UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF'S REPLY TO PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW ON CONTENTION RK-TC-2 (FLOW ACCELERATED CORROSION)

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May 3, 2013

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I. INTRODUCTION[1]

9.272 On March 22, 2013, in accordance with 10 C.F.R. § 2.1209 and the Atomic Safety and Licensing Board's Orders[2], Entergy Nuclear Operations, Inc. ("Entergy" or "the Applicant"),[3] Riverkeeper, Inc. ("Riverkeeper"),[4] and the NRC Staff ("Staff")[5] filed proposed findings of fact and conclusions of law concerning Riverkeeper Contention RK-TC-2 (Flow Accelerated Corrosion). Pursuant to the Licensing Board's Order of February 28, 2013, the

[1] The paragraph numbering system in these reply findings continues from the last numbered paragraph in the NRC Staff's Proposed Findings of Fact and Conclusions of Law Part 9: Contention RK-TC-2 (Flow Accelerated Corrosion) (Mar. 22, 2013) ("Staff PFF"). Thus, ¶ 9.272 should be read to follow Staff PFF ¶ 9.271.

[2] *See* (1) Scheduling Order (July 1, 2010), at 19; (2) Order (Scheduling Post-Hearing Matters and Ruling on Motions to File Additional Exhibits) (Jan. 15, 2013) at 1; and (3) Order (Granting Parties' Joint Motion for Alteration of Filing Schedule) (Feb. 28, 2013).

[3] Entergy's Proposed Findings of Fact and Conclusions of Law For Contention RK-TC-2 (Flow-Accelerated Corrosion), dated March 22, 2013.

[4] Riverkeeper Post-Hearing Proposed Findings of Fact and Conclusions of Law Regarding Contention RK-TC-2 - Flow Accelerated Corrosion (Mar. 22, 2013) (Riverkeeper PFF).

[5] NRC Staff's Proposed Findings of Fact and Conclusions of Law Part 9: Contention RK-TC-2 (Flow Accelerated Corrosion).

Staff herewith files its reply to Riverkeeper's proposed findings of fact and conclusions of law concerning Contention RK-TC-2.[6]

II. REPLIES TO RIVERKEEPER

A. Riverkeeper's Proposed Findings Are Beyond the Scope of the Contention

9.273 When proffering Contention RK-TC-2, Riverkeeper asserted that CHECWORKS™ must be benchmarked for each component and then updated when plant parameters change. 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), at 20. Riverkeeper asserted that CHECWORKS™ can be reliably used to predict pipe wall thinning only so long as: (a) all relevant locations are benchmarked for relevant plant parameters; (b) relevant plant parameters do not change significantly over time; and (c) benchmark data on relevant plant parameters are collected for a sufficiently long period of time. *Id.* at 20.

9.274 According to Riverkeeper, CHECWORKS™ can still be used even when it is not "benchmarked" so long as it is used only "for establishing relative inspection priorities and providing a platform for collecting and evaluating plant data on FAC." *Id.* at 20.

9.275 The Board admitted two aspects of RK-TC-2: (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 Indian Point Energy Center's ("IPEC's") power uprate levels. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), LPB-08-13, 68 NRC 43, 177 (2008).

[6] The Staff has reviewed Entergy's proposed findings and has determined that a detailed reply thereto is not required. In this regard, the Staff has concluded that Entergy's findings concerning Contention RK-TC-2 are not inconsistent with the Staff's findings, and any important substantive differences between the Staff's and Entergy's respective views of the evidence are reflected in their proposed findings of fact and conclusions of law filed on March 22, 2013.

9.276 As admitted, Contention RK-TC-2 is not a challenge to the use of the CHECWORKS™ model, but rather questions the sufficiency of the benchmarking needed to provide valid results at IPEC once the plant parameters changed with the 3.26% and 4.85% power uprates during 2004 and 2005. *Id.* at 176-77.

9.277 The Commission has long held that the scope of admitted contentions cannot be changed at-will and stretched beyond reasonably-inferred bounds. *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-12-1, 75 NRC 39, 56 (2012).

9.278 However, despite the clear framing of RK-TC-2 by the Board, many of Riverkeeper's proposed findings deviate from what was admitted. Riverkeeper's findings re-cast the contention into an attack upon Entergy's current licensing basis ("CLB") and current FAC Program, which uses CHECWORKS™. Additionally, many of Riverkeeper's proposed findings are beyond the scope of Contention RK-TC-2, as admitted. In accordance with the law of the case (defining the scope of the contention), as well as Commission precedent, the Board finds that all issues beyond the two discrete areas are not properly before the Board. As such, Riverkeeper's proposed findings are in contravention to 10 C.F.R. § 54.30 and established Commission precedent, e.g. *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 8-9 (2001). The specific examples are discussed in the sections below.

B. Applicable Legal Standards and Regulatory Requirements[7]

9.279 Riverkeeper's PFF incorrectly relies on a reversed Board decision to support Riverkeeper's assertion that an applicant cannot demonstrate that aging effects will be

[7] The section headings used herein generally follow the headings used by Riverkeeper. However, not all of Riverkeeper's sections are included. Where the sections are not included (e.g. a section on the NRC Staff Witnesses), the Staff determined that it was not necessary to reply to the section, and the issues were adequately addressed by the Staff in its proposed findings. However, whether listed or not, no findings which assert that Entergy's AMP is insufficient should be sustained.

adequately managed by stating that a proposed AMP meets the GALL Report, NUREG-1801. RK PFF at 8-9 (citing *Entergy Nuclear Vermont Yankee, LLC & Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-08-25, 68 NRC 763, 870-871 (2008). In fact, the Commission subsequently reversed and remanded portions of LBP-08-25, saying:

> Moreover, in Oyster Creek, we expressly interpreted section 54.21(c)(1) to permit a demonstration after the issuance of a renewed license: an "applicant's use of an aging management program identified in the GALL Report constitutes reasonable assurance that it *will* manage the targeted aging effect during the renewal period." We reiterate here that a commitment to implement an AMP that the NRC finds is consistent with the GALL Report constitutes one acceptable method for compliance with 10 C.F.R. § 54.21(c)(1)(iii).

Entergy Nuclear Vermont Yankee, LLC & Entergy Nuclear Operations Inc. (Vermont Yankee Nuclear Power Station), CLI-10-17, 72 NRC 1, 36 (2010) (footnote omitted) (emphasis in original) (citing *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-08-23, 68 NRC 461, 468 (2008)).

9.280 The Commission restated that an AMP is sufficient when an applicant states that it is consistent with GALL, writing:

> The GALL Report provides that one way a license renewal applicant may demonstrate that an AMP *will* effectively manage the effects of aging during the period of extended operation is by stating that a program is "consistent with" or "based on" the GALL Report.[204]
>
> An applicant may commit to implement an AMP that is consistent with the GALL Report and that *will* adequately manage aging.
>
> ---
>
> [204] In the GALL Report, the Staff recognizes acceptable AMPs, ... A license renewal application may reference the GALL Report to demonstrate that the applicant's AMP corresponds to one that has been reviewed and approved in that Report

Entergy Nuclear Vermont Yankee, LLC & Entergy Nuclear Operations Inc. (Vermont Yankee Nuclear Power Station), CLI-10-17, 72 NRC 1, 37 (2010) (emphasis in original).

