RAS J-304

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	Docket # 50-293-LR
Entergy Corporation	
Pilgrim Nuclear Power Station	
License Renewal Application	November 22, 2010

PILGRIM WATCH REPLY TO ORDER (OCTOBER 26, 2010) – QUESTIONS FROM BOARD MAJORITY REGARDING THE MECHANICS OF COMPUTING "MEAN CONSEQUENCES"

Pilgrim Watch responds herein to the Board majority's request to submit affidavit's to explain at what point in the process of SAMA computations performed using the MACCS2 code the "mean consequences" referred to by the Commission in CLI-10-22 are done. Specifically the majority wanted to learn the "flow of the computations" and when in that flow the "mean consequences" are computed. In answering the question, experts were directed to reply to four questions.

Pilgrim Watch's affidavit is provided by Dr. Edwin Lyman, along with his CV; and we appreciate the Board's November 5th Order granting extension to submit affidavit's to November 22, 2010 to accommodate Dr, Lyman's return to the United States.

Respectfully Submitted by,

Mary Lampert

Mary Lampert
Pilgrim Watch, pro se
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Complete Secy-037

DS-03

DECLARATION OF EDWIN S. LYMAN, PH.D., REGARDING THE MECHANICS OF COMPUTING MEAN CONSEQUENCES IN SAMA ANALYSES

I, Dr. Edwin S. Lyman, declare as follows:

1. I am a Senior Staff Scientist with the Global Security Program at the Union of Concerned Scientists, 1825 K Street, NW, Suite 800, Washington, D.C. 20006. My education and experience are described in my curriculum vita, which is included as an attachment to my declaration.

2. I am an expert in the technical analysis of safety, security and environmental issues related to nuclear facilities. I hold a Ph.D., a master of science degree, and a bachelor's degree in physics. For eighteen years, I have conducted research on security and environmental issues associated with the management of nuclear materials and the operation of nuclear power plants. My research has included the safety and environmental risks posed by operation of nuclear power plants. I have also published articles on this topic. A list of my publications is included in my C.V.

4. I am familiar with the MACCS2 radiological consequence assessment software used by Entergy to prepare the Severe Accident Mitigation Alternatives (SAMA) Analysis in the Environmental Report supporting its application for license renewal of the Pilgrim Nuclear Power Station. I have used this code extensively and have published papers in technical journals based on these results. In 1998, I discovered and reported to the code manager a significant error in the software that had resulted in overestimates of latent cancer fatalities under certain circumstances, which was subsequently fixed. I am also familiar with the methodology of SAMA analysis.

5. My responses to the four questions posed by the Board are given below. Please note that my responses are informed by my understanding of the process by which MACCS2 code results are used as input parameters in Severe Accident Mitigation Alternatives (SAMA) analyses.

a. The three modules in MACCS2 function as follows:

(i) ATMOS: The ATMOS module computes the dispersal pattern of radionuclides as a function of downwind distance using a Gaussian plume model. Inputs into the module include the radionuclide source term (core inventory, radionuclide release fractions, release time(s) and duration(s) and sensible heat), meteorological conditions (wind speed, wind direction, atmospheric stability class, precipitation), and other characteristics relevant to the dispersion and deposition of the plume, such as aerosol particle sizes. Each run of the module corresponds to a single weather sequence. The output of each run specifies the resulting radionuclide dispersal pattern as a function of time, including the atmospheric concentration of each radionuclide at ground level and the areal concentration of each radionuclide on the ground.

Up to a year's worth of weather data can be input into the module. The user can direct the code to compute the radionuclide concentrations for a release commencing at a specified day and hour over the course of the year. The user can also direct the code to generate results for a release occurring at each hour over the course of the year: this would generate 8,760 separate results for each fixed initial wind direction. In addition, the user can rotate the calculation through all 16 wind directions, and obtain a sum weighted by the frequencies of the site wind rose.

