

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Commission

In the Matter of:)	Docket No. 50-255-LA2
Entergy Nuclear Operations, Inc.)	ASLBP No. 15-939-04-LA-BD01
(Palisades Nuclear Plant))	August 7, 2015
Operating License Amendment Request)	

* * * * *

PETITIONERS' BRIEF IN OPPOSITION TO ENTERGY APPEAL OF LBP-15-20

Terry J. Lodge, Esq.
(Ohio Sup. Ct. No. 0029271)
316 N. Michigan St., Ste. 520
Toledo, OH 43604-5627
(419) 205-7084
tjlodge50@yahoo.com

Counsel for Petitioners-Appellees Beyond Nuclear, Don't Waste Michigan,
Michigan Safe Energy Future - Shoreline Chapter, and Nuclear
Energy Information Service

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Now come Beyond Nuclear (“BN”), Don’t Waste Michigan (“DWM”), Michigan Safe Energy Future - Shoreline Chapter (“MSEF”), and the Nuclear Energy Information Service (“NEIS”) (hereafter collectively called “Petitioners”), and oppose the appeal brought by Entergy to the admission of Petitioners’ contention respecting the equivalent margins analysis for the Palisades reactor pressure vessel (“RPV”).

I. INTRODUCTION

Like an Impressionist painting, the closer one gets to Entergy’s canvas, the less cohesive are the utility arguments in support of reversal of the Atomic Safety and Licensing Board (“ASLB”) ruling, LBP-15-20 (June 18, 2015) (“LBP-15-20”). In this appeal, Entergy indulges arguments that either seriously mischaracterize, or misstate entirely, the facts and/or the legal reasoning on which the two-judge ASLB majority relied in rendering its determination.

Entergy urges that the ASLB improperly supplemented the body of evidence to admit the contention, and that the Petitioners (who established undisputed standing and so became Intervenors) did not write a sufficiently lengthy Petition to Intervene to deserve an adjudication over the ductility and the glaring metallurgical weakness of certain Palisades RPV plates and welds.¹

Below, Petitioners dispel these notions, and expose the diversions and mischaracterizations in detail. Close scrutiny of Entergy’s canvas reveals isolated and disjointed arguments, none of which should dislodge the time-honored principle that for the most part, the Commission must defer to the reasonableness and sensibility of the ASLB if there is no abuse of discretion.

¹See p. 3, fn. 34 of the “Brief in Support of Entergy’s Appeal of LBP-15-20,” which states: “It is telling that Petitioners’ contention admissibility discussion occupies approximately 12 pages of their brief, whereas the majority’s corresponding analysis admitting the contention spans nearly 30 pages.”

The Commission should reject Entergy's appeal in its entirety.

II. STATEMENT OF THE CASE

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.”² 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.³

Charpy upper-shelf energy decreases with exposure to neutron radiation over the reactor vessel's lifetime.⁴ 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.”⁵

²*Cleveland Electric Illuminating Co.* (Perry Nuclear Power Plant, Unit 1), CLI-96-13, 44 NRC 315, 317 (1996).

³10 C.F.R. Pt. 50, App. G.

⁴See 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”).

⁵10 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

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, 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. Following discussions with the Staff, the company resubmitted its equivalent margins analysis (“EMA”) on November 12, 2014, as a license amendment request (“LAR”). The LAR predicts that lower shell plate material D-3804-1 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. 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.”

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. 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.

The Staff’s regulatory guide describes procedures that the Staff considers acceptable for demonstrating equivalent safety margins, provides models for four different operating and emergency scenarios (known as Level A, B, C, and D conditions), and includes references for

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).

generic data on correlations between Charpy impact energy and fracture toughness. 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.⁶

Entergy relied on these generic reference materials in its analysis.⁷ The Staff's guidance also authorizes methods other than the generic analyses "on an individual-case basis if justified."⁸ 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). On March 9, 2015, the Petitioners submitted a timely hearing request. Entergy and the NRC Staff filed answers opposing the petition, to which the Petitioners filed a reply. The Licensing Board issued its "Memorandum and Order (Granting Petition to Intervene and Request for a Hearing)" on June 18, 2015 ("LBP-15-20"). Entergy timely initiated an appeal pursuant to 10 C.F.R. § 2.311 with the filing of a "Notice of Appeal" and supporting brief on July 13, 2015. Petitioners herewith submit their Brief in Opposition to the Entergy appeal.

