ENT000722
Submitted: October 29, 2015

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos. 50-247-LR and 50-286-LR
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	
	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	October 29, 2015
	)	

SUPPLEMENTAL TESTIMONY OF ENTERGY WITNESSES NELSON F. AZEVEDO, TIMOTHY J. GRIESBACH, AND RANDY G. LOTT REGARDING CONTENTIONS NYS-25 (REACTOR VESSEL INTERNALS AMP), NYS-26B/RK-TC-1B (METAL FATIGUE), AND NYS-38/RK-TC-5 (SAFETY COMMITMENTS)

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I. BACKGROUND AND SUMMARY OF CONCLUSIONS

Q1. Please state your full name, your employer, and your position.

A1. My name is Nelson F. Azevedo ("NFA"). I am employed by Entergy Nuclear Operations, Inc. ("Entergy"), the applicant in this matter, as Supervisor of Code Programs at Indian Point Nuclear Generating Units 2 and 3 ("IP2" and "IP3," collectively "Indian Point Energy Center" or "IPEC") in Buchanan, New York.

My name is Timothy J. Griesbach ("TJG"). I am a Senior Associate at Structural Integrity Associates, Inc. I specialize in technical consulting utilizing state-of-the-art technologies for mitigating and resolving material degradation concerns in nuclear reactor pressure vessels, internals, piping, and other major components.

My name is Randy G. Lott ("RGL"). I am a Consulting Engineer at Westinghouse Electric Company ("Westinghouse") with over 35 years of experience in nuclear materials and radiation effects.

Q2. Have you previously testified in this proceeding regarding the Track 2 safety contentions?

A2. (NFA, TJG, RGL) Yes. Most recently, on August 10, 2105, we provided pre-filed direct testimony on behalf of Entergy concerning contentions NYS-25 (Reactor Vessel Internals AMP), NYS-26B/RK-TC-1B (Metal Fatigue), and NYS-38/RK-TC-5 (Safety Commitments (collectively, the "Track 2 Safety Contentions"). As more fully explained in our Pre-filed Track 2 Direct testimony, these contentions present certain overlapping challenges to the adequacy of Entergy's License Renewal Application ("LRA") for IPEC, most pertinently to the adequacy of the Reactor Vessel Internals ("RVI") Aging Management Program ("AMP") and Fatigue Management Program ("FMP").

Q3. Does your prior testimony summarize your professional qualifications?

A3. (NFA, TJG, RGL) Yes. Section I of our Pre-Filed Track 2 Direct Testimony on each contention summarizes our professional qualifications. In addition, Entergy has submitted our *curricula vitae* as Exhibits ENT000032 (NFA), ENT000617 (TJG), and ENT000618 (RGL).

Q4. Does your prior testimony describe the basis for your familiarity with the IPEC license renewal application, including the issues raised in the Track 2 Safety Contentions?

A4. (NFA, TJG, RGL) Yes. We discuss that subject in Section II of our Pre-Filed Track 2 Direct Testimony.

II. <u>PURPOSE AND SCOPE OF SUPPLEMENTAL TESTIMONY</u>

Q5. Have you reviewed Dr. Lahey's additional testimony filed on September 23, 2015, and the new exhibits filed by New York State on that date?

A5. (NFA, TJG, RGL) Yes. We have reviewed the Pre-filed Supplemental Testimony of Dr. Richard T. Lahey, Jr. Regarding Contentions NYS-25, NYS-26B/RK-TC-1B, and NYS-

38/RK-TC-5 (Sept. 23, 2015) ("Lahey Supplemental Testimony") (NYS000576), and the two accompanying additional exhibits filed by the State of New York ("NYS" or "the State"):

- NUREG/CR-7184, ANL-12/56, "Crack Growth Rate and Fracture Toughness Tests on Irradiated Cast Stainless Steels" (July 2015) (NYS000574) ("NUREG/CR-7184"); and
- NUREG/CR-7185, ANL-14/10, "Effects of Thermal Aging and Neutron Irradiation on Crack Growth Rate and Fracture Toughness of Cast Stainless Steels and Austenitic Stainless Steel Welds" (July 2015) (NYS000575) ("NUREG/CR-7185").

