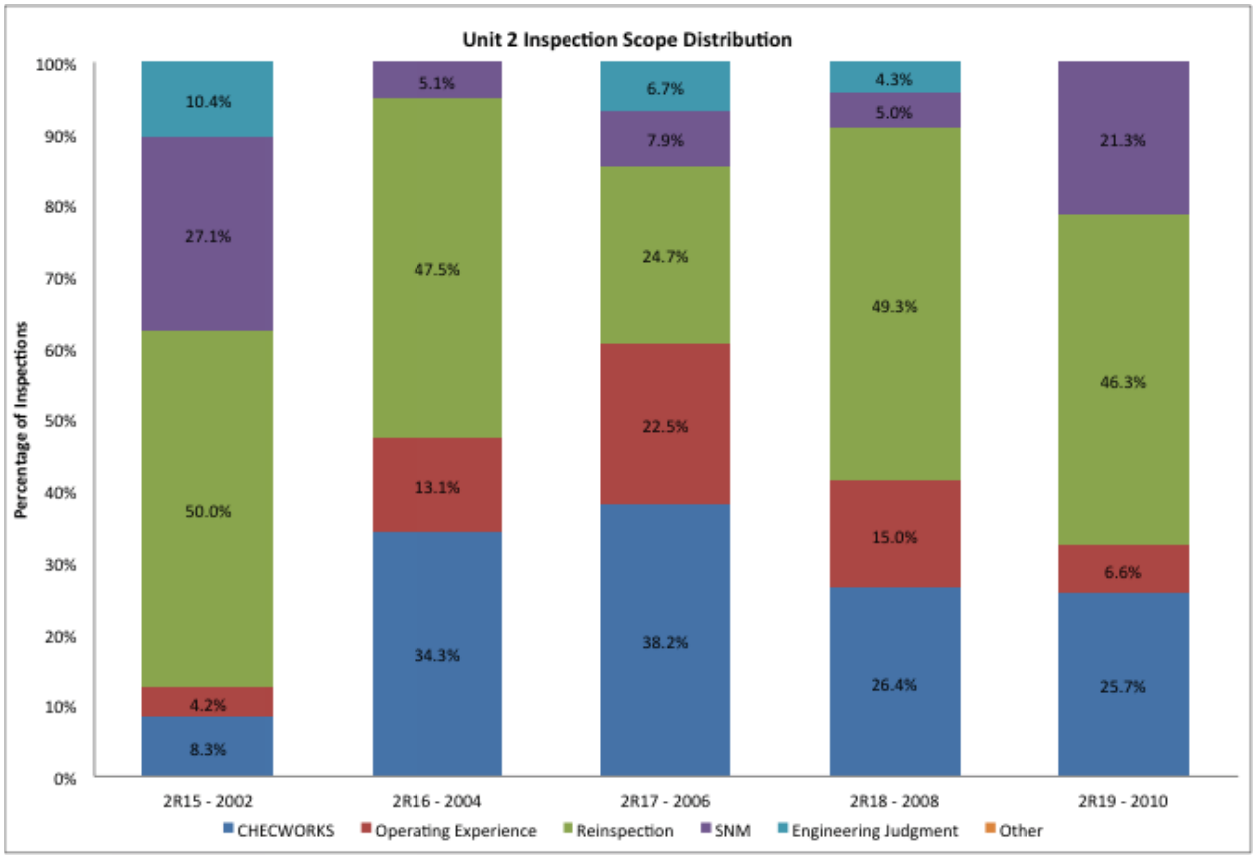
92 *See* Entergy Test. at A77 (ENT000029); Scope of Flow-Accelerated Corrosion Inspection Points for 3R14 Outage (Apr. 2, 2007) (ENT000061).

