

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Ronald M. Spritzer, Chair
Dr. Gary S. Arnold
Dr. Thomas J. Hirons

In the Matter of:

ENTERGY NUCLEAR OPERATIONS, INC.

(Palisades Nuclear Plant)

Docket No. 50-255-LA-2

ASLBP No. 15-939-04-LA-BD01

June 18, 2015

MEMORANDUM AND ORDER
(Granting Petition to Intervene and Request for a Hearing)

Beyond Nuclear, Don't Waste Michigan, Michigan Safe Energy Future – Shoreline Chapter, and the Nuclear Energy Information Service (collectively “the petitioners”) seek a hearing on a license amendment request (“LAR”) concerning whether the reactor vessel plate and weld materials at Palisades Nuclear Power Plant (“Palisades”) have been shown to provide adequate margins of safety against fracture.¹ Because the petitioners have submitted a timely petition, have established representational standing, and have proffered an admissible contention,² the Licensing Board grants their hearing request.³

¹ Petition to Intervene and for a Public Adjudication Hearing of Entergy License Amendment Request for Approval of 10 CFR Part 50 Appendix G Equivalent Margins Analysis (Mar. 9, 2015) [hereinafter “Petition”]. The petitioners first raised this concern with respect to an earlier LAR, but they later deferred that argument to this license amendment proceeding. See Entergy Nuclear Operations, Inc. (Palisades Nuclear Plant), LBP-15-17, 81 NRC __, __ n.164 (slip op. at 29 n.164) (May 8, 2015).

² See 10 C.F.R. § 2.309(a), (f)(1).

³ Judge Arnold agrees that the petitioners have submitted a timely petition and have standing, but he disagrees with the Board’s conclusion that their contention is admissible. His dissent

I. Background

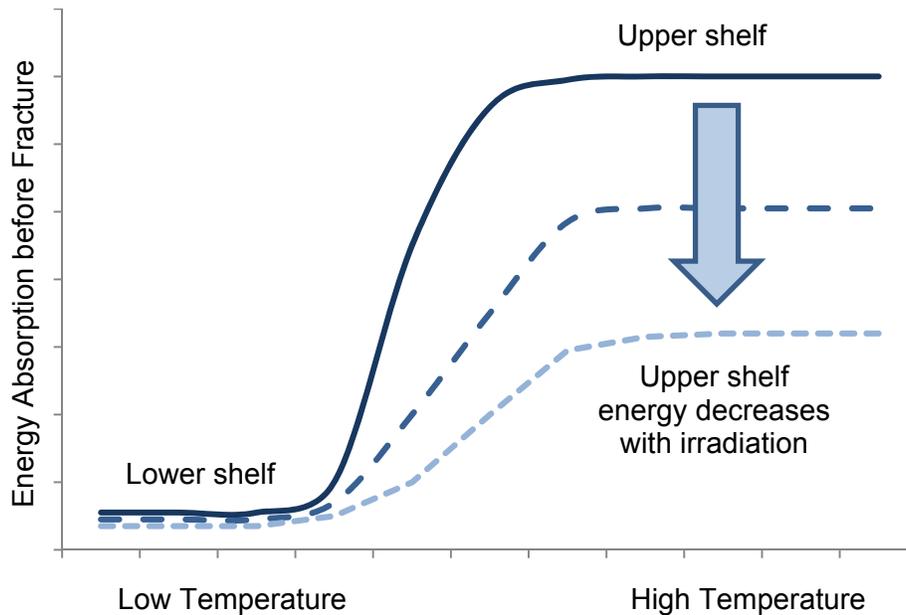
This license amendment proceeding concerns the material properties of the Palisades reactor pressure vessel. “Long-term exposure to neutron radiation and elevated temperatures in a reactor vessel affects vessel materials. Over time, the ductility of ferritic materials decreases, thereby decreasing the vessel materials’ ‘fracture toughness,’ or resistance to fracture.”⁴ Accordingly, Nuclear Regulatory Commission (“NRC”) regulations require that materials in a reactor vessel maintain a minimum level of fracture toughness; this minimum is set at 50 foot-pounds (ft-lb) of Charpy upper-shelf energy, which is a measurement of the amount of energy the material can absorb at high temperatures before it fractures and fails.⁵ Charpy upper-shelf energy decreases with exposure to neutron radiation over the reactor

from the Board’s contention admissibility ruling is attached to the end of this Memorandum and Order.

⁴ Cleveland Electric Illuminating Co. (Perry Nuclear Power Plant, Unit 1), CLI-96-13, 44 NRC 315, 317 (1996).

⁵ 10 C.F.R. Pt. 50, App. G. The Charpy impact test measures the energy required to fracture metal by striking a sample with a pendulum until the sample breaks. See Arthur L. Lowe, Jr., Factors Influencing Accuracy of Charpy Impact Test Data, in Charpy Impact Test: Factors and Variables, American Society for Testing & Materials [(“ASTM”)] Selected Technical Papers 1072, at 55–56 (John M. Holt ed. 1990). The term “upper-shelf” refers to the materials’ ability to absorb more energy at higher temperatures. Id.

vessel's lifetime,⁶ as illustrated in this diagram:⁷



Accordingly, if part of a reactor pressure vessel is expected to fall below the 50 ft-lb standard, the vessel's licensee must demonstrate "that lower values of Charpy upper-shelf energy will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the [American Society of Mechanical Engineers Boiler and Pressure Vessel ('ASME BPV')] Code."⁸

Entergy Nuclear Operations, Inc. ("Entergy") predicted that a plate material and a weld material in the Palisades reactor will fall below the 50 ft-lb standard during the reactor's lifetime,

⁶ See Office of Nuclear Regulatory Research, NRC, Radiation Embrittlement of Reactor Vessel Materials, Regulatory Guide 1.99, at 1 (rev. 2 May 1988) (ADAMS Accession No. ML003740284) [hereinafter "Regulatory Guide 1.99"] (describing methods for calculating "changes in fracture toughness of reactor vessel materials caused by neutron radiation throughout the service life").

⁷ This graph is offered for illustrative purposes and is not part of the record as provided by the parties.

⁸ 10 C.F.R. Pt. 50, App. G § IV.1.a. "This analysis must use the latest edition and addenda of the ASME Code incorporated by reference into [10 C.F.R.] § 50.55a(b)(2) at the time the analysis is submitted." *Id.* The NRC has incorporated Section XI of the ASME BPV Code "through the 2007 Edition with the 2008 Addenda." *Id.* § 50.55a(b)(2). As used in this Order, Section XI refers to Section XI, Division 1, of the ASME BPV Code.

leading the company in October 2013 to submit an analysis to the NRC Staff (“the Staff”) to show that the materials provided “margins of safety” that are “equivalent” to those required by ASME BPV Code, Section XI, Appendix G.⁹ Following discussions with the Staff, the company resubmitted its equivalent margins analysis (“EMA”) on November 12, 2014, as a license amendment request.¹⁰ The LAR predicts that lower shell plate material D-308-1 will drop below the 50 ft-lb screening criterion in December 2016 and that weld material 9-112 will drop below this criterion in November 2027.¹¹ Entergy’s analysis also concludes that a different material, upper shell plate material D-3802-3, could fall below the 50 ft-lb standard “if future operation includes higher flux levels, longer operating cycles, or changes to the reactor internals.”¹²

In its analysis, Entergy determined that all three materials nevertheless show safety margins equivalent to those required by ASME BPV Code, Section XI, Appendix G.¹³ The company based its calculations on ASME BPV Code, Section XI, Appendix K, “Assessment of Reactor Vessels with Low Upper Shelf Charpy Impact Energy Levels,” as supplemented by Regulatory Guide 1.161.¹⁴

⁹ Letter from Anthony J. Vitale, Site Vice President, Palisades Nuclear Plant, to Document Control Desk, NRC, Palisades Nuclear Plant 10 CFR 50 Appendix G Equivalent Margins Analysis (Oct. 21, 2013) (ADAMS Accession No. ML13295A448).

¹⁰ Letter from Anthony J. Vitale, Site Vice President, Palisades Nuclear Plant, to Document Control Desk, NRC, License Amendment Request for Approval of Palisades Nuclear Plant 10 CFR 50 Appendix G Equivalent Margins Analysis (Nov. 12, 2014) (ADAMS Accession No. ML14316A190) [hereinafter “LAR”]. The license amendment request and all attachments are available at ADAMS Package No. ML14316A370.

¹¹ LAR, attach. 1, at 2.

¹² Id.

¹³ Id. at 2–4.

¹⁴ Id. at 3; Office of Nuclear Regulatory Research, Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft-Lb, Regulatory Guide 1.161 (June 1995) (ADAMS Accession No. ML003740038) [hereinafter “Regulatory Guide 1.161”].

The Staff's regulatory guide describes procedures that the Staff considers acceptable for demonstrating equivalent safety margins,¹⁵ provides models for four different operating and emergency scenarios (known as Level A, B, C, and D conditions),¹⁶ and includes references for generic data on correlations between Charpy impact energy and fracture toughness.¹⁷ The guide explains that the use of generic reference materials will often be necessary for an EMA, rather than testing material samples directly:

Unfortunately, the specific material of interest (i.e., the material from the beltline region of the reactor vessel under operation) is seldom available for testing. Thus, testing programs have used generic materials that are expected to represent the range of actual materials used in fabricating reactor pressure vessels in the United States.¹⁸

Energy relied on these generic reference materials in its analysis.¹⁹ The Staff's guidance also authorizes methods other than the generic analyses "on an individual-case basis if justified."²⁰

¹⁵ See Regulatory Guide 1.161, at 1, 8–11. The Staff most recently reviewed this guide in March 2014 and found that it was acceptable for continued use. Memorandum from David Rudland, Chief, Component Integrity Branch, to Michael J. Case, Director, Division of Engineering (Mar. 13, 2014) (ADAMS Accession No. ML14070A206). The Staff is, however, continuing to investigate crack driving forces and methods to improve the reference data on correlations between Charpy impact energy and fracture toughness. See Component Integrity Branch, Regulatory Guide Periodic Review of Regulatory Guide 1.161, at 1–2 (Mar. 2013) (ADAMS Accession No. ML14070A207).

¹⁶ Regulatory Guide 1.161, at 3–4. The Level A scenario concerns normal operating conditions; the Level B scenario concerns "Upset" conditions; the Level C scenario concerns low-probability "Emergency" conditions; and the level D scenario concerns the lowest-probability "Faulted" conditions. ASME BPV Code § XI, Art. IWA-9000 Glossary; *id.*, Art. XI-3000, at IX-3200.

¹⁷ Regulatory Guide 1.161, at 2 (citing E. D. Eason, J. E. Wright, and E. E. Nelson, *Multivariable Modeling of Pressure Vessel and Piping J-R Data*, NUREG/CR-5729 (May 1991)).

¹⁸ *Id.* at 2.

¹⁹ LAR, attach. 5, at 5-2.

²⁰ Regulatory Guide 1.161, at 2; see *id.* at 3 ("Licensees may follow this regulatory guide to determine the equivalent safety margins, or they may use any other methods, procedures, or selection of materials data and transients to demonstrate compliance with Appendix G to 10 CFR Part 50.").

The Staff published notice of Entergy's LAR in the Federal Register on January 6, 2015, and concluded that it qualifies for a "no significant hazards consideration" finding under 10 C.F.R. § 50.92(c).²¹ On March 9, 2015, the petitioners submitted a timely hearing request.²² Entergy and the Staff filed answers opposing the petition,²³ and the petitioners filed a reply.²⁴

II. Petitioners' Standing to Participate in this Proceeding

The standing issue in this case is nearly identical to that recently decided in LBP-15-17, in which the licensing board ruled that the same petitioners had standing to challenge a related license amendment request for the Palisades plant.²⁵ In this case, the four petitioning organizations each seek representational standing on behalf of one of its members, the same four individuals who were found to have standing in LBP-15-17.²⁶ The three individuals who are members of Beyond Nuclear, Don't Waste Michigan, and Michigan Safe Energy Future – Shoreline Chapter reside within fifty miles of Palisades,²⁷ while the fourth, Nuclear Information Resource Service ("NEIS") member Gail Snyder, states that she owns five acres of land approximately fifteen miles from Palisades that she and her family use and on which they intend

²¹ Applications and Amendments to Facility Operating Licenses and Combined Licenses Involving No Significant Hazards Considerations, 80 Fed. Reg. 520, 523–24 (Jan. 6, 2015).

²² Petition at 1.