To the extent relevant to this Supplemental Testimony, we have also reviewed the Pre-filed Supplemental Reply Written Testimony of Dr. Richard T. Lahey, Jr. Regarding Contention NYS-25 (Sept. 9, 2015) ("Lahey NYS-25 Reply Testimony") (NYS000567) and the Pre-filed Supplemental Reply Written Testimony of Dr. Richard T. Lahey, Jr. Regarding Consolidated Contention NYS-26B/RK-TC-1B (Sept. 9, 2015) ("Lahey NYS-26B Reply Testimony") (NYS000569) (collectively, "Lahey Reply Testimony").

Q6. Does the Lahey Supplemental Testimony distinguish between the three Track 2 contentions?

A6. (NFA, TJG, RGL) No. Dr. Lahey's Supplemental Testimony appears to address all three Track 2 contentions, NYS-25, NYS-26B/RK-TC-1B, and NYS-38/RK-TC-5, without identifying whether any arguments apply to one or more contentions or otherwise distinguishing between contentions.

Q7. After reviewing those materials, have you changed any of the conclusions in your pre-filed testimony?

A7. (NFA, TJG, RGL) No. As explained in the remainder of this Supplemental Testimony, the Lahey Supplemental Testimony and the new exhibits present no new information that suggests any deficiency in Entergy's AMPs for IPEC. In general, the new exhibits review and summarize existing research on well-known matters related to the susceptibility of RVI materials to thermal embrittlement ("TE"), irradiation embrittlement ("IE"), and irradiation-assisted stress corrosion cracking ("IASCC") that Entergy fully addresses in the IPEC RVI AMP. Our conclusions are still that: (1) NYS-25 lacks merit because the IPEC RVI AMP provides reasonable assurance that the effects of aging on the IPEC RVIs will be adequately managed throughout the period of extended operation ("PEO"); (2) NYS-26B/RK-TC-1B lacks merit because the IPEC FMP provides reasonable assurance that the effects of aging due to fatigue on reactor coolant system pressure boundary and RVI components at IPEC will be adequately managed throughout the PEO; and (3) NYS-38/RK-TC-5 lacks merit because the commitments at issue in that contention provide further support for the adequacy of Entergy's aging management activities, and support the conclusion that there is reasonable assurance that the effects of aging will be adequately managed at IPEC throughout the PEO.

Q8. Please summarize the reasons why your conclusions have not changed.

A8. (NFA, TJG, RGL) NUREG/CR-7184 (NYS000574) and NUREG-CR-7185 (NYS000575) represent a summary of the status of research on well-known phenomena that are conservatively addressed in the MRP-227-A guidelines and in the RVI AMP. These reports build on previous work by Argonne National Laboratory ("ANL") to document and predict the potential effects of aging on low-molybdenum and low-delta ferrite cast austenitic stainless steel ("CASS") materials such as CF-3 and CF-8. *See*, *e.g.*, Chopra, O.K., "Degradation of LWR Core Internal Materials due to Neutron irradiation," NUREG/CR-7027 (Dec. 2010) (NYS000487); Gavenda, D., "Effects of Thermal Aging on Fracture Toughness and Charpy-Impact Strengths of Stainless Steel Pipe Welds," NUREG/CR-6428 (May 1996) (ENT000723). Throughout the new reports, the authors describe the additional efforts needed to fully characterize the impact of TE and IE and to update the prediction models for the full range of

CASS materials—including high-molybdenum CF-8M with greater than 25% delta ferrite. *See*, *e.g.*, NUREG/CR-7185 at xix, xx, xxi (NYS000575). However, as we have explained and will further explain below, the relevant CASS RVI components in IP2 and IP3 are not made from CF-8M, are low in delta ferrite content, and would not be affected by the bounding predictions for CF-8M from these potential future studies. Furthermore, the existing research also suggests that combined thermal aging and irradiation of representative CASS materials does not appear to lower toughness below what is expected for thermal embrittlement alone. *See generally* Letter from A. McGehee & T. Hanley, EPRI, to NRC Document Control Desk, BWRVIP 2015-025, "Project No. 704 – Summary of Industry Position on Screening Criteria for Thermal and Irradiation Embrittlement for PWR and BWR Reactor Internals Fabricated of Cast Austenitic Stainless Steel" (Mar. 9, 2015) (ENT000663).

