

**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD**

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In re: Docket Nos. 50-247-LR; 50-286-LR

License Renewal Application Submitted by ASLBP No. 07-858-03-LR-BD01

Entergy Nuclear Indian Point 2, LLC, DPR-26, DPR-64
Entergy Nuclear Indian Point 3, LLC, and
Entergy Nuclear Operations, Inc. February 13, 2015
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**NEW YORK STATE
FEBRUARY 2015 SUPPLEMENT TO
PREVIOUSLY-ADMITTED CONTENTION NYS-25**

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**ADDITIONAL BASES FOR
PREVIOUSLY-ADMITTED CONTENTION NYS-25**

For addition after NYS-25, existing ¶ 3.5:

¶ 3.6. On February 17, 2012, Entergy submitted an amendment to its license renewal application entitled “Revised Reactor Vessel Internals Program and Inspection Plan Compliant with MRP-227-A,” which revised and amended Entergy’s proposed aging management plan (AMP) for reactor vessel internals (RVIs). Entergy filing NL-12-037. Over the next 32 months, Entergy modified and developed the revised plan through numerous bi-lateral communications with NRC Staff and responses to a series of requests for additional information (RAIs) from NRC Staff. The February 2012 submission, as modified by those communications and RAI responses, constitutes Entergy’s “Amended and Revised RVI Plan.” In November 2014, NRC Staff issued Supplement 2 to the Safety Evaluation Report (SSER2) for Entergy’s license renewal application, which approved Entergy’s Amended and Revised RVI Plan. Entergy’s Amended and Revised RVI Plan is a “new program.” NL-12-037, Attachment 1, p. 3, 8.

¶ 3.7. Entergy’s current Amended and Revised RVI Plan is inadequate and violates 50 C.F.R. § 54.21(c)(1)(iii) because it does not address or manage the combined, synergistic aging effects of embrittlement and fatigue on reactor pressure vessel internal components including, but not limited to, the core baffle, intermediate shells, former plates and bolts (particularly the re-entrant corners, the baffle-to-baffle bolt locations, the core barrel-to-former bolt locations, and baffle-to-former bolt locations), core barrel (and its welds), lower core plate and support structures, clevis bolts, thermal shield, the lower support column and mixer, and the control rods and their associated guide tubes, plates, and welds. The failure of the current Amended and

Revised RVI Plan to address or manage the combined, synergistic aging effects of embrittlement, fatigue, and other degradation forces on reactor pressure vessel internal components could have profound safety consequences for the State and its citizens.

¶ 3.8. Contrary to the conclusions of Entergy and NRC Staff, Entergy's Amended and Revised RVI Plan is inadequate under 50 C.F.R. § 54.21(c)(1)(iii) because it does not address or manage the combined, synergistic aging effects of embrittlement, fatigue, and other aging mechanisms on RVI components. Rather, Entergy has considered aging effects independently of each other, without accounting for the reality of the harsh conditions within the reactor vessel. Furthermore, Entergy has reaffirmed that it will not take preventative actions in managing aging effects on RVIs, but instead will depend on periodic inspections to detect cracks or other signs of wear. NL-12-037, Attachment 1, p. 5 ("The Reactor Vessel Internals Program is a condition monitoring program that does not include preventive actions."). This inspection-based plan fails to address the possibility that a shock load will cause highly fatigued and degraded RVI components to fail entirely prior to the appearance of cracks or other detectable signs of wear.

¶ 3.9. For similar reasons, EPRI guidance document MRP-227-A, Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines, is also inadequate. It does not adequately address or manage the combined, synergistic aging effects of embrittlement and fatigue on reactor pressure vessel internal components; it also inappropriately relies on inspections that may not detect the significant component degradation before it is visible.

