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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

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OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

In the Matter of)
)
Entergy Nuclear Operations, Inc.)
(Indian Point Nuclear Generating)
Units 2 and 3))

Docket Nos.
50-247-LR
and 50-286-LR

February 25, 2011

**COMBINED REPLY TO NRC STAFF AND ENTERGY'S ANSWERS
IN OPPOSITION TO CLEARWATER AND RIVERKEEPER'S JOINT
MOTION FOR LEAVE AND PETITION TO ADD NEW CONTENTIONS**

Pursuant to 10 C.F.R. § 2.309(h)(2) Hudson River Sloop Clearwater, Inc. ("Clearwater") and Riverkeeper, Inc. ("Riverkeeper") (collectively "Waste Petitioners") respectfully submit this joint combined reply to the U.S. Nuclear Regulatory Commission Staff ("NRC Staff") and Entergy Nuclear Operations, Inc ("Entergy") answers to Waste Petitioners Motion for Leave and Petition to Add New Contentions Based Upon New Information dated January 24, 2011 ("Petition to Add Waste Contentions").

PRELIMINARY STATEMENT

The recent update the waste confidence rule (the "WCD Update") shows definitively that the Commission is now unable to predict when a permanent geological repository or any other waste disposal solution will become available to accept spent fuel waste from reactors. Further, the Commission believes that it lacks sufficient generic environmental and safety work to make a generic finding that long term fuel storage is safe and environmentally protective beyond 60 years after power production ceases. Although Entergy and the NRC Staff attempt to paint this

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development as insignificant,¹ the Commission has actually made a firm prediction about when waste would leave reactor sites since 1984. Thus, this development represented a momentous shift in a settled policy that had been in place for over 25 years. The WCD Update signifies that the Commission believes that the spent nuclear fuel that is currently on-site at Indian Point, and the new spent fuel that could be created during the course of any 20 year period of extended operation, could remain on-site indefinitely or at least for the very long-term. The environmental, health and safety consequences of long-term storage and disposal of nuclear waste at the Indian Point site has have not been assessed generically or on a site-specific basis. Thus, prior to any decision regarding the relicensing of Indian Point, the National Environmental Policy Act (“NEPA”) and the Atomic Energy Act (“AEA”), require the NRC Staff and Entergy (respectively) to determine whether there is reasonable assurance of safety for long-term on-site waste storage and assess the foreseeable environmental consequences of such storage.

Now that the Commission has recognized that the waste could remain on site indefinitely, the NRC Staff and Entergy can no longer rely upon determinations that were based upon an assumption that multiple repositories would be available within 30 years after license expiration.² Therefore this Board should admit the Waste Petitioners' Contentions SC-3 and EC-

¹ See Applicant’s Answer to Clearwater and Riverkeeper’s New Contentions Concerning the Waste Confidence Rule (Feb. 18, 2011) (“Entergy Ans.”), at 13; NRC Staff’s Answer to Clearwater and Riverkeeper’s Joint Motion and Petition to Add New Contentions (Feb. 18, 2011) (“NRC Staff Ans.”)

² A single repository at Yucca Mountain would not have sufficient capacity to accommodate all the waste that is currently at reactor sites, let alone waste that has yet to be generated. Furthermore, it is apparent that the Yucca Mountain project has met its ultimate demise: it has long-faced strong opposition, has been dealt numerous blows in court, and was most recently de-funded when the Obama administration did not seek any money for it in the 2011 budget. See Steven Tetreault, *Las Vegas Review-Journal*, “Budget closes out repository”

9 that address the complete failure of the NRC Staff and Entergy to perform environmental and safety assessments of long-term storage of nuclear waste on-site at Indian Point commencing 60 years after the cessation of power operations, as NEPA and the AEA require. With regard to contentions SC-2 and EC-8, Petitioners are filing a companion petition for a waiver, based upon characterizations of the WCD Update as an “opinion” by an NRC spokesperson and upon evidence that the Commission does not have sufficient generic analyses to show that spent fuel can be safely stored for 60 years beyond the cessation of power operations.

Entergy and the NRC Staff object to the new contentions on the grounds that they are too late. This is absurd, given that they complained that similar contentions were too early when Clearwater previously filed them. The logic of the replies themselves show that because the scope of the old version of 51.23(a) (the “30 Year Rule”) left no safety or environmental issues beyond the generic finding, the Waste Petitioners could not have previously filed valid contentions asking for site-specific analyses of long-term fuel storage issues. Thus, it is clear that these contentions are timely because the gap in the scope of 51.23(a) only emerged when the WCD Update was published. Furthermore, both Entergy and the Staff misread the rules and miss that the exclusions from site-specific analysis only applies *within the scope* of the generic finding. Finally, unlike the Staff, Entergy attempts to suggest that a forthcoming rulemaking could moot the contention in the future. This is entirely illogical. An applicant's speculation

(February 15, 2011). The Commission's CFO has stated that there will be “an orderly closeout” of reviews on the project, and another Commission spokesperson expects to “wrap things up by Sept. 30.” *Id.* Reflecting this reality, the Commission stated that it “assumed, for the purposes of these [WCD] updates, that Y[ucca] M[ountain] would not be built,” and that the updates to the WCD “reflect the uncertainty regarding the timing of the availability of a geologic repository.” WCD Update at 81040.

about the future outcome of a rulemaking that has not even started cannot be the basis for excluding contentions that are currently valid.

Therefore, the Atomic Safety and Licensing Board (the "Board") should grant the Petition to Add Waste Contentions so that the environmental, health and safety concerns of on-site waste storage of waste are fully addressed prior to any relicensing decision about Indian Point.

ARGUMENT

I. The NRC Rules Allow The Contentions To Be Admitted

A. Contentions SC-3 and EC-9 Do Not Challenge NRC Rules

In requesting the admission of contentions SC-3 and EC-9, the Waste Petitioners are neither asking for a rulemaking nor challenging any generic findings. Instead, they are contending that there are site-specific and generic issues relating to the environmental and safety concerns that result from long-term storage of waste that have not been addressed at all. This is because the waste could stay on the site for longer than 60 years after power operation ceases, but the Commission has only promulgated generic findings covering the period of operation of the reactors and 60 years thereafter. *See* Generic Environmental Impact Statement for the License Renewal of Nuclear Plants, NUREG-1437 ("GEIS") and 10 C.F.R. §51.23(a). There are no generic findings that relate to the period 60 years beyond the reactor license expiring.

For example, the GEIS is a generic finding that relates primarily to the period of operation of the facility. The NRC Staff appears to have relied entirely upon the 1990 Waste Confidence rulemaking review in preparing the GEIS and even cites the Waste Confidence rule in determining that there is no significant environmental impact of storage *during the operation*

of the facility and “[o]n-site storage of spent fuel *during the term of a renewed operating license* is a Category I issue.” GEIS 6.4.6.7. (emphasis added). When read together the WCD Update and the GEIS provide a generic finding of no significant impact for on-site waste storage during the operation of the facility through 60 years beyond its licensed life. Thus, there are no generic findings regarding safety and environmental impacts of spent fuel storage beyond the 60 year time period.

In this regard, the Staff attempts to argue that the GEIS states that the environmental impacts of adding 50% more fuel to the site through 20 years of additional operation would be “small.” NRC Staff Ans. at 23. However, it is entirely unclear from the GEIS what time period of storage was assumed when this finding was adopted, which was at least prior to 2001. Because the 30 Year Rule was in place at that time, it is logical to believe the finding was based on a 30 year storage period.

This is reinforced by Commissioner Svinicki's statements about the difficulties of assessing long term storage³ and the Commission's recognition that more generic work is required beyond 60 years after license expiration. Therefore, it appears that this conclusion was based upon an assumption of a maximum of 30 years of post-license storage, in accordance with the former waste confidence rule that was in place when this generic finding was made. It is therefore inapplicable to the contentions at issue here. Making it even clearer than this generic finding is inapplicable at Indian Point, the Board has already admitted a contention regarding spent fuel pool leaks and has recognized that the leaks essentially show that the generic findings

³ See Vote of Commissioner Svinicki re SECY-09-0090-Final Update on the Commission's Waste Confidence Decision (Sept. 24, 2010), *available at* <http://nrc.gov/reading-rm/doc-collections/commission/cvr/2009/2009-0090vtr-cls.pdf> (“Svinicki Vote”)

regarding the spent fuel pools having little environmental impact are not applicable to Indian Point because they have been superseded by events like the leaks. *In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Units 2 and 3)*, 68 N.R.C. 43, (2008), *slip op.* at 182-192.

Moreover, once again, Entergy deliberately misquotes the text of the “no assessment” provision of 51.23(b). Entergy Ans. at 6. In fact, the text of this rule limits its application to “within the scope of the generic determination in paragraph (a) of this section.” 10 C.F.R. § 51.23(b). In turn, the generic finding of no safety or environmental significance is limited by 51.23(a) to the period that ends 60 years after license expiration. 10 C.F.R. § 51.23(a). Thus, the “no assessment provision” does not apply to the current situation where the Commission has found that the waste could stay on reactor sites for longer than 60 years after license expiration. The Staff does not even bother quoting the text and comes to an entirely erroneous conclusion because it fails to note the implications of the “within the scope of . . . § 51.23(b)” language. NRC Staff Ans. at 12. The Staff and Entergy make a similar error in interpreting 10 C.F.R. § 51.53(c)(2). *E.g.* NRC Staff Ans. at 12-13.

Both Entergy and the Staff make contradictory arguments regarding the issue of whether there is a regulatory gap in the WCD Update. For example, Entergy tries to assert that there is no gap, but then goes on to say that it expects that further work from the Commission will fill the gap. Entergy Ans. at 24-25. Similarly, the Staff inconsistently asserts that there are some relevant aging management programs in the License Renewal Application (“LRA”), but that long-term waste storage is beyond the scope of license renewal. NRC Staff Ans. at 30-31.

In fact, as discussed in the Petition, by commissioning additional generic work, the Commission has acknowledged that there is a gap in such work and that it is currently impossible

to have reasonable assurance that the spent fuel will leave the Indian Point site within 60 years of the end of the licenses. Entergy's unfounded speculation about the outcome of a rulemaking that has not even commenced cannot be used as a basis to curtail the Waste Petitioners right to a hearing on this issue.⁴ Furthermore, long-term waste storage was outside the scope of license renewal under the 30 Year Rule, but the WCD Update has changed that.⁵ Therefore, the Waste Petitioners have no need to cite to specific portions of the LRA or the FSEIS, because both were prepared based upon the 30 Year Rule. Because they relied on that rule to exclude any analyses of post-license expiration safety or environmental impacts, they contain no relevant information on waste management after the period of extended operation. That is precisely why the Waste Petitioners have submitted their contentions.

B. All Contentions Are Timely

With regard to timing, the contentions regarding the environmental and safety impacts of long-term fuel storage are clearly timely, because it is the newly opened gap in the scope of the WCD Update that has brought these issues into the scope of license renewal. As Entergy and the

⁴ Entergy cites *In the Matter of Duke Energy Corporation (Oconee Nuclear Station, Units 1, 2, and 3)*, 49 N.R.C. 328 (1999) for support on this point. However, that case is entirely inapplicable here, because formal notice of a proposed rule on the issue raised by that contention had been published and the final rule, resolving the issue generically, was expected within 5 months and before the completion of the LRA proceeding. The Commission therefore rejected the contention. In contrast here, the Commission has just published the WCD Update after years of deliberation and there is no schedule for an update to the WCD Update. Indeed, it appears most unlikely that such an update would be forthcoming prior to the resolution of this proceeding.

⁵ Notably, Table 3.5.2-3, cited by the Staff and Entergy, deals only with aging management of the stainless steel portions of the spent fuel pool rack during the period of extended operation. It is therefore wholly irrelevant to the contentions. The other AMPs cited by Entergy (Entergy Ans. at 21) only deal with the period of extended operation and are therefore irrelevant to the contentions. Declaration of Arnold Gundersen, dated February 25, 2011, attached as Exhibit 1 ("Gundersen Waste Decl.") at ¶¶ 32-33.

NRC point out, Clearwater attempted to have similar contentions admitted before, but the Commission rejected that attempt as premature. *E.g.* Entergy Ans. at 12-13. Thus, the Petition to Add Waste Contentions cannot now be late, as the NRC Staff and Entergy allege. Staff Ans. at 32-34; Entergy Ans. at 15-18.

Furthermore, although some of the information underlying the contentions was available at the outset of this proceeding that does not mean that the contentions are too late. For example, in the proceeding regarding the relicensing for the Vermont Yankee reactor, the panel admitted a new contention when, as here, some of the facts had been previously raised in the proceeding. The Board held in essence that where the circumstances at the time of the original pleading were insufficient for a ripe contention, a party is not foreclosed from bringing a subsequent contention on those circumstances when later discovered facts round-out the contention *Entergy Nuclear Vermont Yankee L.L.C. and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station) LBP-06-14, 63 NRC at __ (slip op. at 13)(May 25, 2006) (“new and material information is sometimes revealed in stages, so that the foundation for the contention is not reasonably apparent until the later pieces fall into place.”)

