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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

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In re:

License Renewal Application Submitted by

Entergy Nuclear Indian Point 2, LLC,
Entergy Nuclear Indian Point 3, LLC, and
Entergy Nuclear Operations, Inc.
-----x

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

ASLBP No. 07-858-03-LR-BD01

DPR-26, DPR-64

February 3, 2011

COPY

STATE OF NEW YORK NEW CONTENTION 12-C
CONCERNING NRC STAFF'S DECEMBER 2010
FINAL ENVIRONMENTAL IMPACT STATEMENT AND
THE UNDERESTIMATION OF DECONTAMINATION AND CLEAN UP COSTS
ASSOCIATED WITH A SEVERE REACTOR ACCIDENT
IN THE NEW YORK METROPOLITAN AREA

Office of the Attorney General
for the State of New York
The Capitol
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TABLE OF CONTENTS

	<u>Page</u>
PRELIMINARY STATEMENT	1
CONTENTION 12-C.....	3
BASES.....	3
SUPPORTING EVIDENCE.....	8

PRELIMINARY STATEMENT

The State of New York respectfully submits this supplemental Contention 12-C based on the Final Supplemental Environmental Impact Statement ("FSEIS") issued by Staff of the Nuclear Regulatory Commission ("NRC") on December 3, 2010.¹ This contention updates previously submitted State Contentions 12, 12-A and 12-B which assert that the Applicant's Environmental Report ("ER"), NRC Staff's Draft Supplemental Environmental Impact Statement ("DSEIS") and Entergy's December 2009 SAMA Reanalysis ("SAMA Reanalysis") failed to address assumptions and inputs to modeling related to clean-up and contamination costs in the event of a plant accident. As set forth in Contentions 12, 12-A and 12-B, New York maintains that NRC Staff and Entergy substantially underestimate the costs of a severe accident and substantially underestimate the costs of decontamination measures which must be considered in this license renewal proceeding under the National Environmental Policy Act ("NEPA"), the Administrative Procedure Act ("APA"), and NRC and Council on Environmental Quality ("CEQ") regulations. Thus, the FSEIS - particularly Appendix G.2.3, Review of Issues Related to NYS Contentions 12 and 16 - does not provide a rational basis for the NRC's Record of Decision ("ROD") as to SAMA decontamination costs and mitigation alternatives.

Contention 12-C asserts that the FSEIS fails to address and meaningfully respond to previously identified deficiencies in the ER, DSEIS, and SAMA Reanalysis. Among other things, important aspects of the SAND96-0957 *Site Restoration* report are misapplied, and the FSEIS wholly ignores a 2008 report, *Survey of Costs Arising from Potential Radionuclide Scattering Events*, which applies *Site Restoration's* results to the New York City area. In addition, while the FSEIS indicates that NRC Staff sought expert review of the State's

¹ In its Order and Memorandum, the Board extended the deadline for filing this contention to February 3, 2011. See Order and Memorandum dated December 27, 2010.

contentions by Sandia National Laboratory ("Sandia"), and the FSEIS states conclusions reached by Sandia that support NRC Staff and Entergy SAMA analyses, and relies heavily upon Sandia's review, NRC Staff has not referenced or produced any expert report regarding that review. The FSEIS's cursory assessment of underlying evidence, including that which purportedly supports Entergy and NRC Staff's dramatically undervalued decontamination cost projections, fails to justify the document's conclusion that Entergy's costs estimates "appear reasonable and acceptable," and "consistent" with those used in other SAMA analyses. Appendix G, at G-24, 35-36.

While recognizing that NRC regulations may not require the State to submit supplemental contentions, the State presents them now to forestall any claim that the State has not pursued its rights as secured by the U.S. Constitution, NEPA, APA, the Atomic Energy Act ("AEA"), or regulations promulgated by the CEQ and the NRC. This contention asserts that the NRC Staff's analysis of SAMA-related issues remains so deficient, arbitrary, and biased that it renders the FSEIS a nullity with respect to Staff's recommendation that the adverse environmental impacts of license renewal are not so great that preserving the option of license renewal for energy planning decision makers would be unreasonable. Accordingly, the FSEIS fails to provide a meaningful and objective "hard look" at the comparative impacts of alternative SAMA mitigation measures. In the absence of a meaningful alternatives analysis, 10 C.F.R. Part 51 does not permit the Board or the Commissioner to adopt this recommendation into the Record of Decision.

CONTENTION 12-C

THE DECEMBER 2010 FSEIS ANALYSIS FOR IP2 AND IP3 UNDERESTIMATES DECONTAMINATION AND CLEAN UP COSTS ASSOCIATED WITH A SEVERE ACCIDENT IN THE NEW YORK METROPOLITAN AREA AND, THEREFORE, FAILS TO CONSIDER MITIGATION MEASURES WHICH ARE RELATED TO LICENSE RENEWAL IN VIOLATION OF NEPA, APA, AND NRC AND CEQ REGULATIONS

BASES

1. This contention incorporates the State of New York's previously-filed, and admitted, contentions on this issue, NYS Contentions 12, 12-A, & 12-B.

2. In December 2010, NRC Staff released the Final Supplemental Environmental Impact Statement for Entergy's application to renew the operating licenses for Indian Point Unit 2 and Unit 3 (FSEIS).

3. NRC regulations require Entergy and NRC Staff to conduct a severe accident mitigation alternatives analysis for the Indian Point reactors as part of the NEPA review and environmental impact statement process. 10 C.F.R. § 51.53(c)(3)(ii)(L). That analysis depends upon an accurate calculation of the cost of a severe accident in order to have a base line against which to measure proposed mitigation measures.

4. An environmental impact statement must contain "high quality" information and "accurate scientific analysis."² This requires the federal agency, here the NRC, to ensure "the professional integrity, including scientific integrity, of the discussions and analyses in

² 40 C.F.R. § 1500.1(b); *Conservation Northwest v. Rey*, 674 F. Supp. 2d 1232, 1249 (W.D. Wash. 2009) (citing *Ctr. for Biological Diversity v. U.S. Forest Svc.*, 349 F.3d 1157, 1167 (9th Cir. 2003)).

environmental impact statements.” 40 C.F.R. § 1502.24. To take the required “hard look” at a proposed project’s effects, an agency may not rely on incorrect assumptions or data.³

5. The December 2010 FSEIS is deficient in determining decontamination and clean up costs resulting from a severe accident in the New York City metropolitan area. The FSEIS conclusions regarding decontamination costs are flawed because they: (a) underestimate the costs associated with a severe accident in the densely populated and developed New York City metropolitan area; and (b) underestimate the costs associated with the dispersion of small particle radiation from a nuclear power facility accident. These cumulative errors render the SAMA analysis and the conclusions in the FSEIS wholly unreliable, arbitrary and without a basis in fact or law.

6. The December 2010 FSEIS relies on Entergy’s 2009 SAMA Reanalysis and the MACCS2 computer program and uses an outdated and inaccurate proxy to represent the decontamination and cleanup costs resulting from a severe accident. The cost formula contained in Entergy’s and NRC Staff’s Indian Point MACCS2 analysis underestimates the costs likely to be incurred as a result of a dispersion of radiation. Therefore, the FSEIS accepts a SAMA analysis that significantly understates the costs associated with such an accident and may have resulted in the rejection of mitigation measures that might be cost effective under a proper analysis.

7. As explained in the accompanying February 3, 2011 Report of David Chanin, the December 2010 FSEIS relies on inaccurate and inapplicable data input into the cost formula, resulting in the substantial underestimation of the costs likely to be incurred as a result of a

³ *Id.* at § 1500.1(b) (“Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA.”); *Native Ecosystems Council v. U.S. Forest Svc.*, 418 F.3d 953, 964, 965 (9th Cir. 2005).

severe accident at a nuclear power plant that releases contamination including cesium-137 and other fission products.

8. The December 2010 FSEIS relies on the cost formula contained in the MACCS2 code which underestimates the costs likely to be incurred as a result of a dispersion of radiation. MACCS2's cost calculation subroutine relies on an assumption that the dispersion and resulting decontamination activities will involve large-sized radionuclide particles.

9. MACCS2's cost calculations subroutine does not take into account the additional costs that would be incurred in decontaminating a suburban/urban area such as the one that exists within the 50-mile Emergency Planning Zone around the Indian Point reactors.

