

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

In the Matter of)	
Entergy Nuclear Generation Co.)	Docket # 50-293-LR
And Entergy Nuclear Operations, Inc.)	
(Pilgrim Nuclear Power Station))	July 5, 2011

**COMMONWEALTH OF MASSACHUSETTS REPLY TO THE
RESPONSES OF THE NRC STAFF AND ENTERGY TO COMMONWEALTH
WAIVER PETITION AND MOTION TO ADMIT CONTENTION OR IN THE
ALTERNATIVE FOR RULEMAKING**

Pursuant to 10 C.F.R. 2.309(h)(2), the Commonwealth of Massachusetts submits this Reply to the Responses of the NRC Staff¹ and Entergy² to the Commonwealth's Motion to Admit Contention³ and Waiver Petition or alternative Rulemaking Petition.⁴

¹ NRC Staff's Response to the Commonwealth of Massachusetts' Petition for Waiver of 10 C.F.R. Part 51 Subpart A, Appendix B or, in the Alternative, Petition for Rulemaking (June 27, 2011)("Staff Response to Waiver Petition"); NRC Staff's Response to Commonwealth of Massachusetts' Motion to Admit Contention and, if Necessary, Re-open the Record Regarding New and Significant Information Revealed by the Fukushima Accident (June 27, 2011)("Staff Opposition").

² Entergy Answer Opposing Commonwealth Contention and Petition for Waiver Regarding New and Significant Information Based on Fukushima (June 27, 2011)(Entergy Opposition).

³ Commonwealth of Massachusetts' Motion to Admit Contention and, if Necessary, to Reopen Record Regarding New and Significant Information Revealed by the Fukushima Accident (June 2, 2011)("Commonwealth Motion"); Commonwealth of Massachusetts' Contention Regarding New and Significant Information Revealed by the Fukushima Accident (June 2, 2011)("Commonwealth Contention").

⁴ Commonwealth of Massachusetts' Petition for Waiver of 10 C.F.R. 51 Subpart A, Appendix B or, in the Alternative, Petition for Rulemaking to Rescind Regulations Excluding Consideration of Spent Fuel Storage Impacts from License Renewal Environmental Review (June 2, 2011)("Commonwealth Waiver Petition").

The Staff and Entergy rely upon three primary arguments to oppose admission of the Commonwealth's contention: 1) that the National Environmental Policy Act (NEPA) and NRC regulations permit the Atomic Safety and Licensing Board (ASLB) to make a final decision now – at the contention admission stage of the proceeding and without a hearing – to reject the Commonwealth's new and significant information on the lessons learned from the Fukushima accident and their significance for the Pilgrim Nuclear Power Plant; 2) that the Commonwealth's challenge to Entergy's Severe Accident Mitigation Alternatives (SAMA) analysis does not raise a significant safety or environmental issue, because the Staff and Entergy claim that the real world radiological accident at Fukushima is irrelevant to assessing risk at the Pilgrim Nuclear Power Plant; and 3) that because the NRC has not yet determined the impacts of the "immense and tragic" events at Fukushima on the NRC's licensing procedures, it would be premature to litigate the Commonwealth's contention at this time, even while the NRC continues to grant license extensions for other nuclear power plants – including Vermont Yankee located ten miles from the Massachusetts border – without first addressing those tragic events and their regulatory implications in the relicensing process.⁵

Separately, Entergy counsel challenge the qualifications of the Commonwealth's expert, Dr. Gordon Thompson, to render an opinion on Probabilistic Risk Assessment (PRA). They fail to disclose that the ASLB, in the same proceeding cited by Entergy, qualified Dr. Thompson as an expert to give an opinion on PRA and related issues.⁶

⁵ See Staff Opposition at 14.

⁶ *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-01-9, 53 N.R.C. 239, 250-251 (2001); see also *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 and 2), CLI-04-21, 60 N.R.C. 21, 28-29 (2004) (approving the qualifications of a

Since none of these arguments provides an adequate basis to deny the Commonwealth's contention, it should be admitted for hearing consistent with NEPA and the Atomic Energy Act (AEA). In the alternative, the ASLB should refer this matter for consideration as a rulemaking proceeding.⁷

1. Because the Commonwealth has presented new and significant information on the environmental impacts of relicensing Pilgrim nuclear power plant, and raised a material dispute between the parties' experts on this information, the NRC is required by NEPA and the AEA to consider it in a hearing process before deciding whether to relicense the Pilgrim plant.