Given the ongoing research in this area, the Electric Power Research Institute ("EPRI") Materials Reliability Program ("MRP") developed conservative screening criteria to identify components that are potentially susceptible to the effects of such mechanisms. MRP-227-A (NRC00014A-F) provides prioritized inspection guidelines for those susceptible RVI components, and the NRC Staff has approved these recommendations for use in license renewal AMPs. Entergy is following those guidelines at IPEC. Nothing in NUREG/CR-7184 or NUREG-CR-7185 changes our conclusion that the use of these guidelines in the IPEC RVI AMP provides reasonable assurance that the effects of aging on IPEC RVI components will be adequately managed.

III. <u>DISCUSSION</u>

Q9. Please summarize the claims in Dr. Lahey's supplemental testimony.

A9. (NFA, TJG, RGL) The Lahey Supplemental Testimony focuses on the two new exhibits: NUREG/CR-7184 (NYS000574) and NUREG/CR-7185 (NYS000575). Dr. Lahey generally asserts that these documents support the concerns, opinions, and testimony that he previously has presented in this proceeding. Lahey Supplemental Testimony at 3 (NYS000576).

Q10. In particular, what does Dr. Lahey say regarding NUREG/CR-7184 (NYS000574)?

A10. (NFA, TJG, RGL) Dr. Lahey generally asserts that this document reports the well-known point that for CASS materials, synergies may exist between TE and IE. Lahey Supplemental Testimony at 6 (NYS000576). Dr. Lahey also vaguely states that this document shows that embrittled CASS materials were observed to experience "transgranular brittle cleavage" and "ductile tearing." *Id*. According to Dr. Lahey, these observations support his previous opinions and testimony. *Id*. at 7.

Q11. Please respond to Dr. Lahey's statement that NUREG/CR-7184 shows that embrittled CASS materials were observed to undergo "transgranular brittle cleavage."

A11. (NFA, TJG, RGL) NUREG/CR-7184 does not provide evidence that CASS materials at IPEC could undergo "brittle cleavage." First, the three heats of CASS material studied in NUREG/CR-7184 had reported delta ferrite contents greater than 23%. *See* NUREG/CR-7184 at 145 (NYS000574). Thus, the materials ANL evaluated had greater susceptibility to thermal embrittlement than the CASS materials at IPEC, which, as shown below, have significantly lower delta ferrite content. Further, the "transgranular cleavage-like cracking" observed during stress corrosion and fatigue crack growth rate tests is indicative of the crack propagation mechanism, not the failure mechanism at elevated loads. In the fracture toughness J-R curve tests, which evaluate the material's resistance to fracture at high loads during faulted conditions, "[a]ll CASS specimens tested in this study failed in a ductile dimple mode . . . ." *Id*.; *see also id*. at 128 ("In the JR test region, the fracture morphology was mostly ductile dimples, suggesting heavy plastic flow during the JR test.”). This demonstrates that even in the embrittled condition, the CASS materials containing large austenitic regions retain sufficient ductility and do not fail by brittle cleavage.

Q12. Does Dr. Lahey acknowledge that NYS has already submitted an NUREG/CR-7184 as an exhibit in this proceeding?

A12. (NFA, TJG, RGL) Yes. Dr. Lahey acknowledges that the new exhibit NYS000574 is a revised version of Exhibit NYS000488, filed with his direct testimony. Lahey Supplemental Testimony at 7-8 (NYS000576). He observes that “[i]t appears that [ANL] and the USNRC have subsequently made some edits and republished the document,” *id.*, but he does not specify what those edits are, nor does he further discuss how the new exhibit differs from the original. In any event, as we have just shown, the issues Dr. Lahey raises regarding NUREG/CR-7184 do not represent any significant new information for the IPEC RVIs.