10. A severe accident resulting in the dispersion of radionuclides from a nuclear power plant likely will result in the dispersion of small-sized radionuclides.⁴

11. Large-sized radionuclide particles are easier and less expensive to remove and clean up than small-sized radionuclide particles.

12. Conversely, it will be more expensive to decontaminate and clean up a suburban/urban area, such as the one that exists within the 50-mile Emergency Planning Zone around the Indian Point reactors, in which small-sized radionuclide particles have been dispersed, than it would be to clean up large-sized radionuclide particles.

13. Because MACCS2's decontamination and clean up costs are based on large-sized radionuclide particles, it underestimates the costs of decontaminating a suburban/urban area following the dispersion of radionuclides from a nuclear power plant.

⁴ The FSEIS mistakenly asserts that Contention 12 "argues that the size of the particles dispersed from a severe reactor accident would be comparable to those released in nuclear weapons tests." FSEIS at G-22. To the contrary, Contention 12 submits that the size of particles dispersed into the atmosphere from a severe reactor accident would be smaller than those released in nuclear weapons tests.

Evaluation, A Survey Conducted by an OECD/NEA Group of Experts, Committee on the Safety of Nuclear Installations, OECD Nuclear Energy Agency, Paris, France, July 1987 and R.E. Luna, H.R. Yoshimura, M.S. Soo Hoo, *Survey of Costs Arising from Potential Radionuclide Scattering Events*, WM2008 Conference, February 2008, Phoenix, AZ, further support the State's position.

17. The State further notes that while the FSEIS refers to assistance and analysis performed by Sandia National Laboratories in this specific licensing proceeding (FSEIS, G-22 – G-24), this work by Sandia is not cited or otherwise identified in the FSEIS's list of references. As NRC Staff has not supplied or identified the Sandia work that went into the FSEIS, it is difficult to comment on the specifics of that work and it is impossible to judge the validity of that work. The State reserves the right to submit additional contentions once the Sandia work has been identified and disclosed.

18. The FSEIS's discussion (at G-22 – G-24) of the State's contention is inadequate, incorrect, and arbitrary. In the FSEIS, NRC Staff incorrectly (1) accepts and employs cost data for moderate decontamination efforts in lieu of cost data for heavy contamination events and (2) fails to scale up the *Site Restoration* decontamination cost data for a high density urban area such as New York City and its metropolitan area.

19. These substantial errors and omissions result in a significant under-reporting of the environmental and economic costs associated with a severe accident at either Indian Point Unit 2 or Indian Point Unit 3 during the term of their new operating licenses and improperly skew the analysis of the alternatives to mitigate the environmental effects of severe accidents at either facility. The FSEIS's errors lead to a significant underestimation of costs that, in turn, undermines the severe accident mitigation alternatives analysis for the Indian Point reactors.

20. Thus, there is no reliable basis on which to conclude that the FSEIS accurately estimates potential decontamination and clean up costs for small-particle radionuclides in the Indian Point Emergency Planning Zone, and the FEIS is arbitrary, capricious and inadequate under NEPA, APA, and NRC and CEQ regulations, and as a basis upon which to determine relicensing.

21. Additionally, the FSEIS must include "consideration of major points of view concerning the environmental impacts of the proposed action and the alternatives, and contain an analysis of significant problems and objections raised by other Federal, State, and local agencies, by any affected Indian tribes, and by other interested persons" (10 C.F.R. § 51.71(b)), and discuss and respond to any relevant responsible opposing view not adequately discussed in the DSEIS. 10 C.F.R. § 51.91(3)(b); *see also* 40 C.F.R. §§ 1503.4, 1505.1(e). In this proceeding the State of New York, as well as the State of Connecticut, have made their concerns about decontamination costs known to NRC Staff. However, while the FSEIS acknowledges the existence of those concerns, the FSEIS does not address those concerns in a meaningful manner in violation of NRC and CEQ regulations. 10 C.F.R. §§ 51.91(a),(b),(c), 51.92(a)(2), 51.95(c)(1).

SUPPORTING EVIDENCE

22. The State incorporates the supporting evidence for the State of New York's Contentions 12, 12-A, and 12-B – contentions that previously were accepted by the Atomic Safety and Licensing Board – to support Contention 12-C.

23. In addition, the State relies on the accompanying February 2011 Report by David Chanin. In place of the outdated decontamination cost figure contained in the MACCS2 code, the December 2010 FSEIS and the December 2009 SAMA Reanalysis for IP2 and IP3 should

have incorporated the analytical framework contained in the 1996 Sandia National Laboratories report concerning site restoration costs, as well as recent studies examining the cost consequences in the New York metropolitan area. See D. Chanin and W. Murfin, *Site Restoration: Estimation of Attributable Costs from Plutonium-Dispersal Accidents*, SAND96-0957, Unlimited Release, UC-502, (May 1996).

24. Additional publicly available reports, such as CSNI 87-139, *Pathway Parameter Evaluation*, A Survey Conducted by an OECD/NEA Group of Experts, Committee on the Safety of Nuclear Installations, OECD Nuclear Energy Agency, Paris, France, July 1987 and R.E. Luna, H.R. Yoshimura, M.S. Soo Hoo, *Survey of Costs Arising from Potential Radionuclide Scattering Events*, WM2008 Conference, February 2008, Phoenix, AZ, further support the State's position.

25. Further supporting evidence includes: Beyea, Lyman, von Hippel, *Damages from a Major Release of ¹³⁷Cs into the Atmosphere of the United States*, Science and Global Security, Vol. 12 at 125-136 (2004) (discussing accident costs at Indian Point and four other sites); Lyman, *Chernobyl on the Hudson? The Health and Economic Impacts of a Terrorist Attack at the Indian Point Nuclear Power Plant*, Union of Concerned Scientists (September 2004).

26. These publicly-available reports should be used to determine the present and future value of decontamination costs for the four counties in the 10-mile Emergency Planning Zone, as well other cities and towns in the New York City-Connecticut-New Jersey metropolitan area that are within the 50-mile Emergency Planning Zone.

27. The Sandia *Site Restoration* study analyzed the expected financial costs for cleaning up and decontaminating a mixed-use urban land and Midwest farm and range land. The *Site Restoration* study, which was commissioned by the U.S. Department of Energy, estimated the activities likely to be involved in the decontamination of an accident involving the dispersal

of plutonium. Although *Site Restoration* studied a scenario in which plutonium from a nuclear weapon is dispersed as a result of an accident resulting from a fire or non-nuclear detonation of the weapon's explosive trigger device, the study's methodology and conclusions on estimating decontamination costs are directly useful to the License Renewal Application.

28. The Sandia study recognized that it is extremely difficult to clean up and decontaminate small radioactive particles (*i.e.*, particles ranging in size from a fraction of a micron to a few microns). See *Site Restoration*, SAND96-0957, at p. 5-7. Such small-sized particles adhere more readily to objects and become more easily lodged in small cracks, crevices, masonry, fabric, or grass and other vegetation. *Id.* at 5-7 to 5-10. The study examined the costs for extended remediation for mixed-use urban land (defined as having the national average population density of 1,344 persons/km²), Midwest farmland, arid western rangeland, and forested area, and concluded that accident costs would be highest for urban areas. *Id.*, Executive Summary, at x, xiii.

29. *Site Restoration* recognized that earlier estimates (such as those incorporated within the MACCS/MAACS2 codes) of decontamination costs are incorrect because they examined fallout from the nuclear explosion of nuclear weapons that produce large particles and high mass loadings (*i.e.*, particles ranging in size from tens to hundreds of microns). *Id.* at 2-9 to 2-10, 5-7. In the words of SAND96-0957, "[d]ata on recovery from nuclear explosions that have been publicly available since the 1960's appear to have been misinterpreted, which has led to long-standing underestimates of the potential economic costs of severe reactor accidents." *Id.* at 2-10.

30. For an extended decontamination and remediation operation in an urban area with an average national population density, *Site Restoration* predicted a clean up cost of

\$311,000,000/km² with on-site waste disposal and \$402,000,000/km² with off-site disposal.