In their responses, the NRC Staff and Entergy submit expert declarations to dispute the opinions and analysis put forward by the Commonwealth's expert that, in light of the real world events at Fukushima, certain material inputs or assumptions in Entergy's SAMA analysis are flawed, have produced a SAMA that significantly understates the risk of continued plant operation, and do not take account of additional SAMA analysis which could be identified as potentially cost-beneficial.⁸ This dispute of expert opinion and fact is the best evidence that a material dispute exists between the parties on an issue (SAMA analysis) material to relicensing.

Specifically, as Dr. Thompson notes in his Reply Declaration, accepted scientific practice and past reports by the NRC itself recognize the imprecision of a theoretical PRA (such as relied upon by Entergy here) and the importance of direct experience and

security expert based on "extensive knowledge and experience at the conceptual and strategic level" rather than requiring "detailed tactical information.").

⁷ The NRC Staff has requested, in the event the Commonwealth's waiver petition is denied, that the petition be forwarded for consideration as a rulemaking. Staff Response to Waiver Petition at 3.

⁸ See e.g. Staff Opposition at 12; Declaration of Joseph R. Lynch, Lori Ann Potts, and Dr. Kevin R. O'Kula in Support of Entergy Answer Opposing Commonwealth Claims of New and Significant Information Based on Fukushima (June 27, 2011).

“the primacy of empirical data in scientific debate” as a truth check on this imprecise PRA model.⁹ According to Dr. Thompson, because a real world event (Fukushima) has happened to challenge the fundamentals of Entergy’s theoretical PRA for Pilgrim, and demonstrated that a radiological accident actually happened which Entergy’s PRA predicted could not, for a plant (Pilgrim) of similar design, it is reasonable and consistent with accepted scientific practice to examine further the lessons of Fukushima for the Pilgrim plant, rather than simply ignore the lessons of Fukushima as an inconvenient truth. *Id.*, at ¶¶ 9-11; *see also* Section 2, *infra*.

Given this expert dispute, the Atomic Safety and Licensing Board should decline to make a final decision at the contention admission stage and without a hearing. Dr. Thompson has raised substantial questions about the validity of Entergy’s PRA analysis, based upon the events of Fukushima, accepted scientific method, and reports by the NRC itself.¹⁰ Thus, the Commonwealth has raised an expert “supported genuine dispute that could materially alter the ultimate conclusions of the SAMA cost-benefit analysis,” and that has identified additional SAMA analysis as potentially cost beneficial. *Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-09-11, __ NRC __* (June 4, 2009). The Commonwealth thereby has raised a material dispute of fact and expert opinion with Entergy’s SAMA analysis and is entitled to a hearing to resolve that dispute. *Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-10-11,*

⁹ Declaration of Gordon R. Thompson in Reply to Entergy’s Answer of June 27, 2011 and NRC Staff’s Response of June 27, 2011 at ¶¶ 7–9, 12-13 (“Thompson Reply Declaration”).

¹⁰ New and Significant Information From the Fukushima Daiichi Accident in the Context of Future Operation of the Pilgrim Nuclear Power Plant, at pp. 14-18 (June 1, 2011) (“Thompson Report”).

__N.R.C. __ (March 26, 2010) (remanding Pilgrim ASLB decision for further proceedings on SAMA analysis); *see also* Section 2, *infra* (discussing further the Thompson Reply Declaration and expert SAMA dispute).

Regardless of NRC regulations, the Supreme Court in *Marsh* found that the agency was required by NEPA to take a hard look at the information – through “careful scientific analysis” – even though ultimately the Court agreed that, once fully evaluated, the information in that case did not warrant a supplement to the Environmental Impact Statement.¹¹ Here, as Dr. Thompson explains in his Report, consideration of the new information revealed by the Fukushima accident would result in a significant increase in the risk of a severe accident. As a result, mitigative measures that formerly were not considered cost-effective may now be considered worthy of implementation. *See* Thompson Report at pp. 14-18. Thus, regardless of whether the NRC ultimately agrees with Dr. Thompson, and determines that Fukushima would change the PRA or other environmental impacts for the Pilgrim plant, the Commonwealth has met its burden of proof under NEPA and the AEA – at the contention admission stage of this proceeding – to “present significant new circumstances or information relevant to the environmental concerns and bearing on the proposed action [relicensing] or its impacts.” *Marsh*, 490

¹¹ Commonwealth Waiver Petition at 26-27 quoting *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 385 (1989)(“[R]egardless of the eventual assessment of the significance of this information, the Corps had a duty to take a hard look at the proffered evidence. However, having done so, and having determined, based on careful scientific analysis, that the new information was of exaggerated importance, the Corps acted within the dictates of NEPA in concluding that supplementation was unnecessary.”).