Q13. What are Dr. Lahey’s specific claims regarding NUREG/CR-7185 (NYS000575)?

A13. (NFA, TJG, RGL) In his supplemental testimony, Dr. Lahey presents a series of points from NUREG/CR-7185 which, he alleges, provide new and additional support for his previous opinions and testimony regarding the potential effects of aging on CASS and austenitic stainless steel weld materials.

Dr. Lahey’s key points regarding NUREG/CR-7185 are: (1) CASS and austenitic stainless steel welds have a duplex structure and may experience TE, which “may increase the hardness and tensile strength of a material,” but it decreases ductility, fracture toughness, and “impact strength” of CASS materials and austenitic stainless steel welds; (2) IE is a concern for “these components” for fluences greater than 2.0×10^{20} n/cm^2 (allegedly equivalent to 10 displacements per atom (“dpa”)), and irradiation makes CASS materials and austenitic stainless steel welds more susceptible to IASCC; (3) “IASCC increases the crack growth rate of cracks induced by stress corrosion cracking,” but there is allegedly “virtually no data” above 10 dpa, although some RVI components may experience several hundred dpa; (4) there is “possible synergy” between TE and IE; and (5) TE could make the welds associated with the pressurizer spray nozzle vulnerable to “seismic and thermal/pressure shock loads.” Lahey Supplemental Testimony at 4-5, 7 (NYS000576).

Q14. With regard the first issue, does the information in NUREG/CR-7185 suggest a need to reconsider the process for screening IPEC CASS materials for TE?

A14. (NFA, TJG, RGL) No. During its review of the IPEC RVI AMP and Inspection Plan, the NRC Staff used a screening value of 15% delta ferrite as a threshold below which CASS materials are not susceptible to either TE or the combined effects of TE and IE. *See* NUREG-1930, Supp. 2, Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 at 3-44 (Nov. 2014) (“SSER 2”) (NYS000507). We concur that this is a reasonable and conservative screening threshold, particularly for the IPEC CASS lower support column caps (“LSCCs”), which are the only IPEC CASS components located in a relatively high-fluence region. *See* Testimony of Entergy Witnesses Nelson F. Azevedo, Robert J. Dolansky, Alan B. Cox, Jack R. Strosnider, Jr., Timothy J. Griesbach, Randy G. Lott, and Mark A. Gray Regarding Contention NYS-25 (Embrittlement) at A105 (ENT000616) (“Entergy’s NYS-25 Testimony”).

NUREG/CR-7185 supports this conclusion by noting that “[a]n evaluation of the NRC screening criteria established to determine the susceptibility of CASS materials to thermal aging embrittlement indicates that the existing criteria are valid, except those for CF-8M materials.”

NUREG/CR-7185 at 117 (NYS000575). As a result, NUREG/CR-7185 proposes certain reduced thresholds for high-molybdenum, high-delta ferrite CF-8M materials. *See id*. But as we have previously explained, the IPEC RVIs do not include CF-8M materials. Entergy's NYS-25 Testimony at A178 (ENT000616). The IP2 and IP3 LSCCs are type CF-8, a low-molybdenum material that is less susceptible to TE than high-molybdenum CF-8M. *See id.*; *see also* NRC Staff Testimony of Dr. Allen Hiser, Jeffrey Poehler, and Gary Stevens on NYS-25 and NYS-38/RK-TC-5 at A163 (NRC000197).