9.281 In Seabrook, the Commission made clear that the holdings above (i.e. that a demonstration may be found though consistency with the GALL report) apply to AMPs under 10

C.F.R. § 54.29(a) as well as the 10 C.F.R. § 54.21(c)(1)(iii) AMP at issue in *Vermont Yankee*, writing:

> 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).

9.282 NextEra *Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC 301, 304 (2012), *petition for review denied sub nom. Beyond Nuclear v. NRC* 704 F.3d 12 (1st Cir. 2013) (citing *Vermont Yankee*, CLI-10-17, 72 NRC 1, 36 (2010); *Oyster Creek*, CLI-08-23, 68 NRC at 467-68).

9.283 Riverkeeper's proposed findings would have this Board reverse Commission precedent.

C. Entergy's Witnesses

9.284 Riverkeeper proposes that the Board find that Mr. Mew, Mr. Cox, and Mr. Azevedo have not demonstrated knowledge needed to understand the capabilities and limitations of CHECWORKS™ based upon a lack of publications. Riverkeeper PFF at 14, ¶¶ 6-8. A witness who is qualified by knowledge, skill, experience, and education may testify when the testimony will help the trier to understand the evidence or determine a fact in issue. *Duke Power Co.* (William B. McGuire Nuclear Station, Units 1 & 2), ALAB-669, 15 NRC 453, 475 (1982) (quoting Fed. R. Evid. 702). The Board is familiar with the qualifications of Mr. Mew, Mr. Cox, and Mr. Azevedo, and has found their testimony and opinions on all matters, including CHECWORKS™, to be experts and helpful to understanding the evidence or determining a fact.

9.285 Riverkeeper proposes that the Board find that Dr. Horowitz and Mr. Aleksick have a direct financial interest in the promotion and use of CHECWORKS™. Riverkeeper PFF at 14, ¶¶ 9-10. Riverkeeper's implication of bias based on financial interests is without merit. As other Boards have noted, it is typical in Commission proceedings to have vendors testifying

about the technical merits of their product, "even if those vendors may receive substantial benefits as a result of a decision in their favor." *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-03-8, 57 NRC 293, 341 (2003), aff'd, CLI-03-8, 58 NRC 11 (2003). Boards do not act on allegations of bias without substantial evidentiary support. *Id.* Riverkeeper offers no substantial evidentiary support to exclude consideration of these witnesses' testimony. The Board finds no disqualifying bias affects the witnesses' testimony.

D. Nature and Significance of FAC

1. Definition of FAC

9.286 Riverkeeper proposes the Board to find that FAC is not controlled by mass transfer processes only. Riverkeeper PFF at 18, ¶ 19 (citing D. D. Macdonald, *The Point Defect Model for the Passive State* in J. Electrochem. Soc., Vol. 139, No. 12, (1992), 3434-3449 (Ex. RIV000127)). The cited article addresses a "Point Defect Model" or "PDM" as a way to explain observed behavior of corrosion-erosion. *See* D. D. Macdonald, *The Point Defect Model for the Passive State* in J. Electrochem. Soc., Vol. 139, No. 12, (1992), 3434-3449 (Ex. RIV000127). Careful examination of Ex. RIV000127 reveals no relevant information about the definition of FAC and how it relates to any aging management program for FAC, let alone CHECWORKS™ efficacy after a power uprate; none of the eight points summarized in the conclusion in RIV000127 address these topics. *See Id.* at 3448. Entergy's witnesses Dr. Horowitz and Mr. Aleksick explained that, although the article by Macdonald (Ex. RIV000127) was acceptable, the real-world FAC measurements and FAC management explicitly excludes pipe degradation caused by mechanisms other than FAC, and that erosion and corrosion do not occur simultaneously. Tr. at 1445, 1442. But such phenomena would be captured during the calibration process nonetheless. Tr. at 1446.

9.287 Along the same vein, Riverkeeper's exhibit NUREG/CR-6936, *Probabilities of Failure and Uncertainty Estimate Information for Passive Components - A Literature Review*

(May 2007) (Ex. RIV000023), at 5.24-5.25, also refutes Riverkeeper's proposal that the Board mix corrosion with erosion-corrosion:

> Flow-accelerated corrosion (FAC) is defined as a chemical process whereby the normally protective oxide layer on carbon or low-alloy steel dissolves into a stream of flowing water or water-steam mixture. FAC corrosion rate controlling conditions are primarily electrochemical. FAC occurs in high-energy piping systems and can occur in single- and two-phase flow regions. The cause of FAC is a specific set of water chemistry conditions (for example, pH, level of dissolved oxygen), and absent of any mechanical contribution to the dissolution of the normally protective iron oxide (magnetite) layer on the inside pipe wall (as in pipe degradation by erosion-corrosion). The cause and effect of FAC is well understood, and the industry has implemented FAC inspection programs, as well as piping replacements using FAC-resistant materials such as stainless steel, carbon steel clad on the inside diameter with stainless steel, or chrome-molybdenum alloy steel.

NUREG/CR-6936 (Ex. RIV000023) at 5.24-5.25.

9.288 Further, NUREG/CR-6936 adds this caveat regarding what is, and what isn't FAC:

> In the United States, flow-accelerated corrosion (FAC) is commonly but incorrectly known as “erosion-corrosion.” Unlike FAC, the accelerated corrosion rates in the erosion-corrosion process are dominated by mechanical factors such as the impact of water droplets on the surface in two-phase flow steam systems, cavitation effects, or entrained particles.

NUREG/CR-6936 (Ex. RIV000023) at 5.24 n.(b).

9.289 Thus, based in part on information introduced by Riverkeeper itself, Riverkeeper's proposed findings on the definition of FAC should not be sustained.

9.290 Riverkeeper proposes that the Board find that numerous ultrasonic reports demonstrate that metal loss is not controlled by chemical dissolution alone. Riverkeeper PFF at 18, ¶ 20 (citing tr. at 1331:2 - 1332:10); Riverkeeper PFF at 33, ¶ 60. The cited sections of the transcript do not support such a broad assertion; at those places in the transcript Dr. Hopenfeld was describing how calculations for corrosion rates at elbows are more difficult to perform than calculations of corrosion rates in straight pipe. *See* Tr. at 1331:2 - 1332:10.