SAND96-0957 at p. 6-4 (Table 6-1). For a so-called expedited decontamination of a heavily-contaminated urban area, *i.e.*, one that is finished within one year (*id.* at 5-1), the cost was predicted to be \$398,000,000/km² using off-site disposal and \$309,000,000/km² using on-site waste disposal. *Id.* at 6-5.⁵

31. The costs could be much higher. For a tourism, educational, transportation, and financial center such as the New York metropolitan area, the economic losses stemming from the stigma effects of the dispersion of radioactive material would likely be staggering. The Sandia *Site Restoration* study further recognized that:

In comparing the numbers of cancer health effects that could result from a plutonium-dispersal accident to those that could result from a severe accident at a commercial nuclear power plant, it is readily apparent that the health consequences and costs of a severe reactor accident could greatly exceed the consequences of even a "worst-case" plutonium-dispersal accident because the quantities of radioactive material in nuclear weapons are a small fraction of the quantities present in an operating nuclear power plant.

Id. at 2-3 to 2-4. All of these costs must be taken into account.

32. Moreover, many areas within the Indian Point Emergency Planning Zones have substantially higher population densities and property values than those examined in the Sandia *Site Restoration* report. Accordingly, as part of its analysis, the NRC in its FSEIS should revise the Sandia results for the densely populated and developed New York City metropolitan area, incorporate the region's property values, and ensure that the resulting financial costs are

⁵ These Sandia *Site Restoration* projections are in 1995 dollars for an area of average population density and did "not include downtown business and commercial districts, heavy industrial areas, or high rise apartment buildings. Inclusion of these areas would increase costs." SAND96-0957, at p. 6-2.

expressed in present value (in 2008/2009/2010 dollars) and future value (until 2035, the likely term of any renewed operating license).

33. In addition, the December 2010 FSEIS wholly ignores *Survey of Costs Arising from Potential Radionuclide Scattering Events*, which applies the Sandia Site Restoration report methodology to New York City.

34. In *Survey of Costs*, Robert Luna and his colleagues at Sandia National Laboratories, H.R. Yoshimura, M.S. Soo Hoo, developed a method to apply *Site Restoration* to high-density urban or hyper density urban areas such as the New York City metropolitan area. Their purpose was to derive cost estimates that could be used to assess Radiological Dispersion Devices (RDDs) which could release the same types of fission products released in reactor accidents, with Cs-137 (cesium 137) being commonly used in commercial irradiator facilities and cancer treatment machines, and to adapt the cost estimates of *Site Restoration* to high-density urban areas.

35. *Survey of Costs* adapted the cost spreadsheets used for *Site Restoration* to reflect the different mix of residential, commercial, and industrial areas of a high-density city. Luna's base case was a recalculation of the *Site Restoration* cleanup cost estimates for a 1344 persons/sq-km city which is presented in Table I (p. 3) of that report and shows a cost of \$391 M/sq-km (in 2005 dollars):

Table I. Urban Area (1344 persons/km²) Remediation Costs for Year 2005 in \$M/km² from Appendix G (Chanin, 1996).

Area Usage Type	Costs per sq. km			Area Fraction	Area Weighted Costs		
	Light (2<DF _s <5)	Moderate (5<DF _s <10)	Heavy (DF _s >10)		Light (2<DF _s <5)	Moderate (5<DF _s <10)	Heavy (DF _s >10)
Residential ^a	\$72.4	\$163.9	\$301.2	0.316	\$22.9	\$51.8	\$95.2
Commercial	\$195.3	\$295.5	\$851.2	0.173	\$33.8	\$51.1	\$147.3
Industrial	\$674.0	\$704.2	\$1,245.9	0.064	\$43.1	\$45.1	\$79.7
Streets	\$15.9	\$18.5	\$247.7	0.175	\$2.8	\$3.2	\$43.3
Vacant Land	\$81.1	\$85.7	\$95.2	0.272	\$22.1	\$23.3	\$25.9
Overall Cost per sq. km					\$124.6	\$174.5	\$391.4

^aincludes single and multiple family dwellings and apartment houses

Notably, Luna's \$391 M figure is substantially larger than what Sandia and NRC have identified in the FSEIS; indeed, it is more than twice as large.

36. Reproduced below are the cost estimates contained in Table 6-2 of *Site Restoration* where the cost for expedited remediation of heavy contamination of 1344 persons/sq-km area is calculated to be \$398.4 M/sq-km:

Table 6-2
 Cleanup Costs for Expedited Decontamination of Urban Areas
 (\$ million / km²)

<u>Usage Type</u>	<u>Light Contamination</u>	<u>Moderate Contamination</u>	<u>Heavy Contamination</u>
Residential	76.4	169.6	312.8
Commercial	195.3	295.5	851.2
Industrial	674.0	704.2	1245.9
Streets	15.9	18.5	247.7
Vacant Land	81.1	85.7	95.2

Combined	127.8	178.7	398.4

Site Restoration, at p. 6.5.

37. Immediately below are the comparable values that *Survey of Costs* derived for New York City (as set forth in Table II), showing a value of \$1699 M/sq-km:

Table II. Estimated Remediation Costs for New York City Reflecting Land Use Distribution and Population Density.

Land Use	Area Fraction ^a	Area Weighted			PD Multiple	Population and Area Weighted		
		Light (2<DF, <5)	Moderate (5< DF,<10)	Heavy (DF, >10)		Light (2<DF, <5)	Moderate (5<DF,<10)	Heavy (DF, >10)
Residential	0.287	\$20.31	\$45.99	\$84.51	6.82 ^b	\$138.55	\$313.64	\$576.38
Commercial	0.164	\$32.09	\$48.55	\$139.84	6.82 ^b	\$218.84	\$331.12	\$953.80
Industrial	0.068	\$45.51	\$47.55	\$84.12	1.00	\$45.51	\$47.55	\$84.12
Streets	0.250	\$3.97	\$4.62	\$61.88	1.00	\$3.97	\$4.62	\$61.88
Vacant Land	0.238	\$19.29	\$20.38	\$22.64	1.00	\$19.29	\$20.38	\$22.64
	1.00							
Overall Cost (\$M/km ²)		\$121.2	\$167.1	\$393.0		\$426	\$717	\$1,699

^a derived from New York City data (http://www.nyc.gov/html/dcp/pdf/landusefacts/landuse_tables.pdf)

^b ratio of New York City population density to that in Table I (9166/1344 = 6.82)

Survey of Costs, p. 4, Table II. *Survey of Costs* assumed a population density of 9166 persons/sq-km, which is an increase of a factor of 6.8 over Albuquerque's population density of 1344 persons/sq-km.

38. Luna's *Survey of Costs* analysis shows that the costs for cleanup of "heavy contamination" in New York City would be \$185,000/person, or \$1699 M/sq-km divided by 9166 persons/sq-km. The \$185,000/person cleanup cost identified in *Survey of Costs* is 14.0 times higher than the \$13,284/person value defended by NRC staff in the FSEIS as appropriate for Indian Point. *Survey of Costs Arising from Potential Radionuclide Scattering Events* should be considered conclusive proof that NRC's use of \$13,284/person for cleanup of the Indian Point area results in a gross underestimation of costs.

39. As recognized by the 1987 *OECD Pathway Parameter* report and the 1996 *Site Restoration* report, a Decontamination Factor of more than 10 would likely involve the removal and disposal of large amounts of soil and the wholesale removal of structures and the disposal of the resulting building wastes. Both *Pathway Parameter* and *Site Restoration* recognize that achieving Decontamination Factors greater than 10 in both farm and non-farm areas would

require the demolition of all structures, the removal and disposal of all the rubble, scraping of the remaining surface soil until the selected cleanup level was reached, and disposal of all rubble and scraped soil as radioactive waste. The practical impossibility of achieving Decontamination Factors greater than 10 for more than a few, select "vital facilities" has been known to the NRC since the mid-1970s, as reflected in the 1975 WASH-1400 report. *See Site Restoration*, Section 2.8 (quoting WASH-1400).