U.S. at 372; *see also* Section 2, *infra*. The NRC is obligated to take a hard look at that information before making a final licensing decision. *Id.*, at 374.¹²

Moreover, the interpretation of NRC regulations supported by the Staff and Entergy, which would deny the Commonwealth a hearing on material SAMA and other Fukushima-related issues it could not have raised previously, is inconsistent with the NRC's obligation under NEPA to consider new and significant information and the Commonwealth's hearing right on all issues material to relicensing under the AEA. *Union of Concerned Scientists v. NRC*, 920 F.2d 50, 56 (D.C. Cir. 1990) (NRC rules should not be applied so as to prevent parties from raising a material issue which could not have been raised previously, because this would constitute a “misapplication[] of the rule[s]”); *see also Union of Concerned Scientists v. NRC*, 735 F.2d 1437, 1443-44 (D.C. Cir. 1984), *cert den.* 469 U.S. 1132 (1985) (a party is entitled to an AEA hearing on all issues material to licensing).¹³

¹² Entergy argues that the ASLB may satisfy its NEPA obligation based solely on consideration of the initial contention filings and without a hearing but cites no case holding that position. Entergy Opposition at 66 (arguing that agencies have used a variety of means to satisfy NEPA's hard look standard). Yet all of these cases are readily distinguishable because they do not involve the application of the AEA, which entitles interested members of the public to participate in that NEPA determination through a hearing process. *See* 10 C.F.R. 51.104(b). Also the cases relied on by Entergy reflect a significantly greater deliberative review – consistent with Marsh's “careful scientific analysis” – than the review proposed by Entergy here.

¹³ The SAMA dispute is but one of several between the parties involving material relicensing issues, including risk of hydrogen explosion, the need for filtered venting to reduce the release of radioactive material under accident conditions, and operator inability to carry out mitigation measures in a timely manner due to blackout or other conditions caused by accident, *see* Thompson Report, pp. 30 – 32, or terrorist attack, *id.*, at pp. 18 – 21; *see also San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006).

Finally, the NRC has an independent obligation to take a hard look at new and significant information under NEPA prior to taking the major federal action (relicensing).¹⁴ That burden cannot be shifted to the Commonwealth. *Dept. of Transportation v. Pub. Citizen*, 541 U.S. 752, 765 (2004) (“the agency bears the primary responsibility to ensure that it complies with NEPA”); *United States v. Coalition for Buzzards Bay*, ___ F.3d ___, *6 (1st Cir. 2011) (burden of ensuring NEPA compliance rests with the agency that is proposing the action and not those who wish to challenge that action).

2. The Staff’s and Entergy’s challenges to the Commonwealth’s SAMA analysis based on the real world lessons of Fukushima, and their attempts to minimize the import of SAMAs for relicensing, are contrary to the NRC’s past practice in considering the direct experience of Three Mile Island as relevant to PRA and the fundamental importance of SAMA analysis to Entergy’s Environmental Impact Statement.

The Staff claims that SAMAs themselves are environmentally insignificant. *See* Staff Opposition at 12. According to the Staff, a SAMA analysis “has no direct safety or environmental significance” because it “merely augments existing programs to identify mitigation alternatives that could ‘further reduce the risk at a plant that ha[s] no identified safety vulnerabilities.’” *Id.*, at 12-13 (quoting Affidavit of Dr. Nathan E. Bixler and Dr. S. Tina Ghosh (June 6, 2011)). The Staff’s position that SAMAs are legally insignificant is incorrect as a matter of law. As the Council on Environmental Quality recognizes, consideration of alternatives “is the heart of the environmental impact statement.” 40 C.F.R. 1502.14. Consistent with NEPA’s requirement to consider alternatives, the NRC’s Severe Reactor Accidents Policy Statement commits the Commission to “take all reasonable steps to reduce the chances of occurrence of a severe accident involving

¹⁴ *See* Commonwealth Waiver Petition at 23 and cases cited.

substantial damage to the reactor core and to mitigate the consequences of such an accident should one occur.” Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants, 50 Fed. Reg. 32,138, 32,139 (August 8, 1985). *See also Limerick Ecology Action v. NRC*, 869 F.2d 719, 737 (3rd Cir. 1989) (requiring the NRC to consider SAMAs or “fully defend its reasons for doing so”).