Moreover, the Staff and Entergy appear to forget that the AEA requires the NRC to provide the public an opportunity to obtain a hearing on all material issues concerning licensing. *Union of Concerned Scientists v. NRC*, 920 F.2d 50, 53 (D.C. Cir. 1990) (holding that “Section 189(a) [of the Atomic Energy Act, 42 U.S.C. 2239(a),] prohibits the NRC from preventing all parties from ever raising in a hearing a specific issue it agrees is material to [a licensing]. . . decision.”). Therefore, there has to be some time in a proceeding when contentions regarding

material issues are timely. Thus, if the waste contentions are not now timely, the Board should consider when they would have been timely.

C. The Contentions Raise Material Issues That Must Be Resolved in This Proceeding

Among other things, for a contention to be admissible a party must provide “sufficient information to show that a genuine dispute exists with regard to a material issue of law or fact, including references to specific portions of the application that the petitioner disputes, or in the case when the application is alleged to be deficient, the identification of such deficiencies and supporting reasons for this belief.” *In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Units 2 and 3)*, 68 N.R.C. 43 (2008), *slip op.* at 5-6. The threshold for admissibility is lower than the threshold required for summary disposition. *Id.* at 8. Indeed, it is well established that a licensing board should not address the merits of a contention when determining its admissibility. *Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2)*, LBP-82-106, 16 NRC 1649, 1654 (1982). The burden to show that an issue raised is material to the dispute is not onerous and only a “minimal showing that material facts are in dispute, indicating that a further inquiry is appropriate.” *Georgia Institute of Technology*, CLI-95-12, 42 N.R.C. 111, 118 (1995); *Final Rule, Rules of Practice for Domestic Licensing Proceedings – Procedural Changes in the Hearing Process*, 54 Fed. Reg. 33,171 (Aug. 11, 1989).

Both the Staff and Entergy allege that dry-cask storage will be dealt with in a separate proceeding. NRC Staff Ans. at 30; Entergy Ans. at 20-21. While that is true, the briefing below shows that law regarding segmentation under NEPA and the need for a “definitive” finding of safety under the AEA mean that this Board cannot leave the environmental and safety issues associated with dry-cask storage for another day. The Staff alone assert that long-term use of

spent fuels will also be dealt with separately. NRC Staff Ans. at 31. However, this Board has already found that a mere promise to comply with a regulation in the future is only a “plan to make a plan,” which is insufficient to moot out a current challenge to the lack of such a plan.⁶

Here, the underlying facts in dispute concern the long-term safety of high density spent fuel pools and dry casks and the import of Commissioner's latest decisions. The facts are material because NEPA and the AEA require the NRC to consider the impacts of nuclear waste storage in licensing proceedings. *Minnesota v. NRC* 602 F.2d 412 (D.C. Cir. 1979). Materiality is confirmed by Commissioner Svinicki, who approvingly quoted Judge Tamm's concurrence in *Minnesota v. NRC*, 602 F.2d 412 (D.C. Cir. 1979), which states “if the Commission determines it is not reasonably probable that an off-site waste disposal solution will be available when the licenses of the plants in question expire, it must then determine whether it is reasonably probable that spent fuel can be stored safely onsite for an indefinite period.” Svinicki Vote at 2-3 *accord Potomac Alliance v. NRC*, 682 F.2d 1030, 1038 (D.C. Cir. 1982). Furthermore, Commissioner

⁶ The Board in this case has stated that a commitment in the LRA to develop a plan does not satisfy §10 C.F.R. 54.21(c)(1). *In the Matter of Entergy Nuclear Operations, Inc.* (Indian Point Units 2 and 3), 68 N.R.C. 43, 66 (2008). In this relicensing proceeding, the State of New York (“NYS”) intervened and contended that Entergy’s Aging Management Plan (AMP) was inadequate under §10 C.F.R. 54.21(c)(1)(iii) because it did not provide details on the analytical methods and assumptions it proposed to use and attempted to delay these calculations until after the approval of the LRA. The Board admitted this contention and stated, “[w]hile the implementation of the AMP can anticipate future actions as implied [in §10 C.F.R. 54.21(c)(1)(iii)], the actual plan must be sufficient to demonstrate *the specific aging management actions* that will take place in the future, *and not just that the AMP will be developed in the future.*” *Id.* at 65 (emphasis added). Similarly, the Board in Vermont Yankee has indicated that a “plan to develop a plan” does not satisfy the license renewal requirements of 10 C.F.R. § 54.21 (c)(1)(iii). *In the Matter of Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), 64 N.R.C. 131, 186-87 (2006) (*rev'd. on other grounds*).

Svinicki recognized that indefinite waste storage would trigger the need for complex additional NEPA analysis. Svinicki Vote at 2-3.

Significantly, the importance of the requirement to perform these analyses was recently highlighted by an NRC notice relating to safety concerns with the storage of spent fuel in pools. NRC Information Notice 2009-26: Degradation of Neutron-Absorbing Materials in Spent Fuel Pool October 28, 2009, ML092440545 (“Information Notice”). The purpose of the Information Notice is to inform nuclear facilities of the deformation of Boral® panels in SFPs. The Information Notice applies to Indian Point because IP uses Boral® panels in the SFPs. Entergy’s License Renewal Application at 2.3-76 and 2.3-77. The Information Notice demonstrates that the Boral® contained in SFP racks can blister and:

the blisters could grow to a point where the water from the flux trap of the region 1 rack could be displaced with gas. This deformation has the potential to challenge dimensional assumptions made in the fuel pool criticality analysis.

Such important aging issues must be accounted for during the period commencing 60 years after the expiration of the license. To date Entergy has failed to provide adequate aging management plans for the spent fuel pool during this period and has specifically failed to provide for adequate aging management plans for the Boral panels. Gundersen Decl. at ¶¶ 15-37.

Furthermore, as discussed above, these contentions have raised a number of sharp legal disputes. First, Entergy and NRC Staff misread 51.23(b) by failing to note that its exclusion is limited to the scope of 51.23, which in turn is limited to 60 years after license expiration. Second, as discussed in more detail below, Entergy and the NRC Staff fail to apply the binding precedent of *Minn. v. NRC*. Third, Entergy and the NRC Staff erroneously allege that the Waste

Petitioners are too late in making the contentions, when the Commission rejected Clearwater's prior similar Petition as premature.

Finally, the new contentions have been supported by State of New York and strongly opposed by Entergy and the NRC Staff. The spirited debate surrounding the New Contentions demonstrates that a genuine dispute exists. Indeed, boards have found a sufficient showing of a genuine dispute solely upon the vigorous defense of an applicant in its answer. *N. Atl. Energy Serv. Corp.* (Seabrook Station, Unit 1), CLI-99-6, 49 N.R.C. 201, 219-220, *dismissed due to settlement*, CLI-99-16, 49 N.R.C. 370 (1999) (“relying upon the applicants own “vigorous response” to determine that a genuine dispute exists regarding the issue). Here not only is there a “vigorous response” from the applicant but additionally other parties have weighed in on these important issues that must be considered during these proceedings.

D. Other Objections Are Not Substantive

The NRC Staff raises no other objections to the Contentions, while Entergy raises some issues that are not substantive. For example, the contentions would require assessment of mitigation alternatives for long-term waste disposal.⁷ As discussed in the Petition, this would include assessment of the alternative of moving fuel from wet pools to dry casks. While there is a circuit split on whether NEPA requires this assessment to include the issue of terrorism, it would surely be prudent to do so. Moreover, the Waste Petitioners believe that consideration of terrorism is required by law. Irrespective of this issue, Entergy's Answer makes clear that the

⁷ *Limerick Ecology Action, Inc. v. Nuclear Regulatory Comm'n*, 869 F.2d 719, 738 (3d Cir. 1989).

generic work to date only concerns core-damage,⁸ which would be much less damaging than a spent fuel pool fire or criticality because the amount of radioactivity in the core is far less and the containment systems for radionuclides resulting from core-damage are far superior. Thus, there is clearly the need for site-specific work on whether moving fuel from wet storage to dry storage would be a preferable long-term waste storage alternative.⁹

Entergy's other objections border on the frivolous. For example, Entergy complains that the Waste Petitioners did not resubmit a declaration from Gordon Thompson that they have already submitted to the Board in this case. Entergy Ans. at 8. This attempt to elevate form over substance, merely exposes Entergy's desperation to curtail the Waste Petitioners hearing rights under the AEA and avoid a thorough examination of long-term waste storage issues in this proceeding. Entergy also suggests that the Waste Disposal Petitioners did not allege that the FSEIS was based upon the old waste confidence rule, Entergy Ans. at 9, when in fact the entire Petition for New Waste Contention was based upon that premise.

E. Even if the Contentions are Considered Untimely, They Should be Admitted Under § 2.309(c) Because the Balancing of Factors Weighs in Favor of their Admission

Entergy and the NRC Staff argue that Petitioners have not satisfied the timeliness test under 10 C.F.R. § 2.309(f)(2) and should instead be scrutinized under the stricter balancing test for untimely contentions set forth in § 2.309(c). If a new contention is timely under 10 C.F.R. § 2.309(f)(2), then the eight factors specified in § 2.309(c) need not be considered. *Vermont*

⁸ See Entergy Ans. at 15.

⁹ Entergy also makes the rather ludicrous assertion that the Waste Petitions should cite specifically to the FSEIS to show that the analysis regarding long-term waste alternatives is missing. Entergy Ans. at 15-16. Of course, this is not necessary because, as New York State pointed out, the FSEIS was compiled on the basis of the old waste confidence rule, which excluded long-term waste disposal from individual licensing proceedings.

Yankee, 62 N.R.C. 813, 821 (2005). As Petitioners have demonstrated the new contentions are timely under 10 C.F.R. § 2.309(f)(2), the standard in Section 2.309(c) does not apply. However, even if the Board accepts the argument that Petitioners' new contentions are untimely under 10 C.F.R. § 2.309(f)(2), the new contentions satisfy the requirements of 10 C.F.R. § 2.309(c).

Under 10 C.F.R. § 2.309(c), if a filing is untimely, it may still be admitted upon the balancing of eight factors:

- i) Good cause, if any, for the failure to file on time;
- ii) The nature of the requestor's/petitioner's right under the Act to be made a party to the proceeding;
- iii) The nature and extent of the requestor's/petitioner's property, financial or other interest in the proceeding;
- iv) The possible effect of any order that may be entered in the proceeding on the requestor's/petitioner's interest;
- v) The availability of other means whereby the requestor's/petitioner's interest will be protected;
- vi) The extent to which the requestor's/petitioner's interests will be represented by existing parties;
- vii) The extent to which the requestor's/petitioner's participation will broaden the issues or delay the proceeding; and
- viii) The extent to which the requestor's/petitioner's participation may reasonably be expected to assist in developing a sound record.

In evaluating the admissibility of a late-filed contention, the most important of these factors is whether good cause exists. *See Commonwealth Edison Co.*, (Braidwood Nuclear Power Station, Units 1 and 2), CLI-86-8, 23 N.R.C. 241, 244 (1986) ("It is well established in our case law that this first factor is a crucial element in the analysis of whether a late-filed contention should be admitted."). The good cause element takes into account two components: "(1) when was sufficient information reasonably available to support the submission of the late-filed contention; and (2) once the information was available, how long did it take for the contention admission

request to be prepared and filed.” *Private Fuel Storage, L.L.C.*, (Independent Spent Fuel Storage Installation), LBP-01-13, 53 N.R.C. 319, 324 (2001).

Here, Petitioners had good cause for not filing their contentions sooner: Petitioners’ contentions are based on the new and material information contained in the WCD Update. Petitioners could not have filed contentions based upon the Update until that Update was finalized. Once the Update was finalized, Petitioners filed their contentions within 30 days. The good cause element weighs heavily in favor of admitting Petitioners’ new contentions.

The other elements are also squarely satisfied. Addressing the second element, Petitioners are already parties to the proceeding. Third, both Clearwater and Riverkeeper have members who live close to the Indian Point facility. Fourth, admitting the proposed contentions are admitted could have a material effect on the licensing decision before the Commission. Fifth, Petitioners currently have no other available means to protect their interests because in the absence of an admitted contention, the analyses they seek will not be done. Sixth, existing parties will not adequately represent Petitioners’ interests because no other parties to the proceeding have any admitted contentions based on the WCD Update that would require a similar analysis. Although, as Entergy argues, the new contentions do raise some concerns related to spent fuel pool leakage and the IPEC ISFSI, these are by no means the full extent of the concerns Petitioners have associated with the WCD Update and the new assumption that spent fuel will be stored on-site indefinitely. Seventh, although admitting the contentions could delay the proceedings, not admitting them could lead to even more delay because the issues will be appealed and a Circuit Court could find, as the Board should find here, that analysis of the spent fuel issues is essential to comply with NEPA. Making this finding now, rather than much

later at the appeals level, would prevent further delay than that which is already necessary for NEPA compliance. Finally, the record at present is insufficient to allow the Commission to conclude that the environmental and safety analysis supporting the Indian Point relicensing is adequate in light of the new information provided in the WCD Update. Thus, admitting the contentions would assist the Commission in developing a sound record.