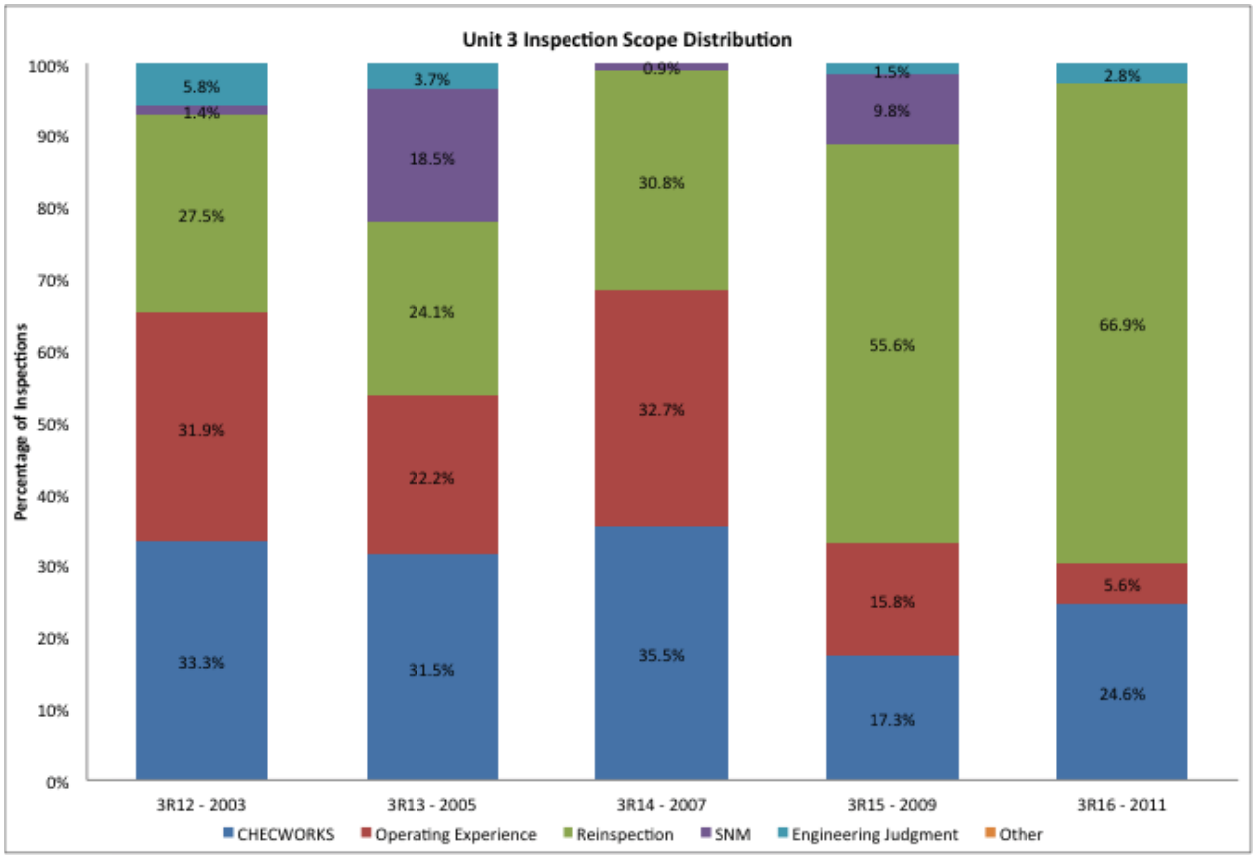
93 Hopenfeld Report at 4 (RIV000005); *see* Entergy Test. at A77 (ENT000029).

Figure 1 – IP2 Inspection Scope Distribution[94]



[94] *See* Entergy Test. at A77 (ENT000029); Scope of Flow-Accelerated Corrosion Inspection Points for 2R19 Outage (Apr. 4, 2010) (ENT000057); Scope of Flow-Accelerated Corrosion Inspection Points for 2R18 Outage (Jun. 2007) (ENT000058); Scope of Flow-Accelerated Corrosion Inspection Points for 2R17 Outage (Apr. 17, 2006) (ENT000059); Scope of Flow-Accelerated Corrosion Inspection Points for 2R15 and 2R16 Outages (Aug. 2002; Jun. 2005) (ENT000060).

Figure 2 – IP3 Inspection Scope Distribution[95]



In sum, Entergy's witnesses demonstrate that many tools are used to determine inspection locations at IPEC, and that for the majority of components at IPEC, CHECWORKS is not even one of them.

b. CHECWORKS is Performing Well at IPEC

In Section VI.B of its prefiled testimony, Entergy's witnesses show that, for those components modeled by CHECWORKS, the software adequately performs its intended purpose of assisting the FAC engineer in identifying locations in need of inspections. First, Entergy's

[95] *See* Entergy Test. at A77 (ENT000029); Scope of Flow-Accelerated Corrosion Inspection Points for 3R14 Outage (Apr. 2, 2007) (ENT000061); Scope of Flow-Accelerated Corrosion Inspection Points for 3R16 Outage (Sept. 19, 2011) (ENT000062); Scope of Flow-Accelerated Corrosion Inspection Points for 3R12 and 3R13 Outages (Jan. 2003; Apr. 2005) (ENT000063); Scope of Flow-Accelerated Corrosion Inspection Points for 3R15 Outage (Mar. 2009) (ENT000064).

