



material issue of law or fact”<sup>3</sup> is incorrect. Petitioner indeed cannot demand adoption of a “superior alternative” to the massive carnage of impingement, entrainment and thermal shock, but when NEP requires an EIS, the Commission must take a harder look at alternatives than if the proposed action were inconsequential. *Florida Power and Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), L B-660, 14 NRC 987, 1005-1006 (1981), citing *Portland General Electric Co.* (Trojan Nuclear Plant), L B-531, 9 NRC 263 (1979). Alternatives to the proposed licensing action must be explored and evaluated whenever the proposed action will entail more than negligible environmental impacts, and when it will involve the commitment of available resources respecting which there are no unresolved conflicts.

It is indisputable that millions of fish and larvae are utterly destroyed by PBNP’s once-through system, day in and day out. That it has gone on for more than half a century has not gradually transformed entrainment and impingement, along with anthropogenic thermal rearrangement of the water column, into “negligible environmental impacts,” because it has not lessened the impacts. The effects are permanent, ongoing and cumulative. The relentless carnage must be seriously accounted for in the “hard look” at extending Point Beach Nuclear Plant (PBNP) operations an additional 20 years.

The Staff apparently believes that the 10 C.F.R. § 51.95(c)(4) requirement to determine “whether or not the adverse impacts are so great that preserving the option of renewal for energy decisionmakers would be unreasonable” has no validity against the Clean Water Act assignment of regulatory primacy over once-through systems to the Wisconsin environmental agency, the Department of Natural Resources. Pursuant to section 316(a) of the Clean Water Act (CWA),

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<sup>3</sup>*Id.*

NPDES permits may address thermal discharges into bodies of water. 33 U.S.C. § 1326(a). Section 511(c)(2) of the CW precludes the NRC from either second-guessing the conclusions in NPDES permits or imposing its own effluent limitations, thermal or otherwise. 33 U.S.C. § 1371(c)(2). NRC regulations at 10 CFR § 51.53(c)(3)(ii)(B) provide that “If the applicant’s plant utilizes [a] once-through cooling . . . system[ ], the applicant shall provide a copy of . . . [a Clean Water Act section] . . . 316a variance . . . or equivalent State permit[ ] and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock . . . .”

The timing in this subsequent license renewal is unique, because within about 60 days, the current Wisconsin approval of PBNP’s once-through cooling system, the Wisconsin Pollution Discharge Elimination System permit, will expire. At this point it is speculation that the WPDES permit will be renewed to allow continued use of PBNP’s archaic once-through cooling system.

It remains the circumstance, as the Staff acknowledges, that “With respect to mitigation, NRC license renewal guidance states that license renewal environmental reports should include ‘a brief description of alternatives considered that would reduce or avoid adverse effects.’” Mitigation alternatives are to be considered “in proportion to the significance of the impact,” and applicants “should identify all relevant, reasonable mitigation measures that could reduce or avoid adverse effects, even if they are outside the jurisdiction of the NRC.”<sup>4</sup> Moreover, at 10 CFR 51.45(c), the NRC requires the consideration of alternatives available for reducing or avoiding any adverse effects. In addition, applicants should identify any ongoing mitigation and *discuss the potential need for additional mitigation.*” (Emphasis added). NRC guidance

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<sup>4</sup>*Id.* at 23-24.

documents are routine agency policy pronouncements that do not carry the binding effect of regulations.<sup>5</sup> Interpretation from NRC guidance documents and history “may not conflict with the plain meaning of the wording used in [a] regulation,” which in the end “of course must prevail.”<sup>6</sup>

Hence the Staff’s insistence that “Cooling towers are not required by this [current] permit and Petitioner proffers no information to indicate that Wisconsin will impose that technology as a condition of the renewal of the § 316(a) variance”<sup>7</sup> is wishful thinking, not adjudicated fact.

Likewise, the Staff’s recitation of the Commission holding in *Vermont Yankee*<sup>8</sup> is unavailing:

‘In future cases where EP [or, as here, a state permitting agency] has made the necessary factual findings for approval of a specific once-through cooling system for a facility after full administrative proceedings, we expect our adjudicatory boards to do as we have done today,’ *i.e.*, defer to the agency that issued the section 316(a) permit.<sup>9</sup>

The Wisconsin agency has not at this point made “the necessary factual findings for approval of a specific once-through cooling system for a facility after full administrative proceedings.”

Staff asserts that while PSR WI proposes a “contention of omission,” “Neither NEP nor NRC regulations . . . require consideration of Petitioner’s proposed alternative because NEP’s hard look requirement is subject to a rule of reason.” Staff answer at 20. The “rule of

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<sup>5</sup>*International Uranium (US) 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). *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. They need not apply in all situations and do not themselves impose legal requirements on licensees.”).

<sup>6</sup>*Long Island Lighting Co.* (Shoreham Nuclear Station, Unit 1), L B-900, 28 NRC 275, 288-90 (1988), *review declined*, CLI-88-11, 28 NRC 603 (1988); *Graystar, Inc.*, LBP-01-7, 53 NRC 168, 186 (2001).

<sup>7</sup>*Id.*

<sup>8</sup>*Entergy Nuclear Vermont Yankee, LLC, and Energy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), CLI-07-16, 65 NRC 371, 389 (2007).

<sup>9</sup>Citing *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), CLI-78-1, 7 NRC 1, 28 n. 42 (1978).



reason, however, merely excuses the NRC from consideration of every impact that could possibly result, instead of only those that are reasonably foreseeable or have some likelihood of occurring. *Southern Nuclear Operating Company* (Early Site Permit for Vogtle ESP Site), LBP-09-7, 69 NRC 613, 631 (2007).<sup>10</sup> Impingement, entrainment and thermal pollution are intertwined, continuing effects of Point Beach’s once-through systems. They are reasonably foreseeable and fall well within the “rule of reason.”

Similarly, respecting the retrofitting of PBNP with cooling tower technology – a widely-recognized mitigation measure – “reasonable alternatives” that are technologically proven must be considered. *See Kelley v. Selin*, 42 F.3d 1501, 1521 (6th Cir. 1995) (rejecting alternative spent fuel storage technologies not sufficiently demonstrated or practicable for use under general license provisions of 10 CFR Part 72); *Natural Resources Defense Council, Inc. v. Morton*, 458 F.2d 827, 837 (D.C. Cir. 1972) (excluded from alternatives discussion of energy sources that “will be dependent on [future] environmental safeguards and [technological] developments”); *Communities, Inc. v. Busey*, 956 F.2d 619, 627 (6th Cir. 1992) (upholding rejection of alternatives as “imprudent” because of “safety hazards, [and] operational difficulties”).

The Staff dissembles at length on the matter of retrofitting cooling towers as mitigation, demonstrating an unwillingness to follow its own internal guidance or requirements.<sup>11</sup> The Staff

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<sup>10</sup>Citing *Long Island Lighting Co.* (Shoreham Nuclear Power Station), L B-156, 6 EC 831, 836 (1973).