Respectfully submitted,



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February 3, 2011

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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
ADDITIONAL FACTUAL BACKGROUND	1
A. The Contention Meets All The Requirements of 10 C.F.R. § 2.309(f)(2).....	3
1. Information Not Previously Available.....	3
2. The New Information Is Materially Different Than Previously Available Information.....	4
3. The Contention is Timely	4
B. The Contention Also Meets the Requirements of 10 C.F.R. § 2.309(c).....	4
1. Good Cause.....	5
2. The State of New York’s Interest In This Proceeding, Its Standing and Its Unique Position As A Sovereign State Have Been Established.....	6
3. Admission Of These New Contentions Will Not Delay the Hearing And Will Assist In Developing The Record.....	6
C. The Contention Meets All The Requirements of 10 C.F.R. § 2.309(f)(1).....	7
1. The Bases are Within the Scope of License Renewal.....	7
2. The Issues Raised Are Material to the Findings that the NRC Must Make to Support the Action that is Involved in this Proceeding.....	8
3. Adequate Bases Have Been Provided For the Contention.....	8
4. A Concise Statement of Facts and Expert Opinion Support the Contention.....	9
5. A Genuine Dispute Exists on a Material Issue of Law or Fact.....	9
CONCLUSION.....	10
C. Consultation With Parties Pursuant to 10 C.F.R. § 2.323.....	A-1

INTRODUCTION

The State of New York respectfully submits this additional contention NYS 12-C based on the Final Supplemental Environmental Impact Statement (“FSEIS”) issued by Staff of the Nuclear Regulatory Commission (“NRC”) on December 3, 2010.¹ The State herein submits this contention (Contention 12-C), which updates the State’s previously submitted contentions, Contentions 12, 12-A, and 12-B, asserting respectively that the Applicant’s April 2007 Environmental Report (“ER”) and Staff’s December 2008 Draft Supplemental Environmental Impact Statement (“DSEIS”), and the Applicant’s December 2009 severe accident mitigation alternatives (“SAMA”) Reanalysis failed to provide an accurate estimate of decontamination and cleanup costs in the event of a severe accident at Indian Point.

FACTUAL BACKGROUND

On November 30, 2007, the State submitted Contention 12, which asserted that Entergy had not, in its ER, accurately modeled the cleanup and decontamination costs for a severe accident over an urban area such as the Westchester County/New York City area surrounding Indian Point. New York State Notice of Intention to Participate and Petition to Intervene, dated November 30, 2007, NRC Docket Nos. 50-247-LR and 50-286-LR, ML073400187. The Board admitted Contention 12 on July 31, 2008. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Memorandum and Order (Ruling on Petitions to Intervene and Requests for Hearing) LBP-08-13 at 82-83, 68 NRC 43 (July 31, 2008) (ML082130436). On February 27, 2009, the State submitted Contention 12-A, which asserted that Staff’s DSEIS adopted the same flawed modeling contained in the ER, and therefore also underestimated the

¹ In its Order and Memorandum dated December 27, 2010, the Board extended the deadline for filing this contention to February 3, 2011. See Order and Memorandum dated December 27, 2010 (ML103610172).

true cost of decontamination and cleanup in the event of a severe accident. State of New York Contentions Concerning NRC Staff's Draft Supplemental Environmental Impact Statement. (February 27, 2009) (ML090690303). The Board admitted Contention 12-A on June 16, 2009, and consolidated it with Contention 12. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3) Order (Ruling on New York State's New and Amended Contentions) (June 16, 2009) (ML091670435).

On December 14, 2009, Entergy submitted revised SAMA analyses which used revised meteorological data and updated Entergy's previous cleanup cost estimates. Entergy, NL-09-165, License Renewal Application – SAMA Reanalysis Using Alternate Meteorological Tower Data (Dec. 14, 2009). On March 11, 2010, the State filed Amended Contention 12-B, challenging Entergy's revised SAMA analysis. State of New York's Motion for Leave to File New and Amended Contentions Concerning the December 2009 Reanalysis of Severe Accident Mitigation Alternatives (March 11, 2010) (ML100780366). On June 30, 2010, the Board admitted Contentions 12-B, and consolidated it with Contentions 12/12-A. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Memorandum and Order (Ruling on the Admissibility of New York's New and Amended Contentions 12B, 16B, 35, and 36), LBP-10-13 at 9-10, 71 N.R.C. – (June 30, 2010).

On December 3, 2011, NRC Staff released its FSEIS. As set forth more fully in the accompanying contention (NYS 12-C) and report of David Chanin, the State asserts in this proposed contention that the FSEIS fails to account for actual population density in the New York Metropolitan Area and misapplied different decontamination factors. In addition, the State notes that the FSEIS relies on undisclosed and unidentified work from Sandia National Laboratories.

A. The Contention Meets All The Requirements of 10 C.F.R. § 2.309(f)(2)

The proposed contention, Contention 12-C, fully meets 10 C.F.R. § 2.309(f)(2) which requires for admissibility, in pertinent part, a showing that:

(i) The information upon which the amended or new contention is based was not previously available;

(ii) The information upon which the amended or new contention is based is materially different than information previously available; and

(iii) The amended or new contention has been submitted in a timely fashion based on the availability of the subsequent information. *Id.*

This contention is based on NRC Staff's Final Supplemental Environmental Statement and the analysis and recommendations contained therein, which was first released for public consideration on December 3, 2010 and was not previously available.

1. Information Not Previously Available

Because this contention is based upon a document first filed on December 3, 2010, and because it relies on the new information contained in that document regarding the costs of decontamination and cleanup following a potential severe accident, the contention relies on information not previously available and thus meets the first prong of the test set forth in 10 C.F.R. § 2.309(f)(e)(i). In fact for the first time, Staff recognizes in the FSEIS (*see* FSEIS Appendix G, § G.2.3, pp. G-22 – G-25), the State of New York's concern that the economic costs of a severe accident at Indian Point have been significantly underestimated in this proceeding, even if Staff based its analysis on incorrect assumptions and inputs. Staff and Entergy had conducted no analysis in the DSEIS or the ER.

2. The New Information Is Materially Different Than Previously Available Information

It was not until NRC Staff had completed the FSEIS in December 2010 that the State was able to determine that the FSEIS (1) fails to account for actual population density in the New York Metropolitan Area, and (2) misapplies different decontamination factors.

The Staff's evaluation - in FSEIS Appendix G, § G.2.3 - of the inputs and assumptions which Entergy used in its SAMA analysis is materially different than the evaluation contained in the previous DSEIS. For the first time, and apparently in response to the State's contentions, NRC Staff has attempted to set forth its position concerning the consequences of Entergy's use of particular inputs and assumptions. Staff uses this comparison, completed by Sandia with undisclosed methodology, to justify its conclusion that the inputs and assumptions of Entergy's SAMA analysis are acceptable. Staff's newly revealed basis for reaching that conclusion -- while still deficient in the State's view -- is materially different than the DSEIS's non-responsiveness on this point, and so meets the requirements of 10 C.F.R. § 2.309(f)(2)(ii).

3. The Contention Is Timely

Pursuant to Orders issued by the Board and referenced above, contentions based on the December 2010 FSEIS were due to be filed on or before February 3, 2011. This contention has been filed on February 3, 2011. Thus, the State of New York State has demonstrated that its proposed new contention meets the requirements for admissibility set forth in 10 C.F.R. § 2.309(f)(2).

B. The Contention Also Meets the Requirements of 10 C.F.R. § 2.309(c)

Although a party is not required to demonstrate compliance with 10 C.F.R. § 2.309(c)

where, as here, it meets the requirements of 10 C.F.R. § 2.309(f)(2), NRC Staff has argued in other proceedings that a new contention is required to meet the provisions of both sections.² Since the State easily meets both sets of standards and, out of an abundance of caution, it provides the following demonstration of its compliance with the requirements of 10 C.F.R. § 2.309(c).

1. Good Cause

Contention 12-C addresses, pursuant to NEPA and NRC regulations, the costs of cleanup and decontamination in the Westchester County area and beyond in the event of a severe accident.