II. Even if the NRC Rules Excluded the Contentions, They Would Need To Be Admitted To Ensure That The NRC Meets Its Obligations under NEPA And The AEA

A. The NRC Is Required To Comply With the Statutes Irrespective of the Implementing Rules

Any decisions and adjudications made by the NRC must be in compliance with NEPA and the AEA. *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006); *Union of Concerned Scientists v. NRC*, 711 F. 2d 370 (D.C. Cir. 1983); and *Union of Concerned Scientists v. NRC*, 735 F.2d 1437 (D.C. Cir. 1984). While NEPA requires the NRC to consider environmental effects of its decisions, the AEA is primarily concerned with setting minimum safety standards for the licensing and operation of nuclear facilities. *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006). The two statutes impose independent obligations, so that compliance with the AEA does not excuse the agency from its NEPA obligations. *Id.*

The AEA lays out the process for consideration of the public health and safety aspects of nuclear power plant licensing, and requires the NRC to determine whether the licensing and operation of a proposed facility is "in accord with the common defense and security and will provide adequate protection to the health and safety of the public." 42 U.S.C. § 2322(a). The AEA also requires that the public must be provided an opportunity to obtain a hearing on all

material issues. *Union of Concerned Scientists v. NRC*, 920 F.2d 50, 53 (D.C. Cir. 1990). That the issues raised here are material is confirmed by Commissioner Svinicki, who approvingly quotes Judge Tamm's concurrence in *Minnesota v. NRC*, 602 F.2d 412 (D.C. Cir. 1979), which states "if the Commission determines it is not reasonably probable that an off-site waste disposal solution will be available when the licenses of the plants in question expire, it must then determine whether it is reasonably probable that spent fuel can be stored safely onsite for an indefinite period." Svinicki Vote at 2-3 accord *Potomac Alliance v. NRC*, 682 F.2d 1030, 1038 (D.C. Cir. 1982).

If the Board feels that the Commission's decisions regarding the WCD Update are unclear, it may either look to the underlying statutes and binding case law interpreting these statutes to determine the best approach or refer the Petition to the Commission once again. For example, with regard to contention SC-3, as Commissioner Svinicki has explicitly recognized, the Commission is bound by D.C. Circuit's interpretation of the AEA which requires long-term safety of on-site spent fuel storage to be addressed in the present circumstances. Similarly with regard to contention EC-9, Commissioner Svinicki recognized that the old waste confidence rule enabled the NRC to avoid undertaking a complex environmental analysis of the long-term storage of spent fuel pool waste on reactor sites that would otherwise be required by NEPA. Because the Commission has now created a regulatory gap in the WCD Update, that analysis must be done. If the Board has any doubt about this outcome it should either refer these matters to the Commission or admit the contentions and then ask the Commission whether it wishes to exercise *sua sponte* interlocutory review.

impacts. 10 C.F.R. § 51.95(c). To accomplish this, the NRC Staff prepares an EIS and Entergy prepares an environmental report to submit with its license renewal application. One of the primary goals of an EIS is to "guarantee[] that the relevant information will be made available" to the public and the States. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989).

Courts have stated that NEPA analysis must include the foreseeable effects of an environmental action. *Minn v. NRC*, 602 F.2d 412 (D.C. Cir. 1979). The starting point for analysis of an agency's compliance with NEPA is the 'rule of reason.' *Potomac Alliance v. NRC*, 682 F.2d 1030, (D.C. Cir. 1982). The "rule of reason" requires an agency to consider only the reasonably foreseeable environmental effects of the action." *Id.* at 1035.¹⁰

Courts have found that the dangers and environmental consequences of creating high level nuclear wastes require particularly close attention to satisfy NEPA. "The environmental problems attendant upon processing, transporting and storing these wastes, and other environmental issues raised by widespread deployment of [breeder reactor] power plants, warrant the most searching scrutiny under NEPA," *Scientists' Institute for Public Information, Inc. v. AEC*, 481 F.2d 1079, 1098 (D.C. Cir. 1973).

Somewhat similarly, in *Potomac v. NRC*, the NRC amended an operating license to increase the storage capacity of the spent fuel pool at a nuclear generation facility. 682 F.2d 1030 (D.C. Cir. 1982). The petitioner claimed the NRC's actions violated NEPA because it

¹⁰ Although the NRC Staff suggests that it is a settled question whether terrorism needs to be assessed under NEPA for nuclear power plants, in fact there is Circuit split on this issue. Although the Commission has stated that it takes the legal position that terrorism need not be assessed, the Waste Petitioners believe that such an assessment is both prudent and legally required.

failed to consider the long-term effects of storage on nuclear waste. The court remanded the case to the NRC to undertake a “meaningful exploration by the NRC of the dangers presented by the continuing existence of the storage pool after the final closing date of the plant.” *Id.*

Similarly, in *Minnesota v. NRC*, the issue before the court was whether the NRC is required to assess the environmental impacts of waste storage. 602 F.2d 412, 418, 420 (D.C. Cir. 1979). The Court of Appeals for the District of Columbia Circuit agreed with the petitioner’s assertion that NEPA requires the NRC to analyze the environmental impacts of on-site storage of nuclear waste:

Prior to the issuance of a license amendment permitting expansion of an on-site storage capacity, [t]he NRC must make a determination of probability that the wastes to be generated by the plants can be “safely handled and disposed of. If no “off-site” solutions (either an ultimate solution to the problem of waste disposal, or some interim solution involving storage facilities of the reactor site) is projected as probably available, the NRC must take into account the safety and environmental implications of maintaining the reactor site as nuclear waste disposal site after the expiration of the license term.

Id. at 416. The court remanded the decision to the NRC to determine whether there was reasonable assurance that an off-site storage solution would be available by 2007-2009. *Id.*

In their Answers, the NRC Staff and Entergy argue that since post-operation and dry cask storage are handled in separate proceedings they are not required to assess the safety or environmental impacts of such storage in this proceeding. *E.g.* NRC Staff Ans. at 30-31. The holding of the D.C. Circuit quoted above makes clear that this reasoning is erroneous because it would violate both the AEA and NEPA.

With regard to compliance with NEPA, just because the dry cask and post-operation storage may also be considered in separate proceedings, that does not mean their impact can be

neglected at this stage. It is well established that in determining whether a project has a significant environmental impact, an agency may not avoid significant environmental impact by improperly "segmenting" a project by dividing the NEPA analysis of a larger action with significant impacts into smaller actions with insignificant impacts. *Save Barton Creek Ass'n v. Fed. Highway Admin.*, 950 F.2d 1129, 1140 (5th Cir. 1992). "Segmentation analysis functions to weed out projects which are pretextually segmented, and for which there is no independent reason to exist. When the segmentation project has no independent jurisdiction, no life of its own, or is simply illogical when viewed in isolation, the segmentation will be held invalid." *Id.* at 1139 (internal quotation marks and emphasis omitted).

Cases concerning NRC licenses have confirmed that the NRC Staff cannot rely upon a separate proceeding to demonstrate compliance with NEPA because segmentation is not permissible under NEPA. *City of West Chicago, Illinois v. NRC*, 701 F.2d 632, (7th Cir. 1983) (the NRC could not use "piecemealing" or "segmentation" to circumvent compliance with NEPA.) Because the dry cask storage area is largely designed to allow the Indian Point reactor site to accommodate additional waste that would be generated during any period of extended operation, the analysis of its impacts cannot be separated from a licensing decision that would allow the production of those wastes.

By claiming that the two different parts are separate and distinct the NRC Staff is attempting to evade NEPA by improperly segmenting two issues that have a significant environmental impact. In any event, all work to date has relied upon the now obsolete 30 Year Rule. No work has been done on the impacts that could occur in the period commencing 60 years after license expiration. Moreover, Commissioner Svinicki recognized that the NEPA

analysis is work that needs to be done in the absence of the 30 Year Rule in accordance with *Minn. v. NRC*. Thus, whether or not the licensing of long-term waste storage in dry casks and wet pools has been or will be separately licensed, the impacts of such storage must be assessed during this licensing process.

C. The NRC is Required to Comply with the AEA

The NRC is required to comply with the AEA when issuing a license. Under the AEA, to issue a license the NRC must find that there will be "adequate protection to the health and safety of the public." 42 U.S.C. § 2232(a). This has been interpreted by NRC Commission to mean that it must be able to find "reasonable assurance that the health and safety of the public will not be endangered by operation of the facility. . . ." 10 C.F.R. § 50.35(c); see also *id.* §§ 50.40(a), 50.57(a)(3). The "reasonable assurance" standard was upheld by the Supreme Court in the landmark case of *Power Reactor Development Co. v. Int'l Union, Electrical Workers*, 367 U.S. 396, 81 S. Ct. 1529, 6 L. Ed. 2D 924 (1961). That case held that the Commission must make a "definitive finding" on safety at the time the license to operate is granted. *Id.*

When the Commission cannot predict when the waste will leave a reactor site, the NRC Staff and the applicant are obligated to analyze the safety of storing waste on-site indefinitely after the license has expired. *Minnesota v. NRC* 602 F.2d 412 (D.C. Cir. 1979). In *Minn. v. NRC*, the court remanded a petition challenging an NRC licensing decision for a determination whether there was "reasonable assurance" that spent fuel could be stored safely at sites. *Id.* Neither the NRC Staff nor Entergy has addressed the safety of long-term storage of waste at Indian Point. Thus, this showing must still be made.

In its answer, Entergy argues that the Waste Petitioners failed to specifically allege the inadequacies of the AMP and therefore SC-2 and 3 are not admissible. (Entergy Ans. at p. 18-20). However, Entergy mis-reads the contentions. SC-3 is focused on the period commencing 60 years after license expiration. Because there are no AMPs in place for the aging management of the spent fuel pools, which have many long-lived passive components, for the period that commences 60 years beyond license expiration, it is impossible for the Waste Petitioners to specifically dispute the non-existent AMPs. Instead, the Waste Petitioners are alleging that the AMPs are necessary, but missing and this must be addressed in a hearing. With regard to the dry casks, there has been no showing that the long-term aging management issues have been already dealt with in a separate licensing proceeding. In the absence of that showing, the safety of long-term dry-cask storage in addition to long-term wet spent fuel pool storage should be addressed by this proceeding, as the D.C. Circuit held in *Minn. v. NRC*.

CONCLUSION

For the reasons stated above and in the Petition for New Contentions and the Petition for an Exemption and Waiver, the Board should grant the Petition for New Contentions. In the alternative, this Board should certify a question to the NRC Commissioners for determination of whether the Commissions' recent WCD Update creates a regulatory gap that must be filled by site-specific analyses of safety and environmental issues relevant to long-term waste storage on the Indian Point site.

Respectfully submitted,

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February 25, 2011

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	Docket Nos.
)	
Entergy Nuclear Operations, Inc.)	50-247-LR
(Indian Point Nuclear Generating)	and 50-286-LR
Units 2 and 3))	
)	February 25, 2011

**HUDSON RIVER SLOOP CLEARWATER, INC. AND
RIVERKEEPER INC.'S PETITION FOR EXEMPTION FROM OR
WAIVER OF RESTRICTIONS CONTAINED IN 10 C.F.R. § 51.23(b)**

INTRODUCTION

On January 24, 2011, Hudson River Sloop Clearwater, Inc. and Riverkeeper, Inc. (hereinafter "Petitioners") filed new contentions in the above-captioned proceeding related to the safety and environmental impacts of long-term on-site nuclear waste storage at Indian Point ("Petitioners' New Waste Contentions"). These new contentions were submitted in light of the U.S. Nuclear Regulatory Commission's ("NRC") issuance of final Waste Confidence Decision update ("WCD Update") and concomitant Temporary Storage Rule revision. In response, both the applicant in the proceeding, Entergy Nuclear Operations, Inc. ("Entergy"), and NRC Staff argue that Petitioners' contentions constitute improper challenges to an NRC rule. *See* Applicant's Answer to Clearwater and Riverkeeper's New Contentions Concerning the Waste Confidence Rule (Feb. 18, 2011) ("Entergy Answer"), at 13; NRC Staff's Answer to Clearwater and Riverkeeper's Joint Motion and Petition to Add New Contentions (Feb. 18, 2011) ("NRC Staff Answer") at 19. NRC Staff criticizes Petitioners for not filing a petition for waiver. NRC Staff Answer at 19.