²³ Entergy's Answer Opposing Petition to Intervene and Request for Hearing (Apr. 3, 2015) [hereinafter "Entergy Answer"]; NRC Staff's Answer to Petition to Intervene and Hearing Request Filed by Beyond Nuclear, Don't Waste Michigan, Michigan Safe Energy Future – Shoreline Chapter, and the Nuclear Energy Information Service (Apr. 3, 2015) [hereinafter "Staff Answer"].

²⁴ Petitioners' Reply in Support of Petition to Intervene on Entergy License Amendment Request for Approval of 10 CFR Part 50 Appendix G Equivalent Margins Analysis (Apr. 10, 2015) [hereinafter "Reply"].

²⁵ Palisades, LBP-15-17, 81 NRC at __ (slip op. at 19).

²⁶ See id. at __ (slip op. at 19–20).

²⁷ Petition, attachs., Declaration of Bette Pierman ¶ 2 (Mar. 9, 2015); Declaration of Alice Hirt ¶ 2 (Mar. 9, 2015); Declaration of Maynard Kaufman ¶ 2 (Mar. 9, 2015) [hereinafter "Petitioners' standing declarations"].

to construct a house.²⁸ All four state that they fear that the risk of the Palisades reactor vessel cracking is greater than Entergy predicts in its LAR, and that Palisades may operate unsafely and pose an unacceptable risk to their health and safety and that of their families unless the safety and environmental concerns of the petitioning organizations are addressed.²⁹

In certain circumstances, the Commission has adopted a proximity presumption that allows a person living, having frequent contacts, or having a significant property interest within fifty miles of a nuclear power reactor to establish standing without the need to make an individualized showing of injury, causation, and redressability.³⁰ The petitioners and the Staff agree that the proximity presumption should apply.³¹ The Staff observes that “[t]he material condition of the plant’s reactor vessel obviously bears on the health and safety of those members of the public who reside in the plant’s vicinity,”³² that the EMA “relates to the integrity of the RPV,”³³ and that “a deficiency in the licensee’s application could result in unintended safety consequences.”³⁴

In this case, unlike LBP-15-17, Entergy does not object to standing for the three members living within fifty miles of Palisades.³⁵ Entergy argues, however, that NEIS lacks

²⁸ Declaration of Gail Snyder ¶ 2 (Mar. 9, 2015) [hereinafter “Snyder Decl.”].

²⁹ Petitioners’ standing declarations; Snyder Decl. ¶ 3.

³⁰ See, e.g., Fla. Power & Light Co. (St. Lucie Nuclear Power Plant, Units 1 & 2), CLI-89-21, 30 NRC 325, 329 (1989) (“[L]iving within a specific distance from the plant is enough to confer standing on an individual or group in proceedings for construction permits, operating licenses, or significant amendments thereto.”); Sequoyah Nuclear Fuels Corp. (Gore, Okla. Site), CLI-94-12, 40 NRC 64, 75 (1994).

³¹ Petition at 4–7; Staff Answer at 3–5.

³² Staff Answer at 4 (quoting Cleveland Electric Illuminating Co. (Perry Nuclear Power Plant, Unit 1), CLI-93-21, 38 NRC 87, 95–96 (1993) (internal quotation marks omitted)).

³³ Id. at 4–5.

³⁴ Id. at 5.

³⁵ Entergy Answer at 5.

standing because Gail Snyder's declaration did not include the street address for her property and failed to provide sufficient detail concerning the frequency and duration of her visits and those of her family.³⁶

The Board concludes that the proximity presumption applies in this case because a contention concerning the fracture toughness of the reactor vessel, like the contention in LBP-15-17, involves an obvious risk of offsite radiological releases.³⁷ The Board further concludes that the petitioners have satisfied the requirements of representational standing for the reasons given in LBP-15-17.³⁸ As to Ms. Snyder, we find, for the reasons stated in LBP-15-17, that her property interest, well within the 50-mile area covered by the proximity presumption, is sufficient to support her standing.³⁹ Given that Entergy does not dispute that the property actually exists or that Ms. Snyder owns it, we will not deny NEIS standing because she did not provide an exact address.⁴⁰

III. Admissibility of Petitioners' Contention

A. Summary of the parties' arguments

The petitioners' contention states:

The methods of prediction used by Entergy concerning whether steel plate and weld materials within the reactor pressure vessel ("RPV") at the Palisades Nuclear Power Plant possess Charpy upper shelf energy ("USE") values of less than 50 ft.-lbs. of ductility stress do not provide adequate assurance of margins of safety against fracture or rupture which are equivalent to those required by Appendix G of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.⁴¹

³⁶ Id.

³⁷ See Palisades, LBP-15-17, 81 NRC at ___ (slip op. at 20–22).

³⁸ Id. at ___ (slip op. at 25).

³⁹ Id. at ___ (slip op. at 24–25).

⁴⁰ Id. at ___ n.144 (slip op. at 25 n.144). A petition must contain the name, address, and phone number of "the requestor or petitioner," 10 C.F.R. § 2.309(d)(1)(i), but NEIS, not Ms. Snyder, is the petitioner. Ms. Snyder's declaration provides the address for NEIS. Snyder Decl. ¶ 1.

⁴¹ Petition at 12.

Relying primarily on a declaration from Arnold Gundersen, a nuclear engineer, the petitioners argue that Entergy's analysis is deficient because it relies exclusively on models instead of testing the materials of interest.⁴²

The petitioners and Mr. Gundersen are particularly concerned that Entergy did not test available "coupons" or "capsules" in connection with the EMA. Appendix H to 10 C.F.R. Part 50 "directs licensees to attach a particular number of surveillance 'capsules' to specified areas within the reactor vessel, typically near the inside vessel wall at the beltline."⁴³ Each capsule contains a number of material specimens, or "coupons," that remain exposed to radiation during plant operation.⁴⁴ "Under the Appendix H surveillance program, licensees must periodically withdraw capsules from the reactor vessel. Capsule removal permits the material specimens to be tested for changes in ductility and fracture toughness — effects of the neutron irradiation and elevated temperatures in a given reactor pressure vessel."⁴⁵ The petitioners stress that "Entergy has not removed or examined any coupons since a 2003 refueling outage, and does not intend to study [another] coupon until at least 2019."⁴⁶ The petitioners contend that "no accurate current assessment of Palisades' severe embrittlement condition exists."⁴⁷ They argue that sufficient capsules remain inside the reactor to permit additional withdrawal and testing, and

⁴² Id. at 13–15, 17–19; see Declaration of Arnold Gundersen ¶¶ 8, 18, 48 (Dec. 1, 2014) [hereinafter "Gundersen Decl."].

⁴³ Perry, CLI-96-13, 44 NRC at 317.

⁴⁴ Id.

⁴⁵ Id.

⁴⁶ Petition at 14.

⁴⁷ Id. at 18 (quoting Gundersen Decl. ¶ 21 (internal quotation marks omitted)).

that some of these capsules should be removed and tested rather than allowing the proposed license amendment based solely upon an “extrapolated analysis.”⁴⁸

The petitioners also allege that Entergy’s fracture toughness calculations are deficient because of sparse data on beltline materials and the Staff’s limited understanding of fracture mechanics “of steel plating with low Charpy upper-shelf energy.”⁴⁹ The petitioners further contend that the safety analysis does not account for the Palisades reactor vessel’s lower-than-average fracture toughness resulting from the vessel’s high sulfur content and “nickel impurities.”⁵⁰

The petitioners also point to safety concerns raised by two material science professors, Digby McDonald of the University of California at Berkeley and Walter Bogaerts of the Katholieke Universiteit Leuven in Belgium, regarding the discovery of microscopic cracks (also known as microcracks or quasi-laminar indications) in two Belgian RPVs.⁵¹ The professors maintain that any RPV can be susceptible to these cracks because, contrary to previous thinking, the alleged microcracking may be the result of hydrogen atoms migrating into RPV walls during operation.⁵² The petitioners argue that Entergy’s EMA is deficient because it has not considered this new source of material weakening and potential cracking at Palisades.⁵³

In response, Entergy and the Staff both argue that the contention is an impermissible challenge to the NRC’s regulations because it seeks additional testing of the capsules

⁴⁸ Id. at 19 (quoting Gundersen Decl. ¶ 51 (internal quotation marks omitted)).

⁴⁹ Id. at 20–21, 23–24 (citing Regulatory Guide 1.161, at 1).

⁵⁰ Id. at 19–20.

⁵¹ Id. at 21–22 (citing Greenpeace, Nuclear Reactor Pressure Vessel Crisis (Feb. 15, 2015) (ADAMS Accession No. ML15068A456) [hereinafter “Greenpeace report”]).

⁵² Id.

⁵³ Id.

containing material samples that are located in the Palisades RPV.⁵⁴ They assert that Palisades' current capsule testing schedule was approved by the NRC under the process laid out in Appendix H of 10 C.F.R. Part 50.⁵⁵ And with respect to "cleavage mode-conversion," nickel impurities, and microcracking, Entergy and the Staff maintain that the petitioners have not provided enough factual support to show a genuine dispute.⁵⁶ They note that these three topics are not discussed in Gundersen's declaration and, they assert, the petitioners do not explain how they are relevant to the Palisades reactor vessel.⁵⁷

The petitioners reply that allowing Entergy to rely on pure computation is an abuse of the Staff's discretion when physical samples are available.⁵⁸ They note that the Staff has admitted that there are not specific regulations for demonstrating "equivalent margins of safety."⁵⁹ They maintain that Palisades is being allowed to operate by the Staff in "ever more dangerous metallurgical conditions" based on untested hypotheses.⁶⁰

B. Admissibility standards

An admissible contention must satisfy all six criteria of 10 C.F.R. § 2.309(f)(1). It must (i) provide a specific statement of the legal or factual issue; (ii) explain briefly the basis for the contention; (iii) demonstrate that the issue is within the scope of the proceeding; (iv) show that the issue is material to findings the NRC must make to grant the license amendment; (v) state concisely the alleged facts or expert opinions that support the petitioners' position, including

⁵⁴ Entergy Answer at 14–16; Staff Answer at 15–17.

⁵⁵ Entergy Answer at 14–15; Staff Answer at 15–17, 27.

⁵⁶ Entergy Answer at 19–22, 25–26; Staff Answer at 20–24.

⁵⁷ Entergy Answer at 19–22, 25–26; Staff Answer at 20–24.

⁵⁸ Reply at 2–4.

⁵⁹ Id. at 3 (citing Staff Answer at 9).

⁶⁰ Id. at 6; see id. at 4 (citing Gundersen Decl. ¶ 48).

references to specific sources and documents; and (vi) provide enough information to show that a genuine dispute exists over a material issue of law or fact, by either referencing portions of the application that the petitioner disputes or identifying alleged deficiencies in the application.⁶¹

Petitioners cannot challenge an NRC regulation without first obtaining a waiver under 10 C.F.R. § 2.335(b).⁶² But they may raise issues not addressed by a specific regulation when unique features in the facility or ongoing development of a generic solution mean that there are some gaps in the regulatory scheme that must be addressed on a case-by-case basis.⁶³

C. Scope of review of license amendments

NRC regulations define the Commission's scope of review of a license amendment application broadly: "In determining whether an amendment to a license, construction permit, or early site permit will be issued to the applicant, the Commission will be guided by the considerations that govern the issuance of initial licenses, construction permits, or early site permits to the extent applicable and appropriate."⁶⁴ The "considerations" the Commission (and the Board, acting based on the Commission's delegation) should review include those defined in 10 C.F.R. § 50.40, entitled "Common standards." As the Atomic Safety and Licensing Appeal Board has explained:

In essence, Section 50.40 requires that the Commission be persuaded, inter alia, that the applicant will comply with all applicable regulations, that the health and safety of the public will not be endangered, that the issuance of the amendment will not be inimical to the health and safety of the public, and that any applicable

⁶¹ 10 C.F.R. § 2.309(f)(1); see FirstEnergy Nuclear Operating Co. (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-8, 75 NRC 393, 395–96 (2012).

⁶² 10 C.F.R. § 2.335(a)–(b).

⁶³ See Duke Power Co. (Catawba Nuclear Station, Units 1 & 2), LBP-82-116, 16 NRC 1937, 1946 (1982) (citing Va. Electric & Power Co. (N. Anna Nuclear Power Station, Units 1 & 2), ALAB-491, 8 NRC 245 (1978)).