Specifically, the chemical composition and delta ferrite content data from plant construction records for the IP2 and IP3 CASS materials show a maximum delta ferrite content of 14.6% at IP2 and 11.8 % for IP3. Entergy's NYS-25 Testimony at A178 (ENT000616) (citing NL-14-013, Letter from F. Dacimo, Entergy to NRC Document Control Desk, "Additional Information Regarding the License Renewal Application – Action Item 7 from MRP-227-A," Attach. 1 at 3, 4 (Jan. 28, 2014) (NYS000503). These values are below the NRC's 15% screening criteria for susceptibility to TE—which NUREG/CR-7185 does not propose to change. *See* SER Supplement 2 at 3-44 (July 2015) (NYS000507) ("SER Supplement 2") (stating that "low-molybdenum statically cast CASS with a ferrite content less than 15 percent can be screened out for TE and any synergistic effects of TE and IE . . . . The ferrite content of the IP2 and IP3 column caps meets this criterion because all heats have calculated ferrite content less than 15 percent."). Indeed, NUREG/CR-7185 relies heavily on data from high-delta ferrite materials in an earlier document, NUREG/CR-7027 (NYS000487), where, as we have also previously explained, many of the heats evaluated had delta ferrite content greater than 20% and as high as 42%. Entergy's NYS-25 Testimony at A178 (ENT000616).

Therefore, there is no need to revise the TE screening criteria for IPEC CASS components.

Q15. Are there other reasons why the IPEC RVI AMP provides reasonable assurance that the LSCCs will continue to perform their intended function throughout the PEO?

A15. (NFA, TJG, RGL) Yes. We must emphasize again that the LSCCs are part of the lower support structure, which is a highly redundant and flaw-tolerant structure. Even if future research were to show that the column caps were more susceptible to embrittlement than the available information shows, the redundancy and flaw tolerance of these components provides reasonable assurance that the lower support structure will maintain functionality under all normal/upset and accident loading design basis conditions, including conditions that Dr. Lahey refers to as "shock" loads. *See* Entergy's NYS-25 Testimony at A199 (ENT000616) (citing PWROG-14048-P, Rev. 0-A, PWROG, Functionality Analysis: Lower Support Columns (Oct. 2014) ("PWROG-14048-P") (ENT000667)). Dr. Lahey has presented no testimony to challenge or refute this information.

Q16. As to Dr. Lahey's claims regarding IE, please respond to his statement that NUREG/CR-7185 (NYS000575) shows that IE can affect RVI components at fluence levels of 2.0 x 10^{20} n/cm^2 (10 dpa), such that the report supports Dr. Lahey's previously-raised concerns about aging effects on RVIs.

A16. (NFA, TJG, RGL) As a threshold matter, Dr. Lahey never explains why or how the data he presents represents a deficiency in the IPEC RVI AMP. Moreover, the specific source for Dr. Lahey's reference to this particular fluence level is not entirely clear; particularly as 2.0 x 10^{20} n/cm^2 corresponds to approximately 0.3 dpa, not 10 dpa as Dr. Lahey states. *See*

NUREG/CR-7815 at 73 (NYS000575). This discrepancy is significant given that EPRI has determined that 6.7 x 10^{20} n/cm^2 (1 dpa) is an appropriate screening value for IE. In addition, the reference to 2.0 x 10^{20} n/cm^2 in NUREG/CR-7815 appears to address susceptibility to IASCC, not IE.

In any event, NUREG/CR-7185 supports the adequacy of the guidelines in MRP-227-A, not Dr. Lahey's criticisms. Specifically, in rebuttal Dr. Lahey presented a graph purporting to show the combined effects of embrittlement and fatigue. This graph assumes that "significant embrittlement" of RVI components begins to develop when the fluence exceeds 1 x 10^{17} n/cm^2. *See* Lahey Rebuttal at 12, 15 (NYS000567). During the development of MRP-227-A, EPRI determined that 6.7 x 10^{20} n/cm^2 (1 dpa) was the appropriate threshold screening value for potential susceptibility to IE for CASS RVI components and welds. *See* EPRI, MRP-191, Materials Reliability Program: Screening, Categorization, and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design at 3-8, tbl. 3-6 (Nov. 2006) ("MRP-191") (NYS000321); *see also* Letter from A. McGehee & T. Hanley, EPRI, to NRC Document Control Desk, BWRVIP 2015-025, "Project No. 704 – Summary of Industry Position on Screening Criteria for Thermal and Irradiation Embrittlement for PWR and BWR Reactor Internals Fabricated of Cast Austenitic Stainless Steel" at 20, Fig. 1 (Mar. 9, 2015) (ENT000663) ("BWRVIP Letter") (showing that CF-8 materials retain sufficiently high fracture toughness at 1 dpa). The threshold Dr. Lahey cites from NUREG/CR-7185 is much closer to EPRI's screening value than to his suggested threshold that is three orders of magnitude below the threshold suggested by EPRI and ANL.