Moreover, the Staff misses the point of the Commonwealth’s contention, which is that new information shows the existence of previously unconsidered accident vulnerabilities that increase the environmental impacts of re-licensing Pilgrim and therefore the outcome of the cost-benefit analysis of alternatives. The Fukushima accident brings severe accident statistics worldwide to a level which is well above the generally accepted goals for nuclear safety of no more than one accident per 100,000 reactor year.¹⁵ The repetition every thirty years or so of such catastrophic accidents is of course unacceptable to societies, and it is imperative to further enhance the safety of nuclear technologies.¹⁶

In addition, although it repeats the point many times, Entergy is simply wrong that actual experience is not used in probabilistic analysis. To the contrary, the actual experience of the Three Mile Island has been cited by the NRC as relevant to its risk analyses in three important policy documents: the introduction to NUREG-1150, *Severe Accident Risks* (1990) (cited by Entergy at page 32 as the “seminal work on probabilistic

¹⁵ *See* Thompson Report, pp. 15–17.

¹⁶ Jacques Repussard, Director General, Institut de Radioprotection et de Surete Nucleaire (IRSN), and Chairman, OECD/CSNI, Speech at the Ministerial Seminar on Nuclear Safety, *Nuclear Safety: past achievements, new goals* at 1 (June 7, 2011) www.irsn.fr/EN/news/Pages/20110608_Ministerial-seminar-on-nuclear-safety.aspx; *see also* Thompson Reply Declaration at ¶ 11, quoting same.

risk assessment”); the Severe Accident Policy Statement, 50 Fed. Reg. at 32,139; and the NRC’s Policy Statement on the Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities, 60 Fed. 42,622 (August 16, 1995). As the NRC stated in NUREG-1150: “The 1979 accident at Three Mile Island substantially changed the character of NRC’s analysis of severe accidents and its use of PRA” including the initiation of “a substantial research program on severe accident phenomenology.” NUREG-1150 at 1-1. Phenomenology, of course, includes actual experience as well as predicted experience, and Dr. Thompson, consistent with NRC precedent and accepted scientific method, reasonably has relied upon it in his challenge to Entergy’s PRA.¹⁷

Finally, the Staff argues that Dr. Thompson has failed to show the existence of additional environmental impacts that were not previously considered for the Pilgrim nuclear power plant. Staff Opposition at 11. According to the Staff, the Commonwealth’s contention must be rejected because Dr. Thompson’s concerns are not “unique” to Pilgrim. *Id.* at 11-12. However, NEPA contains no requirement that environmental impacts must be particular to a facility in order to be worthy of consideration in an EIS. The only relevant question is whether the experience of the Fukushima accident shows that the potential for a severe accident at the Pilgrim nuclear plant is significantly greater than previously considered in the environmental analyses for Pilgrim – and the Commonwealth has met that standard of proof, based upon expert testimony and the NRC’s own past practice and pronouncements on the significance of direct experience to evaluate risk. If the NRC considers it more appropriate to address

¹⁷ See e.g. Thompson Reply Declaration at ¶¶ 7 – 12.

those risks generically, it is free to do so; however, it must address them *before* Pilgrim can be re-licensed.¹⁸ That duty is not discretionary.¹⁹

3. Since the NRC admits that it is still evaluating the lessons learned from Fukushima, including lessons on environmental risk raised by the Commonwealth, it would be premature and inconsistent with NEPA for the ASLB to make a final decision now regarding the Commonwealth's contention.

The NRC acknowledges the “immense and tragic” events at Fukushima, admits that it has not yet determined the full import of the lessons of this accident, and states that “[a]ny effort to determine the nature and extent of the U.S. impact of the Fukushima accident in the context of the Pilgrim license renewal proceeding would be premature, and could reach a result inconsistent with the Commission’s response to Fukushima.”²⁰ If this is so, it is unclear why the NRC continues to grant license extensions now for other nuclear plants – and seeks to do the same for Pilgrim.²¹

Moreover, contrary to NEPA, the Staff urges the ASLB to proceed with the major federal action (relicensing) for the Pilgrim nuclear power plant before it understands the environmental impacts of its decision, in the context of the Fukushima accident, an event it plainly recognizes as of precedent setting dimensions for the NRC and the nuclear industry. The Commonwealth respectfully suggests that the NRC cannot lawfully make

¹⁸ See *Commonwealth of Massachusetts v. Nuclear Regulatory Commission*, 522 F. 3d 115, 127 (1st Cir. 2008) (“NEPA does impose a requirement that the NRC consider any new and significant information regarding environmental impacts before renewing a nuclear power plant’s operating license.”).