⁶⁴ 10 C.F.R. § 50.92(a).

requirements of 10 CFR Part 51 (governing environmental protection) have been satisfied.⁶⁵

Similarly, under the general requirement for operating licenses in 10 C.F.R. § 50.57(a)(3), the Commission must find that the activities that would be authorized by the amendment can be conducted without endangering the health and safety of the public and will be in compliance with Commission regulations.⁶⁶

D. The Board's ruling

1. The contention is not barred by 10 C.F.R. § 2.335(a)

Entergy and the Staff argue that the contention is an impermissible challenge to 10 C.F.R. Part 50, Appendices G and H, and to the 2007 capsule withdrawal schedule.⁶⁷ We are not persuaded by these arguments.

(a) Appendix H to Part 50 and the 2007 capsule withdrawal schedule

Entergy and the Staff argue that the petitioners' contention is an impermissible challenge to 10 C.F.R. Part 50, Appendix H, and the 2007 capsule withdrawal schedule, because it alleges the need to withdraw and test additional capsules to justify the EMA. However, this misinterprets the petitioners' contention. The contention is not a challenge to Appendix H or the schedule, but instead contests the adequacy of the licensee's EMA. Appendix H does not

⁶⁵ N. States Power Co. (Prairie Island Nuclear Generation Plant, Units 1 & 2), ALAB-455, 7 NRC 41, 44 (1978); see also Tenn. Valley Auth. (Browns Ferry Nuclear Plant, Units 1, 2, & 3), ALAB-664, 15 NRC 1, 15–16 (1982) (“Prior to license issuance the NRC must first find reasonable assurance that the activities authorized by the amendment can be conducted without endangering the health and safety of the public, and in compliance with Commission regulations.”), vacated and remanded on other grounds, CLI-82-26, 16 NRC 880 (1982); Fla. Power & Light Co. (Turkey Point Nuclear Generating Station, Units 3 & 4), LBP-81-16, 13 NRC 1115, 1120 (1981) (reviewing a proposed license amendment to determine whether it would “endanger the health and safety of the public”).

⁶⁶ Gen. Pub. Utils. Nuclear Corp. (Three Mile Island Nuclear Station, Unit 2), LBP-89-7, 29 NRC 138, 190–91 (1989); Catawba, LBP-82-116, 16 NRC at 1946 (citing N. Anna, ALAB-491, 8 NRC at 245).

⁶⁷ Entergy Answer at 14–16; Staff Answer at 15–17, 19–20.

establish requirements for an EMA, and therefore the contention does not implicate any provision of Appendix H. It is Appendix G to 10 C.F.R. Part 50, not Appendix H, that grants licensees the option of demonstrating that values of Charpy upper-shelf energy below 50 ft-lb “will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME [BPV] Code.”⁶⁸ In arguing that additional testing of capsules from the Palisades reactor should be required, the petitioners are seeking an EMA that provides margins of safety equivalent to those of ASME BPV Code Appendix G, not to challenge any provision of, or add requirements to, 10 C.F.R. Part 50, Appendix H.

To be sure, if the petitioners’ challenge to the EMA were to prevail on the merits, Entergy would need to test one or more capsules sooner than 2019 to provide adequate support for its EMA. But this does not transform the petitioners’ challenge to the EMA into a challenge to Appendix H or to the NRC’s 2007 approval of the current testing schedule. On the contrary, although Appendix H allows plants to set a schedule for pulling capsules during normal operations, Appendix H itself requires plants to modify their capsule withdrawal schedules when necessary. The minimum frequency with which capsules must be tested is set by ASTM Standard E 185 (1982 version), which is incorporated into Appendix H.⁶⁹ However, “[t]he ASTM standard anticipates that during the course of a nuclear power plant’s life the withdrawal schedule may need to be revised; the standard allows and provides for such changes.”⁷⁰ While Appendix H provides a procedure for seeking Staff approval to set or modify the withdrawal schedule, this schedule is itself not part of the plant’s license.⁷¹ Furthermore, “the very nature of

⁶⁸ 10 C.F.R. Pt. 50, App. G § IV.1.a.

⁶⁹ 10 C.F.R. Pt. 50, App. H § I.

⁷⁰ Perry, CLI-96-13, 44 NRC at 328.

⁷¹ 10 C.F.R. Pt. 50, App. H § III.B.3; see Perry, CLI-96-13, 44 NRC at 327 (“[A]ny changes to the material specimen withdrawal schedule that conform to the ASTM standard referenced in

a withdrawal schedule is such that modifications may need to be made.”⁷² Thus, the Staff’s decision to approve a withdrawal schedule in accordance with Appendix H does not preclude modification of the schedule, much less allow the existing schedule to be a defense to compliance with other regulations.

Modification of the schedule could only be claimed to be contrary to Appendix H if the additional testing requested by the petitioners would necessarily conflict with the requirements of ASTM Standard E 185 (1982 version). Entergy contends that the minimum recommended number of surveillance capsules that need to be tested for Palisades under the ASTM standard is five.⁷³ As of 2003, Entergy had tested four capsules, and the company plans to test the fifth in 2019.⁷⁴ However, the standard not only permits but encourages actual physical testing of materials in situations such as this one:⁷⁵

If the Charpy upper shelf energy of any of the beltline materials is predicted to drop to a marginal level (currently considered to be 68 J (50 ft·lbf) at the quarter thickness (1/4 T) location^[76]) during the operating lifetime of the vessel,

Appendix H will not alter the [plant’s] license.”). Accordingly, a license amendment is not required to change the capsule testing schedule. Perry, CLI-96-13, 44 NRC at 321.

⁷² Perry, CLI-96-13, 44 NRC at 322.

⁷³ Letter from Paul A. Harden, Site Vice President, Palisades Nuclear Plant, to Document Control Desk, NRC, encl. 1, at 2 (Jan. 30, 2007) (Supplement to Reactor Vessel Surveillance Coupon Removal Schedule Palisades Nuclear Plant) (ADAMS Accession No. ML070300405) [hereinafter “Coupon Removal Supplement”].

⁷⁴ Id.

⁷⁵ Two of the materials at issue in Entergy’s EMA, lower shell plate material D-308-1 and weld material 9-112, are part of the beltline region. LAR, attach. 5, at 4-1.

⁷⁶ Appendix G to the ASME BPV Code Section XI sets the minimum requirements for fracture toughness assuming the presence of defects in the material. See ASME BPV Code § XI, App. G § G-2120. The appendix assumes a maximum postulated defect size having “a depth of one-fourth of the section thickness,” id., and appears to measure fracture toughness at the depth of the postulated crack. See id. § G-2215.

provisions shall be made to also include that material in the surveillance program, preferably in the form of fracture toughness specimens.⁷⁷

Section 6.1 confirms that “[a]dditional fracture toughness test specimens shall be employed to supplement the information from the Charpy v-notch specimens if the surveillance materials are predicted to exhibit marginal properties.”⁷⁸ Thus, not only is there no conflict between the petitioners’ request for additional capsule testing and ASTM Standard E 185, but the petitioners’ request appears consistent with the standard’s requirements for additional testing when beltline materials are predicted to exhibit marginal properties.

The Staff approved the current Palisades withdrawal schedule in 2007.⁷⁹ The EMA, by contrast, is dated October 21, 2013, and was submitted to the NRC as part of the LAR on November 12, 2014.⁸⁰ Given that the Staff’s approval of the schedule preceded the EMA by approximately six years, the Staff could not plausibly have considered at the time whether additional capsule testing might eventually be necessary to show equivalent margins of safety under Appendix G of 10 C.F.R. Part 50. There is no indication in the Staff’s 2007 letter approving the schedule that it did so.⁸¹ But it is clear that the 2007 schedule provides for additional capsule removal and testing beyond that specifically called for in the schedule, if further testing is needed. The safety evaluation attached to the NRC’s schedule approval letter, after summarizing the capsule withdrawal schedule, states that “[c]apsules W-280 and W-260

⁷⁷ ASTM E 185-82, Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels § 5.2, in Annual Book of ASTM Standards, vol. 12 (ASTM Int’l 1982) (emphasis added).

⁷⁸ Id. § 6.1 (emphasis added).

⁷⁹ Letter from Travis L. Tate, Acting Chief, Plant Licensing Branch III-1, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, NRC, to Mr. Michael Balduzzi, Senior Vice President, Regional Operations NE, Entergy Nuclear Operations, Inc. (Aug. 14, 2007) (ADAMS Accession No. ML071640310) [hereinafter “Staff’s 2007 Schedule Approval”].

⁸⁰ LAR at 1.

⁸¹ Staff’s 2007 Schedule Approval.

both remain available for subsequent removal and testing, if needed.”⁸² The accompanying table identifies the withdrawal sequence and removal time for five capsules, and then identifies three other capsules as “[r]eserved for future use.”⁸³ Thus, the petitioners’ demand for the withdrawal and testing of capsules that remain available for that purpose⁸⁴ is not a challenge to the 2007 withdrawal schedule,⁸⁵ because Entergy could remove and test the capsules that the schedule expressly reserved for future use.

Furthermore, the contention is not a challenge to Palisades’ current licensing basis or outside the scope of the proceeding, as Entergy briefly suggests.⁸⁶ “Current licensing basis” is “a term of art comprehending the various Commission requirements applicable to a specific plant that are in effect at the time of [a] license renewal application.”⁸⁷ The petitioners are not challenging those requirements. Rather, they allege that the EMA is inadequate to support the LAR, an issue within the scope of this proceeding.⁸⁸ Such a challenge is not transformed into a challenge to the current licensing basis because the result of a ruling in the petitioners’ favor could be the withdrawal and testing of one or more capsules before 2019. As explained above,

⁸² Staff’s 2007 Schedule Approval, Safety Evaluation at 2.

⁸³ Id. at 3; see also Coupon Removal Supplement, encl. 1 at 2 (stating that two capsules not currently scheduled for testing “remain available for subsequent removal and testing should it be deemed necessary”); Letter from Paul A. Harden, Site Vice President, to Document Control Desk, NRC, encl. 1 at 2 (Sept. 19, 2006) (ADAMS Accession No. ML062630071) (asking to revise the surveillance program “to hold the remaining untested surveillance capsules in reserve to meet future needs” and identifying three capsules as “[r]eserved for future use”).

⁸⁴ See Petition at 18 (“Entergy is proposing to operate [Palisades] well outside the norm by proposing to reanalyze the deteriorating metallurgical conditions without using the readily available physical samples that are designed specifically for this purpose.” (quoting Gundersen Decl. ¶ 48)).

⁸⁵ See Dissent at 6.

⁸⁶ Entergy Answer at 14, 15 & n.88.

⁸⁷ Fla. Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 9 (2001).

⁸⁸ 80 Fed. Reg. at 523.

Appendix H, which governs the testing schedule, contemplates modifications of the schedule, so the Staff's 2007 approval of the current testing schedule does not preclude additional testing that may be found necessary to provide for an approvable EMA. And the 2007 withdrawal schedule expressly reserved capsules for future use. Any additional testing that the Board might deem appropriate would be necessarily limited to those samples determined to be available and useful, on the basis of the evidence presented at the evidentiary hearing.

In sum, the petitioners are not barred by 10 C.F.R. § 2.335(a) or the 2007 withdrawal schedule from contending that additional testing is necessary to show margins of safety "equivalent" to those of the ASME BPV Code, Section XI, Appendix G because the petitioners allege noncompliance with 10 C.F.R. Part 50, Appendix G and not Appendix H; their argument comports with Appendix H's expectation that plants modify capsule withdrawal schedules when necessary; and the 2007 withdrawal schedule for Palisades reserved capsules for future testing.

(b) Appendix G to 10 C.F.R. Part 50

The Staff argues that because Appendix G permits, but does not expressly require, licensees to submit evidence of the fracture toughness of beltline materials from physical tests, the petitioners' argument that additional physical testing is required to support Entergy's LAR amounts to a challenge to Appendix G, in violation of 10 C.F.R. § 2.335.⁸⁹ Entergy makes the same argument, noting that "[w]hen a Commission regulation permits the use of a particular analysis, a contention asserting that a different analysis or technique should be utilized is inadmissible because it indirectly attacks the Commission's regulations."⁹⁰

⁸⁹ Staff Answer at 15–16 (citing 10 C.F.R. Pt. 50, App. G § IV.A.1.b). Under the provision the Staff cites, "[a]dditional evidence of the fracture toughness of the beltline materials after exposure to neutron irradiation may be obtained from results of supplemental fracture toughness tests for use in the analysis specified in section IV.A.1.a."