<sup>11</sup>See Staff answer at 23, fn. 105, citing Regulatory Guide 4.2, Supp. 1, Rev. 1, “Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications,” 13 (June 2013) (ML13067-354) (“Regulatory Guide 4.2”) for the point that the Staff is “to consider the environmental impacts of alternatives, and ‘alternatives to reduce or avoid adverse environmental impacts (e.g., constructing and operating a new cooling system).’” Also, *see id.* fn. 106, also citing Regulatory Guide 4.2, § 2 for the proposition that applicants must adhere to 10 CFR § 51.45© and “consider alternatives available for reducing or avoiding any adverse effects, indicating that applicants should ‘identify any ongoing mitigation and discuss the potential need for additional mitigation,’ and that “Mitigation

clings to the belief – for it is only a matter of perception – that NextEra’s compliance with its WPDES permit ensures a “SM LL” impact, which means (to the NRC) that the “environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.” The destabilization commenced half a century ago, when Point Beach operations first “noticeably altered important attributes” of the Great Lake Michigan with impingement, entrainment and thermal discharges. The processes of noticeable alteration continue to the present. To pretend that once-through cooling has not destabilized and altered the Great Lake Michigan for decades and that more of the same is coming, is pure sophistry.

In the same bureaucratic breath, the determination by the Wisconsin DNR that the cooling water intake system is the best available technology is called an “interim determination.”<sup>12</sup> The question is, how many generations of animals and human beings must suffer environmental predation by impingement, entrainment and thermal pollution as a consequence of that temporary, “interim” determination? When does “interim” end?

**REPLY IN SUPPORT OF Contention 2: Point Beach’s continued operation violates 10 CFR Part 50, Appendix , Criterion 14 because the reactor coolant pressure boundary has not been tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture, and the aging management plan does not provide the requisite reasonable assurance.**

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alternatives should be considered in proportion to the significance of the impact,” and applicants “should identify all relevant, reasonable mitigation measures that could reduce or avoid adverse effects, even if they are outside the jurisdiction of the NRC.” In that same footnote, the Staff also cites Regulatory Guide 4.2, § 4 at p. 26 to say that applicants “should consider mitigation measures ‘to reduce or avoid adverse effects where applicable’ and identify and discuss possible mitigation measures in proportion to the significance of the adverse impact.” Also in fn. 106, the Staff points to Regulatory Guide 4.2, § 7.2 for the guidance that “alternatives considered to reducing adverse impacts typically ‘include closed-cycle cooling or intake modification options for nuclear power plants that currently use once-through cooling.’” Applicants ‘should describe the impacts of the alternatives for reducing adverse effects identified for detailed study’ and ‘analyze each alternative on a site-specific basis and in proportion to its significance.’”

<sup>12</sup>Staff answer at p. 25 fn. 115.

PBNP has admitted that it has inadequate physical samples in the form of metal capsules/coupons to enable metallurgical testing through 80 years of operation. The Point Beach units were originally constructed and outfitted with samples to last only 40 years. The failure to have designed and constructed the reactors and associated structural testing methodology for 80 years of operations further supports PSR WI's contention that PBNP is violating general design criterion 14 because of the lack of adequate samples to determine the embrittlement of the vessel and vessel internal structures within the current license extension period, not to mention an additional 20 years beyond that.

In license renewal proceedings, 10 C.F.R. Part 54 establishes the scope of the proceeding for safety concerns.<sup>13</sup> NRC regulations promulgated pursuant to the Atomic Energy Act at 10 CFR § 54.29(a) allow a renewed license to issue if “[a]ctions have been identified and have been or will be taken . . . that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB [current licensing basis],” including “managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under § 54.21(a)(1). . . .”<sup>14</sup> PSR WI maintains that the requisite reasonable assurance is lacking here, and there is a “significant link between the claimed deficiency and either the health and safety of the public or the environment.”<sup>15</sup> A pressurized thermal shock failure at PBNP could result in a Class 9 accident.

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<sup>13</sup>*PPL Susquehanna, LLC* (Susquehanna Steam Electric Station, Units 1 & 2), LBP-07-4, 65 NRC 281, 306 (2007).

<sup>14</sup>10 CFR § 54.29(a).

<sup>15</sup>*Vermont Yankee*, 60 NRC 548, 557 (2004).

Contemporaneously with the filing of this reply memorandum, PSR WI is moving for leave to amend Contention 2 in light of the newly-discovered information in the form of a recent letter sent to the NRC by the Electric Power Research Institute (“EPRI”), a nuclear industry support organization. In the March 22, 2021 letter, EPRI notified the agency that a computer software program it uses to predict the state of reactor internals embrittlement is “nonconservative.”<sup>16</sup>

PSR WI has consulted its expert witness for Contention 2, nuclear engineer Arnold Gundersen, about the significance of the EPRI notification. Gundersen, who has more than 50 years of experience in Nuclear Engineering,<sup>17</sup> has provided a Supplemental Declaration, which is attached hereto.

Mr. Gundersen had stated in his original, March 23, 2021, Declaration, and PSR WI correspondingly has pleaded in its Petition, that in recent years, the NRC has systematically removed conservative calculational aspects of the embrittlement process to allow continued operation by not removing coupons/capsules from reactor pressure vessels in order to metallurgically analyze and develop actual data on the true state of embrittlement. One of the most-embrittled reactor vessels in the country is Point Beach Unit 2.<sup>18</sup> Analysis of capsules/coupons from that reactor, as well as other embrittled reactors should be conducted in order to

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<sup>16</sup>EPRI letter to NRC, “Potential Non-Conservatism in EPRI Report, BWRVIP-100, Rev. 1- , 3002008388 and Impacted BWRVIP Reports” (March 22, 2021) ( D MS No. ML21084 164). The letter is annexed to this Reply.

<sup>17</sup>Mr. Gundersen’s *curriculum vitae* is attached to the Declaration of Arnold Gundersen (“Gundersen Declaration”) previously filed in this proceeding.

<sup>18</sup>Giessner, J., U.S. Nuclear Regulatory Commission, letter to Entergy Nuclear Operations, Inc., “Summary of the March 19, 2013, Public Meeting Webinar Regarding Palisades Nuclear Plant,” April 18, 2013 ( D MS ccession No. ML13108 336) (point #4 at p. 5/15 of .pdf).

assess whether to allow the Point Beach reactors to continue operations. For decades, the NRC has not required Point Beach and its cohorts to examine available coupons/capsules, which has deprived the NRC and the public of significant scientific data on which to justify continued reactor operations – or their termination.

Mr. Gundersen’s opinion expressed as of March 2021 was that the lack of scientific data from metallurgical analysis of capsules/coupons harvested from embrittled nuclear reactor vessels, including both Point Beach units, coupled with the sole use of computerized modeling for embrittlement analysis, has deprived the NRC of a scientific basis to justify the continued operations of the Point Beach reactors for the subsequent, and possibly even the current, license term.<sup>19</sup> Mr. Gundersen concluded that Point Beach’s continued operation violates 10 CFR Part 50 Appendix A, Criterion 14,<sup>20</sup> which requires that “[t]he reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.”

After review of the EPRI letter, Mr. Gundersen provided PSR WI a Supplemental Declaration (attached). In it, he expresses increased concern about the safe operation of the Point Beach Units. He finds as follows:

At some point during 2020, the Electric Power Research Institute (EPRI) became aware of errors in the computer codes its members use to predict the neutron embrittlement of components inside US nuclear reactors. EPRI determined that these embrittlement codes are not accurate and are under-predicting the extent of embrittlement damage to reactor components within the atomic reactor cores.

Underpredicting the damage from neutron embrittlement is definitely “non-conservative” and may create serious safety flaws if left unchecked.

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<sup>19</sup>Declaration of Arnold Gundersen (March 23, 2021) at ¶ 7.8.2.

<sup>20</sup>*Id.* at ¶ 7.8.3.

EPRI and the NRC met in private for a confidential meeting held on February 17, 2021. At that meeting, EPRI informed the NRC of its concerns about the newfound embrittlement errors in the EPRI computer code.