¶ 3.10. Entergy's current Amended and Revised RVI Plan is also inadequate

because it:

(a) does not specify with any meaningful precision when the replacement or repair of embrittled or otherwise degraded reactor vessel internal components will take place (NL-13-052, Attachment 1, p. 9 (Commitment 49); NL-13-122, Attachment 2, p. 20 (Commitment 49);

(b) relies on less reliable remote-control VT-3 examinations, instead of the more reliable volumetric ultrasonic testing (UT), to examine various components such as, for example and without limitation, baffle former assembly plates and edge bolts, control rod guide tube assembly guide plates, thermal shield assembly flexures, and core barrel flanges (NL-12-037, Attachment 2, Table 5-2, Table 5-3, Table 5-4, Table 5-5); and

(c) has not generated, and has not agreed to provide, an error analysis of the CUF_{en} analysis or outputs.

These deficiencies in the proposed aging management program violate 50 C.F.R. § 54.21(c)(1)

(iii) and could have profound safety consequences for the State and its citizens.

**ADDITIONAL SUPPORTING EVIDENCE
FOR PREVIOUSLY-ADMITTED CONTENTION NYS-25**

For addition after NYS-25, existing ¶ 7.8:

¶ 7.9 This contention, as supplemented, is also supported by the accompanying February 12, 2015 declaration of the State’s expert, Dr. Richard T. Lahey, Jr., the documents cited therein, and the attachments to the February 13, 2015 declaration of Assistant Attorney General Lisa S. Kwong.

¶ 7.10 On February 17, 2012, Entergy submitted a “Revised Reactor Vessel Internals Program and Inspection Plan” to NRC. NL-12-037. The scope and details of the Revised Plan were modified, developed, and clarified through a series of meetings and communications between Entergy and NRC Staff, NRC Staff Requests for Additional Information (RAIs), and Entergy submissions, including, but not limited to, submissions dated June 14, 2012 (NL-12-089), September 28, 2012 (NL-12-134), October 17, 2012 (NL-12-140), November 20, 2012 (NL-12-166), May 7, 2013 (NL-13-052), September 27, 2013 (NL-13-122), January 28, 2014 (NL-14-013), June 9, 2014 (NL-14-067), and August 5, 2014 (N-14-093). NRC Staff approved the Amended and Revised RVI Plan in November 2014 through Supplement 2 to the Safety Evaluation Report (SSER2).

¶ 7.11. The revised plan includes a new Commitment 49, in which Entergy agreed to “[r]ecalculate each of the limiting CUFs” for certain RVI components “to include the reactor coolant environment effects (F_{en})” using NUREG/CR-5704 or NUREG/CR-6909. Commitment 49 also provides that “corrective actions” could include “further CUF re-analysis” or replacement or repair of a component “prior to the CUF_{en} reaching 1.0.” NL-13-052, Attachment 1, p. 9; SSER2, at A-15. Entergy, through contractor Westinghouse, has calculated

(or will calculate) CUF_{en} values for IP2 and IP3 using a methodology that does not adequately account for all combined factors affecting component life and functionality, including, though not limited to, the effects of neutron irradiation on metal fatigue, and irradiation-induced embrittlement on the RVI components. The results of some tests were reported in various proprietary documents – although it is not clear whether those output results have been reported yet to NRC. Furthermore, Entergy never conducted an “error analysis” to quantify the accuracy of the CUF_{en} values, some of which were very close to the threshold value of 1.0. Entergy has not completed the commitment to calculate CUF_{en} values for IP3, and has not agreed to complete those calculations until the end of Unit 3’s 40-year operating term in December 2015. SSER2, at A-15.