⁹⁰ Entergy Answer at 16 (quoting Detroit Edison Co. (Fermi Nuclear Power Plant, Unit 3), LBP-09-16, 70 NRC 227, 255 (2009) (citing Metro. Edison Co. (Three Mile Island Nuclear Station, Unit No. 1), LBP-83-76, 18 NRC 1266, 1273 (1983)), aff'd on other grounds, CLI-09-22, 70 NRC 932, 933 (2009)).

In the ruling Entergy quotes, however, the applicant used a specific formula required by regulation to develop a cost estimate.⁹¹ The licensing board in that case accordingly held that the petitioners could not argue for an analysis different from that required by regulation.⁹² Here, by contrast, neither Appendix G of 10 C.F.R. Part 50,⁹³ nor ASME BPV Code, Section XI, Appendix G, the only part of the ASME Code incorporated by the relevant NRC regulation,⁹⁴ establishes a comprehensive methodology for demonstrating equivalent safety margins. The Staff has at least implicitly acknowledged that Appendix G to the ASME BPV Code lacks criteria for demonstrating equivalent margins of safety.⁹⁵ For example, Appendix G to the ASME BPV Code does not describe all possible fracture scenarios that a licensee must examine in an EMA. Instead, the appendix states that “[t]he possible combinations of loadings, defect sizes, and material properties which may be encountered during [emergency and fault conditions] are too diverse to allow the application of definitive rules, and it is recommended that each situation be

⁹¹ Fermi, LBP-09-16, 70 NRC at 255.

⁹² Id.

⁹³ The rulemaking history of Appendix G does not provide any clarification regarding the regulation’s meaning. The rule was first adopted in 1973. See 38 Fed. Reg. 19,012, 19,015 (July 17, 1973) (“Calculated stress intensity factors shall be lower than the reference stress intensity factors by the margins specified in the ASME BPV Code, Section XI, Appendix G, ‘Protection Against Non-Ductile Failure.’ The calculation procedures shall comply with the procedures specified in the ASME Code Appendix G, but additional and alternative procedures may be used if the Commission determines that they provide equivalent margins of safety against fracture, making appropriate allowance for all uncertainties in the data and analyses.”). The NRC changed the wording to its current form a decade later, but did not offer a reason for the change. See 48 Fed. Reg. 24,008, 24,010 (May 27, 1983).

⁹⁴ 10 C.F.R. Pt. 50, App. G § VI.

⁹⁵ See Regulatory Guide 1.161, at 1 (Because of the lack of criteria for demonstrating equivalent margins of safety under Appendix G of the ASME BPV Code, “the NRC Staff asked Section XI of the ASME Boiler Pressure Vessel Code Committee to develop and suggest to the staff appropriate criteria.”).

studied on an individual case basis.”⁹⁶ The Staff attempted to work with ASME to create a complete approach within the ASME BPV Code, but was unsuccessful.⁹⁷

The Staff recognized the lack of sufficient regulatory instruction by issuing Regulatory Guide 1.161, which provides guidance on how to conduct a successful EMA in several areas not covered by regulation, such as analyzing different fracture event sequences, calculating transients (e.g., pressure along the vessel wall and other physical changes in the vessel), and selecting appropriate material properties as inputs for the models.⁹⁸ Because of the gaps in the NRC Regulation and Appendix G to the ASME BPV Code, Entergy based its EMA on Regulatory Guide 1.161, and Appendix K to the ASME BPV Code,⁹⁹ a private standard that was not adopted into 10 C.F.R. Part 50, Appendix G. A challenge to the sufficiency of the methodologies described in those documents is not prohibited by 10 C.F.R. § 2.335. That section proscribes challenges to NRC regulations, not guidance documents or private standards that have not been incorporated in NRC regulations. The petitioners may challenge a Staff guidance document such as Regulatory Guide 1.161,¹⁰⁰ and they have effectively done so here by arguing that Entergy’s EMA (conducted pursuant to Regulatory Guide 1.161) does not meet

⁹⁶ ASME BPV Code § XI, App. G § G-2310.

⁹⁷ Regulatory Guide 1.161, at 1 (discussing the Staff’s difficulty in working with ASME to create a comprehensive methodology to meet the requirements of Appendix G to 10 C.F.R. Part 50).

⁹⁸ Id. at 1–4, 8–11; see supra text accompanying notes 15–18.

⁹⁹ LAR, attach. 1, at 3.

¹⁰⁰ See Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 & 3), CLI-15-6, 81 NRC __, __ (slip op. at 16–19) (Mar. 9, 2015) (affirming Board’s decision to admit a contention that disagreed with NRC Staff’s guidance on definitions of active and passive components); NextEra Energy Seabrook, LLC (Seabrook Station, Unit 1), CLI-12-5, 75 NRC 301, 320 (2012) (“The Board is correct that the applicability of a guidance document may be challenged in an individual proceeding.”); Areva Enrichment Servs., LLC (Eagle Rock Enrichment Facility), CLI-11-4, 74 NRC 1, 8 n.35 (2011) (“NRC guidance documents are not legally binding, and compliance with them is not required.”); S. Tex. Project Nuclear Operating Co. (S. Tex. Project, Units 3 & 4), CLI-10-24, 72 NRC 451, 467 (2010) (“[A] guidance document does not create binding legal requirements.”).

the regulatory standards.¹⁰¹ As Entergy notes, Staff guidance is entitled to “special weight” in a decision on the merits,¹⁰² but arguments about the weight of the evidence are inapposite at the contention admissibility stage, where we do not decide the merits. The petitioners are also free to challenge reliance on private standards such as Appendix K to the ASME BPV Code that have not been explicitly adopted into the NRC’s regulations, and which the Staff itself views as incomplete. Regulatory Guide 1.161 itself states that the analysis methods in ASME BPV Code, Section XI, Appendix K “are technically acceptable but are not complete, because Appendix K does not provide information on the selection of transients and gives very little detail on the selection of material properties.”¹⁰³

When, as here, the applicable regulation does not resolve site-specific technical questions, the petitioners’ safety-related arguments concerning those unresolved questions are within the scope of the license amendment proceeding.¹⁰⁴

[I]t is not true that all valid safety contentions invariably involve alleged noncompliance with a specific safety rule. In some areas, there is no specific rule but only a Staff regulatory guide; such guides are open to challenge in litigation. Moreover, there are some ‘gaps’ in the regulatory scheme which must be addressed case-by-case because of unique features in the facility or ongoing development of some generic solution. . . . A contention about a matter not covered by a specific rule need only allege that it poses a significant safety problem. That would be enough to raise an issue under the general requirement

¹⁰¹ See Petition at 12–15; Reply at 3–4.

¹⁰² Entergy Answer at 8 (citing Indian Point, CLI-15-6, 81 NRC at ___ (slip op. at 19, 21 n.85, 22); Seabrook, CLI-12-5, 75 NRC at 315).

¹⁰³ Regulatory Guide 1.161, at 1; see also id. at 38 (stating that “Appendix K does not currently include (1) analysis procedures for Service Levels C and D, (2) guidance on selecting the transients for evaluation, or (3) details on temperature-dependent material properties”).

¹⁰⁴ See Prairie Island, ALAB-455, 7 NRC at 44 (“Section 50.40 requires that the Commission be persuaded, inter alia, that the applicant will comply with all applicable regulations, that the health and safety of the public will not be endangered, [and] that the issuance of the amendment will not be inimical to the health and safety of the public . . .”).

for operating licenses (10 CFR 50.57(a)(3)) for a finding of “reasonable assurance” of operation “without endangering the health and safety of the public.”¹⁰⁵

Here, as the petitioners note, the EMA is based on a generic analysis derived from Regulatory Guide 1.161 and the ASME BPV Code, Section XI, Appendix K, rather than a rule;¹⁰⁶ and the petitioners’ expert alleges that site-specific factors render that approach inadequate to assure that Palisades’ continued operation in its embrittled condition does not jeopardize public health and safety.¹⁰⁷ The contention is therefore material to and within the scope of the proceeding.

This result is consistent with LBP-15-17, in which the board rejected a contention on a different but related issue, which also argued in part that Entergy should test capsules sooner than required under the current testing schedule. The board rejected this contention because the petitioners were attempting to add a requirement to 10 C.F.R. § 50.61a, the regulation at issue in that proceeding. Section 50.61a provides a comprehensive, step-by-step methodology for demonstrating fracture toughness at low temperatures. The board concluded that the contention was not admissible because “[w]hen the Commission has determined that compliance with a regulation is sufficient to provide for reasonable assurance of public health and safety, a licensing board cannot impose requirements that exceed those in the regulation.”¹⁰⁸ But here Entergy’s EMA applied a generic approach set forth in Staff guidance

¹⁰⁵ Catawba, LBP-82-116, 16 NRC at 1946 (citing N. Anna, ALAB-491, 8 NRC at 245); see also U.S. Dept. of Energy, CLI-09-14, 69 NRC 580, 588 (2009) (explaining that a petitioner may not rely on general allegations, but must show “specific ties to NRC regulatory requirements, or to safety in general” to demonstrate a genuine dispute of fact or law (emphasis added)); Hydro Res., Inc., CLI-01-04, 53 NRC 31, 38 (2001) (Objectives of the NRC adjudicatory procedures and policies include producing “an informed adjudicatory record that supports agency decisionmaking on public health and safety, the common defense and security, and the environment. (emphasis added)).

¹⁰⁶ Reply at 3.

¹⁰⁷ Infra notes 130–138 and accompanying text.

¹⁰⁸ Palisades, LBP-15-17, 81 NRC at ___ & n.237 (slip op. at 42 & n.237) (citing 75 Fed. Reg. 13, 22 (Jan. 4, 2010)); Fermi, LBP-09-16, 70 NRC at 255); see Duke Energy Corp. (Catawba Nuclear Station, Units 1 & 2), CLI-04-19, 60 NRC 5, 12 (2004) (“As a general matter,

and a private standard, not a regulation, and we have no Commission determination that compliance with the guidance or the private standard is necessarily sufficient to provide reasonable assurance that public health and safety will not be endangered. Thus, in this case, unlike LBP-15-17,¹⁰⁹ the petitioners may argue without violating Section 2.335(a) that additional capsule testing is necessary to provide reasonable assurance of safe operation.

2. The Contention satisfies the requirements of 10 C.F.R. § 2.309(f)(1)

The Board majority concludes that the petitioners' contention satisfies the admissibility criteria.

(a) Specific statement of the issue, basis of the contention

The petitioners have supplied a specific statement of the contention.¹¹⁰ They have also explained its basis.¹¹¹ The requirement of 10 C.F.R. § 2.309(f)(1)(ii), that the petition include a “brief explanation of the basis” for the contention, merely requires an explanation of the rationale or theory of the contention. Challenges to the admissibility of a contention pursuant to Section 2.309(f)(1)(ii) on the ground that it does not include an “adequate basis” because it does not include sufficient facts, evidence, or supporting factual information are thus misguided. If the petitioner provides a brief explanation of the rationale underlying the contention, it is sufficient to satisfy 10 C.F.R. § 2.309(f)(1)(ii).¹¹² The petitioners have complied with that requirement.

compliance with applicable NRC regulations ensures that public health and safety are adequately protected in areas covered by the regulations.”) (footnote omitted).

¹⁰⁹ That separately constituted licensing board had the same membership as this Board. See Palisades, LBP-15-17, 81 NRC at ___ n.164 (slip op. at 29 n.164).

¹¹⁰ 10 C.F.R. § 2.309(f)(1)(i); see Petition at 2.

¹¹¹ 10 C.F.R. § 2.309(f)(1)(ii); see Petition at 12–15.

¹¹² Progress Energy Fla., Inc. (Levy County Nuclear Power Plant, Units 1 & 2), LBP-09-10, 70 NRC 51, 99–100 (2009).

(b) Scope of the proceeding

The scope of the proceeding is defined by the Commission in its initial hearing notice and order referring the proceeding to the Licensing Board.¹¹³ Any contention that falls outside the specified scope of the proceeding is inadmissible.¹¹⁴ The Federal Register Notice for this proceeding explained that the proposed license amendment would approve the licensee's EMA.¹¹⁵ The petitioners' contention challenges the sufficiency of the EMA to provide reasonable assurance of reactor safety and is therefore within the scope of the proceeding.¹¹⁶

(c) Materiality

To satisfy Section 2.309(f)(1)(iv), a petitioner must demonstrate that a contention asserts an issue of law or fact that is "material to the findings the NRC must make to support the action that is involved in the proceeding."¹¹⁷ The subject matter of the contention must impact the grant or denial of a pending license application.¹¹⁸ "Materiality" requires a petitioner to show why the alleged error or omission is of possible significance to the result of the proceeding.¹¹⁹ This means that there must be some significant link between the claimed deficiency and the

¹¹³ Duke Power Co. (Catawba Nuclear Station, Units 1 & 2), ALAB-825, 22 NRC 785, 790–91 (1985).