9.291 Riverkeeper proposes that the Board make findings on how FAC occurs based in part on Jianrong Wang & Siamack A. Shirazi, *A CFD based correlation for mass transfer coefficient in elbows* in 44 Int'l J. of Heat and Mass Transfer 1817 (2001) (Ex. RIV000131). Riverkeeper PFF at 19, ¶ 20 (citing Ex. RIV000131). However, careful examination of Ex. RIV000131 reveals the document to be a discussion of the development of a correlation for predicting the maximum mass transfer coefficient in elbows based on three-dimensional computational flow modeling and mass transfer predictions for "CO2 corrosion of oil and gas pipelines." Ex. RIV000131 at 1818. It provides no relevant information about aging management program for FAC at a nuclear power plant, let alone CHECWORKS™ efficacy as part of an existing FAC program after a power uprate.

9.292 Riverkeeper proposes that the Board make a finding based on ratio of the maximum mass transfer coefficient for an elbow to the mass transfer coefficient for fully developed pipe flow (i.e. the maximum elbow-to-pipe mass transfer coefficient ratio ("MTCRE")). Specifically, Riverkeeper would have the Board find that because the MTCRE is in excess of 1.6, FAC is more than a chemically-controlled process. Riverkeeper PFF at 18-20, ¶¶ 20-22 (discussing, *inter alia*, Ex. RIV000131 and Tr. at 1845-64), 33 ¶ 60. However, examination of Ex. RIV000131 reveals no supporting information on how the MTCRE shows which processes are in control. Instead, the model used in Ex. RIV000131 "assumed the flow field results will not be affected by chemical reactions." Ex. RIV000131 at 1818. During the hearing, Dr. Hopenfeld asserted that his observation that erosion was causing part of the wear was important because, according to Dr. Hopenfeld, one could not predict how quickly the wear would occur and could not predict how linear the wear might be. Tr. at 1846. Again, however, the exhibits cited by Riverkeeper do not support Dr. Hopenfeld's claim. Additionally, Dr. Hopenfeld's claim is unrelated to Entergy's FAC AMP and beyond the scope of RK-TC-2.

9.293 Riverkeeper proposes that the Board find that the NRC Staff's draft ISG-2012-01 (ENT000573) incorrectly asserts that FAC is a chemical process. Riverkeeper PFF at 21 ¶¶ 24-

25. On behalf of the NRC Staff, Dr. Hiser explained that most applicants address erosion through design changes. Tr. at 1826-1827. On behalf of Entergy, Mr. Azevedo explained when Entergy finds erosion indications or other signs of mechanical wall thinning; the findings are entered into the corrective actions program. Tr. at 1828. Significantly, the inspection methods and the processes to address erosion are very similar to the flow-accelerated corrosion monitoring activities, and thus Entergy can add findings of erosion to the flow-accelerated corrosion program for easy management. Tr. at 1829.

9.294 Moreover, changes to the definition of FAC in the current licensing basis ("CLB") are not being proposed by Entergy. The disputes about the definition of FAC, whether or not it includes erosion, and related topics are not properly before the Board in this proceeding. Riverkeeper's proposed findings are outside of the scope of Contention RK-TC-2, as admitted, and run afoul of 10 C.F.R. § 54.30 (CLB issues not subject to review in renewal proceedings) and established Commission precedent in *Turkey Point*, CLI-01-17 and *Pilgrim*, CLI-12-1, *supra.*

2. "Local, Non-Linear" Nature of FAC

9.295 Riverkeeper would have the Board find that FAC is inherently unpredictable and progresses at a non-linear rate. Riverkeeper PFF at 21-22 & 33, ¶¶ 26-28 & 61. Not to be confused with the assertions about a non-linear rate of FAC, Dr. Hopenfeld objects to line-based FAC analysis; Dr. Hopenfeld asserts that component-based analysis must be done. Riverkeeper PFF at 22, ¶ 29.

9.296 However, line-based analysis is part of the existing FAC program. *See* e.g. NSAC-202L-R3 (Ex. RIV000012) at 4-1 (describing an analysis line). Thus, the Board finds that Dr. Hopenfeld's objection to line-based analysis challenges the existing CLB and falls outside the scope of RK-TC-2, as admitted. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.297 Additionally, with respect to whether or not FAC wear rates are linear or non-linear, Riverkeeper and Dr. Hopenfeld appear not to account for the five criteria which must be met for a "calibrated line analysis." See NSAC-202L-R3 (Ex. RIV000012) at 4-1.

9.298 Fundamentally, Riverkeeper's concern about non-linear FAC rates boils down to a concern over how well predicted wear matches measured wear. The existing FAC program already explicitly examines how well measured wear matches predicted wear. See, e.g. criterion 3 and 4 of NSAC-202L-R3 (Ex. RIV000012) at 4-1 (stating that for an analysis line to be considered "calibrated" there must be a good correlation between measured and predicted wear, or there must be well understood and documented why the prediction was off). Thus, Riverkeeper's assertions over linear or non-linear rates of FAC wear do not invalidate Entergy's FAC program because the program explicitly looks for such evidence of poor predictions.

9.299 As described in Riverkeeper's proposed findings, Dr. Hopenfeld and Entergy's witnesses disagree about what variations in component thicknesses (or "wall uniformity") were due to original manufacturing, and what variations were attributable to local non-linear wear. Riverkeeper PFF at 23-25, ¶¶ 32-35. However, Dr. Hopenfeld has shown no specialized knowledge or skill with respect to the purchase orders, manufacturing tolerances, design specifications, installation, etc., sufficient to give any weight to his statements regarding original component manufacturing.

9.300 In the end, Riverkeeper's discussions about the definition of FAC and the "local non-linear nature of FAC" amount to Dr. Hopenfeld and Entergy disagreeing about the wear rates. Significantly, the Board asked Dr. Hopenfeld if he observed any post-uprate wear rates beyond what Entergy reported, and Dr. Hopenfeld answered that he was unable to tell any difference, but argued (impermissibly) that after 20 years, CHECWORKS™ has not been calibrated. Tr. at 1755.

9.301 Relative to wear rates, the Board admitted RK-TC-2 only to the extent it addressed post-uprate "benchmarking." Regardless of the "linearity" of the wear rates, and

regardless what caused any non-uniformity in a component wall (e.g. original manufacturing, erosion, FAC), Dr. Hopenfeld was unable to discern any changes to the rates that would impugn the usefulness of CHECWORKS™ post-uprate as part of a FAC AMP.

9.302 The Board finds that Riverkeeper's proposed claims alleging that FAC is a "local non-linear" phenomenon (Riverkeeper PFF at 21-26, ¶¶ 26-38) amount to a dispute with the current FAC Program, and thusly are outside the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

E. Summary of Entergy's FAC Program

9.303 Riverkeeper proposes that the Board find how many components modeled in CHECWORKS™ have been inspected "'since 1992,' i.e., over the plant's lifetime." Riverkeeper PFF at 30, ¶ 50. "The plant's lifetime" is an incorrect characterization of the record; Entergy's witness Mr. Aleksick stated: "There are approximately 8,000 components modeled across both units at approximately 3,700 of those have been inspected since 1992 when we -- which is the earliest data that we have." Tr. at 1508.