(ii) EARLY: The EARLY module utilizes the radionuclide dispersal data generated by ATMOS, together with additional user-specified data, to calculate individual and collective radiation doses and associated health impacts to the affected population resulting from "early" exposures; e.g. those occurring within a user-specified period after the radionuclide release. This period is limited to one week after arrival of the plume at any downwind spatial interval. EARLY only evaluates radiation doses resulting from direct exposure to the plume (cloudshine and inhalation), groundshine (ground deposition), resuspension and skin dose, but does not consider exposures resulting from ingestion of contaminated food or water. The additional inputs required for EARLY are those needed to convert radionuclide concentrations to radiation doses, such as the time individuals spend in a particular location; their breathing rates and whether they are in the open or in shelter. Thus emergency response scenario information (e.g. evacuation or sheltering for specified segments of the population) is needed at this stage. Population data is also necessary to compute collective doses, and can be input into the calculation via a site-specific data file. The output of the module for a single weather trial is a set of consequences for user-specified portions of the affected population, such as the population dose within 10 miles of the release, or the peak individual dose as a function of downwind distance.

(iii) CHRONIC: The CHRONIC module utilizes the same inputs from the ATMOS module as EARLY, but calculates doses and other consequences resulting from exposures subsequent to the emergency-phase period evaluated by EARLY. CHRONIC considers doses resulting from groundshine, resuspension, and consumption of

contaminated food and water. CHRONIC also contains features designed to assess the economic consequences of radiological releases, and models intermediate and long-term protective actions (decontamination, interdiction, condemnation) that can affect both chronic radiation doses and economic costs. Thus the output of CHRONIC includes, as a function of distance, both long-term individual and collective doses, as well as the total economic costs of the accident under various user-specified mitigative action scenarios. As in EARLY, each individual weather trial leads to a single set of results. The MACCS2 code then combines the outputs of the EARLY and CHRONIC modules for each weather trial to obtain the total consequences of the radiological release for the emergency, intermediate and long-term phases.

b. The ASLB cites three examples of "independent variables" --- namely, source term, meteorological conditions, and evacuation (e.g. protective action measures) that cannot be definitively predicted to be occurring at any given time and must be addressed probabilistically in a SAMA analysis, and asks for a description of the process for dealing with them. In fact, the process is different for dealing with each of these, so they will be explained separately below.

(i) The "source term," which defines the magnitude, timing and other properties of the radiological release corresponding to a particular nuclear plant damage state, is typically determined by modeling a particular accident sequence with a code such as MELCOR or MAAP. In a SAMA analysis, the frequencies of occurrence of the plant damage states corresponding to each source term are derived from the probabilistic risk assessment (PRA).

Each MACCS2 calculation corresponds to a single source term corresponding to a particular damage state. In SAMA analysis, the consequences corresponding to each damage state, which are each computed by a MACCS2 run, are multiplied by the frequency of occurrence of the damage state in order to obtain the "population dose-risk" and "off-site economic cost risk." These values are then summed to generate SAMA-relevant quantities such as the avoided dose and avoided off-site cost associated with a mitigative measure, which can be seen as frequency-weighted sums of the consequences resulting from the spectrum of damage states.

The accident frequencies derived from PRA are themselves associated with significant uncertainties. In the Pilgrim SAMA analysis, this is addressed by utilizing the mean point estimate of the core damage frequency (CDF) in the baseline calculation, but also conducting an uncertainty analysis, utilizing the 95^{th} percentile value of the CDF.

Also, within each plant damage state, there are significant uncertainties in the calculation of source terms. There is no fixed methodology as to how these uncertainties are treated in obtaining the source term parameters that are input into the SAMA analysis. For example, since the MAAP code is proprietary, there is no way for external observers to understand or assess how the final source term values are obtained.

(ii) In MACCS2, the impact of meteorological variability on the consequences of radiological releases can be analyzed by utilizing the property of the code that allows it to repeat a calculation for multiple weather trials. As discussed above, the user is able to input

a file containing weather data for each day and hour over the course of a year. This can be used to generate up to 8,760 individual results, each corresponding to a radiological release commencing on a particular day and hour, assuming a fixed wind direction. In addition, the site wind rose can be used to generate a frequency-weighted result over all wind directions. The code also offers a couple of options of weather bin sampling, in which only a few hundred hours are chosen for evaluation. (In my judgment, these options are historical relics of the original 1980's era CRAC2 code that were meant to save computer time, and are simply not necessary with the computing power available today. In my experience, a MACCS2 run over an entire year-long data set only requires an hour or so on a computer of relatively ancient vintage.)

The code then provides various statistical parameters over the resulting data set for each outcome of interest, including the mean, median (50^{th} percentile), 95^{th} percentile, 99^{th} percentile, and the maximum value over all weather trials considered. For instance, for the population dose within 50 miles, it will provide the mean dose, the 95^{th} percentile dose, etc. The meaning of the 95^{th} percentile dose, for example, is that there is a 5% chance that an accident would occur over the course of a year that would result in a 50-mile population dose exceeding this value.