¹⁹ *Silva v. Romney*, 473 F.2d 287, 292 (1st Cir. 1973).

²⁰ Staff Opposition at 14-15, 18 (“The impact of the events at Fukushima on the Commission’s policies, procedures and regulations are unknown at this time...”).

²¹ Entergy Nuclear Operations, Inc.; Vermont Yankee Nuclear Power Station; Notice of Issuance of Renewed Facility Operating License No. DPR-28 for an Additional 20-Year Period; Record of Decision, 76 Fed. Reg. 17,162 (March 28, 2011).

that final relicensing decision, particularly at the contention admission stage of this proceeding, and without conducting a careful scientific review of these issues either through an adjudicatory hearing process or a rulemaking – because the ultimate burden for NEPA compliance remains with the NRC, not the Commonwealth. *Dept. of Transportation v. Public Citizen*, 541 U.S. at 765.

Conclusion

The ASLB should admit the Commonwealth’s contention for an adjudicatory hearing or, in the alternative, refer the matter for consideration through a rulemaking proceeding.

Respectfully submitted,

Signed (electronically) by
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**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

**BEFORE THE ATOMIC SAFETY AND LICENSING BOARD
OR
THE COMMISSION**

In the Matter of
Entergy Corporation

Docket # 50-293-LR

Pilgrim Nuclear Power Station

License Renewal Application

July 5, 2011

**DECLARATION OF GORDON R. THOMPSON
IN REPLY TO ENTERGY'S ANSWER OF JUNE 27, 2011
AND NRC STAFF'S RESPONSE OF JUNE 27, 2011**

I, Gordon R. Thompson, declare as follows:

1. In the course of this proceeding I prepared a declaration dated June 2, 2011, which supported a contention and related petitions and motions by the Commonwealth of Massachusetts. That declaration set forth my affiliations, qualifications, and experience.¹ It also described reports that I have prepared in the context of this proceeding. One such report, dated June 1, 2011, and entitled "New and Significant Information From the Fukushima Daiichi Accident in the Context of Future Operation of the Pilgrim Nuclear Power Plant", is described here as the "Thompson 2011 report".
2. This declaration replies to selected points in submissions in this proceeding by Entergy and the NRC Staff. Entergy's submission, dated June 27, 2011, and entitled "Entergy's Answer Opposing Commonwealth Contention and Petition for Waiver Regarding New and Significant Information Based on Fukushima", is described here as "Entergy's answer". An accompanying declaration, dated June 27, 2011, and entitled "Declaration of Joseph R. Lynch, Lori Ann Potts, and Dr. Kevin R. O'Kula in Support of Entergy Answer Opposing Commonwealth Claims of New and Significant Information Based on Fukushima", is described here as the "Lynch/Potts/O'Kula declaration". The NRC Staff's submission, dated June 27, 2011, and entitled "NRC Staff's Response to Commonwealth of Massachusetts' Motion to Admit Contention and, if Necessary, Re-Open Record Regarding New and Significant Information Revealed by Fukushima Accident", is described here as the "NRC Staff's response". Included in that submission is an affidavit by Dr. Tina Ghosh which is described here as the "Ghosh affidavit".
3. The provision in this declaration of a reply to selected points in submissions by Entergy and the NRC Staff does not imply my agreement with Entergy or the NRC staff on any matter not addressed here.

¹ On June 13, 2011, the Commonwealth of Massachusetts submitted a supplemental attachment to my declaration of June 2, 2011, containing an updated version of my CV.

4. My reply begins by addressing assertions in the Lynch/Potts/O’Kula declaration at paragraph 14, as follows:

“The claim [in the Thompson 2011 report] that the CDF [core damage frequency] should be an order of magnitude larger based on the historical experience of five reactor core melts is fundamentally flawed in two key respects. Dr. Thompson’s “direct experience” method is not an appropriate method for determining CDF at a specific plant and it is not statistically valid. Dr. Thompson’s direct experience CDF violates fundamental PRA [probabilistic risk assessment] precepts underlying the Commission’s application of PRAs for more than two decades.”