III. LEGAL STANDARDS

A. Requirements For An Acceptable Contention

⁶Regulatory 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)).

⁷LAR, attach. 5, at 5-2.

⁸Regulatory 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 irreducible minimum requirements for a contention to be accepted for litigation before the Commission are that it be specific and have a basis. Whether or not the contention is true is left to litigation on the merits in the licensing proceeding. *Washington Public Power Supply System* (WPPSS Nuclear Project No. 2), ALAB-722, 17 NRC 546, 551 n.5 (1983), citing *Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 NRC 542 (1980); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, & 3), LBP-91-19, 33 NRC 397, 411 (1991), *appeal denied*, CLI-91-12, 34 NRC 149 (1991).

B. Standard of Review by the Commission

In reviewing challenges over contention admissibility, the Commission generally defers to the Atomic Safety and Licensing Board unless it finds either an error of law or abuse of discretion. *In re FirstEnergy Nuclear Operating Co.*, 75 N.R.C. 393, 396-397 (2012); *South Carolina Electric & Gas Co.* (Virgil C. Summer Nuclear Station, Units 2 and 3), CLI-10-21, 72 NRC 197, 200 (2010) (citing *Crow Butte Resources, Inc. (In Situ Leach Facility, Crawford, Nebraska)*, CLI-09-9, 69 NRC 331, 336 (2009)).

C. Definition of ‘Abuse of Discretion’

“Abuse of discretion is defined as a definite and firm conviction that the trial court committed a clear error of judgment.” *Tahfs v. Proctor*, 316 F.3d 584, 593 (6th Cir. 2003) (quoting *Amerinational Indus., Inc. v. Action-Tungsum, Inc.*, 925 F.2d 970, 975 (6th Cir. 1991)). Abuse of discretion has also been defined as “‘an arbitrary, capricious, whimsical, or manifestly unreasonable judgment.’” *FDIC v. Oldenburg*, 34 F.3d 1529, 1555 (10th Cir.1994) (quoting *United States v. Hernandez-Herrera*, 952 F.2d 342, 343 (10th Cir.1991)). There is abuse of discretion in a decision that “provides no rational explanation, inexplicably departs from

established policies, is devoid of any reasoning, or contains only summary or conclusory statements.” *Gurung v. Ashcroft*, 371 F.3d 718, 720-21 (10th Cir. 2004) (internal quotation marks omitted).

**IV. ARGUMENT: THE COMMISSION SHOULD
LET STAND THE ASLB DECISION WHICH
ADMITTED PETITIONERS’ CONTENTION**

In its Brief, Entergy argues a wide-ranging set of inconsistent arguments, all of which are belied by the law, the facts, good sense, or a combination of all. Petitioners, as Appellees, respond *seriatim* to those arguments.

A. “[R]elied on a guidance document (ASTM Standard E 185-82) that was not cited by Petitioners and is used to implement the NRC’s RPV surveillance program requirements in 10 C.F.R. Part 50, Appendix H”

This argument is raised in the Entergy Br. at 8. It is a diversionary assertion by Entergy; the Petitioners *did* cite to Appendix H.⁹ But that is not particularly important, because Appendix H is a regulation. It is part of the body of obligations for which Entergy can be held accountable, and the various regulatory guides cited within such regulations are also part of the body of administrative law by virtue of being therein mentioned, discussed and/or applied.

The processes of noting, applying and interpreting the effect of regulations are precisely what ASLBs are charged to do, so it is expected that guidance documents within appendices are fair game for consideration by an ASLB deliberating over a proposed contention. The Licensing

⁹Petition 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 (“Petition to Intervene”) at pp. 23-24.

Board explicitly ruled that Appendix H is not implicated by Petitioners' contention.¹⁰ But the ASLB was not foreclosed from examining and considering the guidance documents on which Appendix H rests, in order to make a thorough preliminary determination as to whether, or how, the guides might fit into the complicated picture. That is the proper role for the ASLB, whether or not such scrutiny of the regulatory guides is deemed "reliance." Entergy's argument is misleading, and upon examination, has no bearing on the merits of the contention.

B. "[F]ound that the Petitioners appropriately challenged an NRC Staff guidance document (Regulatory Guide 1.161) when, in fact, the Petitioners did not do so"

This assignment of error is first raised at Entergy Br. 8-9.