¶ 7.12. The Revised Plan does not include acceptance criteria for use when evaluating inspection results for all components. For example, Entergy has merely committed to develop acceptance criteria for baffle former bolts sometime prior to 2019 for IP2 and 2021 for IP3. Response to RAI 5, Attachment 1 to NL-12-089, at 11. NRC Staff has approved this approach, SSER, at 3-20, even though cracking of baffle former bolts has been observed at European pressurized water reactors (PWRs) and Entergy acknowledges “cracking of baffle former bolts is recognized as a potential issue for the IPEC units.” Attachment 1 to NL-12-037, at 8. In the Revised Plan, Entergy also acknowledges various “material degradation concerns” for reactors operating beyond 40 years. NL-12-037, Attachment 1, Revised Reactor Vessel Internals Program, at 8. “Other confirmed or suspected material degradation concerns that the industry has identified for PWR components are wear in thimble tubes, potential wear in control rod guide tube guide plates, and cracking in some high-strength bolting.” *Id.* The Revised Inspection Plan, which purports to comply with EPRI’s MRP-227-A guidelines, proposes to

manage these aging effects through periodic inspections, and manifestly “does not include preventive actions.” Attachment 1 to NL-12-037, at 5.

¶ 7.13. The Revised Plan reflects a “wait-and-see” approach, in which Entergy proposes to wait for cracks or other visible wear to develop in RVI components before deciding whether preventative steps are necessary. Attachment 2 to NL-12-037. Indeed, for clevis insert bolts, Entergy accepts that crack detection before bolt failure is probably not possible, but proposes to wait for bolt failure to occur during the period of extended operation, under the assumption that bolt failures will not affect the safe operation of the IP facilities. SSER2, at 3-24 to 3-25; Response to RAI 17, Attachment 1 to NL-13-122, at 8. Entergy did not evaluate how the failure of highly fatigued and embrittled components – some of which may have failed entirely – would respond to an unexpected shock load, or whether the core would maintain a coolable geometry in the event that such a shock load caused multiple components or populations of components to fail.

¶ 7.14. During the development of the SSER2, Entergy and NRC Staff devoted significant time to considering the possible synergistic effects of thermal embrittlement (TE) and irradiation-induced embrittlement (IE) effects on the cast austenitic stainless steel (CASS) lower support columns. SSER2, at 3-40 to 3-47; Response to RAI-11C, Attachment 1 to NL-14-093, at 1-4; Response to RAI-11B, Attachment 1 to NL-13-122, at 2-4; Response to RAI-11A, Attachment 1 to NL-13-052, at 1-3; Response to RAI-11, Attachment 1 to NL-12-134, at 11-12. Despite the considerable uncertainty related to the combined effects of irradiation embrittlement, other aging mechanisms, and fatigue, Entergy concluded that there was “no need to consider irradiation embrittlement or synergistic action” on the lower support column. Attachment 1 to NL-13-052, at 3. Furthermore, Entergy never evaluated the synergistic mechanisms that operate

on other important and vulnerable RVI components, including, but not limited, to the core baffles, baffle bolts, and formers.

¶ 7.15. It is important to maintain safety margins when a reactor operates in a period of extended operation beyond its initial 40-year operating term. One reason safety margins should be maintained is to address unanticipated events or potential calculational or modeling mistakes. A recent recognition of a modeling mistake is the discovery that the Standard Review Plan (NUREG-0800) Branch Technical Position (BTP) 5-3 for estimating the initial fracture toughness of reactor vessel materials may be non-conservative for facilities that received their construction permits before 1973. *See* AAG Kwong Decl., Attachments 1, 2, 3.

¶ 7.16. Having now recognized the challenge posed by synergistic age related degradation mechanisms on light water reactor pressure vessel components, the federal government is spending considerable resources to investigate and understand these challenges. For example, NRC's *2016 Congressional Budget Justification* lists research on "materials degradation" as one of the Commission's "major activities" (NUREG-1100, Vol. 31, at 20-21 (February 2015)) and the U.S. Department of Energy recently requested over \$30 million in funding for the Light Water Reactor Sustainability Program as part of its Fiscal Year 2015 Congressional Budget Request (*see* USDOE FY 2015 Congressional Budget Request, DOE/CF-0098, Vol. 3, at 425-426, 430 (March 2014)).

Respectfully submitted,

Signed (electronically) by

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