The State has taken seriously the admonition that “[a]ll parties are obligated, in their filings before the presiding officer and the Commission, to ensure that their arguments and assertions are supported by appropriate and accurate references to legal authority and factual basis, including, as appropriate, citations to the record. Failure to do so may result in appropriate sanctions, including striking a matter from the record or, in extreme circumstances, dismissal of the party.” 10 C.F.R. § 2.323(d); *see* 69 Fed. Reg. 2182, 2183, Statement of Considerations, Changes to Adjudicatory Process (Jan. 14, 2004) referring to “existing requirements . . . to proffer specific, adequately supported contentions in order to be admitted as a party to the proceeding.” The State has presented substantial evidence in the form of an expert report to show that NRC Staff improperly

² 10 C.F.R. § 2.309(c) is only applicable to “late filed contentions.” Contentions that meet the requirements of 10 C.F.R. § 2.309(f)(2) are, by meeting subpart iii, “timely” and thus do not need to meet the provisions of § 2.309(c). *See In the Matter of Entergy Nuclear Vermont Yankee L.L.C. and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station) Docket No. 50-271-OLA, ASLBP No. 04-832-02-OLA (December 2, 2005) LBP-05-32, slip op. at 9-10. *See also In the Matter of Entergy Nuclear Vermont Yankee L.L.C. and Entergy Nuclear Operations, Inc.* (Vermont Yankee) LBP 07-015 (November 7, 2007), ML073110424, slip op. at 6, n.12.

relies on clean up cost estimates for a city with a smaller persons/sq-km ratio than that of New York City, which results in an underestimation factor of 8.93 and improperly substitutes decontamination costs for a moderate contamination event in place of decontamination costs of a heavy contamination event, which results in the underestimation factor of 2.23. According to the accompanying report of David Chanin, these errors and admissions lead to a substantial underestimation of the decontamination costs for a severe accident at the Indian Point reactors and skew the SAMA analysis. *See* Chanin Report at pp. 3, 7-8, 10, 16-17. .

2. The State of New York's Interest In This Proceeding, Its Standing And Its Unique Position As A Sovereign State Have Been Established.

As an admitted party, the State of New York has already demonstrated that it has a right to be in the proceeding, that it has a substantial interest in the proceeding and that its interest will be substantially impacted by any order entered in this proceeding. *See also* 42 U.S.C. § 2021(l) (recognizing important role of States in AEA matters). Thus, it fulfills the provisions of 10 C.F.R. §§ 2.309(c)(ii, iii, and iv). Similarly, no other party can adequately represent the interests of the State of New York, a sovereign governmental entity, particularly on the issues raised here, which issues have not been raised by any other party. Thus, the State also fulfills the provisions of 10 C.F.R. §§ 2.309(c)(v and vi).

3. Admission Of These New Contentions Will Not Delay The Hearing And Will Assist In Developing The Record

Contention 12-C reaffirms the relevance of previously admitted Contentions 12, 12A, and 12B. Assuming that NRC Staff identifies and discloses that Sandia work on this issue, the admission of this contention should not delay the hearing . Finally, new Contention 12C will facilitate the development of a fuller record upon which the Board will be able to base its

decision on whether, pursuant to NEPA, the reasonable mitigation measures to license renewal were identified, developed, and objectively studied by NRC Staff, and if the FSEIS provides an accurate, rational, and objective basis for a decision regarding license renewal. Since the obligation to analyze all reasonable alternatives to the proposed project is imposed by statute, case law and Commission regulation, it will be beneficial to have this fuller record in carrying out the Board's obligations under 10 C.F.R. § 2.340(a).

C. The Contention Meets All The Requirements of 10 C.F.R. § 2.309(f)(1)

1. The Bases Are Within the Scope of License Renewal

New York State Contention 12-C contends that:

THE DECEMBER 2010 FSEIS ANALYSIS FOR IP2 AND IP3 UNDERESTIMATES DECONTAMINATION AND CLEAN UP COSTS ASSOCIATED WITH A SEVERE ACCIDENT IN THE NEW YORK METROPOLITAN AREA AND, THEREFORE, FAILS TO CONSIDER MITIGATION MEASURES WHICH ARE RELATED TO LICENSE RENEWAL IN VIOLATION OF NEPA, APA, AND NRC AND CEQ REGULATIONS

Previous contentions on this issue with similar bases have already been admitted by the Board. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Memorandum and Order (Ruling on Petitions to Intervene and Requests for Hearing) LBP-08-13 at 61-65, 68 NRC 43 (July 31, 2008); Order (Ruling on New York State's New and Amended Contentions) (June 16, 2009) at 3-4; *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Memorandum and Order (Ruling on the Admissibility of New York's New and Amended Contentions 12B, 16B, 35, and 36), LBP-10-13 at 9-10, 71 N.R.C. – (June 30, 2010). The proposed contention brings forward the State's previously admitted contentions on the issue of decontamination costs to the recently issued FSEIS. Thus, NYS 12-C, which

continues the challenge to the analysis of decontamination costs and the SAMA analysis, remains within the scope of this license renewal proceeding.

2. The Issues Raised Are Material to the Findings that the NRC Must Make to Support the Action that is Involved in this Proceeding

NRC regulations require Entergy and NRC Staff to conduct a severe accident mitigation alternatives analysis for the Indian Point reactors as part of the NEPA review and environmental impact statement process. 10 C.F.R. § 51.53(c)(3)(ii)(L). That analysis depends upon an accurate calculation of the cost of a severe accident in order to have a base line against which to measure proposed mitigation measures. Before the NRC Commissioners may issue new operating licenses for the two Indian Point reactors they must ensure that Staff conducted an accurate SAMA review and took a “hard look” at mitigation alternatives. *Id.* 10 C.F.R. § 51.101. In addition, NRC must determine whether it has taken all practicable measures to avoid or minimize environmental harm. 10 C.F.R. § 51.103. Because the State has raised a contention that goes to the heart of the NEPA alternatives analysis, the contention satisfies the materiality standard.

3. Adequate Bases Have Been Provided For the Contention

The State of New York today seeks presents detailed bases in further support of its contention that Entergy and now NRC Staff have significantly underestimated the cost to decontaminate the New York City metropolitan area following a severe accident at either of the Indian Point reactors. These bases are detailed and exceed the regulatory requirement in 10 C.F.R. § 2.309(f)(1)(ii) for a “brief explanation” of the bases. In this proceeding, the Atomic Safety and Licensing Board previously has admitted the State’s contentions on the decontamination cost issue that contain similar bases.

4. A Concise Statement of Facts and Expert Opinion Support the Contention

In today's filings, the State has presented a detailed statement of facts and a report by David Chanin, who provides his opinion that the December 2010 FSEIS discussion of decontamination costs contains significant errors that lead to the underestimation of decontamination costs and skew the SAMA analysis. The Atomic Safety and Licensing Board previously has admitted the State's contentions on the decontamination cost issue that contain similar factual assertions.

5. A Genuine Dispute Exists on a Material Issue of Law or Fact

The State of New York has provided sufficient information demonstrating that a genuine dispute exists with regard to several material issues of fact including: whether Entergy's SAMA analysis and NRC Staff's acceptance of that analysis contains significant underestimation of the decontamination costs for a severe reactor accident at Indian Point that could affect the New York City metropolitan area. As stated by this Board in LBP-10-13:

The Commission has held that a litigable NEPA issue is one that concerns whether the NRC Staff has taken the requisite "hard look" at "mitigation (and the SAMA issue is one of mitigation) . . . in 'sufficient detail to ensure that environmental consequences [of the proposed project] have been fairly evaluated.'"

LBP-10-13, at 5 (citations omitted). In the December 2010 FSEIS, NRC Staff -- for the first time in this proceeding -- has acknowledged the existence of the State's concern and its contentions on this issue. FSEIS, at G-22-24. However, as set forth in Contention 12-C and the accompanying Chanin Report, the Staff's discussion of the issue is inadequate as well as inaccurate. In short, the State contends that the Staff has not taken a hard look at the issue of decontamination costs and that its alternatives analysis is arbitrary. Moreover, the underlying Sandia work on this issue has not been disclosed to the State. Should the State succeed in its

contention, Entergy and Staff would have to reopen the SAMA analysis and reexamine what additional mitigation alternatives would become cost beneficial – an issue that is material to the Staff's NEPA obligations. As this Board ruled in admitting the State's initial contention on this issue, NYS Contention 12 "raises questions of material fact about the applicant's SAMA analysis." LBP 08-13 at 64. In light of the ongoing dispute over decontamination costs, a genuine dispute continues to exist among the parties as to a material issue.

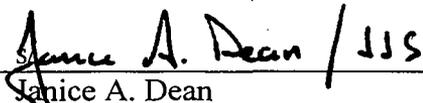
CONCLUSION

For the foregoing reasons, the State respectfully requests that the Board admit the State's new and amended Contention 12C concerning cleanup and decontamination costs.

Respectfully submitted,



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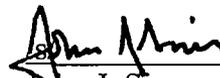


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February 3, 2011

Consultation with Parties Pursuant to 10 C.F.R. § 2.323

I certify that I have made a sincere effort to contact the other parties in this proceeding, to explain to them the factual and legal issues raised in this motion, and to resolve those issues, and I certify that my efforts have been unsuccessful.