In the event that the Atomic Safety and Licensing Board (“ASLB”) disagrees with the arguments contained in Petitioners New Waste Contentions and Petitioners consolidated Reply to NRC Staff and Entergy’s answers (“Petitioners’ Reply”) filed concurrently herewith, which amply demonstrate the appropriateness and legality of the proffered contentions, then, in the alternative, Petitioners hereby request an exemption from or grant of a waiver of the restrictions contained in 10 C.F.R. § 51.23(b), as they apply to the issue of the impacts of long-term onsite waste storage at Indian Point.¹ The following establishes the less onerous showing required for an exemption and the requisite *prima facie* showing required for a waiver.

ARGUMENT

A. Petitioners Should Be Exempted From the Requirements of 10 C.F.R. § 51.23(b) Pursuant to The Provisions of 10 C.F.R. § 51.6

Recognizing the difficulty of creating regulations that can accommodate all circumstances, the NRC included 10 C.F.R. § 51.6 to allow “any interested person” to seek an exemption from a specific requirement of Part 51. There can be no doubt that the Petitioners are interested in this issue since it involves issues that have been at the heart of their Indian Point advocacy. There is also no question that Petitioners are each a “person” within the meaning of

¹ Notably, a spokesperson for NRC has characterized the NRC’s final Waste Confidence Rule as a mere opinion, rather than a rule allowing safe on-site storage. See Matthew L. Wald, *3 States Challenge Federal Policy on Storing Nuclear Waste*, New York Times, Feb. 15, 2011, available at, http://www.nytimes.com/2011/02/16/nyregion/16nuke.html?_r=1&scp=1&sq=Waste%20new%20york%20nuclear&st=cse (“David McIntyre, a spokesman for the Nuclear Regulatory Commission, said the lawsuit by the attorneys general had mischaracterized the nature of the December decision. He described it as a commission ‘opinion’ on how long waste could be safely stored rather than a rule permitting any plant to store spent fuel”). Thus, a waiver or exemption would not appear to be necessary on that basis, and for the various reasons articulated in Petitioners’ New Waste Contentions and Petitioners’ Reply. However, out of an abundance of caution, Petitioners herein demonstrate that, if necessary, exemption and/or waiver is appropriate.

the regulations: "Person means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency . . .". 10 C.F.R. § 2.4.

Part 51 exemptions may be granted where the Commission "determines [the exemption is] authorized by law and [is] otherwise in the public interest." 10 C.F.R. § 51.6. To the extent environmental and safety impacts of spent fuel storage at the Indian Point site after plant shutdown are deemed to be "within the scope of the generic determination in paragraph (a)" of § 51.23 (which Petitioners' New Waste Contentions and Petitioners Reply demonstrate is not the case) Petitioners may not raise any environmental impacts associated with such storage in the license renewal proceeding. 10 C.F.R. § 51.23(b). Petitioners, therefore, seek an exemption from that requirement.

A thorough evaluation of the potential environmental impacts of a proposed action and the environmental benefits of the "no action alternative" are requirements of NRC Regulations, 10 C.F.R. Part 51, President's Council on Environmental Quality ("CEQ") Regulations, 40 C.F.R. Part 1502, and the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 et seq. Petitioners' Reply further elucidates this point and shows that the Atomic Energy Act ("AEA") also requires a full analysis of the safety implications of long-term waste disposal before any renewed license may be granted. Thus, allowing a full discussion of the consequences of the proposed license renewal is not only authorized but required by law. Section 51.23(b) should not stand in the way.

Allowing a full analysis of the waste storage impacts of license renewal at Indian Point is strongly in the public interest, because there are grave public concerns about this issue. It is also in the interests of Entergy, because avoidance of environmental impacts and prevention of accidents is far more economical than post-spill or accident clean up.

Finally, the Commission has been very liberal in granting these exemptions. Entergy was granted an exemption to fire protection requirements for Indian Point when a fire barrier that was supposed to provide one hour of fire protection only actually provided 20 minutes of protection.² Exelon Corporation, owner of the Oyster Creek Generating Station, was even granted an exemption to the requirement that applicants must file their applications five years in advance of license expiration to get the advantage of the administrative extension provisions.³ Moreover, the Appeals Board found that licensing proceedings are governed by a “cardinal rule of fairness.” Houston Lighting & Power Co. (Allens Creek Nuclear Generating Station, Unit 1), ALAB-565, 10 N.R.C. 521, 524 (1979). In the light of these decisions, it would violate that cardinal rule of fairness to impose a high bar on petitioners alone. Instead, the “cardinal rule of fairness” requires that Petitioners are given similarly liberal treatment and to the extent necessary are granted an exemption from the strict requirements of the rules excluding consideration of the safety and environmental impacts of onsite nuclear waste storage.

B. Petitioners Should Be Granted A Waiver Pursuant to 10 C.F.R. § 2.335(b)

Should the ASLB determine that an exemption from the restrictions of § 51.23(b) is not warranted, Petitioners request a waiver from such restrictions.

i. Requirements for a Waiver

The process for seeking waiver of a regulation is set forth in 10 C.F.R. § 2.335(b) and provides, in relevant part:

A party to an adjudicatory proceeding subject to this part may petition that the application of a specified Commission rule or regulation . . . be waived or an exception made for the particular proceeding. The sole ground for petition of waiver or exception is

² See *Brodsky v. Nuclear Regulatory Commission*, 578 F. 3d 175, 177 (2d Cir. 2009).

³ See, e.g., NRC News Release No. 04-163, dated December 16, 2004, *available at*, <http://www.nrc.gov/reading-rm/doc-collections/news/2004/04-163.html>

that special circumstances with respect to the subject matter of the particular proceeding are such that the application of the rule or regulation (or a provision of it) would not serve the purposes for which the rule or regulation was adopted. The petition must be accompanied by an affidavit that identifies the specific aspect or aspects of the subject matter of the proceeding as to which the application of the rule or regulation (or provision of it) would not serve the purposes for which the rule or regulation was adopted. The affidavit must state with particularity the special circumstances alleged to justify the waiver or exception requested.

10 C.F.R. § 2.335(b). The Commission has also expanded on these regulatory requirements, stating in the context of the potential waiver of a safety related regulation, that to grant waiver,

we must first conclude . . . that (i) the rule's strict application "would not serve the purposes for which [it] was adopted;" (ii) the movant has alleged "special circumstances" that were "not considered, either explicitly or by necessary implication, in the rulemaking proceeding leading to the rule sought to be waived;" (iii) those circumstances are "unique" to the facility rather than "common to a large class of facilities"; and (iv) a waiver of the regulation is necessary to reach a "significant safety⁴ problem."

Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3) CLI-05-24, 62 NRC 551, 559-60 (2005) (footnotes omitted); *see also Pacific Gas & Electric Company* (Diablo Canyon Nuclear Power Plant, Units 1 and 2) LBP-10-15 (August 4, 2010) at 9; *Tennessee Valley Authority* (Watts Bar Unit 2) LBP-10-12 (Memorandum And Order (Denial of Petition to Waive 10 C.F.R. §§ 51.53(b), 51.95(b), 51.106(c) in the Watts Bar Operating License Proceeding) (July 29, 2010) at 3. For the following reasons, Petitioners meet all the requirements necessary to warrant the requested waiver.

⁴ The issue in the *Dominion* case involved safety. When applied to safety and environmental issues, as here, it would be reasonable to require a showing that the environmental impact is significant as well.

- ii. *Strict enforcement of the requirements of 10 C.F.R. § 51.23(b) in this proceeding will not serve the purposes of the regulation and exclude consideration of special circumstances not considered in the rulemaking*

One purpose of the updated Temporary Storage Rule, now codified at 10 C.F.R. § 51.23(b) is to address the impacts of post-operation on-site nuclear waste storage. However, as demonstrated by Petitioners newly proffered contentions and Petitioners' Reply, substantial site-specific implications of long term storage of spent nuclear fuel at Indian Point have not been evaluated, explicitly or by implication, in either the Waste Confidence Decision Update, including earlier versions, in the Final Safety Evaluation Report in this proceeding, or in the Final Supplemental Environmental Impact Statement ("FSEIS") in this case. Those substantial site-specific impacts are discussed at length in Petitioners' New Waste Contentions, and in the Declaration of Arnold Gundersen, accompanying Petitioner's Reply and this Petition (Feb. 25, 2011) ("Gundersen Declaration").

The contentions demonstrate that allowing Indian Point to operate for an additional 20 years, generating additional spent fuel that will remain at the site, has the potential to cause substantial safety and environmental impacts. *See* Petitioners' New Waste Contentions at 33-40. For example, Petitioners New Waste Contentions explain how neither Entergy, nor the NRC Staff have assessed the impacts of ongoing leaks of radioactivity from existing spent fuel pools getting worse over the long term, the long term degradation of the Boraflex or other wrapping around the fuel assemblies in the spent fuel pools, or the risk of a spontaneous propagating spent fuel pool fires occurring. *See id.* at 35-36. The Gundersen Declaration further demonstrates in great detail Entergy and NRC Staff's inadequate assessment of critical aging management issues in the Indian Point license renewal proceeding. *See* Gundersen Declaration.

Moreover, the analysis that forms the basis for the restrictions contained in 10 C.F.R. § 51.23(b) at maximum looks generically at wet pool storage for only 60 years. *See* Memorandum from R.W. Borchardt (Executive Director for Operations) to NRC Commissioners, Re: Project Plan for the Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel (June 15, 2010) at 12, ADAMS Accession Nos. ML101390413, ML101390426 (discussing as yet unknown feasibility of storing spent nuclear fuel in pools beyond 60 years). Thus, there is no generic *or* site-specific analysis relating to the storage of nuclear waste at Indian Point for the period of time after 60 years of spent fuel pool operation. This corresponds to the end of the period of extended operation. As the WCD Update makes clear, waste will stay on the site long after the end of that period. *See* Petitioners' New Waste Contentions at 28-29. Thus, application of 10 C.F.R. § 51.23(b) to preclude site-specific analysis during the instant license renewal proceeding clearly would not serve the purpose of the rule.

iii. The circumstances are "unique" to Indian Point and will result in significant impacts

The litany of site-specific impacts left unaddressed by the Waste Confidence Decision manifest uniquely at Indian Point. For example, the contamination resulting from the radioactive leaks from the spent fuel pools at Indian Point is indisputably leaching to the Hudson River, a unique river estuary system of major environmental significance to the New York region. Notably, Indian Point is located right in the vicinity of Haverstraw Bay, a New York State designated Essential Fish Habitat and Significant Coastal Fish and Wildlife Habitat. This is a unique environment not present at other nuclear reactor sites. Thus, the environmental impacts that would foreseeably occur once Indian Point stops operating as the result of decades of continued

pool storage necessitate site-specific review, to ensure that the unique surrounding ecosystem is accounted for.⁵

Similarly, any aging management/safety related impacts are unique to Indian Point because of the starkly different location of the facility in comparison to other nuclear plants: Indian Point has a uniquely high population density because of its proximity to New York City.⁶ So, for example, impacts resulting from spent fuel pool fires or criticalities, which have potentially far spread ramifications,⁷ will impact a uniquely large number of people. Thus, site-specific review of any and all safety and environmental impacts resulting from long term onsite storage of nuclear waste is necessary in light of the unique position of the Indian Point plant.

Thus, Petitioners urge the ASLB to conclude Petitioners have made a *prima facie* case that such site-specific impacts should be allowed to be considered in this license renewal proceeding. While it is true that conceptually the impacts of long-term onsite nuclear waste storage could occur at other plant sites, that does not turn the impacts of such storage at Indian Point into a generic one: as demonstrated above and in Petitioners New Waste Contentions, such

⁵ The NRC's proposed revision of the Generic EIS for license renewal such that the impacts of inadvertent radiological leaks would be a site-specific Category 2 issue further supports this. See Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report — Draft Report for Comment (NUREG-1437, Revision 1, Volume 1), at 4-46, 4-47, available at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/r1/v1/index.html>.

⁶ Indian Point, located just 24 miles north of New York City, (35 miles north of Times Square) tops the list as the nuclear power plant with the greatest population density within a 10-mile radius (at least 300,000) and 50-mile radius (approximately 20 million people). See James Lee Witt Associates, LLC, Review of Emergency Preparedness of Areas Adjacent to Indian Point and Millstone (2003), at 4, 81-82.

⁷ The environmental impacts of a fire in a spent fuel pool may be severe, extending over a geographic area larger than a state's legal boundaries and continuing for decades. See generally Gordon R. Thompson, Risk Related Impacts from Continued Operation of the Indian Point Nuclear Power Plants (Institute for Resource and Security Studies) (November 28, 2007); see also German Reactor Safety Org., *Protection of German Nuclear Power Plants Against the Background of the Terrorist Attacks in the U.S. on Sept. 11, 2001* (Nov. 27, 2002) (finding that large jetliners crashing into nuclear facilities under different scenarios could cause uncontrollable situations and the release of radiation).

impacts will vary depending upon site-specific considerations. The unique characteristics surrounding Indian Point will result in significant impacts from the storage of nuclear waste, necessitating a site-specific assessment.