experts explain that CHECWORKS is designed to provide a best-estimate of wear rates at IPEC, rather than a bounding prediction, and why this approach is more appropriate given the types of components being modeled and CHECWORKS's function within the IPEC FAC Program.[96] In particular, in using CHECWORKS FAC engineers focus on the rankings of relative wear rates for components, not on absolute wear rates.[97] Thus, CHECWORKS helps focus the attention of the FAC Program on those components that may be experiencing wear, *or* where the Analysis Line is not well-calibrated or there are other indicia of uncertainty, such that inspections are necessary.[98] Then, based on actual, measured data, the appropriate corrective action is taken.[99]

In this regard, Entergy's witnesses explain that when modeling FAC-susceptible components, CHECWORKS looks at Analysis Lines with similar characteristics that are being subjected to similar conditions.[100] These Analysis Lines are classified by the analyst as either "calibrated" or "non-calibrated" based on the criteria in NSAC-202L-R3.[101] A calibrated line has a reasonably good correlation between the predicted and measured wall thicknesses,[102] and thus the need for inspections can be determined based on the predicted wall thickness.[103] Under the IPEC FAC Program, if a line is determined to be non-calibrated, then additional inspections are conducted on that line, or the affected components are repaired or replaced.[104] In other words, when CHECWORKS cannot properly model wear rates in a particular Analysis Line, this

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96 *See* Entergy Test. at A103 (ENT000029).

97 *See id.* at A93.

98 *See id.* at A36, A92, A103.

99 *Id.* at A103.

100 *See id.* at A86.

101 *Id.*

102 *See id.*

103 *See id.*

104 *See id.* at A86-87.

is a signal to the FAC engineer that this line should be inspected to measure the wall thickness. It is not—as Dr. Hopenfeld asserts in his testimony—an indication that CHECWORKS is not performing properly.

In his Report, Dr. Hopenfeld posits that if CHECWORKS underestimated the wear rate for a component, then Entergy could forego inspections and critical thickness could be reached well before the end of the PEO.[105] Entergy, however, does not determine inspection locations based on CHECWORKS's predictions of the time to critical thickness.[106] Instead, CHECWORKS is used to *rank* components and assist in the selection of inspection locations based on *relative* predicted wear rates.[107] Moreover, CHECWORKS-modeled components can be selected for inspection for many reasons independent of CHECWORKS.[108] And, once components are inspected, re-inspection and replacement decisions are based on the trending of measurements, not the CHECWORKS predictions.[109]

Thus, Entergy's witnesses show that CHECWORKS is properly performing its intended function within the overall IPEC FAC Program, which is to focus more inspection attention on those Analysis Lines that are most likely to experience FAC *and* on those Analysis Lines where the rate of FAC cannot be accurately modeled. The NRC Staff also concluded that the IPEC FAC Program, of which CHECWORKS is one part, was acceptable.[110] Dr. Hopenfeld's claims to the contrary lack merit.

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105 *See* Hopenfeld Report at 14 (RIV000005).

106 *See* Entergy Test. at A113 (ENT000029).

107 *See id.*

108 *See id.*

109 *See id.*

110 *Id.* at A58.

c. CHECWORKS Does Not Require Extended Benchmarking Following a Power Uprate

In Section VI.C Entergy's witnesses demonstrate that further benchmarking of CHECWORKS is not necessary following the 2004 and 2005 SPUs at IPEC for CHECWORKS to perform its intended function. Dr. Hopenfeld claims that, at least for some components, "at least ten to fifteen years of benchmarking the FAC model" is necessary.[111] The *Vermont Yankee* Board rejected an identical claim as "unreasonable and not defensible in light of the goal of CHECWORKS to merely identify locations for plant inspections."[112] As Entergy's witnesses explain, Entergy uses CHECWORKS for the same purpose at IPEC. As explained further below, both the IPEC and the Vermont Yankee FAC Programs are implemented in accordance with the same Entergy fleet-wide procedure.[113] The extended benchmarking that Dr. Hopenfeld describes is unreasonable and unnecessary for IPEC, just as it was for Vermont Yankee, because CHECWORKS is one among several tools used in the selection of FAC inspection locations.[114]

Finally, contrary to Dr. Hopenfeld's speculative assertion about the need for extended benchmarking, a recent EPRI study examined the impact of SPUs and EPUs of up to 20% on the FAC programs of 22 U.S. nuclear units, and found that CHECWORKS prediction reasonably matched actual inspection conditions and the power uprates for all of the units.[115] Moreover, as noted above, inspection data and predictions from post-power uprate outages at IPEC correlate well with pre-uprate data.