John J. Sipos

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

-----x
In re:

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

License Renewal Application Submitted by

ASLBP No. 07-858-03-LR-BD01

Entergy Nuclear Indian Point 2, LLC,
Entergy Nuclear Indian Point 3, LLC, and
Entergy Nuclear Operations, Inc.

DPR-26, DPR-64

February 3, 2011
-----x

**STATE OF NEW YORK'S SUPPLEMENT TO MOTION FOR LEAVE TO FILE
NEW AND AMENDED CONTENTION 37 CONCERNING
CHAPTER 8 OF THE DECEMBER 3, 2010 FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT**

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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
THE NEW BASES COMPLY WITH THE REQUIREMENTS OF 10 C.F.R. § 2.309(f)(1)	1
1. The Bases Are Within the Scope of License Renewal	1
2. The Issues Raised Are Material to the Findings that the NRC Must Make to Support the Action that is Involved in this Proceeding	3
3. Adequate Bases Have Been Provided For the Contention.....	3
4. A Concise Statement of Facts and Expert Opinion Support the Contention	4
5. A Genuine Dispute Exists on a Material Issue of Law or Fact.....	4
CONCLUSION.....	5

**STATE OF NEW YORK MOTION FOR LEAVE TO FILE
TIMELY NEW CONTENTION 37**

INTRODUCTION

Pursuant to 10 C.F.R. § 2.309(f)(2) and 10 C.F.R. § 2.309(f)(1) the State of New York seeks leave to file Contention 37, which contains new and amended bases. The State of New York demonstrated in its initial motion for leave to admit Contention 37, that these new bases are timely and arise out of new information not previously available that is materially different than previously available information. As set forth below in this supplement to that motion, these amended bases also comply with the requirements of 10 C.F.R. § 2.309(f)(1).

**THE NEW BASES COMPLY WITH THE
REQUIREMENTS OF 10 C.F.R. § 2.309(f)(1)**

1. The Bases Are Within the Scope of License Renewal

New York State Contention 37 claims that:

The FSEIS Discussion of Energy Alternatives (Chapter 8) Fails to Provide a Meaningful Analysis of Energy Alternatives or Responses to Criticisms of the DSEIS, in Violation of the Requirements of NEPA, 10 C.F.R. §§ 51.91(a)(1), and (c), 51.95(c)(4), and Part 51, Subpart A, Appendix A and Appendix B, 40 C.F.R. §§ 1052.1, 1052.2(g), 1502.9, and 1502.14, and 5 U.S.C. § 551 *et seq.*

This contention updates the State's two previously submitted contentions, Contentions 9 (ML073400187) and 33 (ML090690303), which asserted respectively that the Applicant's Environmental Report ("ER)," and Staff's Draft Supplemental Environmental Impact Statement ("DSEIS") failed to give meaningful consideration to non-fossil fuel alternatives to license renewal. These contentions and their bases have already been admitted by the Board. The Board admitted Contention 9 on July 31, 2008. *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Memorandum and Order (Ruling on Petitions to Intervene and

Requests for Hearing) LBP-08-13, 68 NRC 43 (July 31, 2008) (ML082130436). The Board admitted Contention 33 on June 16, 2009. *Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3) Order (Ruling on New York State's New and Amended Contentions)* (June 16, 2009) (ML091670435). The proposed contention and bases set forth the State's claim that NRC Staff's recently issued Final Supplemental Environmental Impact Statement failed to meaningfully consider non-fossil fuel alternatives to license renewal. Thus, the State's additional bases, which continue the challenge to the environmental impact statement, remain within the scope of this license renewal proceeding.

Furthermore, Contention 37 challenges NRC's analysis and recommendations with respect to new alternatives included in the FSEIS, and asserts the FSEIS does not provide a rational basis for the NRC's Record of Decision ("ROD"). The contention argues that the FSEIS fails to address previously identified defects contained in the Applicant's ER and Staff's DSEIS, and that NRC Staff failed to meaningfully respond to this criticism and largely incorporated those defects into the FSEIS. As a result of this flaw, the FSEIS is deficient in how it addresses new and significant information and how it analyzes the consequences of the no-action alternative. Although NRC Staff has modified the FSEIS to give putative recognition to non-fossil fuel alternatives to license renewal not previously given consideration in the DSEIS, Staff nonetheless fails to provide a meaningful and objective "hard look" at the comparative impacts of those alternatives. Thus, the State's additional bases, which continue the challenge to the environmental impact statement and Staff's recently released analysis of the alternatives to license renewal, remain within the scope of this license renewal proceeding.

2. The Issues Raised Are Material to the Findings that the NRC Must Make to Support the Action that is Involved in this Proceeding

The NRC must ascertain the site specific environmental impacts of reasonable alternatives to license renewal and the no action alternative. The new and amended bases are supported by numerous recent studies by State energy planning decision makers, and the declarations of three experts. The new and amended bases include substantial and detailed criticisms of the set of new energy alternatives provided in the FSEIS, and the extent to which NRC Staff failed to (a) meaningfully consider significant new information material to non-fossil fuel alternatives; (b) failed to respond in the FSEIS to the State's detailed criticism of the DSEIS; (c) failed to meaningfully analyze renewable sector generation, energy efficiency and conservation, purchased electrical power and combined heat and power; and (d) relied substantially on obsolete and inaccurate information. The new and amended bases are material to this relicensing proceeding, because, if the State is correct in its contention, the NRC must conduct a meaningful and accurate analysis of non-fossil fuel alternatives to license renewal, in determining whether to approve the proposed action and in evaluating the no action alternative.

3. Adequate Bases Have Been Provided For the Contention

The State of New York today seeks leave to present additional bases in further support of a previously-admitted contention. These additional bases are detailed and exceed the regulatory requirement in 10 C.F.R. § 2.309(f)(1)(ii) for a "brief explanation" of the bases. The additional bases evaluate (a) the extent to which the FSEIS fails to address previously identified defects in the alternatives analysis of the Environmental Report and Draft Supplemental Environmental Impact Statement, (b) fails to meaningfully respond to the State's criticisms of the alternatives analysis in both those documents, (c) fails to meaningfully describe, develop, and objectively

evaluate the environmental impacts of energy conservation, purchased power, renewable sector generation and combined heat and power; and (d) relies substantially on obsolete and inaccurate data, studies, and assumptions in reaching its conclusion that the environmental impacts of license renewal are not so great that preserving the option of license renewal would be unreasonable. These bases are in addition to the bases previously accepted when Contentions 9 and 33 were admitted.

4. A Concise Statement of Facts and Expert Opinion Support the Contention

New York State Contention 37 provides detailed factual assertions supporting the State's position that the FSEIS contains an inadequate analysis of energy alternatives. In addition, the State of New York has supported this contention with the expert declarations of David Schlissel, Peter Bradford and Peter Lanzalotta, who have detailed significant developments in New York State's energy markets and energy infrastructure directly relevant to the timing, cost, and viability of license renewal relative to other energy generation alternatives not addressed in the FSEIS, and have identified substantial errors and/or obsolete assumptions in the FSEIS that render the conclusions therein regarding license renewal substantially flawed, arbitrary, and/or unsupported by substantial evidence.

5. A Genuine Dispute Exists on a Material Issue of Law or Fact

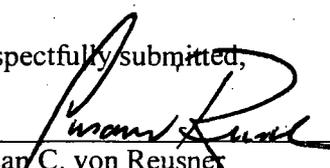
The State of New York has provided sufficient information that a genuine dispute exists with regard to several material issues of fact including extensive and detailed analysis of the current and forecasted status of New York's energy markets and energy infrastructure which are directly relevant to the choice and viability of non-fossil fuel alternatives to license renewal, including information on: new generation, transmission enhancements, the impact of New York

State's implementation of aggressive state-wide policies and programs to significantly increase energy efficiency, conservation and renewables, and has further detailed specific factual errors and inaccuracies in Chapter 8 of the FSEIS. There are also material disputes of law including the extent to which the FSEIS has: (a) incorporated significant new information to accurately depict the status quo of the proposed project and its environment at the time of the final supplement; (b) sufficiently responded to the State's criticisms and comments on the Draft Supplemental Environmental Report; (c) provided NEPA's requisite "hard look" at non-fossil fuel alternatives to license renewal; and (d) whether the alternatives analysis provided in the FSEIS provides a legally sufficient and rational basis for the Record of Decision regarding license renewal.