- iv. The Commission has suggested that Waiver of 10 C.F.R. § 51.23(b) may be appropriate*

When the NRC issued its revised Waste Confidence Decision Update, numerous commenters, including Riverkeeper, commented upon various site-specific impacts associated with the anticipated long term storage of spent fuel at reactor sites after plant shutdown. In response to comments about potential site-specific environmental impacts associated with storage of spent fuel at the reactor site after plant shutdown, the Commission suggested that 10 C.F.R. § 2.335 might offer a vehicle to allow the review of site-specific impacts. *See* Waste Confidence Decision Update RIN 3150-AI47 and NRC-2008-0482 Consideration of Environmental Impacts of NRC-2008-0404 Temporary Storage of Spent Fuel After Cessation of Reactor Operation, 75 Fed. Reg. 81032, 81044 (“10 CFR 2.335(b) provides that a party to an adjudicatory proceeding may petition for the waiver of the application of the rule or for an exception for that particular proceeding”); *id.* at 81050 (“The Commission already has a rule, 10 CFR 2.335, that allows a party to an adjudicatory proceeding to seek a waiver or exception to a rule where its application would not serve the purposes for which the rule was adopted”); *id.* at 81057 (“Site-specific circumstances may require a site specific analysis; the Commission has provided for these situations through its regulations in 10 CFR 2.335, which allows parties to adjudicatory proceedings to petition for the waiver of or an exception to a rule in a particular proceeding The 10 CFR 2.335 waiver process is intended to address the circumstances that the [NYS] Attorney General claims are present at Indian Point; and the adjudicatory proceeding for the Indian Point license renewal, not this rulemaking, is the proper venue to raise these

issues). Thus, the site-specific issues raised herein, as supported by Petitioners' New Waste Contentions and Petitioners' Reply are appropriate for a waiver petition.

CONCLUSION

For the foregoing reasons, the ASLB should grant Petitioners an exemption from or waiver of the restrictions contained in 10 C.F.R. § 51.23(b) as they apply to the issue of the impacts of long-term onsite waste storage at Indian Point.

Respectfully submitted,

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February 25, 2011

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

In the Matter of)	
)	Docket Nos.
Entergy Nuclear Operations, Inc.)	50-247-LR
(Indian Point Nuclear Generating)	and 50-286-LR
Units 2 and 3))	
)	February 25, 2011

Declaration of Manna Jo Green

Pursuant to 28 U.S.C. § 1746, Manna Jo Green hereby declares as follows:

1. I am the Environmental Director for Hudson River Sloop Clearwater, Inc., (“Clearwater”) and representative for Clearwater in the above-captioned proceeding.
2. I submit this declaration in accordance with 10 C.F.R. § 2.335(b) in support of Clearwater and Riverkeeper’s Petition for Waiver of the Restrictions Contained in 10 C.F.R. § 51.23(b).
3. The application of 10 C.F.R. § 51.23(b) in the instant proceeding would not serve the purposes for which the rule was adopted, including the purpose of the rule to address and analyze all the impacts of post-operation on-site nuclear waste storage, because substantial site-specific implications of long term storage of spent nuclear fuel at Indian Point have not been evaluated either explicitly or by implication, in either the Waste Confidence Decision Update (“WCD Update”), including earlier versions, in the Final Safety Evaluation Report in this proceeding, or in the Final Supplemental Environmental Impact Statement (“FSEIS”) in this case.

4. Allowing Indian Point to operate for an additional 20 years, generating additional spent fuel that will remain at the site, has the potential to cause substantial safety and environmental impacts, including but not limited to:

- Impacts of ongoing and future radioactive leaks from the Indian Point spent fuel pools;
- The long-term degradation of the Boraflex or other wrapping around the fuel assemblies in the spent fuel pools, and other fuel rack related safety risks, as described more fully in the accompanying Declaration of Arnold Gundersen (Feb. 25, 2011);
- The risk of a spontaneous propagating spent fuel pool fire.

5. Applying 10 C.F.R. § 51.23(b) to the instant proceeding also does not serve the purposes of the rule because the generic analyses forming the basis for the rule only apply to 60 years of pool storage. *See* Memorandum from R.W. Borchardt (Executive Director for Operations) to NRC Commissioners, Re: Project Plan for the Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel (June 15, 2010) at 12, ADAMS Accession Nos. ML101390413, ML101390426 (discussing as yet unknown feasibility of storing spent nuclear fuel in pools beyond 60 years). Thus, there is no generic or site-specific analysis relating to the storage of nuclear waste at Indian Point for the period of time after 60 years of spent fuel pool operation, i.e. the end of the period of operation, even though the WCD Update makes clear that waste will stay on the site long after the end of that period. *See* Petitioners' New Waste Contentions at 28-29.

6. Numerous special circumstances surrounding Indian Point justify waiver of 10 C.F.R. § 51.23(b) in this proceeding, including the following.

7. The contamination resulting from the radioactive leaks from the spent fuel pools at Indian Point is indisputably leaching to the Hudson River, a unique river estuary system of major environmental significance to the New York region. Notably, Indian Point is located right in the vicinity of Haverstraw Bay, a New York State designated Essential Fish Habitat and Significant Coastal Fish and Wildlife Habitat. This is a unique environment not present at other nuclear reactor sites. Thus, the environmental impacts that would foreseeably occur once Indian Point stops operating as the result of decades of continued pool storage necessitate site-specific review, to ensure that the unique surrounding ecosystem is accounted for.

8. Any aging management/safety related impacts are unique to Indian Point because of the starkly different location of the facility in comparison to other nuclear plants: Indian Point has a uniquely high population density because of its proximity to New York City (300,000 within a 10-mile radius of the plant and about 20 million within a 50-mile radius, *see* James Lee Witt Associates, LLC, Review of Emergency Preparedness of Areas Adjacent to Indian Point and Millstone (2003), at 4, 81-82). So, for example, impacts resulting from spent fuel pool fires or criticalities, which have potentially far spread ramifications, will impact a uniquely large number of people. Thus, site-specific review of any and all safety and environmental impacts resulting from long term onsite storage of nuclear waste is necessary in light of the unique position of the Indian Point plant.

9. Based on the foregoing, it is clear that applying the restrictions set forth in 10 C.F.R. § 51.23(b) would not serve the purposes for which the rule was adopted and that special circumstances justify the requested waiver.

10. I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 25, 2011.

Manna Jo Greene

Manna Jo Greene

February 25, 2011

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
Entergy Nuclear Operations, Inc.) Docket Nos. 50-247-LR/286-LR
)
Indian Point Nuclear Power Plants)
Units 2 and 3)

EXPERT WITNESS DECLARATION OF ARNOLD GUNDERSEN
REGARDING AGING MANAGEMENT OF NUCLEAR FUEL RACKS

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. Riverkeeper has retained me as an expert witness. I have been asked to examine the aging management issues of the fuel racks at Indian Point Units 2 and 3.
3. I earned my Bachelor's Degree in Nuclear Engineering from Rensselaer Polytechnic Institute (RPI) cum laude. I earned my Master's Degree in Nuclear Engineering from RPI via an Atomic Energy Commission Fellowship.
4. I began my career as a reactor operator and instructor in 1971 and progressed to the position of Senior Vice President for a nuclear licensee prior to becoming a nuclear engineering consultant and expert witness. My Curriculum Vitae is Attachment 1.
5. I have qualified as an expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), in Federal Court, the State of Vermont Public Service

Board, the State of Vermont Environmental Court, and the Florida Public Service Commission.

6. I am an author of the first edition of the Department of Energy (DOE) Decommissioning Handbook.
7. I have more than 38-years of professional nuclear experience *including and not limited to*: Cooling Tower Operation, Cooling Tower Plumes, Consumptive Water Loss, Nuclear Plant Operation, Nuclear Management, Nuclear Safety Assessments, Reliability Engineering, In-service Inspection, Criticality Analysis, Licensing, Engineering Management, Thermohydraulics, Radioactive Waste Processes, Decommissioning, Waste Disposal, Structural Engineering Assessments, Nuclear Fuel Rack Design and Manufacturing, Nuclear Equipment Design and Manufacturing, Prudency Defense, Employee Awareness Programs, Public Relations, Contract Administration, Technical Patents, Archival Storage and Document Control, Source Term Reconstruction, Dose Assessment, Whistleblower Protection, and NRC Regulations and Enforcement.
8. I am employed by Fairewinds Associates, Inc, a paralegal services and expert witness firm. My title is chief engineer.

Introduction

9. As a Vice President with Nuclear Energy Services (NES), a division of The Penn Central Corporation (PCC), and later as its Senior Vice President, I was responsible for its Engineering and Engineered Products divisions.
10. The Engineering and Engineered Products divisions of NES designed and fabricated nuclear fuel racks for dozens of nuclear power plants throughout the United States.
11. The NES fuel racks used boroflex neutron absorbers sandwiched between stainless steel. The time period when I was responsible for this NES effort was between 1981 and 1990.

12. The NES division reporting to me also performed criticality calculations on these spent fuel racks.
13. Due to my direct working knowledge and expertise in this area, I can state with certainty that the K-effective criticality calculations conducted by this division and by our competitors did not include any aging issues related to long-term degradation of the boron neutron absorber.
14. Furthermore, neither NES nor other competitors ever assumed that the boron would slip and gradually move downward over time when k-effective calculations were performed.

Indian Point

15. My review of the Indian Point docket confirms that the record shows that boroflex neutron absorbers have indeed experienced degradation problems that were unanticipated when the racks were designed, constructed, and installed.
16. In my review of *the 2001 08 27 Indian Point 2 Operating License Transferred to Entergy* (ML012250459), I found several inaccuracies that I will discuss in my testimony.

3.1.4.2 Spent Fuel Storage Limitations

On April 30, 2001, Con Edison submitted to the NRC a business plan, for years 2001 - 2005, that addresses many of the current and future challenges to the operation of the IP2 facility. In the business plan, Con Edison made the following statement:

At present, Indian Point is licensed to operate until 2013. However, the plant's spent fuel pool can hold assemblies only until 2002. This issue has been exacerbated by the degradation of the spent fuel storage rack liner boron (Boraflex). Therefore, additional fuel storage is needed earlier than anticipated last year. Even premature shutdown of the plant would entail the continued operation of the Spent Fuel Pool at a cost of approximately xx million or more per year until the pool is emptied. All utilities operating nuclear plants have paid fees to the Department of Energy (DOE) for the development of a spent fuel storage facility. Unfortunately, for a variety of reasons, the DOE will not be able to receive spent fuel until 2010, at the earliest.

Entergy Nuclear IP2, and ENO responded to this request in a letter dated June 6, 2001. In their response, the applicants noted that Con Edison is already in the process of addressing the Boraflex issue and evaluating potential solutions in order to regain storage locations within the SFP that are now considered to be unusable. Among the options being reviewed are: taking credit for soluble boron in the SFP water; and, taking credit for pre-discharge burn-up of the fuel stored in the SFP⁵. The response states that the ongoing activities to address spent fuel storage at IP2 are expected to provide sufficient storage capacity to retain full core off-load capability until just before the 2006 refueling outage. Entergy Nuclear IP2 and ENO also stated that, after closing, they will, implement appropriate actions to regain the storage spaces affected by Boraflex degradation and will pursue both on-site and off-site storage options. The applicants stated further that the costs of dry cask storage have been accounted for in the financial projections provided to the NRC in the application.

[Footnote 5 Above]⁵ Design analyses for spent fuel storage typically make the conservative assumptions that (1) the fuel within the SFP is all new fuel, which is more reactive than used (burned) fuel; and, (2) the water in the SFP is pure water. These assumptions lead to SFP rack designs that will, through their own inherent design features, prevent criticality in the SFP (Boraflex is one of those design features). In reality, except for just prior to, and during, a refueling outage, the fuel in the SFP has typically all experienced some burn-up and, thus, is less reactive. Additionally, the water in the SFP contains dissolved boron (soluble boron), a neutron absorber, that provides additional margin in preventing criticality in the SFP.