It is questionable whether a single year's worth of weather data provides a sufficiently conservative data set for the purposes of SAMA analysis. Some MACCS2 analyses utilize data sets spanning multiple years, which must be averaged in order to be input into the MACCS2 code.

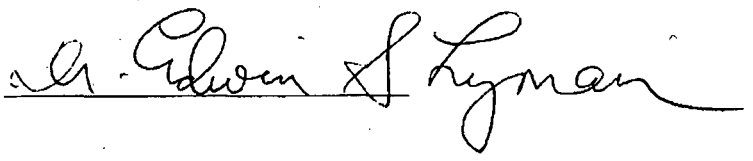
(iii) The MACCS2 code has the capability to model up to three different emergency response scenarios in a given run and generates a weighted sum of the results. For instance, the user can specify that 90% of the population in the emergency planning zone evacuates within a certain time period, 8% seek shelter and 2% continue normal activities. The code will generate a sum of the results weighted over the various population fractions in each cohort.

c. SAMA analysis requires a large number of input variables. It requires population dose-risks and off-site economic cost risks as obtained through PRA, severe accident core modeling and radiological consequence assessment. It also requires input of appropriate discount rates. I am unaware of any uniform "selection process" by which all the necessary data is obtained. The input data are typically a combination of MACCS2 default values, site-specific data where obtainable, source term data obtained through MAAP or MELCOR analysis, and educated guesses. The degrees of accuracy and precision of any particular input parameter varies widely and depends on the parameter in question.

d. The representative consequence chosen for input into the SAMA analysis in order to compare to the cost of mitigation measures is obtained from the results of the MACCS2 model calculations and the choice of statistical input parameter. As discussed above, for each plant damage state, the code is run over a meteorological data set to produce a set of consequence results. For each consequence endpoint, the values corresponding to various statistical parameters of the resulting data set (mean, 95th percentile) are provided. It is then

necessary for the SAMA analyst to determine which statistical parameter should be used as input into the SAMA analysis: e.g. the mean, the median or the 95th percentile. Once this input parameter is chosen, then the population dose-risks and off-site economic dose risks can be calculated, summed and compared to the costs of mitigative measures. The choice of statistical input parameter determines the level of protection that mitigative measures would be expected to provide. A choice of 95th percentile, for example, means that mitigative measures would be considered cost-beneficial if they were no more expensive than the value of the averted risk to the public from a severe accident for 95 percent of the meteorological conditions expected to occur over the course of a year. In contrast, use of the mean consequences would imply that measures would be cost-beneficial if they were no more expensive than the (significantly lower) value of the averted risk to the public for an accident occurring under average meteorological conditions. This is analogous to the situation of a homeowner who is considering whether to spend the money to install windows to protect against a 20-year storm or just an average storm. Thus the outcome of the SAMA analysis is functionally dependent on the choice of statistical input parameter.

5. The facts presented in this declaration are true and correct to the best of my knowledge, and the opinions expressed are based on my best professional judgment.



Dr. Edwin S. Lyman

November 22, 2010

Edwin Stuart Lyman
Curriculum Vitæ

Education

Ph.D, Cornell University, Theoretical Physics, August 1992.
M.S., Cornell University, Physics, January 1990.
A.B., *summa cum laude*, New York University, Physics, June 1986; Phi Beta Kappa.

Professional Experience

May 1, 2003 – Present: Senior Staff Scientist, Union of Concerned Scientists.

June 2002 – April 2003: President, Nuclear Control Institute, Washington, D.C.

July 1995 – May 2002: Scientific Director, Nuclear Control Institute, Washington, D.C.

August 1992 – June 1995: Postdoctoral research associate, Center for Energy and Environmental Studies, Princeton University, Princeton, NJ.

Spring 1995: Preceptor for Environmental Studies 302, "Perspectives on Environmental Issues: Values and Policies."

Spring 1994: Lecturer, Woodrow Wilson School. Preceptor for WWS 304, "Science, Technology and Public Policy."

July 1988 – June 1992: Graduate research assistant, Newman Laboratory of Nuclear Studies, Cornell University, Ithaca, NY. Conducted thesis research on high-energy physics under the supervision of Prof. S.H.-H. Tye.