EPRI mailed a formal letter to the NRC on March 22, 2021, informing the NRC that it had found severe errors in one or more of its computer codes used to calculate neutron embrittlement to core internal structures.<sup>21</sup>

The EPRI letter was filed in the NRC Public Document Room (PDR) on April 2, 2021. I became aware of EPRI's letter several days later.

The EPRI letter is terse at only two pages plus five pages of attachments. Moreover, EPRI's brevity hides most of the problems it discovered under the secrecy cloak of "proprietary" material. Even with its secrecy cloak, the letter clarifies that numerous embrittlement documents are hidden from public scrutiny. While hiding most of the embrittlement problems as "proprietary," the EPRI letter also hints at significant flaws identified in analytical computer codes in use since 2016.

According to the EPRI letter:

*BWRVIP-100, Rev. 1- , published in 2016, was developed to support the evaluation of in-service flaws in BWR core shrouds. It provides fracture toughness relationships as a function of neutron fluence for BWR core shrouds. Research was carried out from 2016 to 2020 to obtain additional fracture toughness data on irradiated stainless steels with an emphasis on weld metal. **preliminary evaluation of results from this testing program, as well as the results of other applicable testing programs, indicates that the relationships published in BWRVIP-100, Rev. 1- are non-conservative in the fluence range from 5E20 n/cm2 to 3E21 n/cm2 when considering the newly acquired weld metal data...***

*As a consequence of this Transfer of Information, the **BWRVIP-235 software should not be used going forward to evaluate flaws in the weld region** of reactor internals where the accumulated fluence is greater than 5E20 n/cm2 ( $E > 1\text{MeV}$ ).*

*Recipients should evaluate their use of these EPRI products to determine if any flaw evaluations could be impacted, **possibly resulting in either a reduction in structural margins or changes in inspection frequencies** (Emphasis added).*

According to EPRI's letter, this particular revision of the flawed EPRI embrittlement code has been applied since 2016. However, analyses on real-world irradiated samples in 2020 proved that the analytical code was faulty and underestimated

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<sup>21</sup>[https://www.nrc.gov/docs/ML2108/ML21084\\_164.pdf](https://www.nrc.gov/docs/ML2108/ML21084_164.pdf)

embrittlement damage at reactors for at least five years.

The EPRI letter confirms several key concerns I identified previously in my first declaration concerning the embrittlement obstacle at Point Beach:

Mathematical modeling of neutron embrittlement is prone to errors and is frequently incorrect, creating unsafe conditions.

There is no substitute for using frequent real-world material samples to determine the actual degraded condition of a reactor's internals subject to high neutron fluence levels.

Point Beach does not have an adequate number of physical samples for NextEra to periodically sample to determine if its core internal structures will remain safe in the extended license period of 60 to 80 years.

These particular real-world embrittled samples EPRI used to assess its code came from Boiling Water Reactors. Yet, the letter's dire warning highlights my expert concern submitted in my first declaration. ***With my professional experience in nuclear reactor non-destructive inspection testing, I opine that the physical specimens and coupons at Point Beach may indeed identify that embrittlement calculations made at Point Beach are not conservative. Moreover, without testing the physical specimens and coupons at Point Beach, NextEra is severely risking public safety.***<sup>22</sup>

High neutron fluence levels similar to those identified by EPRI in the BWRs it examined are already present in the internal core structures at Point Beach. After operating for only 20 years, Point Beach realized this neutron fluence damage to internal core structures when it replaced almost 200 baffle-former bolts during the 1990s.

That replacement of almost 200 baffle-former bolts occurred more than 20 years ago, yet I cannot find any record that the baffle-former plates themselves have been tested and were replaced if warranted. Testing the baffle-former plates, which are known to have undergone high neutron fluence, should have been undertaken by NextEra at Point Beach.

***Therefore, the warning in EPRI's letter is directly applicable to the existing and projected conditions of the internal core structures at Point Beach.***

***Finally, EPRI's letter supports and amplifies my concerns previously submitted in my first declaration and reinforces my conclusion that the Point Beach vessel and internals sampling program is inadequate.***

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<sup>22</sup>Emphasis added.

***It is imperative and prudent for public safety with such an old and degraded reactor that NextEra determines through the physical sampling and testing of coupons if Point Beach may operate safely for the proposed extension.***<sup>23</sup>

Point Beach was originally designed to operate for 40 years. Its original metallurgical sampling program was established to monitor embrittlement by neutron fluence during its 40 year design life.

PSR WI's proposed amended and Substituted Contention 2 follows:

Point Beach's continued operation violates 10 CFR Part 50, Appendix B, Criterion 14 because the reactor coolant pressure boundary has not been tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture, and the aging management plan does not provide the requisite reasonable assurance. The Electric Power Research Institute has recently admitted that its computer software for predicting embrittlement in boiling water reactors is "nonconservative." Physical specimens and coupons at Point Beach may indeed prove that embrittlement calculations made at Point Beach are not conservative. Without testing the physical specimens and coupons at Point Beach, NextEra is severely risking public safety.

As PSR WI noted in its original Petition, PBNP has squandered opportunities to test coupons in the past. The NRC has failed to require timely destructive testing of capsules/coupons from PBNP for years; while there apparently is one remaining sample in Unit 2, it will not be tested until 2024, and then there will be no more available samples in either reactor.<sup>24</sup> The complete absence beyond 2024 of any means of physically measuring and analyzing embrittlement for the ensuing 36+ years of operations of both PBNP units is of grave concern to Petitioner. The reactor coolant pressure boundary has not been tested in Unit 1, and will not be

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<sup>23</sup>Emphasis added.

<sup>24</sup>From p. 1358/1528 of .pdf (p. B-150) of the "Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal Application" (ML20329 247): "The PBN standby capsules (in both Units 1 and 2) do not contain the most limiting material and there are no plans to withdraw these capsules. The current approved withdrawal of capsule is scheduled for Fall of 2024 at a fluence of 1019 n/cm<sup>2</sup>, for the 60-year license renewal period."

The referenced capsule is in Unit 2. There are no remaining capsules whatsoever to test in Unit 1, from now until the permanent termination of operations in the 2050s, see Tables 1 and 2 at p. 1208/1528 of .pdf (p. B-158).



tested, and so there is no reasonable assurance of an extremely low probability of abnormal leakage, rapidly propagating failure, and of gross rupture of the reactor vessel and internals as Criterion 14 requires. The situation of Unit 2 is only slightly better. The nonconservative uncertainty admitted by EPRI about historical use of its software to project the state of embrittlement in nuclear reactor internals, coupled with the lack of available capsules/coupons augurs in favor of admitting Contention 2 for trial. The aging-related issue of embrittlement will not be “adequately dealt with by regulatory processes” as time passes, and so it warrants review in this license renewal application proceeding.<sup>25</sup> The scope of safety review for license renewal is limited to managing the effects of aging of certain systems, structures, and components (“SSCs”)<sup>26</sup> with the aim being to provide “reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB.”<sup>27</sup> The assurance for continued operations in accordance with the Point Beach CLBs is unreasonable at this point.

**REPLY IN SUPPORT OF Contention 3: The PBNP Environmental Report fails to adequately evaluate the full potential for renewable energy sources, such as solar electric power (photovoltaics) to offset the loss of energy production from PBNP, and to make the requested license renewal action from 2030 to 2053 unnecessary.**

In sheer violation of the NRC’s NEP regulations at 10 C.F.R. § 51.53(c)(3)(iii) and 10 CFR § 51.45, the PBNP Environmental Report provides no substantial analysis of the potentially significant alternative of widespread photovoltaic solar power plus storage in the Region of

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<sup>25</sup>*PPL Susquehanna, LLC* (Susquehanna Steam Electric Station, Units 1 & 2), LBP-07-4, 65 NRC 281, 307-09 (2007).