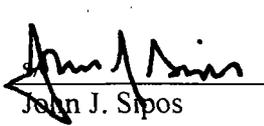
CONCLUSION

The State of New York respectfully requests that the Atomic Safety and Licensing Board admit the new bases for NYS Contention 37.

Respectfully submitted,

s/ 
Susan C. von Reusner
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Dated: February 3, 2011


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**Errors and Omissions in NRC Staff's Economic Cost Estimates of Severe Accident
Mitigation Alternatives Analysis Contained in December 2010 Indian Point Final
Supplemental Environmental Impact Statement (FSEIS), NUREG-1437, Supplement 38**

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Chanin Consulting
Albuquerque, New Mexico

February 2011

TABLE OF CONTENTS

	<u>Page</u>
TABLE OF CONTENTS	i
TIMELINE OF CERTAIN REFERENCES.....	ii
INTRODUCTION AND SUMMARY	1
DISCUSSION	1
Mistake No. 1 – Failure to Account for Actual Population Density in the New York Metropolitan Area	4
Mistake No. 2 – Misapplication of Different Decontamination Factors	8
Consequences of Mistakes	16
REFERENCES	A-1
SUMMARY OF EXPERIENCE	A-3

Timeline of Certain References

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Introduction and Summary

The December 2010 Final Supplemental Environmental Impact Statement for the relicensing of Indian Point Unit 2 and Unit 3 NUREG-1743, Supplement 38 represents an improvement over Entergy's initial Environmental Report, NRC Staff's December 2008 Draft Supplemental Environmental Impact Statement, and Entergy's December 2009 SAMA Reanalysis given that NRC Staff has for the first time recognized the State of New York's concern that the economic costs of a severe accident at Indian Point have been significantly underestimated in this proceeding; however, the FSEIS is inadequate because it bases its analysis of the economic costs of a severe accident on erroneously low cost data, it misapplies the SAND96-0957 *Site Restoration* report, and it ignores other reports showing that the cost of a severe reactor accident in a densely developed and populated urban area would be at least one order of magnitude larger than the cost figures on which the FSEIS relied. Among other things, the FSEIS is deficient because it uses unrealistically optimistic (*i.e.*, low) input values for the economic cost model in the CHRONC module of the MACCS2 computer program that Entergy used in its various license renewal submissions from 2007 through 2009. These substantial errors and omissions result in a significant under reporting of the environmental and economic costs associated with a severe accident at either Indian Point Unit 2 or Indian Point Unit 3 during the term of their new operating licenses and improperly skew the analysis of the alternatives to mitigate the environmental effects of severe accidents at either facility.

Moreover, while the FSEIS makes several references to assistance and analysis performed by Sandia National Laboratories in this proceeding, this work by Sandia is not cited or otherwise identified in the FSEIS's list of references. As NRC Staff has not supplied or identified the Sandia work that went into the FSEIS, it is difficult to comment on the specifics of

that work and it is impossible to judge the validity of that work.

Discussion

In this proceeding, Entergy has applied to the Nuclear Regulatory Commission for authorization to renew the two operating licenses for Indian Point Unit 2 and Indian Point Unit 3, which are located approximately 24 miles north of New York City. As part of the license renewal proceeding, Entergy and NRC Staff have presented information about the economic costs of a severe accident at the Indian Point Unit 2 and Indian Point Unit 3.¹ However, the proffered economic costs of a severe accident at Indian Point are significantly underestimated due to the use of unrealistically optimistic (*i.e.*, low) input values for the economic cost model of MACCS2.²

The State's challenge (Contention 12/12A/12B) is supported by the 1996 Sandia National Laboratories SAND96-0957 *Site Restoration* report,³ which was written by Walter Murfin and myself, as well as by additional reports and studies that confirm that the cost to cleanup fission products in a densely populated and developed area such as the New York City metropolitan area could be at least one order of magnitude larger than the cost figures and inputs used by Entergy and NRC Staff thus far in the Indian Point proceeding. Despite the fact that NRC Staff has now cited the *Site Restoration* report, many aspects of Staff's discussion and cost estimates in FSEIS, Appendix G, § G.2.3 are fallacious.

¹ Entergy, IPEC, Applicant's Environmental Report, Appendix E. p. E.3-83 (submitted 2007); Entergy, Reply to Request for Additional Information Regarding License Renewal Application, Severe Accident Mitigation Alternatives Analysis, NL-08-028, letter from Fred Dacimo dated February 5, 2008, ML080420264; Entergy, Re-analysis of MACCS2 Models for IPEC, IP-CALC-09-00265, Responsible Engineer: K. Hong, December 2009.

² NUREG/CR-6613, SAND97-0594, D.I. Chanin & M.L. Young, *Code Manual for MACCS2: Volume 1, User's Guide*, Sandia National Laboratories, Albuquerque, NM, 1998.

³ SAND96-0957, D.I. Chanin & W.B. Murfin, *Site Restoration: Estimation of Attributable Costs from a Plutonium-Dispersion Accident* (May 1996).

In the FSEIS, NRC Staff now claims that the \$13,284/person value (in 2005 dollars) decontamination cost used by Entergy in its SAMA analysis “appear[s] reasonable and acceptable” because “it is not significantly different” from a \$14,900/person value figure (in the 1995 dollars of *Site Restoration*), which Sandia National Laboratories staff apparently derived for NRC in an unreferenced analysis that purports to apply the cost estimates contained in *Site Restoration’s* Table 6-2 to the New York City metropolitan area. FSEIS, at G-24. In contrast to the FSEIS’s brief conclusory statements, it is my opinion that the \$14,900/person decontamination cost claimed by NRC staff to represent the results of the *Site Restoration* report is an egregious distortion of that report and ignores other reports, such as Luna’s 2008 *Survey of Costs Arising from Potential Radionuclide Scattering Events* and OECD’s 1987 *Pathway Parameter Evaluation*.

In my opinion, the December 2010 FSEIS is affected by two clear errors:

- (1) NRC Staff relies on cleanup cost estimates for a city with 1,344 person/sq-km and made no adjustment to New York City, with its assumed 12,000 persons/sq-km, an underestimation by a factor of 8.93; and
- (2) NRC Staff mistakenly claims that cleanup costs for “moderate” contamination requiring a Decontamination Factor (or DF) from 5 to 10 for plutonium were appropriate for achieving a Decontamination Factor of 15 for cesium based on an undisclosed and unreferenced Sandia effort. Staff cites the judgment of Sandia staffers, which essentially equates apples to oranges, thereby causing underestimation by a factor of \$398 M / \$178 M, for an additional underestimation factor of 2.23.

These errors lead to underestimation of costs. This report will discuss these mistakes and their consequences in more detail, below.

Before discussing these mistakes in more detail, I first address the FSEIS’s passing attempt to avoid *Site Restoration*. FSEIS, Vol. 3, p G-23, lines 28-30. Although *Site Restoration* examined plutonium issues, it also contained significant discussion of fission product

contamination, and private sector and government researchers have applied *Site Restoration's* cost estimate to fission product releases. Among the notable instances of its use, *Site Restoration* was used by the federal government in the U.S. Department of Energy's 2002 Yucca Mountain FSEIS.⁴ In addition, *Site Restoration* was used for various public studies of potential impacts from Radiological Dispersal Devices (RDDs) funded by the Department of Homeland Security (DHS), such as Reichmuth⁵ and Luna.⁶ None of these U.S. government studies using *Site Restoration* has raised any concerns as to its applicability to fission product releases from SNF accidents and to RDD events. Notably, Reichmuth's RDD source term was the same fission product (Cs-137) that is the primary nuclide considered in assessing severe reactor accidents, as mentioned in Section G.2.3 of the Indian Point FSEIS. Academic publications also have cited *Site Restoration*.⁷

Mistake No. 1 – Failure to Account for Actual Population Density in the New York Metropolitan Area

As noted by Robert Luna and his colleagues at Sandia National Laboratories, H.R. Yoshimura, M.S. Soo Hoo, in *Survey of Costs Arising from Potential Radionuclide Scattering Events*, (p 3-4)⁸ the *Site Restoration* study was not intended to be used “as-is” for high-density areas or hyper density urban areas such as New York City. Indeed, as *Site Restoration* made

⁴ Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Nuclear Waste at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250, Volume 2, Appendix J, Department of Energy, Washington, DC, February 2002.