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111 Hopenfeld Report at 3-4 (RIV000005).

112 See *Vt. Yankee*, LBP-08-25, 68 NRC at 890.

113 *See* Entergy Test. at A124 (ENT000029).

114 *See id.* at A115; *Vt. Yankee*, LBP-08-25, 68 NRC at 883.

115 *See* Entergy Test. at A116 (ENT000029); EPRI Report, Plant Engineering: Impact of Electric Power Uprates on Flow-Accelerated Corrosion (July 2011) (ENT000081).

d. The *Vermont Yankee* Board Previously Rejected Many of Dr. Hopenfeld's Theories Regarding FAC

In section VI.D, Entergy's witnesses compare Dr. Hopenfeld's claims in this proceeding to the very similar claims raised in the *Vermont Yankee* license renewal hearing. They explain that the Entergy fleet-wide FAC program that the *Vermont Yankee* Board found to be acceptable in 2008 is the same program at issue in this proceeding.[116] Both facilities' FAC programs utilize CHECWORKS and are implemented in accordance with NSAC-202L-R3 and Entergy's fleet-wide procedure EN-DC-315.[117] Thus, the distinctions Dr. Hopenfeld and Riverkeeper draw between *Vermont Yankee* and IPEC fall short.[118]

The Board in *Vermont Yankee* rejected several of the same Intervenor objections that have been raised again in the current proceeding, including: (1) that CHECWORKS needs 10 to 15 years of benchmarking following a power uprate; (2) that CHECWORKS and the FAC Program did not address physical erosion; and (3) that the FAC program relied solely on CHECWORKS.[119] Entergy's experts demonstrate that the distinctions Dr. Hopenfeld draws between the Vermont Yankee FAC Program from the IPEC FAC Program are incorrect.

For example, Dr. Hopenfeld claims that IPEC and Vermont Yankee are different because of the extent of the two facilities' usage of CHECWORKS.[120] He claims that the *Vermont Yankee* Board found that "only a small fraction of inspection locations were based on the use of CHECWORKS," whereas the IPEC FAC Program relies "integrally" on CHECWORKS to

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116 *See* Entergy Test. at A124 (ENT000029).

117 *Id.*

118 *See id.* § VI.D.

119 *See Vt. Yankee*, LBP-08-25, 68 NRC at 889-894.

120 *See* Hopenfeld Report at 20 (RIV000005).

determine inspection locations.[121] In *Vermont Yankee*, Entergy showed that only one-third of the inspection locations were based on the results from CHECWORKS."[122] Similarly, depending on the outage, about one-quarter to one-third of inspection locations at IPEC are based on CHECWORKS.[123]

Dr. Hopenfeld's testimony also distinguishes Vermont Yankee from IPEC by pointing to the larger size of the IPEC facility and the fact that IP2 and IP3 are PWRs rather than boiling water reactors like Vermont Yankee.[124] Entergy's experts explain that the absolute size of a plant is not strongly related to the rates of FAC experienced by its components.[125] They also show that, since the 1980s, PWR water chemistry practices have improved such that rates of FAC in the two types of reactors are roughly comparable.[126]

Finally, Dr. Hopenfeld argues that Vermont Yankee benefitted from CHECWORKS data dating back to 1989, whereas "Entergy has no CHECWORKS related documentation related to Indian Point Unit 2 generated prior to the year 2000" and that Entergy did not provide any CHECWORKS documentation for IP3 generated prior to 2001.[127] As Energy's experts explain, this distinction is incorrect because inspection data collected during those early outages have been incorporated into and remain a part of the IPEC CHECWORKS model. Therefore, while

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121 *Id.*

122 *Vt. Yankee,* LBP-08-25, 68 NRC at 880; *see also* Intervenor's Statement at 31 (RIV000002).

123 *See* Entergy Test. at A77 (ENT000029).

124 *See* Hopenfeld Report at 20 (RIV000005).

125 *See* Entergy Test. at A126 (ENT000029).

126 *See id* at A127; EPRI, PWR Advanced Amine Application Guidelines, Rev. 2 at 1-1 (Oct. 1997) (ENT000067).