Entergy is referring to this passage from the Petition to Intervene:

The NRC admits that it has poor information about the ductile tearing propensities of steel plating with low Charpy upper-shelf energy:

Ductile tearing is the dominant fracture process in the upper-shelf region of the Charpy impact energy versus temperature curve for RPV materials. The conditions governing cleavage mode-conversion of the ductile tearing process in materials with low Charpy upper-shelf energy *are still not well understood* and are not considered in this regulatory guide.

NRC Regulatory Guide ("RG") 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less than 50 ft.-lb." ADAMS No. ML003740038 (p. 3/40 of .pdf). Petitioners have seen no later regulatory guidance which demonstrates any greater understanding of ductile tearing.

(Emphasis supplied). Petition to Intervene at 20-21. Clearly, Petitioners were citing NRC RG

1.161 as *proof of the NRC Staff's incomplete knowledge of the ductile-tearing properties of steel*

¹⁰From LBP-15-20, pp. 13-14: "Appendix H does not 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.'" (Emphasis supplied).

plating with low Charpy upper-shelf energy. The Licensing Board observed that “. . . 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.’” LBP-15-20 p. 31, citing and quoting from RG 1.161 at 1. The ASLB noted Petitioners’ suggestion in LBP-15-20 that RG 1.161 comprised an NRC Staff admission of its experiential limitations, and then proceeded to explain the reasoning behind allowing the Petitioners to challenge the Regulatory Guide:

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, 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, and they have effectively done so here by arguing that Entergy’s EMA (conducted pursuant to Regulatory Guide 1.161) does not meet the regulatory standards. As Entergy notes, Staff guidance is entitled to “special weight” in a decision on the merits, 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.” (Emphasis supplied).*

Id. at 20-21. Simply put, the ASLB has found that when it comes to equivalent margins analysis requirements, there are regulatory gaps, or matters which are not addressed at all by regulations. There is a patchwork of reliance upon governmental and private regulatory guidance documents, but even those publications do not comprehensively regulate EMA development and underpinnings.

NRC guidance documents are routine agency policy pronouncements, but importantly,

they do not carry the binding effect of regulations. *International Uranium (USA) Corp.*, CLI-00-1, 51 NRC 9, 19 (2000); *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), LBP-07-3, 65 NRC 237, 254 (2007). Regulatory guides, by their very nature, serve merely as guidance and cannot prescribe requirements. *Curators of University of Missouri*, CLI-95-1, 41 NRC 71, 98, 100 (1995). *See also Duke Energy Corp.* (Catawba Nuclear Station, Units 1 & 2), CLI-04-29, 60 NRC 417, 424 (2004), *reconsid. denied*, CLI-04-37, 60 NRC 646 (2004) (“Guidance documents are, by nature, only advisory”). A regulatory guide only presents the Staff’s view of how to comply with the regulatory requirements. *Louisiana Energy Services* (Claiborne Enrichment Center), LBP-96-7, 43 NRC 142 (1996). Guidance consists of the means by which compliance with regulatory requirements might be had. The NRC Staff is required to demonstrate the validity of its guidance if it is called into question during the course of litigation. *Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit 1), ALAB-698, 16 NRC 1290, 1299 (1982), Regulatory guides cannot serve as substitutes for regulations. *Long Island Lighting Co.* (Shoreham Nuclear Power Station, Unit 1), LBP-83-22, 17 NRC 608, 616 (1983).

The Petitioners properly brought to the ASLB’s attention regulatory guidance sources as a means of proving the patchwork regulatory framework governing Charpy USE concerns at Palisades. NRC precedent recognizes that the NRC Staff may be required to demonstrate the validity of its guidance during the course of litigation. Consequently, the Commission must defer in this instance to the ASLB for its finding that the Petitioners have properly challenged NRC Regulatory Guide 1.161.

C. “[C]oncluded that NRC guidance documents are not entitled to ‘special weight’ at the contention admissibility stage”

Entergy first raises this objection in Entergy Br. at 9.

The problem for Entergy is not that weight wasn't duly accorded NRC RG 1.161. Petitioners urged the ASLB to give weight to RG 1.161 as an NRC Staff admission that ductile tearing in low Charpy USE materials is poorly understood. The ASLB majority concluded that Petitioners had articulated a material dispute with the application, but that the weight to be accorded such evidence was "inapposite" at this stage: "As Entergy notes, Staff guidance is entitled to 'special weight' in a decision on the merits, but arguments about the weight of the evidence are inapposite at the contention admissibility stage, where we do not decide the merits." LBP-15-20 at 21.