9.304 Riverkeeper proposes that the Board find that Entergy's FAC program does not consider FAC on components in the steam generators. Riverkeeper PFF at 31, ¶ 54 (citing Entergy Testimony on RK-TC-2 (Ex. ENT000029) at 40. In fact, Entergy explained that components inside the steam generator are addressed by the Steam Generator Integrity Program. Entergy Testimony on RK-TC-2 (Ex. ENT000029) at 40.

9.305 More significantly, Contention RK-TC-2, as proffered and admitted, does not include a claim that the steam generators were improperly excluded from the FAC AMP. *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), at 15-23 (proffering RK-TC-2); *Indian Point*, LPB-08-13, 68 NRC at 176-77 (admitting RK-TC-2). Thus the Board finds

that including steam generator components is beyond the scope of contention RK-TC-2. *See Pilgrim*, CLI-12-1, 75 NRC at 56.

F. CHECWORKS™ Model

1. Nature of CHECWORKS™ Computer Code

9.306 Riverkeeper proposes that the Board find that Riverkeeper's and Dr. Hopenfeld's usage of "calibrated" is different from Entergy's use of "calibrated" within the FAC program. Riverkeeper PFF at 32, ¶ 56. Riverkeeper's decision to usurp the term "calibrated" in this manner as inconsistent with the existing FAC program, NRC guidance, and industry practice. *See*, e.g., "Recommendations for an Effective Flow-Accelerated Corrosion Program" (NSAC-202L-R3) (May 2006) (Ex. RIV00012) at 4-1. The Board finds Riverkeeper's definition of calibrated to be inconsistent with those programs.

9.307 Riverkeeper proposes that the Board find that CHECWORKS™ will not produce reliable results unless "calibrated." Riverkeeper PFF at 32, ¶ 56. On its face, this seems directly contrary to Dr. Hopenfeld's numerous statements that CHECWORKS™ has not been, and cannot be, calibrated, and that he does know how to benchmark CHECWORKS™, and that additional data collection would not be useful because CHECWORKS™ is fundamentally flawed. *See* Rebuttal Hopenfeld (Ex. RIV000108) at 30-34, Tr. at 1729, 1737-38. In other words, Riverkeeper is asserting that actions must be taken to "calibrate" CHECWORKS™ while simultaneously arguing that such calibration cannot be done. In light of the inconsistent stance with respect to the ability to perform "calibration," the Board assigns little to no weight to Dr. Hopenfeld's assertions on the need for further calibration. *Cf. Philadelphia Elec. Co.* (Limerick Generating Station, Units 1 & 2), ALAB-819, 22 NRC 681, 735 (1985) ("where an asserted expert witness can supply no scientific basis for his statements (other than his 'belief') and disparages his own testimony, a board would be remiss in giving such testimony any weight whatsoever.").

9.308 Riverkeeper also uses the term "re-calibration" to mean updating the model with changed plant parameters. Riverkeeper PFF at 32 ¶ 58. Riverkeeper stated that CHECWORKS™ needed to be updated when they originally proffered the contention. *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), at 21. The fact that Entergy updated CHECKWORKS™ with changes in velocities, temperatures, coolant chemistry, etc., is undisputed. *See* e.g. Indian Point Unit 2, CHECWORKS Power Uprate Analysis, Calc. No. 040711-02 (Mar. 23, 2005) (Ex. ENT000072) at 2. Thus, the Board finds that CHECKWORKS™ is "calibrated" with the uprate information.

2. "Problematic" Assumptions in the CHECWORKS™ Model

9.309 Riverkeeper proposes that the Board find that CHECWORKS™ is flawed due to assumptions regarding whether FAC is controlled by chemical dissolution or by chemical dissolution and erosion. Riverkeeper PFF at 33, ¶ 60. Notably, in proffering contention RK-TC-2, Riverkeeper did not claim that separation of dissolution and corrosion is part of RK-TC-2. To the contrary, Riverkeeper's filing suggests this practice was acceptable:

> FAC includes wall thinning by electrochemical corrosion, erosion-corrosion and cavitation- erosion. Although the mechanism of wall damage is different in each case, all three mechanisms are affected to one degree or another by flow velocities and there is no practical reason to categorized them separately as some have suggested.

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), at 17 (emphasis added).

9.310 Riverkeeper proposes that the Board find that CHECWORKS™ is flawed and cannot accurately predict wear for components with complex geometries. Riverkeeper PFF at 33-34, ¶ 61 (citing, *inter alia*, tr. at 1654-55). Riverkeeper linked the claim to an assertion that average thinning rates were being used. *Id.* at 33, ¶ 61. However, Dr. Horowitz explained that Dr. Hopenfeld was incorrect and that CHECWORKS™ uses "the maximum rate of thinning on

the components." Tr. at 1654-55. Thus, Riverkeeper's finding is based upon an incorrect understanding of the record regarding averages and maximum rates of thinning.

9.311 Riverkeeper proposes that the Board find that CHECWORKS™ is flawed for lack of information on how much chromium exists in components being addressed by the FAC program, and that FAC is very sensitive to chrome content. Riverkeeper PFF at 34, ¶ 62. However, Riverkeeper fails to discuss further the consequence of not having information on chromium content, which, according to industry guidance and Dr. Horowitz, is having components remain in the inspection program which otherwise could be excluded from additional evaluation. See NSAC-202L-R3 (ex. RIV00012) at § 4.2.2 page 4-3, JEFFREY S. HOROWITZ, INDEPENDENT REVIEW OF THE INDIAN POINT ENERGY CENTER FLOW-ACCELERATED CORROSION PROGRAM, (March 22, 2012) (Ex. ENT000034) at 13 (stating that alloy measurements make an FAC program more efficient by eliminating the need to inspect items that contain significant amounts of trace chromium). Thus, the Board is hard-pressed to find a problem where the evidence on chromium content shows more tests are being done than would otherwise be needed.

9.312 Riverkeeper's findings with respect to the assumptions described above are challenges to the current assumptions in CHECWORKS™ and, accordingly, are beyond the scope of the contention as admitted. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

3. Role of CHECWORKS™ at Indian Point

Riverkeeper proposes that the Board find that, contrary to the Entergy's witnesses testimony, the role of CHECWORKS™ is "primary and integral" for the determination of which newly-modeled components are inspected for FAC degradation. Riverkeeper PFF at 36, ¶ 70. There is no basis for the Board to make a finding contrary to Entergy's testimony. In fact, the

proposed finding goes against the testimony of Riverkeeper's witness Dr. Hopenfeld. *See* e.g. Tr. at 1609 (Dr. Hopenfeld stating, "It's not the primary tool for inspection").