<sup>26</sup>10 CFR § 54.29(a)(1).

<sup>27</sup>10 CFR § 54.3(a) defines “current licensing basis (CLB)” as “the set of NRC requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with and operation within applicable NRC requirements and the plant-specific design basis (including all modifications and additions to such commitments over the life of the license) that are docketed and in effect.”

Interest for the requested relicensing period of 2030 to 2053. The NRC Staff and NextEra abjectly fail in their defense of the omission.

**. The Present Commercial Viability of Photovoltaic Solar Power Is Incontestable**

The Staff cites *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-5, 75 NRC 301, 342 (2012) to argue that PSR WI “does not provide sufficient information to demonstrate that its proposed solar and storage option is commercially viable on a utility scale or that it will become so in the near future.” But the Commission holding in *Seabrook* stated:

In sum, to submit an admissible contention on energy alternatives in a license renewal proceeding, a petitioner ordinarily must provide “alleged facts or expert opinion” sufficient to raise a genuine dispute as to whether the best information available today suggests that commercially viable alternative technology (or combination of technologies) is available now, or will become so in the near future, to supply baseload power. As a general matter, a “reasonable” energy alternative — one that must be assessed in the environmental review associated with a license renewal application— is one that is currently commercially viable, or will become so in the near term.

*Id.* But PSR WI did provide an expert opinion from Dr. Ivin Compaan, an academic and photovoltaic power advocate and scientist, whose extensive qualifications are not challenged by the Staff, and who explained the industrial-scale viability of photovoltaic solar at length.

*Seabrook* does not support the Staff’s position. PSR WI’s expert declaration and facts raise a genuine dispute. The Staff has offered nothing to counter Dr. Compaan’s portrayal of the present and near-future state of industrial scale photovoltaic power. He described solar’s inexorably improving economics and explosive industrial-scale generation market penetration including, as it happens, by NextEra itself.

The NRC Staff’s and NextEra’s refutations of Contention 3 are belied by overwhelming evidence that industrial-scale photovoltaic solar is a “reasonable” energy alternative *now*; it is

“currently commercially viable” *now*. Photovoltaic solar’s *bona fides* as a “reasonable” alternative are evident, beyond a reasonable doubt. Even if there is any lingering question about the present viability of industrial photovoltaic solar energy, the Commission remains open in the NEP phase to the study of alternative power sources that would not be available until the actual period of extended operation. In *NextEra Energy Seabrook, LLC*, the Commission stated that it remained amenable to consideration of power generation alternatives that would not be available until the actual period of extended operation:

To avoid any misunderstanding, however, we hasten to add that our ruling does not exclude the possibility that a contention could show a genuine dispute with respect to a technology that, while not commercially viable at the time of the application, is under development for large-scale use and is ‘likely to’ be available during the period of extended operation. *See Carolina Env’tl. Study Grp.*, 510 F.2d at 800.

*NextEra Energy Seabrook, LLC*, 75 NRC 342 fn. 245; *affirmed*, *FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-8, 75 NRC 393, 398 fn. 27 (2012).

Thus the Atomic Safety and Licensing Board properly may rely on Dr. Compaan’s future-oriented testimony as added evidence of the likelihood of industrial-scale photovoltaic availability during the subsequent license renewal period 2030-2053.

### **B. The NRC Staff and NextEra Incorrectly Claim that PSR WI argues the Need for Power**

The NRC Staff and NextEra incorrectly read Contention 3 as a challenge to the need for the power from PBNP.<sup>28</sup> The Staff claims that “an applicant’s environmental report ‘is not required to include discussion of need for power or ... economic costs,’”<sup>29</sup> citing 10 CFR §

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<sup>28</sup>“NextEra Energy Point Beach, LLC’s Answer Opposing the Physicians for Social Responsibility Wisconsin’s Petition for Leave to Intervene and Request for Hearing” (NextEra Answer) at 35, 44; Staff Answer at 16.

<sup>29</sup>Staff Answer at 16.

51.53(c)(2) that “[t]he report is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action.” Despite acknowledging the whole text of the regulation, both the NRC Staff and NextEra thoroughly ignored the exception contained in it, which is italicized below:

*The report is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation.*

10 CFR § 51.53(c)(2) (Emphasis added).

PBNP and the Staff know full well that PSR WI is not challenging the “need” – that is, the existing demand for the power from Point Beach. PSR WI is challenging the notion that nuclear power generation is the least environmentally-harmful power source for the subsequent license extension period, and Petitioner discusses costs and benefits related to inclusion of industrial-scale photovoltaic solar as baseload power in the range of alternatives considered to replace PBNP in the no-action alternative. realistic discussion of the costs and benefits of PBNP, matched against a realistic contemporary portrayal of photovoltaic solar with storage and/or backup, is missing from the ER.

**C. NextEra’s Inappropriate Merits Arguments Exaggerate Claimed Deficits Of Industrial Photovoltaic Energy and Distort Contention Admissibility**

NextEra argues that Contention 3 is inadmissible because of PSR WI’s failure to address NextEra’s rejection of photovoltaic solar “due to the acreage requirements.”<sup>30</sup> The company complains that Petitioner’s proposal to locate solar on U.S. Conservation Reserve Program land

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<sup>30</sup>NextEra answer at 36.

as well as on rooftops throughout Wisconsin<sup>31</sup> is not permissible (as to the Conservation Reserve land) and doesn't, in any event, reduce the environmental impacts below "MODERATE to LOW RISK." NextEra states:

As a matter of common sense, installing new solar panels and electrical distribution systems on this Conservation Reserve Program land could impact those protected attributes of the land, in addition to the impacts on wildlife habitats, vegetation, land use, and aesthetics described in the ER. Yet, Compaan provides no support for his bare assertion that these impacts would be minimal. Such a conclusory assertion, even from a purported expert, cannot support a litigable contention.<sup>32</sup>

But PSR WI is not expected to completely litigate its contention at the Petition to Intervene stage. Moreover, it is well established that applicants "should identify all relevant, reasonable mitigation measures that could reduce or avoid adverse effects, even if they are outside the jurisdiction of the NRC."<sup>33</sup>

NextEra clearly is attempting to try Contention 3 as a substitute trial on the merits, on paper, without the due process guarantees attendant to a live adversarial hearing. The thrust of its arguments call upon the trier of fact to sift through NextEra's version of the facts or allegations passed off as fact, to conduct weighing, and deny admission of the contention on the ruse that it doesn't meet the NRC's "strict by design" threshold. But that's not how it's supposed to work.

At its essence, an acceptable contention need only be specific and have a basis. The standard for admitting a contention is not meant to be equivalent to the standard of evidence at a trial on the merits; the truth or falsity of the contention is reserved for adjudication. *Washington*

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<sup>31</sup>See generally NextEra answer pp. 39-41.

<sup>32</sup>*Id.* at 38.

<sup>33</sup>Regulatory Guide 4.2, Supp. 1, Rev. 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications," § .2 ("General Guidance to Applicants" at pp. 8-9) (June 2013) (ML13067-354).

*Public Power Supply System* (WPPSS Nuclear Project No. 2), L B-722, 17 NRC 546, 551 n. 5 (1983). Arguments over the interpretation of the evidence are “inappropriate in the context of a contention admissibility ruling, where we do not decide the merits or draw factual inferences in favor of the party opposing the admission of a contention.” *Detroit Edison Company* (Fermi Nuclear Power Plant, Unit 3), SLBP No. 09-880 05-BD01, LBP 10-09 (June 15, 2010) (slip op.).