Though not regulations, regulatory guides constitute evidence of methods preferred by the NRC Staff. Here, Petitioners used RG 1.161 as part of the factual basis for their contention. The legal weight to be accorded the Staff admissions in the regulatory guide, however, is for a later stage of the proceedings.

D. "[R]uled that the Palisades EMA essentially is a 'generic' analysis"

Entergy first raises this objection in Entergy Br. at 9.

The ASLB said the following as part of its ruling.

But here Entergy's EMA applied a generic approach set forth in Staff guidance 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.

LBP-15-20 at 22-23. Further, the ASLB observed this about NRC RG 1.161:

. . . [T]he 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.'

Id., quoting RG 1.161 at 2. The ASLB did not "rule" that the Palisades EMA is essentially

generic, but noted that the approach for the EMA is not based upon a regulation. The EMA, said the Board, is instead predicated on a generic analysis contained in RG 1.161, is coupled with a private engineering standard, and these two things do not equal a formal regulation. While admittedly, Westinghouse has compiled a plant-specific EMA, the point of the ASLB's determination and Petitioners' contention argument is that there is only nonbinding, revocable, ignorable guidance. There is not a seamless, enforceable set of regulations in place which address equivalent margins analyses, but only guidance material.

E. “Found that Mr. Gundersen had disputed the adequacy of the inputs used in the EMA despite never having mentioned those inputs”

This objection is first raised in Entergy Br. at 9.

The ASLB explained the nature of the dispute raised by Arnold Gundersen, Petitioners' expert witness, this way:

Gundersen 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. His explanation is concrete and specific, and thus provides adequate support for disputing the lack of capsule data in the EMA.

LBP-15-20 at 28.

The Licensing Board explained the above conclusion by adding this:

Instead, they provide an expert declaration that challenges the conservatism and usefulness of the Entergy EMA. Mr. Gundersen has provided sufficient explanation of his opinion that the generic analysis that forms the basis of the EMA is inadequate without capsule testing to validate the analysis. He describes the history and characteristics of Palisades that make embrittlement a particular concern. 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.

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.

Id. at 30. Arnold Gundersen does not have to provide a point-by-point refutation of the Entergy LAR application to opine the existence of the following material dispute:

Basically, Entergy is proposing to operate its Palisades NPP *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. (Emphasis added)

Gundersen Declaration, ¶ 48.

Entergy's Impressionist canvas looks less like a coherent picture the more closely its arguments are scrutinized. In examining contention admissibility, the Commission generally defers to the Board absent either an error of law or abuse of discretion. *In re FirstEnergy Nuclear Operating Co.*, 75 N.R.C. 393, 396-397 (2012). Neither is present in this instance.

F. “[F]ound that Petitioners’ proposed contention ‘need only allege that it poses a significant safety problem’”

This objection is first raised in Entergy Br. at 9.

Entergy argues that two of the cases cited by the ASLB predate the 1989, strict-by-design, contention pleading rules and so should not apply. But other precedent cited by the ASLB post-dates the 1989 changes, and Entergy does not explain that discrepancy. LBP-15-20 at 22 fn. 105 (citing *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)).

Thus while some of the legal precedent pre-dates the arrival of tougher pleading

standards, the essential nature of content pleading remains unchanged. This is a meaningless assignment of error.

G. “[I]ndependently researched and misinterpreted references related to ‘microcracking’ never cited by Petitioners or their expert to bolster the proposed contention”

This objection is first raised in Entergy Br. at 9.

Regarding Entergy’s complaint that “the Gundersen Declaration contains no discussion of the Greenpeace Briefing or the ‘microcracking’ issue,” (Entergy Br. at 24), the explanation is simple. Arnold Gundersen’s declaration was prepared on December 1, 2014 and filed shortly thereafter by Petitioners in support of their Petition to Intervene in Case No. 50-255-LA. The Greenpeace briefing was not published until mid-February, 2015. Petitioners’ March 9, 2015 intervention petition in the instant case used Gundersen’s December 1, 2014 expert declaration, as well as the then just-published Greenpeace briefing, as foundations for their contention on ductile fracture risk in Palisades’ RPV.

The concerns about both brittle and ductile fracture risks, raised by Gundersen on December 1, 2014, are only further amplified by the Greenpeace briefing of mid-February, 2015, which matters were noted in the majority ASLB ruling in the instant proceeding.