August 1986–June 1988: Andrew D. White Graduate Fellow, Physics, Cornell University.

Publications

E. Lyman and D. Lochbaum, "Protecting Vital Targets: Nuclear Power Plants," in *Homeland Security: Protecting America's Targets, Vol. III* (J. Forest, ed.), Praeger, Westport, CT, 2006, 157-173.

J. Beyea, E. Lyman and F. von Hippel, "Damages from a Major Release of ^{137}Cs Into the Atmosphere of the United States," *Science and Global Security* **12** (2004) 125-136.

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R. Alvarez, J. Beyea, K. Janberg, J. Kang, E. Lyman, A. Macfarlane, G. Thompson and F. von Hippel, "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," *Science and Global Security* **11** (2003) 1-51.

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S.-w. Chung, E. Lyman and S.H.-H. Tye, "Fractional Supersymmetry and Minimal Coset Models in Conformal Field Theory," *Int. J. Mod. Phys* A7 (1992) 3337.

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E. Lyman, "Chernobyl on the Hudson? The Health and Environmental Impacts of a Terrorist Attack at the Indian Point Nuclear Power Plant," commissioned by Riverkeeper, Inc., September 2004.

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E. Lyman, "The Solubility of Plutonium in Glass," PU/CEES Report No. 275, Center for Energy and Environmental Studies, Princeton University, April 1993.

Selected Invited Talks and Testimony

"Licensing Challenges for Fuel Cycle Facilities Under the Global Nuclear Energy Partnership," U.S. Nuclear Regulatory Fuel Cycle Information Exchange, Rockville, MD, June 12, 2007.

"The 'Nuclear Renaissance' and the Spread of Nuclear Weapons," American Physical Society Ohio Chapter Meeting, May 7, 2007.

"Recycling Nuclear Waste," American Physical Society Annual April Meeting, Jacksonville, FL, April 15, 2007.

"The Security Imperative of Eliminating Commercial Use of HEU," presentation to the

Committee on Medical Isotope Production Without Highly Enriched Uranium, National Academy of Sciences, Washington, DC, February 15, 2007.

"Recycling Nuclear Waste," Peace Studies Seminar, Cornell University, November 29, 2006.

"Nuclear Power and Nuclear Proliferation," Citizens for Global Solutions conference, Washington, DC, November 13, 2006.

"Next-Generation Nuclear Plants: Safety and Security," presented at "Is Nuclear Power a Solution to Global Warming and Rising Energy Prices?," American Enterprise Institute conference, Washington, DC, October 6, 2006.

"Recycling Nuclear Waste: Technical Difficulties and Proliferation Concerns," Physics Department Colloquium, Case Western Reserve University, Cleveland, OH, September 14, 2006.

"The Chernobyl Source Term: Implications for Nuclear Safety," international conference "Chornobyl +20: Remembrance for the Future," Kiev, Ukraine, April 23-25, 2006.

"Public Health Consequences of a Severe Accident or Attack at a Nuclear Plant," Nuclear Policy Research Institute Conference on Nuclear Power and Global Warming, Airlie House, Warrenton, VA, November 7, 2005.

Testimony before the Subcommittee on Clean Air, Climate Change on Nuclear Safety, Committee on Environment and Public Works, United States Senate, May 26, 2005.

"Safeguarding the U.S. Plutonium Disposition Program Against Nuclear Terrorism," Science and Global Security Program seminar, Woodrow Wilson School of Public and International Affairs, Princeton University, December 9, 2004.

"Status of the Security Regime for the U.S. Mixed-Oxide Fuel Program," Managing the Atom Project seminar, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, November 2, 2004.

"U.S. Nonproliferation Policy, Plutonium Disposition and the Threat of Nuclear Terrorism," seminar on "Recycling Plutonium: Risks and Alternatives," sponsored by the Green Group, European Parliament, Brussels, Belgium, January 9, 2003.

"Current Status of the U.S. Plutonium Disposition Program," seminar, Princeton University Program on Science and Global Security, Princeton University, Princeton, NJ, June 12, 2002.

"Controlling Fissile and Radioactive Material," Public Health Summit on Weapons of Mass Destruction, sponsored by Physicians for Social Responsibility and the UCLA School of Public

Health, Ackerman Hall, UCLA, Los Angeles, June 2, 2002.

"Assessing the U.S. Government Response to the Nuclear Terrorism Threat After 9/11," presentation to the Joint Atomic Energy Intelligence Committee, McLean, VA, May 9, 2002.