5. In this context it is important to note two introductory points about the art of PRA as applied to nuclear power plants (NPPs). First, when NPPs such as Pilgrim were designed, nuclear safety regulation was founded on the principle that abnormal situations, such as accidents, would occur within a plant’s design basis. Over time, analysis and operating experience revealed that the design basis originally adopted was inadequate, resulting in a significant risk of core damage and radioactive release. PRA was introduced by NRC as the central pillar of an effort to understand and accommodate this risk. A major means of accommodation has been to designate risk as “acceptable” if the probability of an adverse outcome is deemed to be sufficiently low. Second, the radiological risk posed by an NPP is not readily susceptible to actuarial analysis because core-damage events are comparatively rare. In an effort to compensate for this difficulty, PRA practitioners seek to build a theoretical model – a PRA – describing the significant failure modes of an NPP.

6. The challenge of developing a credible PRA was succinctly described in 1978 by an NRC review group – which was chaired by the physicist Harold Lewis – as follows:²

“RSS [the NRC’s Reactor Safety Study of 1975] was faced with the problem of estimating the probability of occurrence of an extremely rare event – core melt – in a system of great complexity, a nuclear power reactor. Since the event has never occurred in a commercial reactor, there are no direct experimental data on which to base an estimate. The only datum that exists is the observation that there have been no core melts [as of 1978] in several hundred reactor-years of light water power reactor operation, and this fact provides at best an upper bound on the probability to be estimated. Therefore, it is necessary to resort to a theoretical calculation of the probability. But since the system is so complex, a complete and precise theoretical calculation is impossibly difficult. It is consequently necessary to invoke simplified models, estimates, engineering opinion, and in the last resort, subjective judgments.”

7. The preparation of a “complete and precise theoretical calculation” of NPP risk remains “impossibly difficult” today, just as it was when Lewis and his colleagues wrote in 1978. The difficulty is intrinsic to the complexity of an NPP and the vast number of

² H. W. Lewis (chair) and six other authors, “Risk Assessment Review Group Report to the US Nuclear Regulatory Commission”, NUREG/CR-0400, September 1978, page 6.

potential failure modes. No amount of PRA manipulation can alter this fundamental fact. Thus, the radiological risk posed by an NPP will always be much more uncertain than other technological risks that are readily susceptible to actuarial analysis (e.g., automobile accidents). One could reasonably expect any PRA practitioner to readily acknowledge the fundamental uncertainty in the findings of a PRA. One could further expect the practitioner to acknowledge the primacy of empirical data in a scientific debate. Neither acknowledgment is evident in the Lynch/Potts/O’Kula declaration or the Ghosh affidavit.

8. NRC has recognized the value of direct experience as a cross-check on PRA findings. This recognition is evident from the existence of NRC’s Accident Sequence Precursor (ASP) program, which was initiated in response to the findings of the NRC review group, chaired by Harold Lewis, that I mention above.³ The ASP program has examined events at NPPs that are judged to be significant precursors of core-damage sequences.⁴ One of the outputs of the ASP program has been an annual ASP index which is, in effect, an estimate of CDF for the US fleet of NPPs, drawing from direct experience.⁵ The ASP index is aggregated across all NPPs in the US fleet, despite the differences in their individual features.

9. One could reasonably expect that a PRA practitioner who makes assertions about the role of direct experience as a reality check for PRAs would acknowledge the ASP program. Neither the Lynch/Potts/O’Kula declaration nor the Ghosh affidavit discusses the ASP program.

10. The Thompson 2011 report does not assert that direct experience of core-damage events worldwide provides a high-confidence estimate of CDF at the Pilgrim plant. Instead, the report says that direct experience provides a reality check for PRA estimates, which are known to be uncertain. For the purposes of safety regulation, it would be prudent and responsible to assume, until proven otherwise, that a particular NPP has a CDF as indicated by direct experience. The licensee should have the burden of proving that a particular NPP has – by virtue of its design, site, or standard of operation – a CDF that is substantially lower than is indicated by direct experience. In the case of the Pilgrim plant, the licensee’s burden of proof is especially significant because the design of the Pilgrim plant is close to the design of the Fukushima units that now account for the majority of core-damage experience at NPPs. Within the context of the worldwide fleet of NPPs, the similarities between the Pilgrim plant and the affected Fukushima units are much greater than the differences.