H. Response to claimed error that ASLB majority gave undue weight to Greenpeace Briefing and improperly supplemented Petitioners’ microcracking claims

Entergy claims (Entergy Br. at 23) that the ASLB majority’s “reliance on the Greenpeace Briefing in admitting Petitioners’ contention constitutes both reversible error and an abuse of discretion.” It is neither. The Greenpeace Briefing is formally titled “Nuclear Reactor Pressure Vessel Crisis, Greenpeace Briefing” (“Greenpeace Briefing”) and appears at ADAMS ML 15068A456.

Petitioners have well established the need for destructive coupon testing, in both their brittle fracture proceeding initiated on Dec. 1, 2014, and in this ductile fracture proceeding initiated on March 9, 2015. Petitioners identified as a high-priority need for Entergy to undertake an examination of actual RPV plating and welds for the micro-cracking uncovered in the Belgium reactor inquiry for self-evident reasons. Palisades is age-degraded enough to require Entergy to file LARs on both brittle fracture risks, as well as ductile fracture risks. On brittle fracture risks, Palisades has long been acknowledged, repeatedly, as the worst in the U.S. So besides the urgent need to test actual physical metal coupons (four of which remain at Palisades, but only one of which is planned to be tested, and not until 2019), there is also the urgent need to undertake ultrasonic tests (“UT”) at Palisades to identify or guard against potential widespread micro-cracking. Even in Belgium, at Doel-3 and Tihange-2, according to the Greenpeace Briefing, many thousands of micro-cracks remained invisible, undetected, and unknown, until the appropriate UT was applied to identify them.

Given the well documented age-related degradation of Palisades’ RPV, both the neutron embrittlement of plates and welds, but also the loss of Charpy V-Notch Upper Shelf Energy fracture toughness, are conditions which require UT to guard against potentially extensive, yet otherwise undetectable micro-cracking of Palisades’ RPV.

Petitioners timely raised a matter of generic concern to embrittled reactors. Internal RPV flaws, such as micro-cracks, are an essential ingredient (along with embrittlement, and PTS) for RPV failure due to brittle fracture. Likewise, extensive micro-cracking, along with loss of fracture toughness due not only to embrittlement but also to thermal stresses over time on RPV walls and welds (causing loss of Charpy V-Notch USE strength), could also result in catastrophic

failure of the RPV as a consequence of ductile fracture.

The Greenpeace Briefing relates that Belgium's Federal Agency for Nuclear Control ("FANC") reported that "the material's embrittlement appears to be greater than one would expect based on the trend curves reported in the existing literature." *Id.* at 6. The shutdown decisions were made "after one of the tests 'related to the mechanical strength of a sample analogue to the composition of the concerned vessels did not deliver results in line with experts' expectations.'" *Id.* at 5. Significantly, although the unexpected behavior of the embrittled metal was reconfirmed by an additional round of testing, the root cause of the problem has not yet been identified. *Id.*

The Greenpeace Briefing's "New Disclosures" section (pp. 6-7) quotes Dr. Digby MacDonald of the University of California at Berkeley, as well as Dr. Walter Bogaerts of the Belgian Nuclear Higher Education Network and the University of Leuven. These two nuclear materials scientists allege that the root cause of the Belgian RPV micro-cracking could well be hydrogen corrosion due to reactor operations, and that the consequent risks could be severe, including fracture of the weakened RPV. Given such high risks, and lingering uncertainties regarding the root cause, the internationally-regarded materials scientists advise that UT tests should be deployed at RPVs worldwide, to seek to detect potentially invisible, yet extensive micro-cracking.

In the Greenpeace Briefing's section entitled "Safety implications and ageing nuclear reactors" (*id.* at 7), the head of FANC, Director General Jan Bens, is quoted. He warns that the Doel-3 and Tihange-2 micro-cracking problem could be of global concern, to RPVs worldwide.

Judge Arnold states in his dissent (LBP-15-20, Dissent at 4) that micro-cracking 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.” And nowhere do Petitioners claim that Palisades vessel components were manufactured at the facility that produced the Doel 2¹¹ and Tihange 2 forgings.