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.” *Gulf States Utilities 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 *Connecticut Bankers Association v. Board of Governors*, 627 F.2d 245 (D.C. Cir. 1980).

In postulating its supposedly “SMALL” environmental impacts off against the “MODERATE to LARGE” effects of photovoltaic solar, NextEra makes it necessary for PSR WI to respond with its merits arguments. NextEra has contrived the comparison of alternatives by eliding the impacts of continued operation of PBNP Units 1 and 2 as “SMALL” compared to other power sources.

When it promulgated the 1996 License Renewal Rule, the Commission observed that “The conditional cost benefit balance has been removed from the GEIS and the rule” and that “In place of the cost-benefit balancing, the NRC will use a new standard that will require a

determination of whether or not the adverse environmental impacts of license renewal are so great, compared with the set of alternatives, that preserving the option of license renewal for future decision-makers would be unreasonable.” Final Rule, Environmental Review for Renewal of Nuclear Power Plant Licenses, 61 Fed. Reg. 28,467, 28,468 (June 5, 1996). PBNP’s ER skirts evidence tending to show that the adverse environmental effects of renewing the PBNP operating license are “so great, compared with the set of alternatives, that preserving the option of license renewal for future decisionmakers would be unreasonable.”

NRC regulations at 10 C.F.R. § 51.53(c)(2) oblige PBNP to perform a cost-benefit comparison between the proposed action of renewing PBNP’s license as against energy alternatives, *if* the environmental impacts of license renewal are great enough to tip the balance against license renewal. NextEra precludes such a cost-benefit analysis by maximizing the environmental negatives of photovoltaic solar while minimizing those of Point Beach Units 1 and 2.

These machinations are exemplified in the “combination alternative” of natural gas turbine power backing up photovoltaic solar postulated by NextEra as the solar alternative. It portends more significant impacts because of its reliance on natural gas than would the photovoltaic-as-baseload alternative envisioned by PSR WI’s expert physicist, Dr. Ivin Compaan. On Table 8.0-1 of the Environmental Report (PBNP’s “Environmental Impacts Comparison Summary” at p. 8-2), PBNP lists the existing plant’s enormous aquatic wildlife predation impacts as “SM LL” as directly compared to the “small” effects of the natural

gas/photovoltaic combination.<sup>34</sup> This is seriously misleading, if not false and impossible, since NextEra compares its unmitigated once-through aquatic carnage machine directly with a hypothetical natural gas/photovoltaic generation system featuring “natural gas combined cycle units with mechanical draft cooling towers.”<sup>35</sup> The photovoltaic systems foreseen by PSR WI don’t include natural gas turbine backup, nor would they require massive – nor indeed, any – amounts of cooling water from the Great Lake Michigan, so the NextEra comparison there would fail even more dismally.

Similarly, NextEra engages in sleight-of-hand in its representation of “waste management” on Table 8.0-1. The environmental impacts of “waste management” for both PBNP and the Combination Alternative are deemed to be “small.” It’s true that the NRC considers the environmental impacts of storing spent fuel and other radioactive waste during the license renewal term to be “small” (*see* Table B-1 of 10 C.F.R. Part 51, Subpart , Appendix B), but the agency has a very different conclusion about the environmental effects of storing and disposing of radioactive waste following the end of the license renewal term. Table B-1 references the impact assessment in NUREG-2157, the NRC’s “Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel” (Sept. 2014) (“Continued Spent Fuel Storage GEIS”). Table ES-3 of the Continued Spent Fuel Storage GEIS shows that the NRC considers the environmental impacts of at-reactor spent fuel storage to be “small to large” with

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<sup>34</sup> t NextEra answer p. 15, NextEra cites its ER conclusion “that impacts from impingement and entrainment of aquatic organisms during the proposed operating term would be SMALL” and that “ adherence to the 316(b) rule (79 FR 48300) and Wisconsin legislation (Ch. NR 111), combined with continued compliance to permit regulation with BT and ongoing studies to identify any potential concerns, will minimize the already existing SMALL impacts.”

<sup>35</sup>Environmental Report, p. 7-4.



respect to historic and cultural resources and “small to moderate” with respect to non-radioactive waste management.<sup>36</sup> Table ES-4 of the GEIS describes the environmental impacts of away-from-reactor spent fuel storage as “small to large” for historic and cultural resources, “small to moderate” for aesthetics,” “small to moderate” for non-radioactive waste management, and “small to moderate” for transportation-related traffic.<sup>37</sup> Likewise, according to Table ES-5, continued storage of spent fuel would have “small to moderate” or “small to large” adverse cumulative impacts in a variety of categories, including land use, air quality, climate change, geology and soils, surface water quality and use, groundwater quality, aquatic ecology, waste management and transportation.<sup>38</sup>

Admittedly, the NRC on Table B-1 deems the impacts during continued operations to “not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated.” But the overall environmental impacts of spent fuel are much larger and infinitely longer-lasting than the environmental negatives that would be caused by the worst imaginable photovoltaic solar scenario.

It further bears noting that by extending PBNP’s operating life an additional 20 years, the aggregate amount of radioactive and non-radioactive waste that must be handled and stored will increase commensurately and be added to the existing accumulations on site. The costs of decommissioning will similarly increase in relation to the additional onsite activities, along with the risks of spills, accidents and assorted mishaps. Unless there is explicit acknowledgment of these fundamental qualitative differences in the environmental impacts of PBNP as compared to

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<sup>36</sup>*Id.* at xlvi.

<sup>37</sup>*Id.* at lix.

<sup>38</sup>Table ES-5 at lx – lxi.

photovoltaic solar energy, NextEra's Tables 8.0-1 is utterly misrepresentative propaganda, and proves the need for a genuine cost-benefit comparison under NEP . Since no explicit acknowledgment is likely to be forthcoming from NextEra or the NRC Staff, Contention 3 must be admitted for trial to determine, objectively, the actual facts.

**REPLY IN SUPPORT OF Contention 4: PBNP has an elevated risk of a turbine missile accident owing to the poor alignment of its major buildings and structures.**

PSR WI incorporates by reference and realleges herein the contents of its original Contention 4 filing on March 23, 2021 and stands by its previous arguments. Irrespective of what the NRC Staff or NextEra consider the processes to be, the turbine shafts in Units 1 and 2 are aging and will continue to do so for a score more years in a subsequent license renewal period. In turbine missile mitigation, Petitioner's has identified both a current operating issue but also an aging management matter in the event the subsequent extension is granted.

**WHEREFORE**, PSR WI prays the Commission admit Contentions 1, 2, 3 and 4 for adjudication.

April 26, 2021

/s/ Terry J. Lodge

Terry J. Lodge, Esq.  
316 N. Michigan St., Suite 520  
Toledo, OH 43604-5627  
(419) 205-7084  
Fax (419) 932-6625  
tjlodge50@yahoo.com  
lodgelaw@yahoo.com  
Counsel for Physicians for Social Responsibility-  
Wisconsin, Petitioner

**CERTIFICATE OF SERVICE**

I hereby certify that on April 26, 2021, I deposited the foregoing "PHYSICIANS FOR SOCIAL RESPONSIBILITY WISCONSIN'S REPLY IN SUPPORT OF PETITION FOR LEAVE TO INTERVENE IN POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUBSEQUENT LICENSE RENEWAL PROCEEDING, AND REQUESTING “N  
ADJUDICATORY HEARING” in the NRC’s electronic docket of this proceeding and that  
according to the protocols of that system, it was to be automatically transmitted to all parties of  
record registered to receive electronic service.