127 Hopenfeld Report at 5, 20 (RIV000005).

some CHECWORKS *reports* from this much earlier time period were unavailable, inspection *data* remain in the CHECWORKS model.[128]

Thus, Entergy's experts demonstrate that Dr. Hopenfeld's claims that the *Vermont Yankee* decision does not apply to this proceeding are inconsistent with the facts.

e. Riverkeeper's Criticisms Based on Selected IPEC Operating Experience Lack Merit

In his Report, Dr. Hopenfeld points to instances in several Entergy reports which he believes document "numerous leaks and reports of excessive wall thinning."[129] In Section VI.E of Entergy's testimony, its witnesses explain that the vast majority of the events listed in Riverkeeper's exhibits either did not involve FAC-susceptible systems or documented the results of inspections where the FAC Program detected wall-thinning before the component's wall thickness reached the design minimum thickness.[130] Dr. Hopenfeld's broad-brush criticisms do not distinguish between FAC Program successes and failures, or between leaks caused by FAC and those caused by other degradation mechanisms.[131]

Ultimately, Riverkeeper's numerous exhibits reveal a small number of leaks in FAC-susceptible systems within the extensive secondary steam systems at the two units over a period of many years.[132] All of these items were of low safety significance; all were corrected, and, when appropriate, were used as operating experience to inform the FAC inspection scope for future outages.[133]

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128 *See* Entergy Test. at A129 (ENT000029).

129 Hopenfeld Report at 17 (RIV000005).

130 *See* Entergy Test. § VI.E (ENT000029).

131 *See id.* at A131.

132 *See id.* at A131-32.

133 *See id.*

None of these examples show any deficiency in CHECWORKS or the FAC Program.[134] The reasonable assurance standard does not require perfection.[135] The Commission very recently reiterated this principle, when it reversed the 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).[136] This is consistent with NSAC-202L-R3, which states that, even with an effective FAC Program, "it will never be possible to prevent all FAC-related leaks and ruptures from occurring."[137] Thus, Dr. Hopenfeld's examples of purported FAC-related leaks that were corrected long ago are not indicative of any deficiency in the FAC Program.

f. Riverkeeper's Criticisms Based on Selected Operating Experience at Other Facilities Lack Merit

Dr. Hopenfeld also asserts that failures as a result of FAC have occurred throughout the industry, citing historical events at Surry, San Onofre, Fort Calhoun, and Mihama plants.[138] As Entergy's experts explain in Section VI.F of their testimony, these examples are quite dated; one of these events even predates the existence of CHEC, the very first version of the CHECWORKS model. None of the examples that Dr. Hopenfeld cites involved plants that were properly implementing either NSAC-202L or CHECWORKS.[139] Dr. Hopenfeld's other vague statements about "pipe thinning events" or "numerous leaks and pipe ruptures" in recent years at other

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134 *See id.*

135 *See id.* at A132.

136 *See Seabrook, LLC*, CLI-12-05, slip op. at 17.

137 *See* Entergy Test. at A131 (ENT000029).

138 *See* Hopenfeld Report at 3 (RIV000005).

139 *See* Entergy Test. at A135 (ENT000029).

plants are unsupported and unclear.[140] Finally, Entergy's experts explain that Dr. Hopenfeld does not accurately describe the questioning that occurred at an Advisory Committee on Reactor Safeguards ("ACRS") subcommittee meeting for a different facility.[141]

g. Riverkeeper's Programmatic Challenges to the FAC AMP Lack Merit

Dr. Hopenfeld concludes his Report by claiming that, in order to comply with NUREG-1801 and the SRP-LR, with respect to "the method for determining component inspections, frequency of such inspections, and attendant criteria for component repair and replacement . . . Entergy cannot simply rely on procedural documents which depend upon the *proper* use of CHECWORKS."[142] Dr. Hopenfeld asserts that Entergy's FAC AMP is deficient because it "simply" relies on the proper use of CHECWORKS, but Entergy demonstrates that this is not true.[143] On the contrary, as shown throughout Entergy's Testimony, CHECWORKS is only one aspect of Entergy's FAC Program—a program that is consistent with the NRC Staff-approved guidance in NSAC-202L-R3.

As Entergy's witnesses show, the FAC Program at IPEC is consistent with NUREG-1801, Revision 1 and meets the intent of NUREG-1801, Revision 2,[144] which constitutes a finding of reasonable assurance under 10 C.F.R. §§ 54.21(a) and 54.29(a).[145] Any challenges to a program that is consistent with Staff guidance that has been implicitly endorsed by the

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140 *See* Hopenfeld Report at 16 (RIV000005).