Although Palisades RPV was not fabricated at Rotterdam, the next section of the Greenpeace briefing raises further concerns that the micro-cracking was not due to RPV fabrication, but rather to ongoing reactor operations which have induced hydrogen corrosion. Moreover, 10 U.S. RPVs, deployed at operational and now decades-old nuclear power plants across the U.S. were in fact fabricated at the Rotterdam forge,¹² and yet little to no followup action has been taken, by either NRC or industry, to address the concerns raised by the micro-cracking at Doel-3 and Tihange-2.

Entergy counters (Entergy Br. at 25) that “Judge Arnold’s characterization of the Greenpeace Briefing as an “unrefereed” “editorial with no probative value” that comprises “cherry-picked alarming statements from a variety of sources” “is accurate.” But Greenpeace does not portray the Briefing as a refereed technical dissertation, nor did Petitioners present it as such. It contains extensive citations and documented conclusions. It must be considered, at a minimum, as a warning (a red flag) to the world nuclear industry, based on lessons learned in Belgium.

Entergy further quotes Judge Arnold in dissent, warning “that verifying the accuracy of the Greenpeace Briefing is ‘problematical,’ and that his ‘spot check of five citations [found] that four of them are of questionable value.’ In short, everything about the briefing—its provenance,

¹¹Judge Arnold presumably meant to refer to the Doel 3 reactor, not Doel 2.

¹²Greenpeace briefing at 4, fn. 11.

objectivity, and technical accuracy—is highly questionable.” Entergy Br. at 25.

This is a confusing accusation. No fewer than seven Greenpeace International staffers are listed at the end of the briefing, including two with primary responsibility for analyzing the Belgian nuclear power industry, where micro-cracking was first detected, at Doel-3 and Tihange-2. Greenpeace staff nuclear power analysts are found not only in Western Europe, but also in Central and Eastern Europe, as well as Japan. As reflected by this listing, Greenpeace International’s concern, well documented by the experts listed above, extends to reactor pressure vessels worldwide.

Respecting Judge Arnold’s accusation of “cherry-picking,” it is true that the Greenpeace Briefing is extensively footnoted. As of the date of this filing (August 7, 2015), all URLs or web citations in its 35 footnotes remain viable links. Countering the dissenting judge, the ASLB majority found that “review of the information cited in the Greenpeace report’s footnotes finds that it fairly represents its sources.” LBP-15-20 at 38, fn. 187. The majority finds fault with several aspects of the dissent, as revealed in that very extended footnote.¹³

¹³In its entirety, LBP-15-20 fn. 187 says as follows:

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

Notably, Judge Hirons, who voted with Chief Judge Spritzer as part of the majority on the ASLB, in favor of granting Petitioners an evidentiary hearing on the technical merits of their ductile fracture concerns, is also “a nuclear engineer by training and trade.” This is reflected by his extensive qualifications summarized at the NRC website,¹⁴ including his doctorate, his 32 years at the Los Alamos National Laboratory in a number of Reactor Technology areas, and during more than 10 years in the Nuclear Weapons and Nuclear Safeguards & Security Programs. Before coming to the Los Alamos National Laboratory, Judge Hirons was an Assistant Professor of Mechanical & Nuclear Engineering at the University of Notre Dame. His views of the evidence and regulatory concepts at stake in this proceeding directly counter Judge Arnold’s.

I. Entergy Grossly Misreads Evidence Reference To Conclude The ASLB Erred in Citing Factual Support for Petitioners’ Claim Related to Above-Normal Sulfur Content and Lower Fracture Toughness

Both Petitioners and the ASLB majority got it right in citing the authority for the assertion that the Palisades RPV has above-normal sulfur content in its plating, and consequently lower fracture toughness. Both Petitioners and the Licensing Board cite as their authority Attachment 5 to Entergy’s License Amendment Request, Westinghouse WCAP-17651-NP, Revision 0, “Palisades Nuclear Power Plant Reactor Vessel Equivalent Margins Analysis,” 2/28/2013), ML14316A208. At p. 24/45 of that .pdf, Petitioners cite a full, single-spaced page-length quotation. Petition to Intervene at 19-20. The Licensing Board states (LBP-15-20 at 27-

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.

¹⁴<http://www.nrc.gov/about-nrc/organization/panel-members.html#Hirons>

28) that “As further factual support for why generic models do not accurately reflect the unique material properties of the Palisades reactor vessel, the petitioners also note that the Palisades materials have lower fracture toughness due to the plate’s above-average sulfur content.” The ASLB majority notes the Petitioners’ authority for that claim as “Petition at 19 (citing LAR, attach. 5, at 5-2).” *Id.* At 28, fn. 137.