"Upgrading Physical Protection at Nuclear Facilities to Address New Threats," MIT Security Studies Seminar, MIT, Boston, MA, April 18, 2002.

"Perspectives on New Plant Licensing," presentation at the U.S. Nuclear Regulatory Commission Briefing on Readiness for New Plant Applications and Construction, Washington, DC, July 19, 2001.

"Regulatory Challenges for Future Nuclear Plant Licensing: A Public Interest Perspective," U.S. NRC Advisory Committee on Reactor Safeguards (ACRS) Workshop on New Nuclear Plant Licensing, Washington, DC, June 5, 2001.

"The Future of Nuclear Power: A Public Interest Perspective," 2001 Symposium of the Northeast Chapter of Public Utility Commissioners, Mystic, CT, May 21, 2001.

Statement at the U.S. Nuclear Regulatory Commission Briefing on Office of Nuclear Regulatory Research Programs and Performance, May 11, 2001.

"Barriers to Deployment of Micro-Nuclear Technology," presentation at the workshop on "New Energy Technologies: A Policy for Micro-Nuclear Technologies," James A. Baker III Institute for Public Policy, Rice University, Houston, TX, March 19-20, 2001.

"Aging Research and Public Confidence," presentation at the U.S. Nuclear Regulatory Commission 2001 Regulatory Information Conference (RIC), Washington, DC, March 14, 2001.

NRC Reactor Safeguards Activities," presentation at the U.S. Nuclear Regulatory Commission 2001 Regulatory Information Conference (RIC), Washington, DC, March 14, 2001.

"DOE's Nuclear Material Stabilization Approach: The Failure of Transparency," Embedded Topical Meeting on DOE Spent Nuclear Fuel and Fissile Material Management, American Nuclear Society Annual Meeting, San Diego, CA, June 2000.

"The Status of Reactor Safeguards Initiatives," presentation at the U.S. NRC 2000 Regulatory Information Conference, Washington, DC, March 29, 2000.

"Safety Questions Concerning MOX Fuel Use in Proposed U.S. Reactors," Sixth International Policy Forum on the Management and Disposition of Nuclear Weapons Materials, sponsored by Exchange/Monitor Publications, Washington, DC, June 1999.

"Transparency and Plutonium Disposition," ISIS Workshop on Comprehensive Controls on Plutonium and Highly Enriched Uranium: Long-Term Problems and Prospects for Solutions, sponsored by the Institute for Science and International Security, Washington, DC, June 1997.

"Ship Transportation of Radioactive Materials," presentation to the Marine Board of the National Research Council, U.S. National Academy of Sciences, Woods Hole, MA, June 20, 1996.

"The Importation and Storage of High-Level Radioactive Wastes at Rokkasho-Mura: Safety Concerns," presentation at the Public Forum on High-Level Nuclear Waste and Reprocessing," Aomori, Japan, April 16, 1996.

"Perspectives on U.S. Options for Disposition of Excess Plutonium," Third International Policy Forum on the Management and Disposition of Nuclear Weapons Materials, sponsored by Exchange/Monitor Publications, Landsdowne, VA, March 21, 1996.

"Addressing Safety Issues in the Sea Transport of Radioactive Materials," presentation to the Special Consultative Meeting of Entities Involved in the Marine Transport of Nuclear Materials Covered by the INF Code," International Maritime Organization, London, March 4-6, 1996.

"Prospects and Unsolved Issues for Plutonium Immobilization," INESAP/IANUS/UNIDIR Fissile Cutoff Workshop, Palais des Nations, Geneva, June 1995.

"An Intermediate Solution for Plutonium from Dismantled Nuclear Warheads," Annual Meeting of the German Physical Society, Berlin, Germany, March 1995.

"The Sea Transport of High-Level Radioactive Waste: Environmental and Health Concerns," Channel Islands International Conference on Nuclear Waste, St. Helier, Jersey, United Kingdom, January 1995.

Conference Papers

E. Lyman, "Regulatory Challenges Facing the Global Nuclear Energy Partnership," GLOBAL 2007 Conference, Boise, ID, September 2007.

E. Lyman, "Envisioning a World Without Uranium Enrichment," 48th Annual Meeting of the Institute of Nuclear Materials Management, Tucson, AZ, July 2007.