¹¹⁴ See Portland Gen. Electric Co. (Trojan Nuclear Plant), ALAB-534, 9 NRC 287, 289–90 n.6 (1979).

¹¹⁵ 80 Fed. Reg. at 523.

¹¹⁶ Petition at 2, 6; see Pa'ina Hawaii LLC, LBP-06-12, 63 NRC 403, 414 (2006); see also Catawba, LBP-82-116, 16 NRC at 1946 (citing N. Anna, ALAB-491, 8 NRC at 245).

¹¹⁷ 10 C.F.R. § 2.309(f)(1)(iv).

¹¹⁸ Private Fuel Storage, LLC (Independent Spent Fuel Storage Installation), LBP-98-07, 47 NRC 142, 179–80, aff'd as to other matters, CLI-98-13, 48 NRC 26 (1998).

¹¹⁹ Id. at 179.

agency's ultimate determination whether the license applicant will adequately protect the health and safety of the public and the environment.¹²⁰

The petitioners' contention is material to the result of the proceeding because it concerns whether the LAR demonstrates equivalent margins of safety as required by regulation.¹²¹ The adequacy of the EMA is therefore material to the agency's decision to approve or deny the license amendment request.¹²²

(d) Factual or expert support necessary to show a genuine dispute

With respect to the requirement for petitioners to provide sufficient factual support to demonstrate a genuine dispute,¹²³ they are required to make "a minimal showing that material facts are in dispute, thereby demonstrating that an 'inquiry in depth' is appropriate."¹²⁴ The petitioner must provide "factual evidence or supporting documents that produce some doubt about the adequacy of a specified portion of applicant's documents or that provide supporting reasons that tend to show that there is some specified omission from applicant's documents."¹²⁵ The Board examines the information, facts, and expert opinions provided by the petitioners to confirm that they do indeed provide adequate support for the contention.¹²⁶ Nevertheless, at the

¹²⁰ Id. at 180.

¹²¹ 10 C.F.R. § 2.309(f)(1)(iii); see Petition at 13.

¹²² 10 C.F.R. § 2.309(f)(1)(iv); see Petition at 13–14.

¹²³ 10 C.F.R. § 2.309(f)(1)(v)–(vi).

¹²⁴ Gulf States Utils. Co. (River Bend Station, Unit 1), CLI-94-10, 40 NRC 43, 51 (1994) (citing Final Rule, Rules of Practice for Domestic Licensing Proceedings – Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,171 (Aug. 11, 1989), quoting Conn. Bankers Ass'n v. Bd. of Governors, 627 F.2d 245, 251 (D.C. Cir. 1980)).

¹²⁵ Fla. Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 & 4), LBP-90-16, 31 NRC 509, 515, 521 & n.12 (1990) (citing 10 C.F.R. § 2.714(b)(2)(ii)–(iii) (now codified as amended at 10 C.F.R. § 2.309(f)(1)(v)–(vi))).

¹²⁶ Vt. Yankee Nuclear Power Corp. (Vt. Yankee Nuclear Power Station), ALAB-919, 30 NRC 29, 48 (1989), vacated in part on other grounds and remanded, CLI-90-4, 31 NRC 333 (1990).

contention admissibility stage, petitioners are not required to prove their case on the merits or even to provide expert or factual support as strong as that necessary to withstand a summary disposition motion.¹²⁷ It is sufficient at this stage that petitioners “[p]rovide a concise statement of the alleged facts or expert opinions which support the requestor’s/petitioner’s position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue.”¹²⁸ We find that the Gundersen Declaration and the Greenpeace report on the microcracking issue provide sufficient support to show a material dispute with the sufficiency of the EMA. The remainder of the petitioners’ arguments are inadequately supported or otherwise inadmissible.

(i) Gundersen declaration

The petitioners’ first support comes from the proffered expert opinion of Arnold Gundersen.¹²⁹ In his declaration, Mr. Gundersen distinguishes Palisades from other power plants by noting that it is one of the oldest reactor vessels still operating in the United States; has welding materials with above-average variability in chemical composition and above-average concentrations of copper; and, unlike most other power plants of a similar type, lacks a thermal shield, leading to greater irradiation of the vessel materials.¹³⁰ He asserts that at

¹²⁷ S. Nuclear Operating Co. (Vogtle Electric Generating Plant, Units 3 & 4), CLI-11-8, 74 NRC 214, 221 (2011); River Bend, CLI-94-10, 40 NRC at 51; USEC, Inc. (Am. Centrifuge Plant), LBP-05-28, 62 NRC 585, 596–97 (2005).

¹²⁸ 10 C.F.R. 2.309(f)(1)(v).

¹²⁹ See Gundersen Decl. From Mr. Gundersen’s resume—which summarizes his education in nuclear engineering, work experience in the industry, and publications on nuclear power plants—we conclude that he has enough knowledge in the subject area to allow him to proffer an expert opinion for the purposes of determining contention admissibility. Curriculum Vitae of Arnold Gundersen (Dec. 1, 2014); see Progress Energy Fla., Inc. (Levy County Nuclear Power Plant, Units 1 & 2), CLI-10-27, 71 NRC 2, 40–41 (2010).

¹³⁰ Gundersen Decl. ¶¶ 9, 11, 44 n.21.

Palisades “the metal used for welding the nuclear reactor pieces together contained metallic components, like copper, that are now considered unacceptable due to impurities that cause Neutron Embrittlement.”¹³¹ He adds that the Staff admits that Palisades is “one of the most embrittled plants” in the United States,¹³² which correlates with a decrease in upper-shelf Charpy energy.¹³³ In light of these distinguishing factors, Mr. Gundersen concludes that “Entergy is proposing to operate its Palisades [Nuclear Power Plant] well outside the norm by proposing to reanalyze the deteriorating metallurgical conditions without using the readily available physical samples that are designed specifically for this purpose.”¹³⁴

Additionally, Mr. Gundersen asserts that Entergy has the material available in the form of test capsules placed within the reactor, but that Entergy has not performed any capsule tests since 2003 and is not scheduled to perform another test until 2019.¹³⁵ He maintains that this physical data is necessary to determine the actual toughness of the reactor vessel and declares that “[v]alidating the analytical models by testing additional samples gives Entergy and the NRC Regulators a methodology by which to assure the public that Palisades’ continued operation in its embrittled condition does not jeopardize public health and safety.”¹³⁶ As further factual support for why generic models do not accurately reflect the unique material properties of the

¹³¹ Id. ¶ 11.

¹³² Id. ¶ 15 n.6.

¹³³ Petition at 13–14; see also Regulatory Guide 1.99, at 1.

¹³⁴ Gundersen Decl. ¶ 48.

¹³⁵ Id. ¶¶ 17–18.

¹³⁶ Id. ¶ 51. With respect to capsule testing, the petitioners also raise issues that were the focus of a previous LAR that involved fracture toughness at low temperatures. Petition at 12–15. These concerns are addressed in Palisades, LBP-15-17, 81 NRC at __ (slip op. at 5–16).

Palisades reactor vessel, the petitioners also note that the Palisades materials have lower fracture toughness due to the plate's above-average sulfur content.¹³⁷

The petitioners have pointed to site-specific factors, supported by an expert opinion, to justify their factual allegation that the Palisades reactor vessel requires additional physical testing to substantiate the applicant's mathematical analysis.¹³⁸ Mr. Gundersen's declaration offers enough factual support and explanation to dispute the adequacy of the inputs used in Entergy's EMA. He has pointed to an alleged deficiency in the analysis (lack of recent capsule data) and he has provided a foundation for this opinion with a discussion of the characteristics of the Palisades reactor vessel that allegedly make this data significant.¹³⁹ His explanation is concrete and specific, and thus provides adequate support for disputing the lack of capsule data in the EMA.¹⁴⁰

Entergy argues that the Petition boils down to "requests for more testing, more methods of testing, and more information, all of which are sought without explaining why the current

¹³⁷ Petition at 19 (citing LAR, attach. 5, at 5-2).

¹³⁸ Gundersen Decl. ¶¶ 8–11, 45–48.

¹³⁹ See Entergy Nuclear Generation Co. & Entergy Nuclear Operations, Inc. (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 300–01 (2010) (holding that a licensing board failed to provide sufficient justification for rejecting a challenge to the applicant's meteorological model where the petitioners pointed to site-specific meteorological patterns to argue that the model and inputs were inaccurate and insufficiently conservative); Tenn. Valley Auth. (Watts Bar Nuclear Plant, Unit 2), LBP-09-26, 70 NRC 939, 33–34 (2009) (admitting a challenge where a fisheries biologist opined that TVA lacked adequate data on which to conclude that impacts on the aquatic environment were insignificant).

¹⁴⁰ Consol. Edison Co. of N.Y. (Indian Point, Units 1 & 2), CLI-01-19, 54 NRC 109, 134 (2001) ("Mere 'notice pleading' is insufficient under these standards; however, our requirement for specificity and factual support rather than vague or conclusory statements is not intended to prevent intervention when material and concrete issues exist." (citing Power Auth. of the State of New York (James A. Fitzpatrick Nuclear Power Plant; Indian Point, Unit 3), CLI-00-22, 52 NRC 266, 295 (2000))).

program is inadequate,” quoting from a licensing board decision in a Davis-Besse proceeding.¹⁴¹ The Davis-Besse decision reflects different circumstances, however. In Davis-Besse, the intervenors asserted that the applicant’s shield building monitoring program was insufficient to prevent the structure from cracking in cold weather.¹⁴² The intervenors, however, merely emphasized the dangers of this cracking phenomenon in their pleadings while not challenging the fix put forward by the applicant, other than to call it “statistically insignificant.”¹⁴³ The licensing board emphasized that the intervenors put forward “few alleged facts in support of their position” and no scientifically plausible theory for why the applicant’s monitoring program was inadequate.¹⁴⁴ The intervenors did not touch on the applicant’s scientific approach employed when developing its monitoring program.¹⁴⁵

In the current proceeding, however, the petitioners do more than merely request additional testing. Instead, they provide an expert declaration that challenges the conservatism and usefulness of the Entergy EMA.¹⁴⁶ Mr. Gundersen has provided sufficient explanation of his opinion that the generic analysis that forms the basis of the EMA is inadequate without capsule

¹⁴¹ Entergy Answer at 13 (quoting FirstEnergy Nuclear Operating Co. (Davis-Besse Nuclear Power Station, Unit 1), LBP-15-1, 81 NRC __ (slip op. at 30) (Jan. 15, 2015) (internal quotation marks omitted)). The dissent makes a similar argument, claiming that “[p]etitioners did not provide a description of new information that could be provided by coupon removal that is not already available from the earlier coupon removal.” Dissent at 1–2.

¹⁴² Davis-Besse, LBP-15-1, 81 NRC at __ (slip op. at 13).

¹⁴³ Id. at 28. The licensing board concluded that their “allegations, while serious, do not refer to any deficiencies in the shield building [monitoring program the applicant] has proposed to address ice-wedging.” Id. at 29.

¹⁴⁴ Id. at 28–29 (the licensing board also noting that whatever few facts were put forward did “not ‘plausibly’ indicate that the shield building would lose its functionality under the proposed” monitoring program (quoting Private Fuel Storage, LLC (Independent Spent Fuel Storage Installation), CLI-04-22, 60 NRC 125, 138–39 (2004))).

¹⁴⁵ Id. at 29–30.

¹⁴⁶ Gundersen Decl. ¶¶ 8, 45–46.

testing to validate the analysis. He describes the history and characteristics of Palisades that make embrittlement a particular concern.¹⁴⁷ He continues:

The current analysis cannot be substantiated because physical data is lacking to support any mathematical analysis. The last physical capsule coupon sample was withdrawn from within the reactor and analyzed more than 10 years ago. The reactor vessel at Palisades is the most important safety barrier to protect the public in the case of a design basis accident. It is impossible to ascertain the condition of the reactor vessel without analyzing the hard physical data by sampling the weld-based capsule coupon and doing a complete analysis.¹⁴⁸

Thus, he both explains the basis of his expert opinion and connects it to the regulatory standard that the NRC must satisfy in order to grant the LAR.¹⁴⁹

Therefore, the petitioners may rely on Mr. Gundersen's expert opinion to allege that "absent the scientific information that would be provided by physical destruction testing of one or more metal coupons," the current LAR is inadequate to ensure that public health and safety is not endangered.¹⁵⁰ This is a material contention that genuinely disputes the LAR.¹⁵¹ In addition, the petitioners' theory that capsule testing is required to provide reasonable assurance of public

¹⁴⁷ See id. ¶¶ 9, 11, 15 n.6, 17–18, 44 n.21, 51.