Perplexingly, Entergy attempts to pillory Petitioners and the ASLB majority for citing as authority a generation-old letter which contains nothing about sulfur content:

Petitioners allege that the higher sulfur content of the plates means lower fracture toughness. But their only support for this claim is a “see generally” reference to Carolina Power and Light Company’s response to a 1998 NRC request for additional information (“RAI”) involving the Robinson plant. The Robinson RAI Response, however, provides no information on the effect of sulfur content on material toughness as relevant to the EMA, and Petitioners provide no further explanation or basis.

Entergy Br. at 27. Somehow, Entergy is simply **wrong** in its attribution as to Petitioners’ lack of documentation for a key statement. That might be excusable, but Entergy completely fails to note the correct citation of authority at fn. 137 of LBP-15-20. Entergy’s focus on discrediting the ASLB majority, not to mention the Petitioners, manifestly exposes its disjoint, free-wheeling, anything-goes attacks.

V. CONCLUSION

While Petitioners agree that the statements and revelations in the Greenpeace Briefing are indeed alarming, they are not sensational, hollow, irrelevant, nor without merit. In fact, they address the very risks to public health, safety, and the environment that NRC Staff is supposed to defend against, per its mandate. The concerned public, which Petitioners represent, is certainly alarmed by the warnings raised by the Greenpeace Briefing, just as it is alarmed by the warning raised by nuclear engineer Arnold Gunderson, Petitioners’ expert.

The ultimate problems at Palisades are severe and ongoing deterioration of metallurgical properties of the metals plates and welds of the RPV, both in terms of the vessel's ability to withstand a rapid cooldown (embrittlement), or a rapid surge in heat during operations (fracture toughness/ ductile tearing). At Palisades, those temperature extremes are moving closer together, such that there is an increasingly narrow range of operating temperatures which can be afforded to Entergy as it runs the reactor.

Entergy and the NRC Staff are very desirous of substituting the power of discretionary calculations and theorizing about the state of the Palisades RPV for physical testing of the coupons in the RPV. Despite the Staff's insistence that no one and no regulation requires that physical testing take place, the evidence shows that Petitioners should be granted a hearing to demonstrate that the Staff choices here are arbitrary, manifestly unreasonable and irrational.

Applying Regulatory Guide 1.161, the Staff uses supposedly "significant conservatisms," such as the assumption that "flaws in the beltline material [are] significantly larger than have been observed in any nuclear RPV." NRC Answer at 10. In other words, although there are untested physical specimens at hand inside the Palisades RPV which could settle the question of whether PNP possesses unprecedented beltline flaws, or not, the Staff prefers to protect public health and safety by assuming flaws are there. Given the highly unique circumstances of Palisades, the Staff simply cannot tell whether its assumptions concerning flaws in the beltline are "conservative estimates," or estimates which might not be at all "conservative."

At Palisades, the Staff is indulging a sorely-untested hypothesis and the abuse of considerable discretion respecting acceptance criteria. While the Staff maintains that there is no

compulsory examination required of the metal coupons remaining in the Palisades RPV, NRC

Answer at 15, the abuse of discretion under the circumstances is manifest.

WHEREFORE, Petitioners pray the Commission affirm LBP-15-20 in all respects, and that it reject and dismiss Entergy's appeal.

Respectfully,

/s/ Terry J. Lodge
Terry J. Lodge (OH #0029271)
316 N. Michigan St., Ste. 520
Toledo, OH 43604-5627
(419) 255-7552
Fax (419) 255-7552
Tjlodge50@yahoo.com
Counsel for Petitioners

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Commission

In the Matter of:)	Docket No. 50-255-LA2
Entergy Nuclear Operations, Inc.)	ASLBP No. 15-939-04-LA-BD01
(Palisades Nuclear Plant))	August 7, 2015
Operating License Amendment Request)	

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing “PETITIONERS’ BRIEF IN OPPOSITION TO ENTERGY APPEAL OF LBP-15-20” was served by me upon the parties to this proceeding via deposit into the NRC’s Electronic Information Exchange system this 7th day of August, 2015.

/s/ Terry J. Lodge
Terry J. Lodge (OH #0029271)
316 N. Michigan St., Ste. 520
Toledo, OH 43604-5627
(419) 255-7552
Fax (419) 255-7552
Tjlodge50@yahoo.com
Counsel for Petitioners