4. Predictive Performance of CHECWORKS™ at Indian Point

9.313 Riverkeeper proposes that the Board find that the predictive performance of CHECWORKS™ has been poor. Riverkeeper PFF at 37-43, ¶¶ 72-79. Specifically, Riverkeeper would have the Board find that the range of predictions is "too wide for practical applications" (*id*. at 40, ¶ 79) both before and after the 2004 and 2005 power uprates.[8] *Id.* at 38 ¶¶ 74-75. The Board finds that Riverkeeper claims with respect to past and current performance of CHECWORKS™ attempt to raise a challenge to the use of the model and are beyond the scope of the contention as admitted. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.314 Riverkeeper proposes that the Board make findings based upon Dr. Hopenfeld's review of thousands of data points and hundreds of graphs of preliminary and post-uprate data. Riverkeeper PFF at 38, ¶ 75. According to Riverkeeper, Dr. Hopenfeld's conclusion was that the "computer model as employed at Indian Point is highly inaccurate and produces results that demonstrate a complete lack of correlation." *Id.* These claims and findings amount to a challenge to the model used at Indian Point, and thus are beyond the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.315 But Dr. Hopenfeld also testified that, based upon his review of data on wear rates, he could not tell any difference, and there was no difference in the scatter of the data. Tr. at 1755. Thus, Dr. Hopenfeld admits that, as far as he can tell, the historical uprates at Unit 2

[8] This is one of the very few times Riverkeeper makes any effort to frame its findings within the bounds of RK-TC-2, as admitted, and the concern over post-uprate performance. *See Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), LPB-08-13, 68 NRC 43, 176-177 (2008).

and Unit 3 did not affect the performance of CHECWORKS™, and his admission shows that Riverkeeper cannot sustain their claim that post-uprate benchmarking is required.

9.316 Riverkeeper proposes that the Board reject Entergy's testimony (which shows that CHECWORKS™ predictions are consistent with actual field measurements) and instead the Board find that, based on Dr. Hopenfeld's review, most data plots exhibited disagreement. Riverkeeper PFF at 38-39, ¶ 76. These claims and findings amount to a challenge to the model used at Indian Point, and thus are beyond the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.317 In addition, for Entergy Mr. Azevedo explained that field measurements are subject to measurement uncertainty and repetitive measurements at the same location will not be exactly the same. Tr. at 1758-60. Dr. Horowitz elaborated concerning the "propagation of errors" within the measurements and subsequent analyses. Tr. at 1760. By contrast, Dr. Hopenfeld did not support his claims with any sort of detailed statistical analysis on the thousands of data points (*id.* at 38, ¶ 75) he reviewed, and instead states that the does not know what was done. Tr. at 1760-62. Accordingly the Board should make findings based on Entergy's knowledgeable testimony, rather than findings based on Dr. Hopenfeld's uninformed opinion.

9.318 Riverkeeper proposes that the Board make findings concerning the "Line Correction Factor" (LCF). Riverkeeper PFF at 41, ¶ 83. Riverkeeper's witness Dr. Hopenfeld admits that he does not know why the LCF values were selected, and he opines it should be based on safety. Tr. at 1757. The evidence shows that, as used in "calibrated" line analysis, the "Line Correction Factor" (the median value of the ratios of measured wear for a given component divided by its predicted wear for a given analysis line) must be between 0.5 and 2.5, or the reason for not reaching these values must be understood. NSAC-202L-R3 (Ex. RIV000012) at 4-1. Thus the Board finds that the LCF is used as part of the current FAC

program, and is beyond the scope of the contention. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.319 Riverkeeper proposes that the Board make findings concerning how the predictive ability of CHECWORKS™ is not improving with time.[9] Riverkeeper PFF at 42, ¶¶ 85-86. These claims and findings amount to a challenge to the model used at Indian Point, and thus are beyond the scope of RK-TC-2. *Indian Point*, LPB-08-13, 68 NRC at 176-177. Additionally, inasmuch as the admitted contention concerns the post-uprate benchmarking, and Riverkeeper and Dr. Hopenfeld assert there's no difference in the pre-uprate and post-uprate wear predictions by CHECWORKS™ (Riverkeeper PFF at 42, Tr. at 1755), Riverkeeper fails to demonstrate a need for post-uprate benchmarking.

5. Implications of Using CHECWORKS™ at Indian Point

9.320 Riverkeeper would have the Board make various findings associated with the consequences of continuing to use CHECWORKS™. Riverkeeper PFF at 43-45, ¶¶ 88-92. A dispute over the consequences of *failing* to manage FAC is not before the Board and is not within the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.321 Riverkeeper would have the Board find that "conservative predictions can affect plant safety" under the theory that Entergy would become complacent in light of the conservatism. Riverkeeper PFF at 44-45 ¶ 92. Riverkeeper provides no support that such compliancy exists, and "complacency" is not part of RK-TC-2. *See Indian Point*, LPB-08-13, 68

[9] Logically, under Riverkeeper's theory, the performance of CHECWORKS™ would be worse after the uprates, because the uprates would exacerbate the disparity between predictions and actual wear. However, Riverkeeper presents nothing to demonstrate a degraded post-uprate performance based on the "11 years worth of data" (Riverkeeper PFF at 42 ¶ 85) reviewed by Riverkeeper's expert. *See* tr. at 1755 (Dr. Hopenfeld stating that you could not tell a difference with the post-uprate data).

NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.322 Riverkeeper asserts that CHECWORKS™ produces non-conservative results "upwards of 60% of the time." Riverkeeper PFF at 45, ¶ 92 (citing Hopenfeld Testimony (RIV00003) at 10-11[10]; Hopenfeld Expert Report (RIVR00005) at 15). However, Dr. Hopenfeld's testimony is: "CHECWORKS™ has yielded non-conservative predictions about 40-60% of the time" (RIV00003 at 6) and his report says: "approximately 40%-60% of CHECWORKS™ wear predictions are non-conservative" (RIVR00005 at 15), and he testified that it was non-conservative 40%-60% of the time (Tr. at 1727). Thus, "upwards of 60%" is an incorrect characterization of the record concerning the conservative/non-conservative nature of CHECWORKS™ predictions.[11]

6. Track Record of CHECWORKS™ at Indian Point

9.323 Riverkeeper would have the Board find that throughout the industry, CHECWORKS™ has been unsuccessful in predicting wall thinning. Riverkeeper PFF at 45-46, ¶ 94-95. This assertion is a challenge to the model used at Indian Point (and elsewhere), and thus is beyond the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.324 Riverkeeper would have the Board find that CHECWORKS™ is ineffective based upon information in NUREG/CR-6936, *Probabilities of Failure and Uncertainty Estimate Information for Passive Components - A Literature Review* (May 2007) (Ex. RIV000023), as well as Dr. Hopenfeld's report (Ex. RIVR0005) at 16-17 and rebuttal testimony (Ex. RIV000108) at 40-41. Riverkeeper PFF at 45-46, ¶ 95. Riverkeeper's finding is entirely unsupported in that

[10] RIV00003 at 10-11 does not address 60%.