11. In providing evidence to support its burden of proof, a licensee should be expected to uphold high scientific standards. Any supporting analysis that is presented, such as a

³ In illustration of the ASP program, see: Memo from Luis A. Reyes to the NRC Commissioners, “Status of the Accident Sequence Precursor (ASP) Program and the Development of Standardized Plant Analysis Risk (SPAR) Models”, SECY-04-0210, 8 November 2004.

⁴ The ASP program has not addressed potential core-damage sequences initiated by fires, floods, external events (e.g., earthquakes, hurricanes, ice storms), or malicious acts.

⁵ One interesting finding from the ASP program (see SECY-04-0210, Attachment 2, Section 3.9) is that about 20 percent of the precursors identified over the period FY 1994-2002 were not modeled in the PRA (or equivalent study) for the plant at which the precursor occurred. That finding illustrates the uncertainty of PRA estimates.

PRA, should be thoroughly documented, transparent, replicable, independently reviewed, and anchored in empirical data. Assumptions should be explicit and justified. Assertions should not be accepted simply because they are rooted in precedent. Informed observers have questioned the present ability of the nuclear industry to meet such standards. For example, Jacques Repussard, Chair of the Scientific Council of the Nuclear Energy Agency, stated recently:⁶

“There has been in recent years a noticeable shift from science basis to rule basis in safety management. Could the multiplication of rules be a surrogate for reduced science and technology based expertise?”

12. The Fukushima accident provides a rich body of evidence to support science-based investigations of potential core-damage accidents at NPPs. Such investigations should not only determine what actually happened at Fukushima, but also examine what might have happened if events took a different course. The Lynch/Potts/O’Kula declaration does not exhibit any interest in such investigations. Instead, it projects the impression that the authors believe they have nothing to learn from the Fukushima accident. For example, they state, at paragraph 91:

“The Pilgrim SAMA analysis has considered larger radioactive releases than that which occurred at Fukushima, and it is thus not necessary to redo the SAMA analysis to take account of the radiological releases from the Fukushima accident.”

13. As a further example of its dismissive approach to empirical evidence, the Lynch/Potts/O’Kula declaration states, at paragraph 64, that “none of the spent fuel pools at Fukushima experienced a zirconium fire”. That conclusion is premature, as discussed at pages 26 and 27 of the Thompson 2011 report. At present, there are at least two theories about the source of the hydrogen that exploded in the reactor building of Fukushima Unit 4. One theory is that the hydrogen came from Unit 3 through a ventilation system. The other theory is that an episode of steam-zirconium reaction (a “fire”) occurred in the Unit 4 pool. Such an episode could be consistent with the apparent normal appearance of the upper surface of the spent-fuel racks in the Unit 4 pool, as viewed from above the pool via a TV camera in the weeks following the accident.

⁶ Jacques Repussard, Director General, Institut de Radioprotection et de Surete Nucleaire (IRSN), speech at the ministerial seminar on nuclear safety, organized under the French presidency of the G8-20, 7 June 2011; accessed at http://www.irsn.fr/EN/news/Pages/20110608_Ministerial-seminar-on-nuclear-safety.aspx on 2 July 2011.

I declare, under penalty of perjury, that the foregoing facts provided in my Declaration are true and correct to the best of my knowledge and belief, and that the opinions expressed herein are based on my best professional judgment.

Executed on 5 July 2011.

A handwritten signature in black ink that reads "G. R. Thompson". The signature is written in a cursive style with a large, looped initial "G".

Gordon R. Thompson

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

In the Matter of)	
Entergy Nuclear Generation Co.)	Docket No. 50-293-LR
And Entergy Nuclear Operations, Inc.)	
(Pilgrim Nuclear Power Station))	July 5, 2011

CERTIFICATE OF SERVICE

I hereby certify that copies of the Commonwealth of Massachusetts Reply to the Responses of the NRC Staff and Entergy to Commonwealth Waiver Petition and Motion to Admit Contention or in the Alternative for Rulemaking, and Declaration Of Gordon R. Thompson In Reply To Entergy's Answer Of June 27, 2011 and NRC Staff's Response of June 27, 2011, in the above captioned proceeding, have been served upon the following persons by electronic mail this date:

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