(ML012250459 page 20 of enclosure 4, 60th page of pdf file)

17. My experience with criticality design indicates that the statements above are incorrect for specific unanalyzed fuel configurations, and in fact an inadvertent criticality is possible under certain circumstances if the boroflex is degraded.
18. In particular, my experience managing the design of spent fuel racks indicates that there are circumstances when new fuel criticality is possible unless the boroflex retains its integrity.
19. More specifically, new fuel that is temporarily stored in spent fuel racks prior to loading it into the reactor may have an inadvertent criticality. The design as analyzed appears to be over moderated and not conservatively analyzed. In other words, as the concentration density decreases in the water surrounding the new fuel, K-effective may rise because there is less borated water and more reliance is placed

- upon the boroflex to absorb the spent fuel pool with its additional burden of fresh fuel.
20. Indian Point's boroflex has indeed become degraded. Based upon my direct knowledge of criticality analyses performed on Cray super computers, the evidence shows the k-effective for new fuel stored on spent fuel racks in the spent fuel pool, the worst-case conditions in the scenario quoted above have not been adequately analyzed for Indian Point Units 2 and 3, even if the Boroflex had retained its integrity.
 21. Furthermore, in my experience, in the event that there are steam voids in the water caused by fire or inadequate cooling, criticality is possible unless the boroflex retains complete integrity.
 22. My personal knowledge of spent fuel rack criticality shows that the worst-case criticality occurs when the new fuel is surrounded by 90-percent-water and 10-percent-voids.
 23. In my professional opinion, and based upon my professional experience as delineated in this declaration, the *NRC's Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3* is inadequate in its assessment of criticality issues (k-effective). adequately addresses
 24. The criticality issues (k-effective) associated with the storage of new fuel in spent fuel racks where the boroflex is degraded, as it appears to be at Indian Point, has not been adequately analyzed and/or addressed in the *NRC's Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3*.
 25. More specifically, boroflex aging is not managed by the Indian Point's aging management program, rather Entergy watches as the boron degrades, according to the Boroflex Monitoring Program detailed in the *NRC Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 Docket Nos. 50-247 and 50-286* Entergy Nuclear Operations, Inc.

3.0.3.2.3 Boraflex Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.3 describes the existing Boraflex Monitoring Program as consistent with GALL AMP XI.M22, "Boraflex Monitoring," with exceptions.

The Boraflex Monitoring Program prevents degradation of the Boraflex panels in the spent fuel racks from compromising the criticality analysis supporting the design of the spent fuel storage racks. The program relies on 1) areal density testing, 2) a predictive computer code, and 3) determination of boron loss through correlation of silica levels in spent fuel water samples to maintain the required five percent subcriticality margin. Corrective actions follow if test results find that the five percent subcriticality margin cannot be maintained because of current or projected Boraflex degradation. This program applies to IP2 only as no Boraflex is used for criticality control of IP3 spent fuel.....

Conclusion. On the basis of its review of the applicant's Boraflex Monitoring Program, the staff determines that those program elements, for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the program is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this program and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

26. Table 3.5.2-3, cited by the Staff and Entergy, appears to deal only with aging management of the stainless steel portions of the spent fuel pool rack during the period of extended operation and leaves the boroflex degradation issue completely unanalyzed.
27. Boroflex will continue to degrade despite the institution of any aging management program to the stainless steel within the fuel racks. Therefore, any fuel rack aging management program is wholly irrelevant to my contention because it still neglects the significant industry-wide issue of boroflex degradation. The other aging management programs (AMPs) cited by Entergy (Entergy Ans. at 21) also are not applicable to the unique condition of boroflex degradation because Entergy has only reviewed the anticipated period of extended operation rather than a complete

operational history, and are therefore are also irrelevant to the aforementioned contentions.

28. Due to the industry-wide issue of boroflex degradation, on February 16, 2011 the NRC issued *NRC Information Notice 2011-03: Nonconservative Criticality Safety Analyses For Fuel Storage* that discusses the issue of k-effective criticality. (ML103090055)

Both of these uncertainties, if not properly treated, may lead to non-conservative estimation of the maximum k-effective, and regulatory compliance may not be assured. Analyses with small margins to the regulatory limit are especially vulnerable to noncompliance with 10 CFR 50.68 and non-conservative technical specifications if these issues are present.

29. In *NRC Information Notice 2011-03*, the NRC itself acknowledges that there is a very small margin between criticality and non-criticality in densely packed spent nuclear fuel racks and that calculational uncertainties may indeed exceed the margin of difference.
30. Additionally, the October 28, 2009 *NRC Information Notice 2009-26: Degradation Of Neutron-Absorbing Materials In The Spent Fuel Pool* highlights the problems associated with degradation of boron used as a neutron absorber in a nuclear fuel rack. In this notice, the NRC alerts the nuclear industry that in certain circumstances more than 60-percent of the boron may have dissolved from the absorber. (ML092440545)

The licensee performed in situ Boron-10 Areal Density Gauge for Evaluating Racks (BADGER) testing of approximately 2 percent of the storage locations, which revealed that the Boron-10 areal density of the SFP racks was, at a minimum, approximately one-third of its original design value.

31. Furthermore, *NRC Information Notice 2009-26* also warns the nuclear power generators that “The exact degradation mechanism or mechanisms are not clearly understood...” and in some circumstances the Boral® contained in SFP racks can blister and “the blisters could grow to a point where the water from the flux trap of the region 1 rack could be displaced with gas. This deformation has the potential to challenge dimensional assumptions made in the fuel pool criticality analysis.”

32. Finally, because there is no legal requirement that the fuel in the Indian Point Units 2 and 3 spent fuel pools is removed at shutdown, the fuel may remain in the spent fuel pool long after Entergy's Indian Point license extension and its associated aging management programs have ended, maybe for decades after the eventual shut down of the nuclear power plants. Neither the aging management program nor any other license or license application document address this scenario.
33. In summary, Entergy has failed to provide adequate aging management plans for the spent fuel pool during this period and has specifically failed to create an aging management program for the spent fuel pool Boral panels.

Conclusion

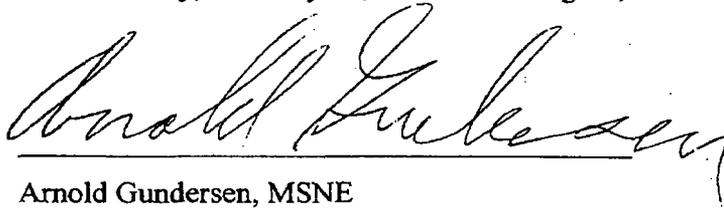
34. My experience analyzing rack criticality indicates that a conservative criticality analysis does not appear to have been completed for the Indian Point Units 2 and 3 Fuel Racks.
35. More importantly, the lack of a conservative criticality analysis is compounded by the continuing degradation of boron absorbers in the Indian Point Units 2 and 3 fuel racks.
36. Finally, the NRC itself has issued a series of information notices alerting the nuclear power generators to spent fuel rack physical failures (identified in Information Notice 2009-26) and spent fuel rack analytical failures identified in (Information Notice 2011-03)
37. In conclusion, the evidence shows that the spent fuel pool aging management programs for the period of extended operation are inadequate to assure inadvertent criticality and the generic findings regarding 60-years of safe and minimal impact storage are not applicable to the spent fuel pool at Indian Point Units 2 and 3.

Attachments:

Attachment 1 – Curriculum Vitae

I declare under penalty of perjury that the foregoing is true and correct.

Executed this day, February 25, 2011 at Burlington, Vermont.

A handwritten signature in cursive script, appearing to read "Arnold Gundersen". The signature is written in black ink and is positioned above a horizontal line.

Arnold Gundersen, MSNE

Chief Engineer, Fairewinds Associates, Inc

CURRICULUM VITAE
Arnold Gundersen
Chief Engineer, Fairewinds Associates, Inc
February 2011

Education and Training

ME NE	Master of Engineering Nuclear Engineering Rensselaer Polytechnic Institute, 1972 U.S. Atomic Energy Commission Fellowship Thesis: Cooling Tower Plume Rise
BS NE	Bachelor of Science Nuclear Engineering Rensselaer Polytechnic Institute, Cum Laude, 1971 James J. Kerrigan Scholar
RO	Licensed Reactor Operator, U.S. Atomic Energy Commission License # OP-3014

Qualifications – including and not limited to:

- Chief Engineer, Fairewinds Associates, Inc
- Nuclear Engineering, Safety, and Reliability Expert
- Federal and Congressional hearing testimony and Expert Witness testimony
- Former Senior Vice President Nuclear Licensee
- Former Licensed Reactor Operator
- 39-years of nuclear industry experience and oversight
 - Nuclear engineering management assessment and prudence assessment
 - Nuclear power plant licensing and permitting – assessment and review
 - Nuclear safety assessments, source term reconstructions, dose assessments, criticality analysis, and thermohydraulics
 - Contract administration, assessment and review
 - Systems engineering and structural engineering assessments
 - Cooling tower operation, cooling tower plumes, thermal discharge assessment, and consumptive water use
 - Nuclear fuel rack design and manufacturing, nuclear equipment design and manufacturing, and technical patents
 - Radioactive waste processes, storage issue assessment, waste disposal and decommissioning experience
 - Reliability engineering and aging plant management assessments, in-service inspection
 - Employee awareness programs, whistleblower protection, and public communications
 - Quality Assurance (QA) & records

Publications

- Co-author — *Fairewinds Associates 2009-2010 Summary to JFC, July 26, 2010* State of Vermont, Joint Fiscal Office, (<http://www.leg.state.vt.us/jfo/envy.aspx>).
- Co-author — *Supplemental Report of the Public Oversight Panel Regarding the Comprehensive Reliability Assessment of the Vermont Yankee Nuclear Power Plant July 20, 2010*, to the Vermont State Legislature by the Vermont Yankee Public Oversight Panel.

- Co-author — The Second Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding buried pipe and tank issues at Entergy Nuclear Vermont Yankee and Entergy proposed Enexus spinoff. See two reports: *Fairewinds Associates 2nd Quarterly Report to JFC* and *Enexus Review by Fairewinds Associates*.
- Author — Fairewinds Associates, Inc *First Quarterly Report to the Joint Legislative Committee*, October 19, 2009.
- Co-author — *Report of the Public Oversight Panel Regarding the Comprehensive Reliability Assessment of the Vermont Yankee Nuclear Power Plant*, March 17, 2009, to the Vermont State Legislature by the Vermont Yankee Public Oversight Panel.
- Co-author — *Vermont Yankee Comprehensive Vertical Audit – VYCVVA – Recommended Methodology to Thoroughly Assess Reliability and Safety Issues at Entergy Nuclear Vermont Yankee, January 30, 2008 Testimony to Finance Committee Vermont Senate*.
- Co-author — *Decommissioning Vermont Yankee – Stage 2 Analysis of the Vermont Yankee Decommissioning Fund – The Decommissioning Fund Gap*, December 2007, Fairewinds Associates, Inc. Presented to Vermont State Senators and Legislators.
- Co-author — *Decommissioning the Vermont Yankee Nuclear Power Plant: An Analysis of Vermont Yankee's Decommissioning Fund and Its Projected Decommissioning Costs*, November 2007, Fairewinds Associates, Inc.
- Co-author — *DOE Decommissioning Handbook, First Edition*, 1981-1982, invited author.

Patents

Energy Absorbing Turbine Missile Shield – U.S. Patent # 4,397,608 – 8/9/1983

Committee Memberships

Vermont Yankee Public Oversight Panel, appointed 2008 by President Pro-Tem Vermont Senate
 National Nuclear Safety Network – Founding Board Member
 Three Rivers Community College – Nuclear Academic Advisory Board
 Connecticut Low Level Radioactive Waste Advisory Committee – 10 years, founding member
 Radiation Safety Committee, NRC Licensee – founding member
 ANSI N-198, Solid Radioactive Waste Processing Systems

Honors

U.S. Atomic Energy Commission Fellowship, 1972
 B.S. Degree, Cum Laude, RPI, 1971, 1st in nuclear engineering class
 Tau Beta Pi (Engineering Honor Society), RPI, 1969 – 1 of 5 in sophomore class of 700
 James J. Kerrigan Scholar 1967–1971
 Teacher of the Year – 2000, Marvelwood School
 Publicly commended to U.S. Senate by NRC Chairman, Ivan Selin, in May 1993 – “It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service.”

Expert Witness Testimony and Nuclear Engineering Analysis and Consulting

Vermont State Nuclear Advisory Panel (VSNAP) – February 22, 2011
 Testimony and presentation entitled the *Vermont Yankee Public Oversight Panel Supplemental Report* regarding management issues at the Vermont Yankee Nuclear Power Plant to the reconvened Vermont State Nuclear Advisory Panel.

Vermont State Legislature Senate Committee On Natural Resources And Energy

February 8, 2011. Testimony: *Vermont Yankee Leaks and Implications*.

(<http://www.leg.state.vt.us/jfo/envy.aspx>)

Vermont State Legislature – January 26, 2011

House Committee On Natural Resources And Energy, and
Senate Committee On Natural Resources And Energy

Testimony regarding Fairewinds Associates, Inc's report: *Decommissioning the Vermont Yankee Nuclear Power Plant and Storing Its Radioactive Waste*

(<http://www.leg.state.vt.us/jfo/envy.aspx>). Additional testimony was also given regarding the newest radioactive isotopic leak at the Vermont Yankee nuclear power plant.