Q17. As to Dr. Lahey's claims regarding austenitic stainless steel welds, does the information in NUREG/CR-7185 suggest a need to reconsider how the potential effects of IE or IASCC on such welds are addressed in the RVI AMP?

A17. (NFA, TJG, RGL) No. Dr. Lahey again raises only general concerns about this topic, and identifies no specific disputes with the inspections of RVI welds specified in the IPEC RVI AMP and Inspection Plan.

During the development of MRP-227-A, the EPRI MRP identified 6.7 x 10^{20} n/cm^2 (1 dpa) as a threshold screening value for potential susceptibility to IE in structural welds in Westinghouse plants such as IP2 and IP3. *See* MRP-191 at 3-8 (NYS000321). For those components with structural functions, EPRI categorized them as Primary, Expansion, or Existing Programs components based on their relative susceptibility to and tolerance of applicable aging effects and the existence of other programs. *See* MRP-227-A at 3-15 to 3-16 (NRC00014A). Based on this process, the IPEC RVI AMP includes inspections of the control rod guide tube lower flange welds and the lower core barrel cylinder girth welds as Primary components. *See* Entergy NYS-25 Testimony at A139 (ENT000616). Based on our review of NUREG/CR-7185 and Dr. Lahey's allegations, there is no new fracture toughness data in that document that calls into question the categorization of the IPEC welds.

Q18. Relatedly, Dr. Lahey suggests that NUREG/CR-7185 shows that there is "virtually no data" for IASCC of RVI components at high fluences, above 10 dpa up to "several hundred" dpa that some components "may experience," thereby suggesting that certain unidentified RVI components may be subject to greater fluences than the RVI AMP can address. Lahey Supplemental Testimony at 5 (NYS000576). Does this testimony raise any concerns regarding the adequacy of the IPEC RVI AMP?

A18. (NFA, TJG, RGL) No. As a threshold matter, we do not agree that there is "virtually no data" for IASCC of RVI components exposed to fluences above 10 dpa. *See* NUREG/CR-7815 at 74, fig. 42 (NYS000575); NUREG/CR-7027 at 59, fig. 51 (NYS000487); EPRI, MRP-227-A, Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines at 6-8, fig. 6-5 (Dec. 2011) ("MRP-227-A") (NRC00014B) (showing high-fluence data regarding IASCC of RVI materials). "Virtually no data" is Dr. Lahey's phrase, not ANL's. In any event, Table 4-6 of MRP-191 lists materials of construction for Westinghouse RVI components and provides conservative anticipated fluence ranges. There are no IPEC CASS materials or welds expected to experience "several hundred dpa," contrary to Dr. Lahey's speculation. *See* MRP-191 at 4-22 to -29 (NYS000321).

Detailed, IPEC-specific fluence mappings indicate that 6 dpa is a realistic 60-year projection of the peak fluence for the LSCCs**.** *See* SSER 2 at 3-46 (NYS000507), PWROG-14048-P at 5-1 (ENT000667); Westinghouse, Calculation Note CN-RIDA-13-48, "Indian Point Units 2 and 3 Reactor Internals Lower Support Column Bodies Thermal Embrittlement and Irradiation Embrittlement Screening Assessment" (Oct. 15, 2013) (ENT000724). Laboratory data shows that large stresses are required to initiate IASCC at fluences below 10 dpa. *See* SSER 2 at 3-46 (NYS000507). Nevertheless, as a conservative measure, the IPEC RVI AMP addresses potential IASCC in the LSCCs. *See* Entergy NYS-25 Testimony at A139 (ENT000616); SSER 2 at 3-40 to -47 (NYS000507). NUREG/CR-7185 adds nothing new on this topic.