¹⁴⁸ Id. ¶ 8.

¹⁴⁹ Supra notes 130–140 and accompanying text.

¹⁵⁰ Petition at 11.

¹⁵¹ In judicial review under the Administrative Procedure Act, 5 U.S.C. § 706(2), an agency's failure to adequately validate a quantitative model on which it relies may lead the reviewing court to conclude that the agency's decision is arbitrary, capricious, or contrary to law. See Lands Council v. Powell, 395 F.3d 1019, 1026, 1034 (9th Cir. 2005) ("We are asked to trust the Forest Service's internal conclusions of the reliability of the spreadsheet model when the Forest Service did not verify the predictions of the spreadsheet model. Under the circumstances of this case, the Forest Service's basic scientific methodology, to be reliable, required that the hypothesis and prediction of the model be verified with observation."). In substance the petitioners raise this concern, arguing that the EMA's reliance on a generic model without validation through physical testing of available coupons constitutes an abuse of administrative discretion. Reply at 2–3; see Petition at 19. This further supports our conclusion that the issues raised by the petitioners' contention are worthy of exploration at an evidentiary hearing.

safety is supported by the industry standards referenced in the NRC's regulations that require physical testing of marginal materials.¹⁵²

The dissent argues that Mr. Gundersen's declaration is inadequate because he does not "cite to any rule requiring such testing or any staff guidance document advising" testing of more capsules.¹⁵³ But, as we have explained, this is not a situation where the regulations resolve the specific issue raised by the petitioners.¹⁵⁴ On the contrary, the Staff's regulatory guidance acknowledges important regulatory gaps in the ASME BPV Code, Section XI, Appendix K, including that the guidance provides "very little detail on the selection of material properties."¹⁵⁵ Moreover, the Staff's guidance authorizes methods other than the generic analyses described in the guidance: "[Generic] analyses provide a method for determining the material's . . . fracture resistance that the NRC staff finds acceptable for use in the methods described in this guide. Other methods for determining the material property may be used on an individual-case basis if justified."¹⁵⁶

As we noted earlier, "[a] contention about a matter not covered by a specific rule need only allege that it poses a significant safety problem" in order to raise an issue under 10 C.F.R. § 50.57(a)(3), which requires reasonable assurance that the plant's operation will not endanger the health and safety of the public.¹⁵⁷ Because important issues such as the appropriate material properties for the EMA analysis are not covered by a specific regulation, the petitioners,

¹⁵² See supra notes 75–78 and accompanying text.

¹⁵³ Dissent at 1–2; see also Entergy Answer at 11–13; Staff Answer at 15–17.

¹⁵⁴ Supra text accompanying notes 93–100.

¹⁵⁵ Regulatory Guide 1.161, at 1.

¹⁵⁶ Id. at 2; see id. at 3 ("Licensees may follow this regulatory guide to determine the equivalent safety margins, or they may use any other methods, procedures, or selection of materials data and transients to demonstrate compliance with Appendix G to 10 CFR Part 50.").

¹⁵⁷ Catawba, LBP-82-116, 16 NRC at 1946 (citing N. Anna, ALAB-491, 8 NRC at 245).

supported by Mr. Gundersen, may argue that the particular safety-related conditions of the Palisades reactor require the testing of additional capsules to show the equivalent margins of safety required by Appendix G of 10 C.F.R. Part 50.

Whether Mr. Gundersen is correct about the necessity of additional capsule testing is a merits question that we cannot resolve at this stage of the proceeding.¹⁵⁸ The petitioners need not prove their case on the merits at this stage, but need only identify facts or expert opinions sufficient to raise a genuine dispute.¹⁵⁹ For the reasons stated above, we find the petitioners have complied with that requirement and have put forward an admissible contention. Although the admissibility criteria are strict by design,¹⁶⁰ the Commission has also repeatedly warned against turning them into a “fortress to deny intervention.”¹⁶¹

(ii) **Microcracking**

The petitioners also put forward a separate factual foundation for the contention—the alleged potential for microcracking caused by operation in an environment containing hydrogen at high pressure.¹⁶² The petitioners assert that these cracks can occur because “the plates of [the reactor vessel] are under stress from the pressure inside the vessel.”¹⁶³ The petitioners

¹⁵⁸ See Vogtle, CLI-11-8, 74 NRC at 221 (“[T]he evaluation of a contention that is performed at the contention admissibility stage should not be confused with the evaluation that is later conducted at the merits stage of a proceeding. At the contention admissibility stage, a Board evaluates whether a petitioner has provided sufficient support to justify admitting the contention for further litigation. The facts and issues raised in a contention are not ‘in controversy’ and subject to a full evidentiary hearing unless the proposed contention is admitted.”).

¹⁵⁹ Id.; River Bend Station, CLI-94-10, 40 NRC at 51; USEC, LBP-05-28, 62 NRC at 596–97.

¹⁶⁰ See Dissent at 6.

¹⁶¹ See, e.g., Consumers Energy Co. (Palisades Nuclear Power Plant), CLI-07-18, 65 NRC 399, 414 n.49 (2007) (quoting Phila. Electric Co. (Peach Bottom Atomic Power Station, Units 2 & 3), ALAB-216, 8 AEC 13, 20–21 (1974)); Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2, & 3), CLI-99-11, 49 NRC 328, 335 (1999) (same).

¹⁶² Petition at 21–22.

¹⁶³ Id. at 22.

attach a Greenpeace report that summarizes research and technical expert opinions on this issue.¹⁶⁴ Among other sources, the report quotes the expert opinions of two material science professors, Digby MacDonald and Walter Bogaerts, who conclude that hydrogen atoms moving from pressurized water into steel materials could have caused the microcracking discovered at two Belgian reactors in 2012, rather than a manufacturing defect, as was previously suspected.¹⁶⁵ Of particular relevance to this case, the professors assert that microcracks could occur in any reactor pressure vessel.¹⁶⁶ The report indicates that microcracking may be worse at lower temperatures, but can affect material properties at high temperatures as well.¹⁶⁷

Additionally, the Greenpeace report ties microcracking to fracture toughness by alleging that “[m]aterials susceptible to this process exhibit a marked decrease in their energy absorption ability before fracture in the presence of hydrogen. This phenomenon is also known as hydrogen-assisted cracking, [or] hydrogen-induced blister cracking.”¹⁶⁸ As support for this statement, the report cites a paper from a materials scientist at Savannah River National Laboratory. Like the professors’ statements, that paper describes how hydrogen migrating into

¹⁶⁴ Id. at 21–22 (citing Greenpeace report).

¹⁶⁵ Greenpeace report at 6–7. The Commission previously explored whether the microcracking condition discovered at the Belgian reactors was the result of a manufacturing defect that could affect U.S. reactors, and concluded that there was no such risk. See Electric Power Research Institute, Materials Reliability Program: Evaluation of the Reactor Vessel Beltline Shell Forgings of Operating U.S. PWRs for Quasi-Laminar Indications (MRP-367) at v–vi, 6-2 (Oct. 2013) (ADAMS Accession No. ML14064A411) [hereinafter “EPRI Report”]. However, neither Entergy nor the Staff provide any indication that the agency has examined this newly alleged embrittlement mechanism.

¹⁶⁶ Greenpeace report at 6–7.

¹⁶⁷ Id. at 7 (noting that the microcracking phenomenon is “enhanced” at low temperatures).

¹⁶⁸ Id. (citing M. R. Louthan, Jr., Hydrogen Embrittlement of Metals: A Primer for the Failure Analyst, Savannah River Nat’l Lab., WSRC-STI-2008-00062, available at <http://sti.srs.gov/fulltext/WSRC-STI-2008-00062.pdf> [hereinafter “Louthan paper”]). The Louthan paper discusses potential implications of “Hydrogen-Induced Blistering,” and “Hydrogen Embrittlement,” two of the names given to the phenomenon discussed in the Greenpeace report. See Louthan paper at 4, 11; Greenpeace report at 7.

steel during operation can “lower[] the strength of various interfaces in metals and alloys.”¹⁶⁹

The report also indicates that microcracking is dependent on material properties,¹⁷⁰ making the issue more relevant in an EMA scenario, where the metal is already at lower fracture toughness due to neutron-induced weakening of the metal.

These microcracking allegations imply that the Palisades RPV materials may be of lower fracture toughness than described by Entergy, and thus that Entergy’s EMA fails to show that the Palisades reactor vessel demonstrates equivalent margins of safety under 10 C.F.R. Part 50, Appendix G. This alleged deficiency arises because the NRC Staff’s regulatory guidance does not cover this type of cracking scenario at all.¹⁷¹

In addition, although the Staff’s guidance states that generic analyses “provide a method for determining the material’s . . . fracture resistance that the NRC staff finds acceptable for use in the methods described in this guide,” it also states that “[o]ther methods for determining the material property may be used on an individual-case basis if justified.”¹⁷² The petitioners’ position is that additional capsule testing is not only justified but necessary to support the Palisades EMA. Indeed, based on the professors’ expert opinions concerning the risk of RPV microcracking, the petitioners reemphasize their position, also supported by Mr. Gundersen,

¹⁶⁹ Louthan paper at 12; see also id. at 15 (“Hydrogen in a service environment may also adversely alter the properties of metals and alloys.”). Although the focus of the Louthan paper is not on how hydrogen enters the steel, but more on potential implications, the paper works off the assumption that hydrogen enters the steel from a gaseous state. See id. at 3; but see id. at 16 (noting that hydrogen can be taken up “from in-service corrosion”). The scientists quoted in the Greenpeace report implicitly challenge this assumption in arguing that hydrogen can enter a reactor during normal operation. Further exploration of the causes of hydrogen microcracking is best left, however, to a merits determination after evidence is presented at a hearing.

¹⁷⁰ Id. at 12 (“The time required for this event to occur will depend on the metallurgical condition of the material.”), 14 (“The characteristics of hydrogen assisted fracture are dependent on the metallurgical condition of the material. . . .”).

¹⁷¹ See Regulatory Guide 1.161, at 3–11 (advising license amendment applicants to test for four types of possible operating and emergency scenarios, which do not include microcracking).

¹⁷² Id. at 2.

that “[a] mere projected equivalent margins analysis should not be allowed to stand against serious physical investigation into the status of the uniquely-embrittled Palisades RPV,” and that “Palisades should be made a priority for destructive coupon testing.”¹⁷³

With respect to this claim, Entergy responds that evidence of microcracking in Belgian beltline ring forgings is irrelevant here because the Palisades beltline is constructed of welded plates, not forgings.¹⁷⁴ But according to the statements of professors MacDonald and Bogaerts cited in the Greenpeace report, hydrogen-induced microcracking is not limited to beltline forgings,¹⁷⁵ making Entergy’s response a dispute on the merits. Without determining whether Entergy or the petitioners are correct about this issue, the potential for hydrogen-induced microcracking provides additional support for the petitioners’ contention that Entergy’s analysis fails to show “equivalent” margins of safety.¹⁷⁶ The petitioners have appropriately raised a previously unconsidered materials phenomenon that may reduce reactor vessel material toughness,¹⁷⁷ as well as itself act as a crack creation mechanism,¹⁷⁸ both of which are relevant to determining the adequacy of the Palisades EMA.

¹⁷³ Petition at 22.

¹⁷⁴ Entergy Answer at 26; see also Staff Answer at 25 n.101; Dissent at 4. When the NRC conducted a study after discovery of the Belgian cracks, it focused on beltline ring forgings, so Palisades was not part of the study. See EPRI Report at vi.

¹⁷⁵ Greenpeace report at 6–7.

¹⁷⁶ Ariz. Pub. Serv. Co. (Palo Verde Nuclear Generating Station, Units 1, 2, & 3), CLI-91-12, 34 NRC 143, 155 (1991) (recognizing that a licensing board may appropriately view a petitioner’s supporting information in a light favorable to the petitioner, although it may not do so by ignoring other admissibility requirements); Nuclear Innovation N. Am. LLC (S. Tex. Project, Units 3 & 4), LBP-11-25, 74 NRC 380, 397 (2011) (“At the contention admissibility stage of a proceeding, Intervenors need not marshal their evidence as though preparing for an evidentiary hearing.”); U.S. Dep’t of Energy (High-Level Waste Repository), LBP-09-6, 69 NRC 367, 416 (2009) (noting that requiring petitioners to proffer conclusive support for the effect of their proposed contention “would improperly require . . . Boards to adjudicate the merits of contentions before admitting them”).