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy

Nuclear Vermont Yankee Decommissioning the Vermont Yankee Nuclear Power Plant and Storing Its Radioactive Waste January 2011. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards (NRC-ACRS) AP1000 Sub-Committee

Nuclear Containment Failures: Ramifications for the AP1000 Containment Design, Supplemental Report submitted December 21, 2010. (<http://fairewinds.com/reports>)

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy

Nuclear Vermont Yankee Reliability Oversight Entergy Nuclear Vermont Yankee, December 6, 2010. Discussion regarding the leaks at Vermont Yankee and the ongoing monitoring of those leaks and ENVY's progress addressing the 90-items identified in Act 189 that require remediation. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Declaration Of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contention Regarding Consumptive Water Use At Dominion Power's Newly Proposed North Anna Unit 3 Pressurized Water Reactor in the matter of Dominion Virginia Power North Anna Power Station Unit 3 Docket No. 52-017 Combined License Application ASLBP#08-863-01-COL, October 2, 2010.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Declaration Of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's New Contention Regarding AP1000 Containment Integrity On The Vogtle Nuclear Power Plant Units 3 And 4 in the matter of the Southern Nuclear Operating Company Vogtle Electric Generating Plant, Units 3&4 Combined License Application, Docket Nos. 52-025-COL and 52-026-COL and ASLB No. 09-873-01-COL-BD01, August 13, 2010.

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – July 26, 2010

Summation for 2009 to 2010 Legislative Year For the Joint Fiscal Committee Reliability Oversight Entergy Nuclear Vermont Yankee (ENVY) Fairewinds Associates 2009-2010. This summary includes an assessment of ENVY's progress (as of July 1, 2010) toward meeting the

milestones outlined by the Act 189 Vermont Yankee Public Oversight Panel in its March 2009 report to the Legislature, the new milestones that have been added since the incident with the tritium leak and buried underground pipes, and the new reliability challenges facing ENY, Entergy, and the State of Vermont. (<http://www.leg.state.vt.us/jfo/envy.aspx>)

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Declaration Of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions in the matter of Dominion Virginia Power North Anna Station Unit 3 Combined License Application, Docket No. 52-017, ASLBP#08-863-01-COL, July 23, 2010.

Florida Public Service Commission (FPSC)

Licensing and construction delays due to problems with the newly designed Westinghouse AP1000 reactors in *Direct Testimony In Re: Nuclear Plant Cost Recovery Clause By The Southern Alliance For Clean Energy (SACE)*, FPSC Docket No. 100009-EI, July 8, 2010.

U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards (NRC-ACRS) AP1000 Sub-Committee

Presentation to ACRS regarding design flaw in AP1000 Containment – June 25, 2010
Power Point Presentation: <http://fairewinds.com/content/ap1000-nuclear-design-flaw-addressed-to-nrc-acrs>.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Second Declaration Of Arnold Gundersen Supporting Supplemental Petition Of Intervenors Contention 15: DTE COLA Lacks Statutorily Required Cohesive QA Program – June 8, 2010.

NRC Chairman Gregory Jaczko, ACRS, Secretary of Energy Chu, and the White House Office of Management and Budget

AP1000 Containment Leakage Report Fairewinds Associates - Gundersen, Hausler, 4-21-2010.
This report, commissioned by the AP1000 Oversight Group, analyzes a potential flaw in the containment of the AP1000 reactor design.

Vermont State Legislature House Committee On Natural Resources And Energy – April 5, 2010
Testified to the House Committee On Natural Resources And Energy regarding discrepancies in Entergy's TLG Services decommissioning analysis. See *Fairewinds Cost Comparison TLG Decommissioning* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee – February 22, 2010

The Second Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding buried pipe and tank issues at Entergy Nuclear Vermont Yankee and Entergy proposed Enexus spinoff. See two reports: *Fairewinds Associates 2nd Quarterly Report to JFC* and *Enexus Review by Fairewinds Associates*. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Senate Natural Resources – February 16, 2010

Testified to Senate Natural Resources Committee regarding causes and severity of tritium leak in unreported buried underground pipes, status of Enexus spinoff proposal, and health effects of tritium.

Vermont State Legislature Senate Natural Resources – February 10, 2010

Testified to Senate Natural Resources Committee regarding causes and severity of tritium leak in unreported buried underground pipes. <http://www.youtube.com/watch?v=36HJiBrJSxE>

Vermont State Legislature Senate Finance – February 10, 2010

Testified to Senate Finance Committee regarding *A Chronicle of Issues Regarding Buried Tanks and Underground Piping at VT Yankee*. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature House Committee On Natural Resources And Energy – January 27, 2010

A Chronicle of Issues Regarding Buried Tanks and Underground Piping at VT Yankee. (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Submittal to Susquehanna River Basin Commission, by Eric Epstein – January 5, 2010

Expert Witness Report Of Arnold Gundersen Regarding Consumptive Water Use Of The Susquehanna River By The Proposed PPL Bell Bend Nuclear Power Plant In the Matter of RE: Bell Bend Nuclear Power Plant Application for Groundwater Withdrawal Application for Consumptive Use BNP-2009-073.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Declaration of Arnold Gundersen Supporting Supplemental Petition of Intervenors Contention 15: Detroit Edison COLA Lacks Statutorily Required Cohesive QA Program, December 8, 2009.

U.S. NRC Region III Allegation Filed by Missouri Coalition for the Environment

Expert Witness Report entitled: *Comments on the Callaway Special Inspection by NRC Regarding the May 25, 2009 Failure of its Auxiliary Feedwater System, November 9, 2009.*

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee

Oral testimony given to the Vermont State Legislature Joint Fiscal Committee October 28, 2009. See report: *Quarterly Status Report - ENVY Reliability Oversight for JFO* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Vermont State Legislature Joint Fiscal Committee Legislative Consultant Regarding Entergy Nuclear Vermont Yankee

The First Quarterly Report by Fairewinds Associates, Inc to the Joint Legislative Committee regarding reliability issues at Entergy Nuclear Vermont Yankee, issued October 19, 2009. See report: *Quarterly Status Report - ENVY Reliability Oversight for JFO* (<http://www.leg.state.vt.us/jfo/envy.aspx>).

Florida Public Service Commission (FPSC)

Gave direct oral testimony to the FPSC in hearings in Tallahassee, FL, September 8 and 10, 2009 in support of Southern Alliance for Clean Energy (SACE) contention of anticipated licensing and construction delays in newly designed Westinghouse AP 1000 reactors proposed by Progress Energy Florida and Florida Power and Light (FPL).

Florida Public Service Commission (FPSC)

NRC announced delays confirming my original testimony to FPSC detailed below. My supplemental testimony alerted FPSC to NRC confirmation of my original testimony regarding licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Supplemental Testimony In Re: Nuclear Plant Cost Recovery Clause By The Southern Alliance For Clean Energy*, FPSC Docket No. 090009-EI, August 12, 2009.

Florida Public Service Commission (FPSC)

Licensing and construction delays due to problems with the newly designed Westinghouse AP 1000 reactors in *Direct Testimony In Re: Nuclear Plant Cost Recovery Clause By The Southern Alliance For Clean Energy (SACE)*, FPSC Docket No. 090009-EI, July 15, 2009.

Vermont State Legislature Joint Fiscal Committee Expert Witness Oversight Role for Entergy Nuclear Vermont Yankee (ENVY)

Contracted by the Joint Fiscal Committee of the Vermont State Legislature as an expert witness to oversee the compliance of ENVY to reliability issues uncovered during the 2009 legislative session by the Vermont Yankee Public Oversight Panel of which I was appointed a member along with former NRC Commissioner Peter Bradford for one year from July 2008 to 2009. Entergy Nuclear Vermont Yankee (ENVY) is currently under review by Vermont State Legislature to determine if it should receive a Certificate for Public Good (CPG) to extend its operational license for another 20-years. Vermont is the only state in the country that has legislatively created the CPG authorization for a nuclear power plant. Act 160 was passed to ascertain ENVY's ability to run reliably for an additional 20 years. Appointment from July 2009 to May 2010.

U.S. Nuclear Regulatory Commission

Expert Witness Declaration regarding Combined Operating License Application (COLA) at North Anna Unit 3 *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions* (June 26, 2009).

U.S. Nuclear Regulatory Commission

Expert Witness Declaration regarding Through-wall Penetration of Containment Liner and Inspection Techniques of the Containment Liner at Beaver Valley Unit 1 Nuclear Power Plant *Declaration of Arnold Gundersen Supporting Citizen Power's Petition* (May 25, 2009).

U.S. Nuclear Regulatory Commission

Expert Witness Declaration regarding Quality Assurance and Configuration Management at Bellefonte Nuclear Plant *Declaration of Arnold Gundersen Supporting Blue Ridge Environmental Defense League's Contentions in their Petition for Intervention and Request for Hearing*, May 6, 2009.

Pennsylvania Statehouse

Expert Witness Analysis presented in formal presentation at the Pennsylvania Statehouse, March 26, 2009 regarding actual releases from Three Mile Island Nuclear Accident. Presentation may be found at: <http://www.tmia.com/march26>

Vermont Legislative Testimony and Formal Report for 2009 Legislative Session

As a member of the Vermont Yankee Public Oversight Panel, I spent almost eight months examining the Vermont Yankee Nuclear Power Plant and the legislatively ordered Comprehensive Vertical Audit. Panel submitted Act 189 Public Oversight Panel Report March 17, 2009 and oral testimony to a joint hearing of the Senate Finance and House Committee On Natural Resources And Energy March 19, 2009. (See: <http://www.leg.state.vt.us/JFO/Vermont%20Yankee.htm>)

Finestone v FPL (11/2003 to 12/2008) Federal Court

Plaintiffs' Expert Witness for Federal Court Case with Attorney Nancy LaVista, from the firm Lytal, Reiter, Fountain, Clark, Williams, West Palm Beach, FL. This case involved two plaintiffs in cancer cluster of 40 families alleging that illegal radiation releases from nearby nuclear power plant caused children's cancers. Production request, discovery review, preparation of deposition questions and attendance at Defendant's experts for deposition, preparation of expert witness testimony, preparation for Daubert Hearings, ongoing technical oversight, source term reconstruction and appeal to Circuit Court.

U.S. Nuclear Regulatory Commission Advisory Committee Reactor Safeguards (NRC-ACRS)

Expert Witness providing oral testimony regarding Millstone Point Unit 3 (MP3) Containment issues in hearings regarding the Application to Uprate Power at MP3 by Dominion Nuclear, Washington, and DC. (July 8-9, 2008).

Appointed by President Pro-Tem of Vermont Senate to Legislatively Authorized Nuclear Reliability Public Oversight Panel

To oversee Comprehensive Vertical Audit of Entergy Nuclear Vermont Yankee (Act 189) and testify to State Legislature during 2009 session regarding operational reliability of ENVY in relation to its 20-year license extension application. (July 2, 2008 to present).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Expert Witness providing testimony regarding *Pilgrim Watch's Petition for Contention 1 Underground Pipes* (April 10, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Expert Witness supporting *Connecticut Coalition Against Millstone In Its Petition For Leave To Intervene, Request For Hearing, And Contentions Against Dominion Nuclear Connecticut Inc.'s Millstone Power Station Unit 3 License Amendment Request For Stretch Power Uprate* (March 15, 2008).

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
Expert Witness supporting *Pilgrim Watch's Petition For Contention 1: specific to issues regarding the integrity of Pilgrim Nuclear Power Station's underground pipes and the ability of Pilgrim's Aging Management Program to determine their integrity.* (January 26, 2008).

Vermont State House – 2008 Legislative Session

- House Committee on Natural Resources and Energy – Comprehensive Vertical Audit: *Why NRC Recommends a Vertical Audit for Aging Plants Like Entergy Nuclear Vermont Yankee (ENVY)*
- House Committee on Commerce – Decommissioning Testimony

Vermont State Senate – 2008 Legislative Session

- Senate Finance – testimony regarding Entergy Nuclear Vermont Yankee Decommissioning Fund
- Senate Finance – testimony on the necessity for a Comprehensive Vertical Audit (CVA) of Entergy Nuclear Vermont Yankee
- House Committee on Natural Resources and Energy – testimony regarding the placement of high-level nuclear fuel on the banks of the Connecticut River in Vernon, VT

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)
MOX Limited Appearance Statement to Judges Michael C. Farrar (Chairman), Lawrence G. McDade, and Nicholas G. Trikouros for the “Petitioners”: Nuclear Watch South, the Blue Ridge Environmental Defense League, and Nuclear Information & Resource Service in support of *Contention 2: Accidental Release of Radionuclides, requesting a hearing concerning faulty accident consequence assessments made for the MOX plutonium fuel factory proposed for the Savannah River Site.* (September 14, 2007).

Appeal to the Vermont Supreme Court (March 2006 to 2007)

Expert Witness Testimony in support of *New England Coalition's Appeal to the Vermont Supreme Court Concerning: Degraded Reliability at Entergy Nuclear Vermont Yankee as a Result of the Power Uprate.* New England Coalition represented by Attorney Ron Shems of Burlington, VT.