/s/ Terry J. Lodge  
Terry J. Lodge, Esq.  
Counsel for Petitioner PSR WI

**UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION**

In the Matter of ) Docket Nos. 50-266 and 50-301  
NextEra Energy Point Beach, LLC ) NRC-2021-0021  
(Point Beach Nuclear Plant, Units 1 and 2) ) April 26, 2021  
)

\* \* \* \* \*

**SUPPLEMENTAL DECLARATION OF ARNOLD GUNDERSEN,  
NUCLEAR ENGINEER**

Under penalty of perjury, I, Arnold Gundersen, declare as follows:

1. My name is Arnold Gundersen. I am sui juris. I am over the age of 18 years old.
2. Physicians for Social Responsibility Wisconsin (PSR-WI) has retained Fairewinds Associates, Inc., of which I am an officer and employee, to review a license application to the nuclear regulatory commission to extend the licensed life of NextEra's Point Beach nuclear reactors until they have operated for 80-years, along with the related Environmental Report for NextEra Energy Point Beach, LLC's Point Beach Nuclear Plant, Units 1 and 2. My observations and conclusions are offered to a reasonable degree of scientific certainty based on my experience and relevant information sources.
3. This declaration supplements an earlier declaration I provided in this case on March 23, 2021.
4. My professional qualifications are identified in my CV that was provided to the parties in my original declaration. It is important to note that previously I served as a member of the Radiation Safety Committee and the Senior Vice President of an ASME Section XI nuclear reactor non-destructive inspection division of an NRC (Nuclear Regulatory Commission) licensed corporation (Nuclear Energy Services / NES division of PCC – Penn Central Corporation). The division I headed provided construction and outage-related inspection activities on nuclear reactor vessels and piping and reactor internal structures throughout the United States.
5. At some point during 2020, the Electric Power Research Institute (EPRI) became aware of errors in the computer codes its members use to predict the neutron embrittlement of

components inside US nuclear reactors. EPRI determined that these embrittlement codes are not accurate and are under-predicting the extent of embrittlement damage to reactor components within the atomic reactor cores.

6. Underpredicting the damage from neutron embrittlement is definitely “non-conservative” and may create serious safety flaws if left unchecked.
7. EPRI and the NRC met in private for a confidential meeting held on February 17, 2021. At that meeting, EPRI informed the NRC of its concerns about the newfound embrittlement errors in the EPRI computer code.
8. EPRI mailed a formal letter to the NRC on March 22, 2021, informing the NRC that it had found severe errors in one or more of its computer codes used to calculate neutron embrittlement to core internal structures.<sup>1</sup>
9. The EPRI letter was filed in the NRC Public Document Room (PDR) on April 2. I became aware of EPRI’s letter several days later.
10. The EPRI letter is terse at only two pages plus five pages of attachments. Moreover, EPRI’s brevity hides most of the problems it discovered under the secrecy cloak of “proprietary” material. Even with its secrecy cloak, the letter clarifies that numerous embrittlement documents are hidden from public scrutiny. While hiding most of the embrittlement problems as “proprietary”, the EPRI letter also hints at significant flaws identified in analytical computer codes in use since 2016.

According to the EPRI letter):

*BWRVIP-100, Rev. 1-A, published in 2016, was developed to support the evaluation of in-service flaws in BWR core shrouds. It provides fracture toughness relationships as a function of neutron fluence for BWR core shrouds. Research was carried out from 2016 to 2020 to obtain additional fracture toughness data*

*on irradiated stainless steels with an emphasis on weld metal. **A preliminary evaluation of results from this testing program, as well as the results of other applicable testing programs, indicates that the relationships published in BWRVIP-100, Rev. 1-A are non- conservative in the fluence range from 5E20 n/cm<sup>2</sup> to 3E21 n/cm<sup>2</sup> when considering the newly acquired weld metal data...***

1. *As a consequence of this Transfer of Information, the BWRVIP-235 software should not be used going forward to evaluate flaws in the*

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<sup>1</sup> <https://www.nrc.gov/docs/ML2108/ML21084A164.pdf>

*weld region of reactor internals where the accumulated fluence is greater than  $5E20$  n/cm<sup>2</sup> ( $E > 1\text{MeV}$ ).*

2. *Recipients should evaluate their use of these EPRI products to determine if any flaw evaluations could be impacted, **possibly resulting in either a reduction in structural margins or changes in inspection frequencies [Emphasis Added]**.*
11. According to EPRI's letter, this particular revision of the flawed EPRI embrittlement code has been applied since 2016. However, analyses on real-world irradiated samples in 2020 proved that the analytical code was faulty and underestimated embrittlement damage at reactors for at least five years.
12. The EPRI letter confirms several key concerns I identified previously in my first declaration concerning the embrittlement obstacle at Point Beach:
  - 12.1. Mathematical modeling of neutron embrittlement is prone to errors and is frequently incorrect, creating unsafe conditions.
  - 12.2. There is no substitute for using frequent real-world material samples to determine the actual degraded condition of a reactor's internals subject to high neutron fluence levels.
  - 12.3. Point Beach does not have an adequate number of physical samples for NextEra to periodically sample to determine if its core internal structures will remain safe in the extended license period of 60 to 80 years.
13. These particular real-world embrittled samples EPRI used to assess its code came from Boiling Water Reactors. Yet, the letter's dire warning highlights my expert concern submitted in my first declaration. With my professional experience in nuclear reactor non-destructive inspection testing, I opine that the physical specimens and coupons at Point Beach may indeed identify that embrittlement calculations made at Point Beach are not conservative. Moreover, without testing the physical specimens and coupons at Point Beach, NextEra is severely risking public safety.
14. High neutron fluence levels similar to those identified by EPRI in the BWRs it examined are already present in the internal core structures at Point Beach. After operating for only 20 years, Point Beach realized this neutron fluence damage to internal core structures when it replaced almost 200 baffle-former bolts during the 1990s.
15. That replacement of almost 200 baffle-former bolts occurred more than 20 years ago, yet I cannot find any record that the baffle-former plates themselves have been tested and were

replaced if warranted. Testing the baffle-former plates, which are known to have undergone high neutron fluence, should have been undertaken by NextEra at Point Beach.

16. Therefore, the warning in EPRI's letter is directly applicable to the existing and projected conditions of the internal core structures at Point Beach.
17. Finally, EPRI's letter supports and amplifies my concerns previously submitted in my first declaration and reinforces my conclusion that the Point Beach vessel and internals sampling program is inadequate.
18. It is imperative and prudent for public safety with such an old and degraded reactor that NextEra determines through the physical sampling and testing of coupons if Point Beach may operate safely for the proposed extension.
19. Point Beach was originally designed to operate for 40 years. Its original metallurgical sampling program was established to monitor embrittlement by neutron fluence during its 40 year design life.
20. Currently, Point Beach is licensed to operate for 60 years. Point Beach has applied to extend its current 60-year license for an additional 20 year period to create a total of 80 years for the continued proposed operation of the Point Beach reactor. Yet, Point Beach never had enough samples placed in the original core to support an 80 year license.