¹⁷⁷ Petition at 21–22; Greenpeace report at 7.

For the same reasons, Entergy and the dissent are mistaken in claiming that, even if the microcracking phenomenon affects the Palisades plant, it is a dispute with the current licensing basis and outside the scope of this proceeding.¹⁷⁹ We have previously explained the concept of the current licensing basis.¹⁸⁰ No evidence has been put forward by the Staff or Entergy that the Palisades Safety Analysis Report, or any other part of the license, considers the petitioners' hydrogen-assisted microcracking concern. Nor are the petitioners challenging ongoing plant operations or the adequacy of the Staff's oversight of plant operations. Rather, as explained in the immediately preceding paragraph, the petitioners' microcracking allegations provide additional support for their claim that the EMA fails to show "equivalent" margins of safety. The petitioners have provided adequately supported allegations concerning whether the EMA ensures the required level of protection of public health and safety absent examination of the potential for microcracking caused by high-pressure hydrogen. These alleged facts are adequate to demonstrate the existence of a genuine dispute on a material issue of fact concerning the sufficiency of the LAR.¹⁸¹ This does not empower the petitioners to argue at the hearing that the entire Palisades RPV is at risk due to microcracking. The scope of the hearing relates to the EMA on the three materials projected to fall below the 50 ft-lb standard. The Board has ample authority to ensure that evidence offered concerning microcracking is limited to

¹⁷⁸ See supra note 171 and accompanying text.

¹⁷⁹ Entergy Answer at 25; Dissent at 4.

¹⁸⁰ See supra notes 86–88 and accompanying text.

¹⁸¹ See Pac. Gas & Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 & 2), CLI-11-11, 74 NRC 427, 442–43 (2011) (admitting contention that applicant had failed to discuss a report on a recently identified seismic fault near the plant); see also San Luis Obispo Mothers for Peace v. NRC, 799 F.2d 1268, 1270 (9th Cir. 1986) ("The [NRC] regulations thus appropriately require a hearing before the proposed license amendment becomes effective whenever the amendment creates the possibility of a new or different kind of accident.").

that specific material issue, and does not stray into issues outside the scope of the license amendment proceeding.¹⁸²

The dissent claims that the Greenpeace report “apparently cherry-picked alarming statements from a variety of sources,” and characterizes the report as “an editorial with no probative value.”¹⁸³ The dissent’s document-specific evidentiary objections are not properly before the Board because they were not raised by either the Staff or Entergy.¹⁸⁴ Moreover, such evidentiary objections made for the first time after briefing has been completed unfairly deprive the petitioners of the opportunity to file the response expressly provided in the NRC’s procedural rules.¹⁸⁵ This would deprive the petitioners of a fair opportunity to present argument on the issues raised for the first time by the dissent.¹⁸⁶

In any event, although the Greenpeace report is argumentative, the dissent mischaracterizes it as merely an “editorial” or a collection of “alarming statements.” The report in fact provides a summary of technical research and analysis relevant to the microcracking issue. The report includes 35 footnotes identifying the specific technical sources it discusses and provides links to many of those sources, thereby enabling the reader to verify the accuracy

¹⁸² 10 C.F.R. § 2.319 (d), (e) and (g).

¹⁸³ Dissent at 3–4.

¹⁸⁴ While the Federal Rules of Evidence are not directly applicable to NRC proceedings, NRC adjudicatory boards often look to those rules for guidance. S. Cal. Edison Co. (San Onofre Nuclear Generating Station, Units 2 & 3), ALAB-717, 17 NRC 346, 365 n.32 (1983). And “[i]t is a fundamental rule of evidence that an objection not timely made is waived.” United States v. Jamerson, 549 F.2d 1263, 1266–67 (9th Cir. 1977) (citing FED. R. EVID. 103(a)(1); 1 J. Wigmore, Evidence 18 (3d ed. 1940)); see also United States v. Carney, 468 F.2d 354, 357 (8th Cir. 1972) (In absence of objection, hearsay evidence is treated as being properly admitted and may be given such probative effect and value as it is entitled to); United States v. Alexander, 326 F.2d 736, 741 (5th Cir. 1964) (same); Moreland v. United States, 270 F.2d 887, 890 (10th Cir. 1959) (same).

¹⁸⁵ 10 C.F.R. § 2.323(c).

¹⁸⁶ See Progress Energy Fla. (Levy County Nuclear Power Plant, Units 1 & 2), CLI-10-2, 71 NRC 27, 45 (2010).

of the statements in the report based on those sources. Neither Entergy nor the Staff alleges that the report misstates the conclusions or analysis of any of the cited sources.¹⁸⁷ At the contention admissibility stage, the Board may consider the Greenpeace report insofar as it summarizes expert opinion and technical analysis supporting the petitioners' contention:

At the contention filing stage the factual support necessary to show that a genuine dispute exists need not be in formal evidentiary form, nor be as strong as that necessary to withstand a summary disposition motion. What is required is "a minimal showing that material facts are in dispute, thereby demonstrating that an 'inquiry in depth' is appropriate."¹⁸⁸

The Board concludes that the report's summary and citations show that an inquiry in depth is appropriate here. Whether there is other data or expert opinion that counters the statements made by the professors in the Greenpeace report is a question to be addressed at an evidentiary hearing or at summary disposition.

¹⁸⁷ The dissent asserts that at least four of the citations are incorrect, see Dissent at 4 n.13, but none of the examples suggests that the document mischaracterizes its sources. Two citations involve statements made in Dutch that the Greenpeace report translated into English. We see no reason to doubt that "Dit is mogelijk een wereldwijd probleem voor de hele nucleaire sector" means "This may be a global [worldwide] problem for the entire nuclear industry [sector]." See Greenpeace report at 7. The Dissent was also unable to locate the original quotes from Professor Bogaerts in the cited video, presumably because these statements are also in Dutch ("Vrees ik dat de corrosie aspecten zijn onderbelicht." and "Als ik een inschatting moest maken, zou ik inderdaad verwonderd zijn als het zich nog nergens anders had voorgedaan."). See Greenpeace report at 7 (citing De Redactie, Terzake (Feb. 13, 2015), <http://deredactie.be/cm/vrtnieuws/videozone/programmas/terzake/2.37612>). His complaint about Professor MacDonald's quote boils down to the fact that it should have included an ellipsis. And he notes that a quote of a final evaluation report did not state that it was in turn quoting the provisional evaluation report. Despite such minor nitpicks, our review of the information cited in the Greenpeace report's footnotes finds that it fairly represents its sources. Our conclusion is consistent with the fact that neither the Staff nor Entergy has argued that report misstates the content of its sources. The minor issues noted by the dissent are nothing like the situation in Calvert Cliffs 3 Nuclear Project, LLC (Calvert Cliffs Nuclear Power Plant, Unit 3), LBP-10-24, 72 NRC 720, 750-52 (2010), cited by the Dissent at 3. In that case, the licensing board concluded that information on a website cited by the Intervenor, "instead of supporting Intervenor's theory of an ongoing decline in peak load demand, contradicts that claim." Id. at 752. The dissent fails to come close to identifying any such contradiction between the Greenpeace report's sources and the opinions of professors MacDonald and Bogaerts described in the report.

¹⁸⁸ River Bend, CLI-94-10, 40 NRC at 51 (citing 54 Fed. Reg. at 33,171 (quoting Conn. Bankers Ass'n, 627 F.2d at 251)).

The dissent also complains that the Greenpeace report comes from an “un-refereed” website and “provide[s] no indication that the Greenpeace personnel had any qualifications as experts in any relevant technical field.”¹⁸⁹ But the Board majority has not assumed that the Greenpeace personnel who prepared the report are themselves experts in any relevant field. Instead, the majority may properly consider the technical analyses summarized in the report as relevant expert opinion.

Those analyses include, most notably, the expert opinions of materials science professors McDonald and Bogaerts. Neither the Staff, Entergy, nor the dissent maintains that the professors are not qualified experts in the field of materials science. In any event, the report describes the professors’ areas of expertise and provides links to their faculty pages and videos of their statements regarding microcracking.¹⁹⁰ The report describes Digby MacDonald as a materials scientist and professor at the University of California at Berkeley.¹⁹¹ His faculty page identifies him as a “Professor in Residence” in the Department of Materials Science and Engineering and states that he has a PhD in Chemistry and studies corrosion effects in water-cooled nuclear power reactors.¹⁹² The web page provides detailed information on his areas of interest, current research activities, professional honors and awards, and professional activities.¹⁹³ Professor Bogaerts, also a materials scientist, teaches at Katholieke Universiteit Leuven in Belgium and is described as “a specialist in nuclear material corrosion.”¹⁹⁴ A link in

¹⁸⁹ Dissent at 3–4.

¹⁹⁰ Greenpeace report at 2, 6 & nn.26–28.

¹⁹¹ Id. at 2, 6.

¹⁹² See id. at 6 n.27 (citing University of California – Berkeley, Nuclear Engineering Department, Digby Macdonald’s faculty page, <http://www.nuc.berkeley.edu/people/digby-macdonald> (last visited June 18, 2015)).

¹⁹³ Id.

¹⁹⁴ Id. at 2, 7 & n.28.

the report lists Professor Bogaerts as one of three instructors for a course on “Nuclear Materials” offered by the “Belgian Nuclear Higher Education Network.”¹⁹⁵ Given this information, in the context of determining whether to admit the petitioners’ contention, the Board may consider the professors’ expert opinions in the field of materials science.

The petitioners’ microcracking allegations are therefore adequately supported and are material to and within the scope of this license amendment proceeding.

(e) References to specific, disputed portions of the LAR

Under 10 C.F.R. § 2.309(f)(1)(vi), petitioners must include references to specific portions of the application they dispute, in addition to the reasons for each dispute. The requirement that a contention refer to specific portions of the application ensures that the Board will be able to determine whether the contention is within the scope of the proceeding and that the applicant knows which portions of the application it must defend.¹⁹⁶ The requirement is satisfied when a “commonsense reading of [the] petition makes abundantly clear which sections of [the] application” the petitioners are challenging, even though the petitioners do not specifically cite particular sections.¹⁹⁷

Here, the petitioners make clear that they are challenging the EMA, which is Attachment 5 to the LAR. In particular, they dispute Entergy’s failure to undertake additional coupon testing to support the EMA and to address the microcracking issue, which affects sections four and five of the EMA, “Equivalent Margins Analysis Inputs” and “Equivalent Margins Analysis Evaluations.”¹⁹⁸ Because the EMA does not discuss either of those issues, we cannot expect

¹⁹⁵ Id. at 7 n.28 (citing Belgian Nuclear Higher Education Network, Nuclear Materials, http://bnen.sckcen.be/en/Courses/Nuclear_materials (last visited June 18, 2015)).

¹⁹⁶ Crow Butte Res., Inc. (Marsland Expansion Area), LBP-13-6, 77 NRC 253, 292 (2013), aff’d, CLI-14-2, 79 NRC 11 (2014).

¹⁹⁷ Id. at 293.

¹⁹⁸ LAR, attach. 5 §§ 4, 5 (emphasis and capitalization removed).

the petitioners to do more than identify the reasons they believe it should have addressed them. On the sulfur content issue, which is discussed in the EMA, the petitioners have identified the specific part of the EMA at issue.¹⁹⁹ Neither the Staff nor Entergy has argued with respect to any of those three issues that they are unable to understand the portions of the application in dispute. We therefore conclude that the petitioners have adequately identified the portions of the LAR at issue.

3. Inadmissible issues

The petitioners' remaining arguments raise inadmissible issues. Challenges based on 10 C.F.R. § 50.61a and the question of whether Entergy demonstrated "substantial advantage" under 10 C.F.R. Part 50, Appendix H as a reason to not test capsules are beyond the scope of this license amendment proceeding, which concerns compliance with Appendix G of 10 C.F.R. Part 50.²⁰⁰ Similarly, Mr. Gundersen does not offer any rationale for his assertion that Entergy manipulated the data in its analysis,²⁰¹ nor do the petitioners articulate why Entergy should have considered "cleavage mode-conversion" in its analysis.²⁰² And the petitioners have not adequately supported their allegation that "nickel impurities" will weaken the materials in the Palisades reactor because the support they cite, a response to a Request for Additional Information for the H.B. Robinson plant, does not explain how high nickel content results in

¹⁹⁹ Petition at 19 (quoting LAR, attach. 5, at 24–25).