[11] Additionally, Entergy's witness Dr. Horowitz agreed with the Board that any best-estimate model is expected to under predict half the time, and to over predict half the time. Tr. at 1649-50. Dr. Hopenfeld's report and testimony thus show behavior of a best-estimate model, and alleviate any concerns about conservative predictions affecting plant safety.

NUREG/CR-6936 (Ex. RIV000023) never even mentions CHECWORKS™, let alone offer any information suggesting that CHECWORKS™ is the cause of pipe failures attributed to FAC, as tabulated in the document. *See* NUREG/CR-6936 (Ex. RIV00023) at 5.24-5.26. It does not even state if the failed lines listed in the document were modeled in CHECWORKS™. *See id.*

9.325 Similarly, examination of Dr. Hopenfeld's report (Ex. RIV00005) at 16-17 shows that Dr. Hopenfeld bootstrapped the tabulation of pipe failures in NUREG/CR-6936 (Ex. RIV000023) into a claim that CHECWORKS™ does not work, while ignoring the fact that the authors of NUREG/CR-6936 made no such conclusion. *See* Hopefeld Report (Ex. RIVR00005) at 16-17. Last, examination of Dr. Hopenfeld's rebuttal testimony shows that Dr. Hopenfeld correctly acknowledged, but then baselessly dismissed, Entergy's testimony that CHECWORKS™ was not used to model certain components. Hopenfeld Rebuttal (Ex. RIV000108) at 40-41. Additionally, in both his report and in his testimony, Dr. Hopenfeld provides no evidence to show how any FAC-induced leaks on lines modeled in CHECWORKS™ were, in fact, caused by flaws in CHECWORKS™. *See* Hopenfeld Report (Ex. RIV00003) at 17-18 and Hopenfeld Testimony (Ex. RIVR00005) at 12. Dr. Hopenfeld's assertion that the existence of FAC-related incidents demonstrates that CHECWORKS™ is ineffective is a non sequitur. Dr. Hopenfeld fails to relate the incidents he cites to how Entergy uses CHECWORKS™ within it FAC Program.

9.326 The Board finds that the evidence on FAC piping failures presented by Riverkeeper does not support CHECWORKS™ as the proximate cause of the failures. Simply put, the Board cannot find CHECWORKS™ was deficient in the above matters when there is no showing that CHECWORKS™ was even used.

9.327 Riverkeeper proposes that the Board make various findings concerning the "track record of performance" of CHECWORKS™ at Indian Point and how CHECWORKS™ has not prevented FAC-related incidents. Riverkeeper PFF at 46-48 ¶¶ 96-103 (citing *inter alia* Hopenfeld Report (Ex. RIV00003) at 17-18 and Hopenfeld Testimony (Ex. RIVR00005) at 12.

The attacks on CHECWORKS™ as currently used, and as used in the past, are contrary to the scope of the contention and the Commission's regulations. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

7. CHECWORKS™ and Compliance with the GALL Report

9.328 Riverkeeper proposes the Board find that using CHECWORKS™ causes Entergy's FAC AMP to fail to comply with the GALL Report, Revisions 1 and 2. Riverkeeper PFF at 48-52, ¶¶ 107-113. But, as Riverkeeper acknowledges, Revisions 1 and 2 of the GALL Report *explicitly* contemplate using CHECWORKS™. Riverkeeper PFF at 51, ¶ 111 (citing GALL Report Rev. 1 (NYS000146C) at pp. XI M-61 to XI M-62, GALL Report Rev. 2 at XI M17-1). Riverkeeper's assertion that using CHECWORKS™ does not comply with the GALL Report is factually incorrect; a finding saying that using CHECWORKS™ creates a non-compliance with the GALL Report cannot be sustained. *See id.*

9.329 Riverkeeper's proposed findings claim in part that the use of CHECWORKS™ by Entergy is contrary to the GALL Report because Entergy characterized CHECWORKS™ as "best estimate," whereas Riverkeeper says CHECWORKS™ is "highly non-conservative upwards of 60% of the time." Riverkeeper PFF at 51-52 ¶ 112. However, Dr. Hopenfeld's testimony and report assert that approximately 40%-60% of CHECWORKS™ wear predictions are non-conservative." Ex. RIVR00005 at 15; Ex. RIV00003 at 6; Tr. at 1727. Thus Dr. Hopenfeld shows that CHECWORKS™ is a "best estimate" model, in that on average half the wear predictions are non-conservative, and half are conservative. It does not show how using CHECWORKS™ is contrary to the GALL Report, and the proposed findings do not match the evidentiary record.

9.330 Riverkeeper proposes that Entergy's FAC Program is contrary to the Staff's Draft Interim Staff Guidance LR-ISG-2012-01 (ENT000573). Riverkeeper PFF at 53-54, ¶¶ 115-118.

In particular, Riverkeeper asserts that, based upon the Staff's testimony, Entergy's FAC program would not meet the GALL Report if the draft ISG was incorporated into the GALL Report. *Id.* at 53-54 ¶ 118 (citing tr. at 1674-75 (Yoder) and 1676-77 (Hiser)). However, Mr. Yoder testified that the FAC AMP is consistent with both Revision 1 and Revision 2 of the GALL Report. Tr. at 1680. Dr. Hiser testified that the draft ISG would have no impact on the acceptability of Entergy's FAC Program, and CHECWORKS™ would still be a tool within the program. Tr. at 1679. A finding that the draft creates a mismatch between the FAC AMP and the GALL Report based on CHECWORKS™ cannot be sustained.

8. Alternative Computer Modeling Suitable for Managing FAC

9.331 Riverkeeper proposes a variety of findings concerning alternate computer models. Riverkeeper PFF at 54-55, ¶¶ 119-126. Inasmuch as Riverkeeper's proposed findings concern items which Entergy has not proposed, they are not relevant and immaterial to the sufficiency of the FAC AMP, and are outside the scope of RK-TC-2. No findings are warranted.

G. Entergy's Other Tools

9.332 Riverkeeper proposes a variety of findings concerning "tools" (e.g. trending of actual wall thickness measurements, engineering judgment) other than CHECWORKS™ used by Entergy in its FAC program. Riverkeeper PFF at 56-66, ¶¶ 127-164.

9.333 As a threshold matter, Riverkeeper asserts that Entergy's goal in using these tools is to "ensure that components are inspected prior to reaching a critical wall thickness." *Id.* at 56 ¶ 128 (citing Tr. at 1674 (Yoder); GALL Report Rev. 1 (NYS000146C) at pp. XI M-61 to XI M-62; GALL Report Rev. 2 (NYS00147D) at pp. XI M17-1, XI M17-2). Riverkeeper's description of the goal is too narrow. Entergy's FAC program is implemented under a fleet-wide procedure EN-DC-315, Revision 6, “Flow Accelerated Corrosion Program,” (Ex. ENT000038). Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 30. Procedure EN-DC-315 describes the objectives of the FAC program as predicting, detecting, monitoring and minimizing degradation

in single and two-phase flow piping (safety and non-safety related systems) to prevent failures while enhancing plant safety and reliability. EN-DC-315, Rev. 6 (Ex. ENT000038) at 3 . In particular, EN-DC-315 procedure provides criteria and methodology for selecting components for inspection, performing inspections, evaluating inspection data and disposition of results, sample expansion requirements, piping repair/replacement criteria, program responsibilities, and documentation requirements. EN-DC-315, Rev. 6 (Ex. ENT000038) at 3. Thus the goal is more than just assuring when inspections occur.