2021/04/26

Dated 2021/04/26

Arnold Gundersen

Arnold Gundersen

2021-030 \_\_\_\_\_ BWR Vessel & Internals Project (BWRVIP)

(via e-mail)

March 22, 2021

Document Control Desk  
U. S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852

Attention: Hipolito Gonzalez

Subject: Potential Non-Conservatism in EPRI Report, BWRVIP-100, Rev. 1-A,  
3002008388 and Impacted BWRVIP Reports

Reference: 1. BWRVIP-100, Revision 1-A: BWR Vessel and Internals Project, Updated  
Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core  
Shrouds. EPRI, Palo Alto, CA: 2016. 3002008388.  
2. BWRVIP-235: BWR Vessel and Internals Project, Structural Analysis  
Software for BWR Internals, DLL Version 3.1. EPRI, Palo Alto, CA: 2009.  
1018251.  
3. 10 CFR Part 21 – Transfer of Information Notice – Potential Non-  
Conservatism in EPRI Software, BWRVIP-235, 1018251, February 19, 2021.  
4. Update Regarding 10 CFR Part 21 Transfer of Information Notice – Potential  
Non-Conservatism in EPRI Software (BWRVIP-235) and Inspection and  
Evaluation Guidance for the BWR Core Shroud (BWRVIP-76 Revision 1-A,  
BWRVIP-76 Revision 2, and BWRVIP letter 2016-030)

On February 17, 2021, during an information exchange between NRC management and industry materials issues program leadership, the NRC was made aware of a potential non-conservatism in Boiling Water Reactor Vessel and Internals Project (BWRVIP) guidance on fracture toughness values for evaluation of irradiated stainless steel reactor internals components. This guidance is contained in EPRI report BWRVIP-100, Revision 1-A [1]. It was subsequently determined that, although BWRVIP-100, Revision 1-A was not prepared under EPRI's 10 CFR 50 Appendix B nuclear quality assurance (NQA) program, the report had been incorporated into another EPRI product (BWRVIP-235 [2]) that was prepared under EPRI's NQA program. As such, a 10 CFR Part 21 Transfer of Information Notice [3] was sent to EPRI members on February 19, 2021. That transfer of information notice is being provided for your information as **Attachment 1** to this letter.

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On March 19, 2021, EPRI issued an update to the original transfer of information notice [4]. This update revised a recommended action in the original notice and informed recipients of additional impacted documents that were identified during EPRI's extent of condition review. The updated transfer of information notice is also being provided for your information as Attachment 2 to this letter. Please note however that the attachments to the update transfer of information notice contain EPRI proprietary information and are not being provided at this time.

If you have any questions or need further assistance, please contact Nathan Palm by telephone at 724-288-4043 or by e-mail at [npalm@epri.com](mailto:npalm@epri.com).

Sincerely,

The image shows two handwritten signatures in black ink. The signature on the left is for Nathan Palm, and the signature on the right is for Timothy Hanley. Both signatures are cursive and appear to be written on a white background.

Nathan Palm, EPRI BWRVIP Program Manager  
Timothy Hanley, Exelon, BWRVIP Chairman

c: Robert Carter, EPRI  
Wynter McGruder, EPRI  
Robert Villegas, EPRI  
Drew Odell, Exelon  
Steve Richter, Energy Northwest  
Hipolito Gonzalez, USNRC  
David Rudland, USNRC  
Allen Hiser, USNRC



February 19, 2021

**Subject:** 10 CFR Part 21 – Transfer of Information Notice – Potential Non-Conservatism in EPRI Software, BWRVIP-235, 1018251

Dear Sir/Madam:

**References:**

1. BWRVIP-235: BWRVIP-235: BWR Vessel and Internals Project, Structural Analysis Software for BWR Internals, DLL Version 3.1. EPRI, Palo Alto, CA: 2009. 1018251.
2. BWRVIP-100, Revision 1-A: BWR Vessel and Internals Project, Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds. EPRI, Palo Alto, CA: 2016. 3002008388.

This letter is a formal Transfer of Information notification under 10 CFR Part 21.21(b) of a deviation in products supplied by EPRI. EPRI has insufficient information as to the basic product's actual use to determine if the condition described below represents a defect reportable under 10 CFR Part 21. Recipients of this letter should evaluate the condition pursuant to 10 CFR Part 21.21 (a) to determine if it could represent a substantial safety hazard, were it to remain uncorrected.

**Identified Problem**

BWRVIP-235, named DLL 3.1 [1], is a software code for evaluating flaws in BWR core shrouds and reactor internal piping components that was prepared under EPRI's 10 CFR Appendix B nuclear quality assurance (NQA) program. DLL 3.1 incorporates the methodologies specified in BWRVIP-100, Rev. 1-A [2] for the evaluation of flaws in irradiated core shroud materials. BWRVIP-100, Rev. 1-A was not prepared under EPRI's NQA program.

BWRVIP-100, Rev. 1-A, published in 2016, was developed to support the evaluation of in-service flaws in BWR core shrouds. It provides fracture toughness relationships as a function of neutron fluence for BWR core shrouds. Research was carried out from 2016 to 2020 to obtain additional fracture toughness data on irradiated stainless steels with an emphasis on weld metal.<sup>1</sup> A preliminary evaluation of results from this testing program, as well as the results of other applicable testing programs, indicates that the relationships published in BWRVIP-100, Rev. 1-A are non-conservative in the fluence range from  $5E20$  n/cm<sup>2</sup> to  $3E21$  n/cm<sup>2</sup> when considering the newly acquired weld metal data. Specifically, the lower bound fracture toughness of 50 ksi-√in specified in BWRVIP-100, Revision 1-A may be reached at a fluence of  $5E20$  n/cm<sup>2</sup> as opposed to the previously defined threshold of  $3E21$  n/cm<sup>2</sup>. This non-conservatism extends to the analysis methods contained in DLL 3.1 for evaluating flaws in irradiated core shroud materials, thus necessitating this 10 CFR Part 21 Transfer of Information.

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<sup>1</sup> Prior evaluations of fracture toughness data published in BWRVIP-100 did not distinguish between base metal, HAZ and weld, and were considered to be appropriately conservative.

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## **10 CFR Part 21 – Transfer of Information Notice – Potential Non-Conservatism in EPRI Software, BWRVIP-235, 1018251**

February 19, 2021

Page 2

### **Recommended Actions**

1. As a consequence of this Transfer of Information, the BWRVIP-235 software should not be used going forward to evaluate flaws in the weld region of reactor internals where the accumulated fluence is greater than  $5E20$  n/cm<sup>2</sup> ( $E > 1\text{MeV}$ ).
2. Recipients should evaluate their use of these EPRI products to determine if any flaw evaluations could be impacted, possibly resulting in either a reduction in structural margins or changes in inspection frequencies, specifically those components having an accumulated fluence in the range of  $5E20$  n/cm<sup>2</sup> to  $3E21$  n/cm<sup>2</sup>.
3. If BWRVIP-100, Rev. 1-A was implemented without the use of BWRVIP-235, the specific requirements associated with this 10 CFR Part 21 Transfer of Information may not be applicable. However, the potential non-conservatism of BWRVIP-100, Rev. 1-A would still need to be evaluated.

### **Corrective Actions to Be Taken by EPRI**

The BWRVIP will be working with its members to address the potential non-conservatism associated with BWRVIP-235 and BWRVIP-100, Rev. 1-A, which may include future revisions to these EPRI products. In the interim, these products have been removed from [www.epri.com](http://www.epri.com) and are no longer available for download.

If you have any technical questions, please contact Bob Carter at [bcarter@epri.com](mailto:bcarter@epri.com) or 704-595-2519 or Nathan Palm at [npalm@epri.com](mailto:npalm@epri.com) or 724-288-4043.

If you have received this letter, it is because our records indicate that you or a staff member in your organization have received BWRVIP-235. If this is incorrect, then please promptly provide this correspondence to the correct staff in your organization and notify Robert Villegas at [rvillegas@epri.com](mailto:rvillegas@epri.com) or 704-595-2787.