²⁰⁰ Id. at 12–15, 23–24; see Consumers Energy Co. (Palisades Nuclear Power Plant), CLI-07-22, 65 NRC 525, 529 (2007) (explaining that issues addressed in a separate proceeding are beyond the scope of a later proceeding). A board found that these issues were not admissible in a recent decision. Palisades, LBP-15-17, 81 NRC at __ (slip op. at 32).

²⁰¹ Gundersen Decl. ¶ 46.

²⁰² See Petition at 21.

“nickel impurities” or otherwise leads to any undue risk to the Palisades RPV.²⁰³ Finally, the petitioners’ argument that Palisades is being operated as a “test reactor” reflects a misreading of the regulations.²⁰⁴

IV. Conclusion

The Board concludes that the petitioners have standing, admits the petitioners’ contention, and accordingly grants their hearing request and admits them as parties to the proceeding. This Order is subject to appeal to the Commission to the extent permitted by 10 C.F.R. § 2.311. Any notice of appeal meeting applicable requirements set forth in that section must be filed within 25 days of service of this Memorandum and Order.

It is so ORDERED.

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

Ronald M. Spritzer, Chair
ADMINISTRATIVE JUDGE

/RA/

Dr. Thomas J. Hirons
ADMINISTRATIVE JUDGE

Rockville, Maryland
June 18, 2015

²⁰³ Petition at 20 (citing Response to Request for Additional Information Regarding Reactor Pressure Vessel Integrity from T. M. Wilkerson, Robinson Nuclear Plant, to Document Control Desk (July 23, 1998) (ADAMS Accession No. ML14178B146)).

²⁰⁴ Id. at 18; see 10 C.F.R. § 50.59. The board rejected this allegation in Palisades, LBP-15-17, 81 NRC at ___ (slip op. at 44).

Dissenting Opinion of Judge Arnold

A majority of this Board consider Petitioners' contention to be admissible. I must respectfully disagree. I believe that the information provided by Petitioners is inadequate to establish a material dispute with the application and thus Petitioners fail to meet the contention admissibility criteria.

Petitioners provide a clear and concise statement of their contention. They charge that analyses provided by the licensee "do not provide adequate assurance of margins of safety against fracture or rupture which are equivalent to those required by Appendix G of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code."¹ But beyond this, their petition fails to express any clear argument concerning their contention.

Petitioners provide eight specific points of support for this contention. Petitioners first claim that "three areas of the Palisades RPV are predicted to fall below the 50 ft-lb ductility stress limit."² But this is simply information provided by the licensee in the LAR. It is the reason for performing the equivalent margin analysis and the reason for the LAR. It in no way establishes a challenge to that application.

Petitioners follow this with their expert opinion in which Arnold Gunderson principally opines that the embrittlement of the RPV and licensee's response to it is "disturbing." He asserts that Westinghouse manipulated data, but he fails to include specifics of that manipulation and does not provide any support for this assertion. He notes that many coupon samples remain installed in the reactor vessel and asserts that these should be removed and tested "to benchmark the analysis described in 10 CFR 50.61 and in 10 CFR 50.61(a)." But he fails to cite to any rule requiring such testing or any staff guidance document advising such testing. Petitioners did not provide a description of new information that could be provided by

¹ Petition at 12.

² Id. at 15.

coupon removal that is not already available from the earlier coupon removal. Thus Petitioners' reference to the Gunderson statement does not support admissibility of this contention.

Thirdly, the petition discusses the "above-normal sulfur content" in the RPV plating. Petitioners cite from Westinghouse documentation of the Palisades equivalent margin analysis.³ In this quotation Westinghouse noted the sulfur contents of two subject plates as 0.029 wt.% and 0.024 wt.%, and that these are considered high-sulfur content. Westinghouse refers to relevant material data, "the most data available for a high-sulfur A-302 B plate are for the V-50 plate in NUREG/CR-5265."⁴ This citation goes on to qualitatively show that the toughness used in the equivalent margin analysis for plate A-302 B is lower than the toughness of the V-50 plate, which is itself "a very conservative lower bound of the available high-sulfur A-302 B plate."⁵

Petitioners then assert that "Palisades takes credit for the nickel content of the RPV on the one hand (for increasing the toughness against Upper Shelf Energy loss in RPV upper shell)."⁶ But this is directly contradicted by the Westinghouse information cited by Petitioners that shows that the analysis did not take credit for the toughening effect of the nickel beyond a concentration of 0.23 wt.% of the V-50 plate.

Petitioners then claim that Palisades failed "to mention or account for in the EMA that nickel impurities worsen RPV neutron embrittlement and PTS risk."⁷ Petitioners provide no

³ Petition at 19 (citing LAR, attach. 5, Palisades Nuclear Power Plant Reactor Vessel Equivalent Margins Analysis, at 5-2 (Feb. 2013) [hereinafter "Westinghouse WCAP-17651-NP"]).

⁴ Westinghouse WCAP-17651-NP at 5-2.

⁵ Id.

⁶ Petition at 20.

⁷ Id.

support for the assertion that “nickel impurities worsen RPV neutron embrittlement”⁸ other than a vague reference to a response to a Request for Additional Information for a different nuclear plant. In general, “providing any material or document as a basis for a contention without setting forth an explanation of its significance, is inadequate to support admission of that contention.”⁹

As explained by the Calvert Cliffs board:

Although a licensing board does not decide the merits or resolve conflicting evidence at the contention admissibility stage, materials cited as the basis for a contention are subject to scrutiny by the board to determine whether they actually support the facts alleged. We may examine both the statements in the document that support the petitioner’s assertions and those that do not.¹⁰

In this case review of the cited response to the Request for Additional Information reveals that the response provides no information on the Palisade’s vessel material properties. It makes no attempt to relate vessel steel chemistry to any property related to vessel strength. This document does not support Petitioners’ assertion.

Fourthly, Petitioners assert that “ductile tearing in low Charpy use materials is not well understood.”¹¹ But they do not even attempt to relate this assertion to their contention.

The fifth argument of Petitioners relate to microcracking found in the beltline forgings at the Doel 2 and Tihange 2 reactor vessels in Belgium. They base this assertion on an un-refereed statement posted on a Greenpeace web page, that apparently cherry-picked alarming

⁸ It is unclear here if Petitioners mean nickel as an impurity, or other impurities within the nickel that weaken the steel. Since the title to this section is about sulphur impurities, one might infer the latter.

⁹ Dominion Nuclear N. Anna, LLC (Early Site Permit for N. Anna ESP Site), LBP-04-18, 60 NRC 253, 265 (2004) (citing Fansteel, Inc. (Muskogee, Oklahoma), CLI-03-13, 58 NRC 195, 205 (2003)).

¹⁰ Calvert Cliffs 3 Nuclear Project, LLC (Calvert Cliffs Nuclear Power Plant, Unit 3), LBP-10-24, 72 NRC 720, 750 (2010).

¹¹ Petition at 20.

statements from a variety of sources. The statement provided no indication that the Greenpeace personnel had any qualifications as experts in any relevant technical field.

This Greenpeace reference states that investigations indicate that micro-cracks were likely due to the process used to manufacture the forgings but stated that other possible causes could not be definitively ruled out. But it remains a fact that these defects have only been found in forgings, and only those manufactured in one specific facility. Applicant points out that “the Palisades RPV beltline is constructed of welded plates, not forgings.”¹² And nowhere do Petitioners claim that Palisades vessel components were manufactured at the facility that produced the Doel 2 and Tihange 2 forgings. If the phenomenon affecting the two Belgian plants is an issue at all with the Palisades plant, then it is an issue with the current license basis of the plant and should be addressed by the NRC’s normal oversight processes. But Petitioners failed to relate the Belgian micro-cracking experience to the Palisades plant in any way other than as a speculative generic concern.

The Board majority states that Petitioners “point to safety concerns of two material science professors,” Digby MacDonald and Walter Bogaerts. But apparently Petitioners did not consider these professors important enough to mention. Neither of these individuals are named in the petition, they are only individuals referenced by the Greenpeace web page.

The Greenpeace briefing, while it may suggest that facts exist somewhere else to support the contention, may itself be characterized as an editorial with no probative value.¹³

¹² Entergy Answer at 26 (citing Westinghouse WCAP-17651-NP at 4-1).

¹³ Verifying the accuracy in the Greenpeace brief is problematical. The very first citation “This may be a global problem for the entire nuclear industry” is attributed to the Belgian Nuclear regulator Jan Bens. But checking out the citation one finds that what he really said was, “Dit is mogelijk een wereldwijd probleem voor de hele nucleaire sector. De oplossing is om bij alle 430 kerncentrales wereldwijd, nauwkeurige inspecties uit te voeren.” One citation attributed to Professor Digby MacDonald is “The importance of this could range from inconsequential to being so severe that it would shut down all the reactors . . . All of them.” This is taken from a television interview, and the extent to which that interview was edited cannot be determined. In fact the Greenpeace quotation is a concatenation of two MacDonald quotes from different points

The vague speculation by Greenpeace that this type of flaw may exist in other reactor vessels is not sufficient to establish a material challenge to Applicant's equivalent margin analysis.

In their sixth argument, Petitioners complain that the regulatory "guidance for 10 CFR 50.61a alternative calculations is only in draft form."¹⁴ They claim that the Palisades EMA, being predicated upon non-final guidance, should not be accepted."¹⁵ However they failed to explain the significance of 10 C.F.R. § 50.61a to the equivalent margin analysis performed under Appendix G of Part 50, not under 10 C.F.R. § 50.61a.

In their seventh argument, Petitioners allege that "although the NRC admits the scarcity of embrittlement data, it declines to order destructive testing" of vessel coupons.¹⁶ Petitioners fail to explain why the coupons that have already been removed and evaluated do not provide adequate characterization of the state of embrittlement of the vessel. They cite to no requirement to test a coupon. They do not explain how additional testing would improve knowledge of the vessel embrittlement. In fact, they do not relate this concern to their contention in any way. They merely lament that the NRC has allowed "16 years to pass without actual physical testing."¹⁷

in the interview. On the fifth page of the Greenpeace piece they cite a final evaluation report as saying that "it is not possible to confirm the exact root cause of the hydrogen flaking." They failed to note that this statement was itself a quote from a "Provisional Evaluation Report" and it stated, "Meanwhile, the exact root cause of the hydrogen flaking could not be precisely defined **so far**." Greenpeace failed to mention that page 30 of final evaluation report states, "Regarding structural integrity of the reactor pressure vessel . . . the presence of hydrogen-induced flaws in the Tihange 2 and Doel 3 RPV shells has not a significant impact." On their seventh page, Greenpeace attributes two sentences to the Belgian professor Walter Bogaerts. But Greenpeace does not reference where he made those statements so their accuracy and context cannot be determined. I have not attempted to verify all of the Greenpeace citations. But my spot check of five citations finds that four of them are of questionable value.

¹⁴ Petition at 22.

¹⁵ Id.

¹⁶ Id. at 23.

¹⁷ Id.

Petitioners' eighth and final argument is that "10 CFR Part 50, Appendix H requires 'substantial advantage' if coupons are not evaluated."¹⁸ They do not discuss the relevance of this to an alternative margins analysis performed under Appendix G to Part 50, not under Appendix H. Appendix H applies to the vessel surveillance program, and Licensee has an NRC approved surveillance program. Petitioners are essentially challenging the NRC approval of the coupon removal schedule, which is not within the scope of this proceeding.

The Commission has repeatedly stated that contention admissibility criteria are "strict by design."¹⁹ Licensing boards have repeatedly cited this. In my opinion, no strict interpretation of admissibility standards could possibly find Petitioners' arguments sufficient support for the admissibility of their contention.

¹⁸ Id.

¹⁹ Dominion Nuclear Conn., Inc. (Millstone Nuclear Power Station, Unit 2), CLI-03-14, 58 NRC 207, 213 (2003) (citing Dominion Nuclear Conn., Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 358–59 (2001); Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2, & 3), CLI-99-11, 49 NRC 328, 334–35 (1999)).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
ENTERGY NUCLEAR OPERATIONS, INC.) Docket No. 50-255-LA-2
(Entergy))
)
(Palisades Nuclear Plant))
)

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **MEMORANDUM AND ORDER (Granting Petition to Intervene and Request for a Hearing) (LBP-15-20)** have been served upon the following persons by Electronic Information Exchange.

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MEMORANDUM AND ORDER (Granting Petition to Intervene and Request for a Hearing)
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[Original signed by Herald M. Speiser]
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Dated at Rockville, Maryland
this 18th day of June, 2015