1. Reinspections Based on Wall Measurements

9.334 Riverkeeper proposes that the Board find that measurements of actual wall thicknesses are ineffective methods for selecting where to inspect and where to re-inspect as a consequence of CHECWORKS™ being deficient. Riverkeeper PFF at 56-58, ¶¶ 129-134. However, Riverkeeper acknowledges that CHECWORKS™ has no role in re-inspections, but avers no initial inspection will take place due to CHECWORKS™. Riverkeeper PFF at 57-58, ¶¶ 134-135. Extrapolation from prior results, i.e. trending from past measurements, is a useful consideration regardless of whether piping is modeled in CHECWORKS™. *See* Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 45-46. Trending is recognized by the industry as one of the seven factors considered for component inspections under the FAC Program. "Recommendations for an Effective Flow-Accelerated Corrosion Program" (NSAC-202L-R3) (May 2006) (Ex. RIV00012) at 4-5 to 4-6.

9.335 Thus, the reasons asserted by Riverkeeper that trending cannot be used are in reality challenges to CHECWORKS™ as a whole as it is currently used, and are beyond the scope of RK-TC-2. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

9.336 Riverkeeper acknowledges that Entergy does not use CHECWORKS™ to determine re-inspections, but proposes that the Board find that not using CHECWORKS™ for

re-inspections runs afoul of the GALL Report. Riverkeeper PFF at 58, ¶ 135. However, both Entergy and the NRC Staff find that the entire FAC AMP, including how CHECWORKS™ is or is not used, meets the GALL report. Tr. at 1680; Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 108. Accordingly the Board finds the usage is consistent with the GALL Report.

9.337 Riverkeeper proposes that the Board find that re-inspections will not work because the rate of FAC is non-linear and FAC is a local phenomenon. Riverkeeper PFF at 58, ¶ 136. Contrary to Riverkeeper's view, the decades of observations of FAC show that the rate of FAC is fairly constant, and an analyst may predict a trend based on real measurements. *See* Entergy Testimony at (ENTR00029) 33 (A54), 69-70 (A95). Riverkeeper's hypothesis of non-linear unpredictable rates of FAC is inconsistent with the real-world data. See Tr. at 1837-38. In any event, unexpected local rates of FAC in a particular component (e.g. an elbow) would be detected based on the trends observed from inspections of similar components. Tr. at 1838-39, 1842.

9.338 Riverkeeper proposes that the Board find Entergy's re-inspections and data-trending not to meet the necessary standards. Riverkeeper PFF at 58-59, ¶ 137. In fact, Entergy's FAC program follows the relevant industry standards in *Recommendations for an Effective Flow-Accelerated Corrosion Program (NSAC-202L-R3)* (Ex. RIV000012). *See* Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 35, 38. Thus the Board finds that Entergy's program is following the industry standards.

2. Operating Experience

9.339 Riverkeeper proposes that the Board find Entergy's operating experience to be insufficiently described and, to the extent that operating experience is fed into CHECWORKS™, its usefulness might be affected. Riverkeeper PFF at 59, ¶¶ 138-40. Citing Entergy's corporate operating experience procedure, Entergy's witnesses testified that sources of operating experience for FAC program include the NRC, other utilities, and experiences at Entergy's other

sites. Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 47 (citing Entergy, EN-OE-100, Rev. 12, Operating Experience Program (Apr. 15, 2011) (Ex. ENT000055)). Entergy provided information showing how operating experience was incorporated into the selection of FAC inspection points. E.g. Scope of Flow-Accelerated Corrosion Inspection Points for 3R15 Outage (Mar. 2009) (ENT000064) at 7 (showing operating experience from Surry and Braidwood). The Staff found the FAC program scope to be consistent with NRC-identified, industry-identified, IP2-specific, and IP3-specific operating experience. SER (Ex. NYS000326B) at 3-23. Thus the Board finds the program is sufficiently described.

3. Other Programs

9.340 Riverkeeper proposes that the Board find the description of "other plant inspection programs" to be insufficient because the record does not establish what percentage the program contributes to the inspections. Riverkeeper PFF at 59-60 ¶ 141 (citing Entergy Testimony (ENT00029) at A77, Figures 1 and 2). However, examination of the source documents cited in Entergy's testimony (e.g. ENT00064) reveals percentages for selections of inspection locations. See ENT00029 at 52; ENT000064 at 19 (showing, inter alia, selection percentages for: calculation reinspection, power uprate, and snapshot scope assessment).

9.341 Riverkeeper proposes that the Board find that Entergy has not established how Entergy's use of "other plant inspection programs" prevents undetected FAC. Riverkeeper PFF at 60, ¶ 142 (citing Hopenfeld Rebuttal Testimony (RIV000108) at 15). Examination of Dr. Hopenfeld's testimony reveals no useful information about what detail on “other programs” is allegedly deficient. *See* RIV000108 at 15. In any event, Entergy's program incorporates by reference many additional programs and their associated procedures. For example, EN-DC-315, section 5.5 "NDE Test Methods and Documentation" states "Components can be inspected for FAC wear using ultrasonic testing (UT), radiography testing (RT), visual observation or other approved methods." EN-DC-315, Rev. 6 (Ex. ENT000038) at 20. Entergy's witnesses

described the methods and noted that the ASME Code must be followed where appropriate. Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 41.

4. Engineering Judgment

9.342 Riverkeeper proposes that the Board find engineering judgment to be insufficient, and to play a larger role than what Entergy represents. *See* Riverkeeper PFF at 60-63, ¶¶ 143-155. In particular, Riverkeeper proposes that the Board find that Entergy did not "espouse" Dr. Hopenfeld's "key elements" necessary for engineering judgment. *Id*. at 63, ¶ 154 (citing Hopenfeld Testimony (Ex. RIV00003) at 14-15.