141 *See id.* (stating that "the Advisory Committee on Reactor Safeguard [sic] ("ACRS") Subcommittee on Thermal Hydraulics recognized the poor correlation between CHECWORKS predictions and operating data in relation to the Waterford nuclear power plant"); Entergy Test. at A142 (ENT000029).

142 Hopenfeld Report at 25 (RIV000005) (emphasis in original).

143 *See* Entergy Test. at A141 (ENT000029).

144 *See id.* at A48.

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

Commission—such as NUREG-1801—must be specifically and substantially supported in order to overcome the special weight accorded to such documents.[146]

Riverkeeper has not done so here. The IPEC FAC Program has been evaluated and approved by the NRC Staff.[147] Riverkeeper has not set forth any reason why compliance with NUREG-1801, Revision 1 or Revision 2, is insufficient to show compliance with the license renewal regulations—much less leveled a specific and substantial challenge to this approved Staff guidance.[148]

Thus, Entergy has shown that its FAC Program is consistent with NUREG-1801, Revision 1 and meets the intent of NUREG-1801, Revision 2, and therefore has demonstrated reasonable assurance that the effects of aging will be adequately managed throughout the PEO under 10 C.F.R. §§ 54.21(a) and 54.29(a).

h. Riverkeeper's Assorted New Challenges to the FAC Program Lack Merit

Riverkeeper characterizes its contention as including "broad criticisms of the Indian Point flow accelerated corrosion ('FAC') aging management program."[149] But as the Commission recently confirmed, a contention cannot be interpreted to include new claims that are outside of the admitted bases for that contention.[150] Consistent with its Motion in Limine, Entergy asserts that Riverkeeper's assorted new challenges to the FAC Program, as set forth in Section VI of Dr. Hopenfeld's Report, are outside the scope of the admitted contention.

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

147 *See* SER at 3-22 to -30 (NYS00326B).

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

149 Riverkeeper Answer at 4.

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

Nevertheless, without waiving its arguments regarding the scope of proceeding and the admitted contention, Entergy's witnesses explain in Section VI.H of their testimony that Dr. Hopenfeld's various challenges to the FAC Program's ability to withstand LOCAs, earthquakes, SBOs, and the synergistic effects of FAC and metal fatigue lack merit.[151] Entergy's witnesses demonstrate that the FAC Program provides reasonable assurance that IPEC components will continue to perform their intended functions throughout the PEO.[152] This includes evaluating components to ensure that they will continue to function under design loading conditions (*i.e.*, plant transients like seismic loads).[153] Entergy's witnesses explain that the FAC Program adheres to the applicable ANSI B31.1 requirements, which ensure that the appropriate margins exist to address potential fatigue cracking in FAC-susceptible piping.[154]

V. CONCLUSION

For the foregoing reasons, Entergy's FAC Program is consistent with NUREG-1801, Revision 1 and meets the intent of Revision 2. Therefore, Entergy's LRA provides reasonable assurance that the effects of aging due to FAC will be adequately managed throughout the PEO.

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151 *See* Entergy Test. § VI.H (ENT000029); Hopenfeld Report at 24-25 (RIV000005).

152 *See* Entergy Test. § VI.H (ENT000029).

153 *See id.* at A143.

154 *See id.* at A144.

Riverkeeper has not carried its burden of providing sufficient evidence to support the claims made in RK-TC-2. Accordingly, RK-TC-2 should be resolved in Entergy's favor.

Respectfully submitted,

Signed (electronically) by Raphael P. Kuyler

Kathryn M. Sutton, Esq.
Paul M. Bessette, Esq.
Raphael P. Kuyler, Esq.
MORGAN, LEWIS & BOCKIUS LLP
1111 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
Phone: (202) 739-3000
Fax: (202) 739-3001
E-mail: ksutton@morganlewis.com
E-mail: pbessette@morganlewis.com
E-mail: rkuyler@morganlewis.com

William B. Glew, Esq.
William C. Dennis, Esq.
ENTERGY NUCLEAR OPERATIONS, Inc.
440 Hamilton Avenue
White Plains, NY 10601
Phone: (914) 272-3202
Fax: (914) 272-3205
E-mail: wglew@entergy.com
E-mail: wdennis@entergy.com

Counsel for Entergy Nuclear Operations, Inc.

Dated in Washington, D.C.
this 28th day of March 2012

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