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E. Lyman, "Extending the Foreign Spent Fuel Acceptance Program: Policy and Implementation Issues," 26th International Meeting on Reduced Enrichment for Research and Test Reactors, IAEA, Vienna, Austria, November 2004.

E. Lyman, "Using Bilateral Mechanisms to Strengthen Physical Protection Worldwide," 45th Annual Meeting of the Institute of Nuclear Materials Management, Orlando, FL, July 2004.

E. Lyman, "The Congressional Attack on RERTR," 25th International Meeting on Reduced Enrichment for Research and Test Reactors, RERTR-2003, Chicago, IL, October 2003.

E. Lyman, "Nuclear Plant Protection and the Homeland Security Mandate," 44th Annual Meeting of the Institute of Nuclear Materials Management, Phoenix, AZ, July 2003.

E. Lyman and A. Kuperman, "A Reevaluation of Physical Protection Standards for Irradiated HEU Fuel," 24th International Meeting on Reduced Enrichment for Research and Test Reactors, RERTR-2002, Bariloche, Argentina, November 2002.

E. Lyman, "Material Protection, Control and Accounting at the U.S. MOX Fuel Fabrication Plant: Merely and Afterthought?" 43rd Annual Meeting of the Institute of Nuclear Materials Management (INMM), Orlando, FL, June 2002.

E. Lyman, "Terrorism Threat and Nuclear Power: Recent Developments and Lessons to be Learned," Symposium on Rethinking Nuclear Energy and Democracy after 9/11, sponsored by PSR/IPPNW Switzerland, Basel, Switzerland, April 2002.

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E. Lyman, "The Future of Immobilization Under the U.S.-Russian Plutonium Disposition Agreement," 42nd Annual Meeting of the Institute of Nuclear Materials Management (INMM), Indian Wells, CA, July 18, 2001.

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E. Lyman and P. Leventhal, "Radiological Sabotage at Nuclear Power Plants: A Moving Target Set," 41st Annual Meeting of the INMM, New Orleans, LA, July 2000.

E. Lyman, "Comments on the Storage Criteria for the Storage and Disposal of Immobilized Plutonium," Proceedings of the Institute for Science and International Security Conference on "Civil Separated Plutonium Stocks --- Planning for the Future," March 14-15, 2000, Washington, DC, Isis Press, 135.

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E. Lyman, "A Critique of Physical Protection Standards for Irradiated Materials," 40th Annual Meeting of the INMM, Phoenix, AZ, July 1999.

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E. Lyman, "Unresolved Safety Issues in the Storage and Transport of Vitrified High-Level Nuclear Waste," 38th Annual Meeting of the INMM, Phoenix, AZ, July 1997.

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E. Lyman, "Assessing the Proliferation and Environmental Risks of Partitioning-Transmutation," Fifth International Summer Symposium on Science and World Affairs, Cambridge, MA, USA, July 1993.

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E. Lyman, "Indian Point Reactor," New York Times, January 27, 2002.

E. Lyman, "Spent Nuclear Fuel," New York Times, June 3, 2001.

E. Lyman and P. Leventhal, "Better Plutonium Plan," New York Times, February 5, 1998.

E. Lyman, "A Safer Plutonium Plan," Washington Post, August 24, 1997.

P. Leventhal and E. Lyman, "Who Says Iraq Isn't Making a Bomb?" International Herald Tribune, November 2, 1995.

H. Feiveson and E. Lyman, "No Solution to the Plutonium Problem," Washington Post, July 29, 1994.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	Docket # 50-293-LR
Entergy Corporation	
Pilgrim Nuclear Power Station	
License Renewal Application	November 22, 2010

CERTIFICATE OF SERVICE

I hereby certify that *Pilgrim Watch Reply To Order (October 26, 2010) – Questions From Board Majority Regarding The Mechanics Of Computing "Mean Consequences"* was served November 22, 2010 in the above captioned proceeding to the following persons by electronic mail this date, followed by deposit of paper copies in the U.S. mail, first class.

Secretary of the Commission
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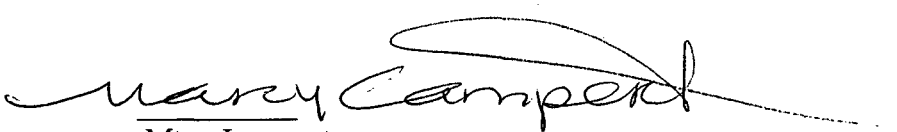

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November 22, 2010