9.343 Dr. Hopenfeld's "key elements" are 1) knowledge of plant history, 2) communication, 3) knowledge of FAC assessment methods, and 4) understanding of risk. *See* RIV00003 at 14-15. Entergy explained how formal documented qualifications are required before an engineer can provide engineering judgment with respect to FAC. Entergy Testimony (Ex. ENT000029) at 48 (A75) (citing Entergy, FTK-ESPP-G00019, Rev. 2, Nuclear Engineering Qualification Card, Implementing the Flow-Accelerated Corrosion (FAC) Program (Ex. ENT000056)). The requirements therein are sufficient to demonstrate knowledge and expertise in the field of FAC. *Id.* Dr. Hopenfeld posits that all are lacking at Entergy and thus Entergy has failed to show that "engineering judgment alone" will manage FAC. *Id.* at 15; Hopenfeld Rebuttal (Ex. RIV000108) at 15-16. However, the Board finds that the qualification program appears reasonable to provide the engineer with skills needed to exercise "engineering judgment." In any event, Riverkeeper's proposed finding is irrelevant because Entergy is not proposing to rely upon engineering judgment alone.

5. Selection of SNM Components

9.344 Riverkeeper proposes that the Board find the process by which Entergy selects "susceptible non-modeled" or "SNM" piping to be flawed because trending, operating

experience, and engineering judgment are used, there is no track record, and leaks have occurred. Riverkeeper PFF at 64-65, ¶¶ 156-161.

9.345 However, the evidence shows that, as specified in EN-DC-315, every two operating cycles Entergy updates its SNM reports. Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 46 (citing EN-DC-315, Revision 6 at 28 (Ex. ENT000038)). In this manner, Entergy's accounts for physical changes to the plant as well as changes in how the plant is operated. Entergy Testimony on RK-TC-2 (Ex. ENTR00029) at 46 (listing as examples IP2 SSE Report 0700.104-02 (Ex. ENT000048); IP2 SNM Report 0700.104-03 (Ex. ENT000052); IP3 SSE Report 0700.104-17 (Ex. ENT000049); IP3 SNM Report 0700.104-18 (Ex. ENT000053). Thus the Board finds, by undisputed evidence, that the SNM reports are updated. The other faults claimed on the SNM components are addressed *supra.*

H. Safety Consequences

9.346 Riverkeeper proposes that the Board make findings regarding the safety consequences of improperly-managed FAC. Riverkeeper PFF at 66-69, ¶¶ 165-172. It is not necessary for the Board to make findings with respect to the consequences of failing to maintain the CLB caused by an inadequate AMP. Riverkeeper's proposed findings with respect to loss of coolant accidents, earthquakes, station blackout, and metal fatigue, and transients (Riverkeeper PFF at 67-68, ¶¶ 168-172) are matters not subject to a license renewal review pursuant to 10 C.F.R. § 54.30 and well beyond to the scope of RK-TC-2, as admitted. *See Indian Point*, LPB-08-13, 68 NRC at 176-77; 10 C.F.R. § 54.30; *Turkey Point*, CLI-01-17, 54 NRC at 8-9; *Pilgrim*, CLI-12-1, 75 NRC at 56.

I. Sufficiency of Documentation and Details

9.347 Riverkeeper proposes findings concerning the details of the FAC Program in the LRA. Riverkeeper PFF at 69-76, ¶¶ 173-196. Riverkeeper emphasizes that the LRA proposes to perform actions in accordance with the NRC's GALL Report, which in turn allows use of

industry-wide NSAC-202L. *Id.* at 69-71, ¶¶ 173-181. No evidence was presented to show that the NRC's guidance and the industry guidance could not be used at Indian Point. Riverkeeper asserts the GALL Report and NSAC-202L are insufficient standing alone. Riverkeeper PFF at 75, ¶ 195. But the Commission does not require plant-specific procedures, and accepts a commitment to implement AMP that is consistent with the GALL report as an adequate demonstration of reasonable assurance under section 54.29(a). *NextEra Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC 301, 304 (2012), *petition for review denied sub nom. Beyond Nuclear v. U.S. Nuclear Regulatory Com'n,* 704 F.3d 12 (1st Cir. 2013).

9.348 Riverkeeper proposes the Board find that the LRA does not meet the GALL Report. Riverkeeper PFF at 74, ¶ 193. However, the Board finds Dr. Hopenfeld is incorrect in his belief that the GALL Report is not met. Entergy and the NRC Staff provided ample evidence that the LRA meets the GALL Report, and accordingly, the LRA provides what the Commission requires under *Seabrook*, CLI-12-05, 75 NRC 301 (2012).

J. Factual Conclusions

9.349 Riverkeeper summarizes its proposed factual findings. Riverkeeper PFF at 76-79 ¶¶ 197-217. For the reasons discussed above, the Riverkeeper's proposed factual conclusions lack the requisite factual support in the record, are irrelevant to the factual findings associated with an FAC AMP, and/or are beyond the scope of RK-TC-2 as admitted.

K. Conclusions of Law

9.350 Riverkeeper summarizes its conclusions of law. Riverkeeper PFF at 80-83, ¶¶ 218-224. For the reasons discussed above, the Riverkeeper's conclusions of law lack the requisite support in the record, are irrelevant to the factual findings associated with an FAC AMP, and/or are beyond the scope of RK-TC-2 as admitted. The record does not support Riverkeeper's proposed conclusions of law (Riverkeeper PFF at 80-81, ¶ 220) that Entergy's AMP does not meet the guidance in the GALL Report, that CHECWORKS™ is inaccurate, and

that other tools are useless. Riverkeeper's proposed conclusions of law (Riverkeeper PFF at ¶ 220) repeat incorrect facts concerning linearity of FAC and the definition of FAC, and repeat attacks on the CLB.

9.351 Riverkeeper's proposed conclusion of law (Riverkeeper PFF at 82 ¶ 222) proposes irrelevant conclusions of law regarding risks of undetected FAC. Riverkeeper also proposes findings against Entergy with respect to meeting 10 C.F.R. Part 50, Appendix A, General Design Criteria. *Id.* Such findings are irrelevant to RK-TC-2, unsupported, and are out of scope of license renewal and directly contrary to 10 C.F.R. § 54.30.

9.352 Riverkeeper's proposed conclusions of law (Riverkeeper PFF at 83 ¶¶ 223-24) asserts that Entergy failed to meets its burdens, and that RK-TC-2 is resolved in favor of Riverkeeper. As discussed above, the opposite is true.

9.353 Riverkeeper's proposed order (Riverkeeper PFF at 83) proposes that the Board authorize the director of NRR to deny the LRA. A final decision on whether license renewal for Indian Point Units 2 and 3 may be authorized will be made following the resolution of other matters, including the four Track 2 contentions that are before the Board.

Respectfully submitted,

/Signed (electronically) by/

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Dated at Rockville, Maryland
this 3rd day of May 2013

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

Pursuant to 10 C.F.R § 2.305 (as revised), I hereby certify that copies of the foregoing "NRC STAFF'S PROPOSED REPLY TO FINDINGS OF FACT AND CONCLUSIONS OF LAW ON CONTENTION RK-TC-2 (FLOW ACCELERATED CORROSION" dated May 3, 2013, have been served upon the Electronic Information Exchange (the NRC's E-Filing System), in the above- captioned proceeding, this 3rd day of May 2013.

/Signed (electronically) by/

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