Sincerely,

Rick Way  
Quality Assurance Manager  
1300 West WT Harris Blvd, Charlotte NC 28262  
704-595-2679 (w) - 980-228-7613 (c)  
[rway@epri.com](mailto:rway@epri.com)

c: R. Baranwal  
S. Swilley  
K. Edsinger  
N. Palm



March 19, 2021

**Subject:** Update Regarding 10 CFR Part 21 Transfer of Information Notice – Potential Non-Conservatism in EPRI Software (BWRVIP-235) and Inspection and Evaluation Guidance for the BWR Core Shroud (BWRVIP-76 Revision 1-A, BWRVIP-76 Revision 2, and BWRVIP letter 2016-030)

Dear Sir/Madam:

**References:**

1. 10 CFR Part 21 – Transfer of Information Notice – Potential Non-Conservatism in EPRI Software, BWRVIP-235, 1018251, February 19, 2021.
2. BWRVIP-235: BWR Vessel and Internals Project, Structural Analysis Software for BWR Internals, DLL Version 3.1. EPRI, Palo Alto, CA: 2009. 1018251.
3. BWRVIP-100, Revision 1-A: BWR Vessel and Internals Project, Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds. EPRI, Palo Alto, CA: 2016. 3002008388.
4. BWRVIP-76, Revision 1-A: BWR Vessel and Internals Project: BWR Core Shroud Inspection and Flaw Evaluation Guidelines. EPRI, Palo Alto, CA: 2015. 3002005566.
5. BWRVIP-76, Revision 2: BWR Vessel and Internals Project: BWR Core Shroud Inspection and Flaw Evaluation Guidelines. EPRI, Palo Alto, CA: 2014. 3002003095
6. BWRVIP Letter 2016-030, Core Shroud Off-Axis Cracking Interim Inspection & Flaw Evaluation Guidance, March 4, 2016.

EPRI recently provided a 10 CFR Part 21 Transfer of Information Notice [1] regarding a potential non-conservatism in BWRVIP-235 [2], which is a software code that was developed under EPRI's 10 CFR Appendix B nuclear quality assurance (NQA) program. This notification was necessitated by the identification of potential non-conservatisms in BWRVIP-100, Revision 1-A [3] that were incorporated into BWRVIP-235. For reference, BWRVIP-100 Revision 1-A was not developed under EPRI's NQA program and does not formally require reporting under 10 CFR Part 21 except that information from this product was used in other EPRI products that were produced under EPRI's NQA program, including BWRVIP-235. The purpose of this letter, as an update to reference [1], is to:

- Revise a recommended action in [1] concerning BWRVIP-235 [2].
- Inform recipients of additional impacted documents that were identified during EPRI's extent of condition review.

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## **10 CFR Part 21 – Amended Transfer of Information Notice – Potential Non-Conservatism in EPRI Software, BWRVIP-235, 1018251**

March 19, 2021

Page 2

### **BWRVIP-235**

The original Transfer of Information Notice [1] stated that BWRVIP-235 software should not be used going forward to evaluate flaws in the weld region of reactor internals where the accumulated fluence is greater than  $5E20$  n/cm<sup>2</sup> ( $E>1$  MeV). EPRI has concluded that, as long as acceptable workarounds are implemented, BWRVIP-235 may continue to be used to evaluate flaws in the weld

region of reactor internals where the accumulated fluence is greater than  $5E20$  n/cm<sup>2</sup> ( $E>1$  MeV). Acceptable workarounds are provided in Attachment 1.

### **Additional Impacted Documents**

As described in Reference 1, a preliminary evaluation of results from fracture toughness testing conducted since 2016 indicates that the relationships published in BWRVIP-100, Rev. 1-A are non-conservative in the fluence range from  $5E20$  n/cm<sup>2</sup> to  $3E21$  n/cm<sup>2</sup>. Specifically, the lower bound fracture toughness of 50 ksi- $\sqrt{\text{in}}$  specified in BWRVIP-100, Revision 1-A may be reached at a fluence of  $5E20$  n/cm<sup>2</sup> as opposed to the previously defined threshold of  $3E21$  n/cm<sup>2</sup>. While performing an extent of condition review, EPRI has determined that three additional EPRI products are also impacted by the potential non-conservatism in BWRVIP-100. These are BWRVIP-76, Revision 1-A [4], BWRVIP-76, Revision 2 [5], and BWRVIP Letter 2016-030 [6].

BWRVIP-76, Revision 1-A [4] and BWRVIP-76, Revision 2 [5] provide criteria for inspection of BWR core shroud welds and the evaluation of flaws found that may be identified while performing these inspections. The methods and acceptance criteria contained in [4, 5] have been determined to use the potentially non-conservative fracture toughness values contained in BWRVIP-100, Revision 1-A. Therefore, BWRVIP-76, Revision 1-A and BWRVIP-76, Revision 2 cannot be used<sup>1</sup>, in their entirety, as written. Attachment 2 contains details of the specific impacted elements of BWRVIP-76, Revision 1-A along with recommended actions.

BWRVIP letter 2016-030 contains interim guidance for the evaluation of off-axis cracking identified in BWR core shroud welds. Off-axis flaws are those flaws that are not oriented parallel to the weld. BWRVIP letter 2016-030 contains acceptance criteria for off-axis flaws and it has been determined that these acceptance criteria were developed using the potentially non-conservative fracture toughness values contained in BWRVIP-100, Revision 1-A. Attachment 3 contains details of the specific impacted elements of BWRVIP letter 2016-030 along with recommended actions.

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<sup>1</sup> For clarity, BWRVIP-76, Rev. 1 was prepared under EPRI's 10 CFR 50 Appendix B program and has been approved for implementation by the U.S. NRC. BWRVIP-76, Rev. 2 was not prepared under EPRI's 10 CFR 50 Appendix B program and has not been approved by the U.S. NRC and further states in Section 1.4 that the inspection recommendations in this report shall not be implemented immediately upon issuance of the report. However, since BWRVIP-76, Rev. 2 does contain criteria from BWRVIP-100, Rev. 1-A, it is included with this update.

**10 CFR Part 21 – Amended Transfer of Information Notice – Potential Non-Conservatism in EPRI Software, BWRVIP-235, 1018251**

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**Corrective Actions to Be Taken by EPRI**

The BWRVIP is working with its members to address the potential non-conservatism associated with BWRVIP-235, BWRVIP-76, Rev. 1-A, BWRVIP-76, Rev. 2 and BWRVIP letter 2016-030, along with BWRVIP-100, Rev. 1-A that may result in future revisions to these EPRI products. In the interim, these products have been removed from [www.epri.com](http://www.epri.com) and are no longer available for download.

If you have any technical questions, please contact Bob Carter at [bcarter@epri.com](mailto:bcarter@epri.com) or 704-595-2519 or Nathan Palm at [npalm@epri.com](mailto:npalm@epri.com) or 724-288-4043.

If you have received this letter, it is because our records indicate that you or a staff member in your organization have received BWRVIP-235, BWRVIP-76, Rev. 1-A, BWRVIP-76, Rev. 2 and/or BWRVIP letter 2016-030. If this is incorrect, then please promptly provide this correspondence to the correct staff in your organization and notify Robert Villegas at [rvillegas@epri.com](mailto:rvillegas@epri.com) or 704-595-2787.

Sincerely,

Rick Way  
Quality Assurance Manager  
1300 West WT Harris Blvd, Charlotte NC 28262  
704-595-2679 (w) - 980-228-7613 (c)  
[rway@epri.com](mailto:rway@epri.com)

c: R. Baranwal  
S. Swilley  
K. Edsinger  
N. Palm