State of Vermont Environmental Court (Docket 89-4-06-vtec 2007)

Expert witness retained by New England Coalition to review Entergy and Vermont Yankee's analysis of alternative methods to reduce the heat discharged by Vermont Yankee into the Connecticut River. Provided Vermont's Environmental Court with analysis of alternative methods systematically applied throughout the nuclear industry to reduce the heat discharged by nuclear power plants into nearby bodies of water and avoid consumptive water use. This report included a review of the condenser and cooling tower modifications.

U.S. Senator Bernie Sanders and Congressman Peter Welch (2007)

Briefed Senator Sanders, Congressman Welch and their staff members regarding technical and engineering issues, reliability and aging management concerns, regulatory compliance, waste storage, and nuclear power reactor safety issues confronting the U.S. nuclear energy industry.

State of Vermont Legislative Testimony to Senate Finance Committee (2006)

Testimony to the Senate Finance Committee regarding Vermont Yankee decommissioning costs, reliability issues, design life of the plant, and emergency planning issues.

U.S. Nuclear Regulatory Commission Atomic Safety and Licensing Board (NRC-ASLB)

Expert witness retained by New England Coalition to provide Atomic Safety and Licensing Board with an independent analysis of the integrity of the Vermont Yankee Nuclear Power Plant condenser (2006).

U.S. Senators Jeffords and Leahy (2003 to 2005)

Provided the Senators and their staffs with periodic overview regarding technical, reliability, compliance, and safety issues at Entergy Nuclear Vermont Yankee (ENVY).

10CFR 2.206 filed with the Nuclear Regulatory Commission (July 2004)

Filed 10CFR 2.206 petition with NRC requesting confirmation of Vermont Yankee's compliance with General Design Criteria.

State of Vermont Public Service Board (April 2003 to May 2004)

Expert witness retained by New England Coalition to testify to the Public Service Board on the reliability, safety, technical, and financial ramifications of a proposed increase in power (called an uprate) to 120% at Entergy's 31-year-old Vermont Yankee Nuclear Power Plant.

International Nuclear Safety Testimony

Worked for ten days with the President of the Czech Republic (Vaclav Havel) and the Czech Parliament on their energy policy for the 21st century.

Nuclear Regulatory Commission (NRC) Inspector General (IG)

Assisted the NRC Inspector General in investigating illegal gratuities paid to NRC Officials by Nuclear Energy Services (NES) Corporate Officers. In a second investigation, assisted the Inspector General in showing that material false statements (lies) by NES corporate president caused the NRC to overlook important violations by this licensee.

State of Connecticut Legislature

Assisted in the creation of State of Connecticut Whistleblower Protection legal statutes.

Federal Congressional Testimony

Publicly recognized by NRC Chairman, Ivan Selin, in May 1993 in his comments to U.S. Senate, "It is true...everything Mr. Gundersen said was absolutely right; he performed quite a service." Commended by U.S. Senator John Glenn for public testimony to Senator Glenn's NRC Oversight Committee.

PennCentral Litigation

Evaluated NRC license violations and material false statements made by management of this nuclear engineering and materials licensee.

Three Mile Island Litigation

Evaluated unmonitored releases to the environment after accident, including containment breach, letdown system and blowout. Proved releases were 15 times higher than government estimate and subsequent government report.

Western Atlas Litigation

Evaluated neutron exposure to employees and license violations at this nuclear materials licensee.

Commonwealth Edison

In depth review and analysis for Commonwealth Edison to analyze the efficiency and effectiveness of all Commonwealth Edison engineering organizations, which support the operation of all of its nuclear power plants.

Peach Bottom Reactor Litigation

Evaluated extended 28-month outage caused by management breakdown and deteriorating condition of plant.

Special Remediation Expertise:

Director of Engineering, Vice President of Site Engineering, and the Senior Vice President of Engineering at Nuclear Energy Services (NES) Division of Penn Central Corporation (PCC)

- NES was a nuclear licensee that specialized in dismantlement and remediation of nuclear facilities and nuclear sites. Member of the radiation safety committee for this licensee.
- Department of Energy chose NES to write *DOE Decommissioning Handbook* because NES had a unique breadth and depth of nuclear engineers and nuclear physicists on staff.
- Personally wrote the "Small Bore Piping" chapter of the DOE's first edition *Decommissioning Handbook*, personnel on my staff authored other sections, and I reviewed the entire *Decommissioning Handbook*.
- Served on the Connecticut Low Level Radioactive Waste Advisory Committee for 10 years from its inception.
- Managed groups performing analyses on dozens of dismantlement sites to thoroughly remove radioactive material from nuclear plants and their surrounding environment.
- Managed groups assisting in decommissioning the Shippingport nuclear power reactor. Shippingport was the first large nuclear power plant ever decommissioned. The decommissioning of Shippingport included remediation of the site after decommissioning.
- Managed groups conducting site characterizations (preliminary radiation surveys prior to commencement of removal of radiation) at the radioactively contaminated West Valley site in upstate New York.
- Personnel reporting to me assessed dismantlement of the Princeton Avenue Plutonium Lab in New Brunswick, NJ. The lab's dismantlement assessment was stopped when we uncovered extremely toxic and carcinogenic underground radioactive contamination.

- Personnel reporting to me worked on decontaminating radioactive thorium at the Cleveland Avenue nuclear licensee in Ohio. The thorium had been used as an alloy in turbine blades. During that project, previously undetected extremely toxic and carcinogenic radioactive contamination was discovered below ground after an aboveground gamma survey had purported that no residual radiation remained on site.

Additional Education

Basic Mediation Certificate Champlain College, Woodbury Institute
28-hour Basic Mediation Training September 2010

Teaching and Academic Administration Experience

Rensselaer Polytechnic Institute (RPI) – Advanced Nuclear Reactor Physics Lab
Community College of Vermont – Mathematics Professor – 2007 to present

Burlington High School

Mathematics Teacher – 2001 to June 2008

Physics Teacher – 2004 to 2006

The Marvelwood School – 1996 to 2000

Awarded Teacher of the Year – June 2000

Chairperson: Physics and Math Department

Mathematics and Physics Teacher, Faculty Council Member

Director of Marvelwood Residential Summer School

Director of Residential Life

The Forman School & St. Margaret's School – 1993 to 1995

Physics and Mathematics Teacher, Tennis Coach, Residential Living Faculty Member

Nuclear Engineering Work Experience 1970 to Present

Vetted as expert witness in nuclear litigation and administrative hearings in federal, international, and state court and to Nuclear Regulatory Commission, including but not limited to: Three Mile Island, US Federal Court, US NRC, NRC ASLB & ACRS, Vermont State Legislature, Vermont State Public Service Board, Florida Public Service Board, Czech Senate, Connecticut State Legislature, Western Atlas Nuclear Litigation, U.S. Senate Nuclear Safety Hearings, Peach Bottom Nuclear Power Plant Litigation, and Office of the Inspector General NRC.

Nuclear Engineering, Safety, and Reliability Expert Witness 1990 to Present

- Fairewinds Associates, Inc – Chief Engineer, 2005 to Present
- Arnold Gundersen, Nuclear Safety Consultant and Energy Advisor, 1995 to 2005
- GMA – 1990 to 1995, including expert witness testimony regarding the accident at Three Mile Island.

Nuclear Energy Services, Division of PCC (Fortune 500 company) 1979 to 1990

Corporate Officer and Senior Vice President - Technical Services

Responsible for overall performance of the company's Inservice Inspection (ASME XI), Quality Assurance (SNTC 1A), and Staff Augmentation Business Units – up to 300 employees at various nuclear sites.

Senior Vice President of Engineering

Responsible for the overall performance of the company's Site Engineering, Boston Design Engineering and Engineered Products Business Units. Integrated the Danbury based, Boston based and site engineering functions to provide products such as fuel racks, nozzle dams, and transfer mechanisms and services such as materials management and procedure development.

Vice President of Engineering Services

Responsible for the overall performance of the company's field engineering, operations engineering, and engineered products services. Integrated the Danbury-based and field-based engineering functions to provide numerous products and services required by nuclear utilities, including patents for engineered products.

General Manager of Field Engineering

Managed and directed NES' multi-disciplined field engineering staff on location at various nuclear plant sites. Site activities included structural analysis, procedure development, technical specifications and training. Have personally applied for and received one patent.

Director of General Engineering

Managed and directed the Danbury based engineering staff. Staff disciplines included structural, nuclear, mechanical and systems engineering. Responsible for assignment of personnel as well as scheduling, cost performance, and technical assessment by staff on assigned projects. This staff provided major engineering support to the company's nuclear waste management, spent fuel storage racks, and engineering consulting programs.

New York State Electric and Gas Corporation (NYSE&G) — 1976 to 1979Reliability Engineering Supervisor

Organized and supervised reliability engineers to upgrade performance levels on seven operating coal units and one that was under construction. Applied analytical techniques and good engineering judgments to improve capacity factors by reducing mean time to repair and by increasing mean time between failures.

Lead Power Systems Engineer

Supervised the preparation of proposals, bid evaluation, negotiation and administration of contracts for two 1300 MW NSSS Units including nuclear fuel, and solid-state control rooms. Represented corporation at numerous public forums including TV and radio on sensitive utility issues. Responsible for all nuclear and BOP portions of a PSAR, Environmental Report, and Early Site Review.

Northeast Utilities Service Corporation (NU) — 1972 to 1976Engineer

Nuclear Engineer assigned to Millstone Unit 2 during start-up phase. Lead the high velocity flush and chemical cleaning of condensate and feedwater systems and obtained discharge permit for chemicals. Developed Quality Assurance Category 1 Material, Equipment and Parts List. Modified fuel pool cooling system at Connecticut Yankee, steam generator blowdown system and diesel generator lube oil system for Millstone. Evaluated Technical Specification Change Requests.

Associate Engineer

Nuclear Engineer assigned to Montague Units 1 & 2. Interface Engineer with NSSS vendor, performed containment leak rate analysis, assisted in preparation of PSAR and performed radiological health analysis of plant. Performed environmental radiation survey of Connecticut Yankee. Performed chloride intrusion transient analysis for Millstone Unit 1 feedwater system. Prepared Millstone Unit 1 off-gas modification licensing document and Environmental Report Amendments 1 & 2.

Rensselaer Polytechnic Institute (RPI) — 1971 to 1972Critical Facility Reactor Operator, Instructor

Licensed AEC Reactor Operator instructing students and utility reactor operator trainees in start-up through full power operation of a reactor.

Public Service Electric and Gas (PSE&G) — 1970Assistant Engineer

Performed shielding design of radwaste and auxiliary buildings for Newbold Island Units 1 & 2, including development of computer codes.

Public Service, Cultural, and Community Activities

2005 to Present – Public presentations and panel discussions on nuclear safety and reliability at University of Vermont, Vermont Law School, NRC hearings, Town and City Select Boards, Legal Panels, Local Schools, Television, and Radio.

2007-2008 – Created Concept of Solar Panels on Burlington High School; worked with Burlington Electric Department and Burlington Board of Education Technology Committee on Grant for installation of solar collectors for Burlington Electric peak summer use

Vermont State Legislature – Public Testimony to Legislative Committees

Certified Foster Parent State of Vermont – 2004 to 2007

Mentoring former students – 2000 to present – college application and employment application questions and encouragement

Tutoring Refugee Students – 2002 to 2006 – Lost Boys of the Sudan and others from educationally disadvantaged immigrant groups

Designed and Taught Special High School Math Course for ESOL Students – 2007 to 2008

Featured Nuclear Safety and Reliability Expert (1990 to present) for Television, Newspaper, Radio, & Internet – Including, and not limited to: CNN (Earth Matters), NECN, WPTZ VT, WTNH, VPTV, WCAX, Cable Channel 17, The Crusaders, Front Page, Mark Johnson Show, Steve West Show, Anthony Polina Show, WKVT, WDEV, WVPR, WZBG CT, Seven Days, AP News Service, Houston Chronicle, Christian Science Monitor, New York Times, Brattleboro Reformer, Rutland Herald, Times-Argus, Burlington Free Press, Litchfield County Times, The News Times, The New Milford Times, Hartford Current, New London Day, evacuationplans.org, Vermont Daily Briefing, Green Mountain Daily, and numerous other national and international blogs

NNSN – National Nuclear Safety Network, Founding Advisory Board Member, meetings with and testimony to the Nuclear Regulatory Commission Inspector General (NRC IG)

Berkshire School Parents Association, Co-Founder

Berkshire School Annual Appeal, Co-Chair

Sunday School Teacher, Christ Church, Roxbury, CT

Washington Montessori School Parents Association Member

Marriage Encounter National Presenting Team with wife Margaret

Provided weekend communication and dialogue workshops weekend retreats/seminars

Connecticut Marriage Encounter Administrative Team – 5 years

Northeast Utilities Representative Conducting Public Lectures on Nuclear Safety Issues

End

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Manna Jo Greene

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