Q19. Regarding potential "synergistic" effects, do you agree with Dr. Lahey that NUREG/CR-7184 and NUREG/CR-7185 provide new or additional support for his already-expressed concerns about potential synergies between TE, IE, and IASCC?

A19. (NFA, TJG, RGL) No. We disagree with Dr. Lahey's claims that Entergy's RVI AMP, FMP, and other AMPs for IPEC have not adequately addressed the aging effects discussed in the new exhibits. The potential susceptibility of CASS RVI components and welds to TE, the potential for IE and TE to produce combined effects, and the susceptibility of RVI components to IASCC are all well known and Entergy has thoroughly addressed these issues in the IPEC RVI AMP. *See* Entergy's NYS-25 Testimony at A111, A172, A174, A202 (ENT000616); *see also* SSER 2 at 3-40 to -47 (NYS000507). Dr. Lahey's supplemental testimony only includes very general statements about the need to consider these issues, and he fails to identify any specific deficiencies in *how* the EPRI MRP evaluated the potential effects of these aging mechanisms or *how* the IPEC RVI AMP manages those effects. This continues to be a fundamental flaw in Dr. Lahey's testimony on the Track 2 contentions.

In sum, the new exhibits are focused on specific set of well-known aging phenomena, and Dr. Lahey's conclusion that these documents generally support his previous opinions regarding unaddressed "synergies between the various aging-related degradation mechanisms" is overstated and incorrect.

Q20. Finally, Dr. Lahey claims that the data regarding the susceptibility of CASS and austenitic stainless steel welds to TE in NUREG/CR-7185 "means that the welds associated with the pressurizer spray nozzle, for example, are particularly vulnerable to significant seismic and thermal/pressure shock loads." Lahey Supplemental Testimony at 7 (NYS000576). How do you respond?

A20. (NFA, TJG, RGL) This statement from Dr. Lahey is speculative, baseless, and unsupported by any information in NUREG/CR-7185. As an initial matter, the susceptibility of the pressurizer spray nozzle welds to TE is not an issue related to any of the contentions. Specifically, pressurizer components are not RVI components, so they are not managed under the RVI AMP. Nor is the FMP used to manage the effects of TE on any component. And in any event, contrary to Dr. Lahey's speculation, the pressurizer spray nozzle welds are constructed of materials that are not susceptible to TE.

The pressurizer spray nozzle-to-safe end welds at IP2 and IP2 are type 308 or 309 stainless steel. *See* WCAP-14574-A, License Renewal Evaluation: Aging Management Evaluation for Pressurizers at 51, tbl. 3.1 (Dec. 2000) (approved as a topical report by NRC Staff, Oct. 26, 2000) (ENT000725) ("WCAP-14574-A"). This material is microstructurally stable at PWR operating temperatures; and by design, it is not susceptible to TE. *See id*. at 54. This low susceptibility to TE is assured by the relatively low delta ferrite content of such welds, which is below 10%. NUREG/CR-7185 focuses mainly on potential TE and IE aging effects of susceptible CASS materials and asustanitic stainless steel welds in the RVIs, *see* NUREG/CR-7185 at iii (NYS000575), and the report does not discuss the pressurizer spray nozzle welds, nor does it suggest that the NRC Staff-approved conclusions in WCAP-14574-A must be revisited.

IV. <u>CONCLUSION</u>

Q21. What do you conclude from your review of the new exhibits and the Lahey Supplemental Testimony?

A21. (NFA, TJG, RGL) The Lahey Supplemental Testimony and the new exhibits filed by the State present no new information that suggests any deficiency in the IPEC AMPs at issue in the Track 2 contentions. The State's contentions lack merit for all of the reasons set forth in our Pre-Filed Track 2 Direct Testimony and as further explained in our Supplemental Testimony.

Q22. Does this conclude your testimony?

A22. (NFA, TJG, RGL) Yes.

Q23. In accordance with 28 U.S.C. § 1746, do you state under penalty of perjury that the foregoing testimony is true and correct?

A23. (NFA, TJG, RGL) Yes.

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