⁵ B. Reichmuth, S. Short, T. Wood, *Economic Consequences of a Rad/Nuc Attack: Cleanup Standards Significantly Affect Risk*, Pacific Northwest Laboratory, Working Together Conference, April 28, 2005, Boston, MA.

⁶ R.E. Luna, H.R. Yoshimura, M.S. Soo Hoo, *Survey of Costs Arising from Potential Radionuclide Scattering Events*, WM2008 Conference, February 24-28, 2008, Phoenix, AZ.

⁷ J. Beyea, E. Lyman, F. Hippel, *Damages from a Major Release of Cs-137 into the Atmosphere of the United States*, *Science and Global Security*, 12:125–136, 2004.

⁸ R.E. Luna, H.R. Yoshimura, M.S. Soo Hoo, *Survey of Costs Arising from Potential Radionuclide Scattering Events*, WM2008 Conference, February 24-28, 2008, Phoenix, AZ

clear:

The cost estimates thus derived are applicable to the majority of the U.S. land area. Not addressed, because of their complexity, are coastal regions, wetlands, and the centers of large cities.

Costs were not estimated for very high density urban areas (centers of large cities), coastlines, or wetlands. Nuclear weapons operations scrupulously avoid city centers.

Site Restoration at pp. 1-1, x, n.2. *Site Restoration* refers to making direct observation and taking measurements of residential, commercial, and industrial areas which were made in our home city of Albuquerque, New Mexico which had a population density of 1344 persons/sq-km at the time of our research in the 1990's. NRC Staff's December 2010 FSEIS for the two Indian Point reactors, however, fails to acknowledge or understand the fact that the *Site Restoration* report was based on a city with only a moderate population density. In FSEIS Section G.2.3, NRC staff appears to rely on *Site Restoration's* cleanup cost estimates derived for Albuquerque and apply them without adjustment to the most urban nuclear power reactors in the country and to New York City, with an assumed population density of 12,000 persons/sq-km.⁹

In *Survey of Costs Arising from Potential Radionuclide Scattering Events*, Robert Luna and his colleagues developed a way to apply *Site Restoration* to high-density urban areas or hyper density urban areas. Their purpose was to derive cost estimates that could be used to assess Radiological Dispersion Devices (RDDs) which could release the same types of fission products as those released in reactor accidents, with Cs-137 (cesium 137) being commonly used in commercial irradiator facilities and cancer treatment machines and therefore a possible source

⁹ NRC Staff states that New York City has a population density of about 12,000 persons/sq-km. FSEIS at G-24. Because of the high population density, the Indian Pt. Reactors are the only reactors in the country for which the NRC requires that EPZ sirens have battery backup power. NRC News, No. 07-094, NRC Issues Order to Entergy on Indian Pt. Sirens, July 30, 2007

material of concern. Fortuitously, the “base case” in Luna’s *Survey of Costs* was New York City and costs were measured in 2005 dollars. Thus, the cost numbers are apples-to-apples comparable to the cost numbers in the FSEIS’s Section G.2.3 analysis, which also examines New York City and presents cost estimates in 2005 dollars.

Survey of Costs adapted the cost spreadsheets used for *Site Restoration* to reflect the different mix of residential, commercial, and industrial areas of a high-density city. Luna’s base case was a recalculation of the *Site Restoration* cleanup cost estimates for a 1344 persons/sq-km city which is presented in Table I (p. 3) of that report and shows a cost of \$391 M/sq-km (in 2005 dollars)¹⁰:

Table I. Urban Area (1344 persons/km²) Remediation Costs for Year 2005 in \$M/km² from Appendix G (Chanin, 1996).

Area Usage Type	Costs per sq. km			Area Fraction	Area Weighted Costs		
	Light (2<DF,<5)	Moderate (5<DF,<10)	Heavy (DF, >10)		Light (2<DF,<5)	Moderate (5<DF,<10)	Heavy (DF, >10)
Residential ^a	\$72.4	\$163.9	\$301.2	0.316	\$22.9	\$51.8	\$95.2
Commercial	\$195.3	\$295.5	\$851.2	0.173	\$33.8	\$51.1	\$147.3
Industrial	\$674.0	\$704.2	\$1,245.9	0.064	\$43.1	\$45.1	\$79.7
Streets	\$15.9	\$18.5	\$247.7	0.175	\$2.8	\$3.2	\$43.3
Vacant Land	\$81.1	\$85.7	\$95.2	0.272	\$22.1	\$23.3	\$25.9
Overall Cost per sq. km					\$124.6	\$174.5	\$391.4

^aincludes single and multiple family dwellings and apartment houses

Notably, Luna’s \$391 M figure is substantially larger than what Sandia and NRC have identified in the FSEIS; indeed, it is more than twice as large.

Reproduced below are the cost estimates contained in Table 6-2 of *Site Restoration* where the cost for expedited remediation of heavy contamination of 1344 person/sq-km area is calculated to be \$398.4 M/sq-km.:

¹⁰ I note that this number is slightly lower than the \$398 M/sq-km value of *Site Restoration* (in 1995 dollars)

Table 6-2
Cleanup Costs for Expedited Decontamination of Urban Areas
(\$ million / km²)

<u>Usage Type</u>	<u>Light Contamination</u>	<u>Moderate Contamination</u>	<u>Heavy Contamination</u>
Residential	76.4	169.6	312.8
Commercial	195.3	295.5	851.2
Industrial	674.0	704.2	1245.9
Streets	15.9	18.5	247.7
Vacant Land	81.1	85.7	95.2

Combined	127.8	178.7	398.4

Site Restoration, at p. 6.5.

Immediately below are the comparable values that *Survey of Costs* derived for New York City (as set forth in Table II), showing a value of \$1699 M/sq-km:

Table II. Estimated Remediation Costs for New York City Reflecting Land Use Distribution and Population Density.

Land Use	Area Fraction ^a	Area Weighted			PD Multiple	Population and Area Weighted		
		Light (2<DF, <5)	Moderate (5< DF,<10)	Heavy (DF, >10)		Light (2<DF, <5)	Moderate (5<DF,<10)	Heavy (DF, >10)
Residential	0.287	\$20.31	\$45.99	\$84.51	6.82 ^b	\$138.55	\$313.64	\$576.38
Commercial	0.164	\$32.09	\$48.55	\$139.84	6.82 ^b	\$218.84	\$331.12	\$953.80
Industrial	0.068	\$45.51	\$47.55	\$84.12	1.00	\$45.51	\$47.55	\$84.12
Streets	0.250	\$3.97	\$4.62	\$61.88	1.00	\$3.97	\$4.62	\$61.88
Vacant Land	0.238	\$19.29	\$20.38	\$22.64	1.00	\$19.29	\$20.38	\$22.64
	1.00							
Overall Cost (\$M/km ²)		\$121.2	\$167.1	\$393.0		\$426	\$717	\$1,699

^a derived from New York City data (http://www.nyc.gov/html/dcp/pdf/landusefacts/landuse_tables.pdf)

^b ratio of New York City population density to that in Table I (9166/1344 = 6.82)

Survey of Costs, p. 4, Table II. *Survey of Costs* assumed a population density of 9166 persons/sq-km, which is an increase of a factor of 6.8 over Albuquerque's population density of 1344 persons/sq-km.

Luna's *Survey of Costs* analysis therefore tells us that cleanup cost is sub-linear, with the costs for cleanup "heavy contamination" in New York City being \$185,000/person, or \$1699 M/sq-km divided by 9166 persons/sq-km. Because Luna's values for cleanup cost are based on the lower starting point of \$391.4 M/sq-km (even after adjusting for inflation from 1995 to

2005), Luna's estimate of \$1699 M/sq-km represents a viable alternative to assuming linearity when extrapolating cleanup costs from a city like Albuquerque to New York City.

The \$185,000/person cleanup cost identified in *Survey of Costs* is 14.0 times higher than the \$13,284/person value defended by NRC staff in the FSEIS as appropriate for Indian Point. *Survey of Costs Arising from Potential Radionuclide Scattering Events* should be considered conclusive proof that NRC's use of \$13,284/person for cleanup of the Indian Point area results in a gross underestimation of costs.

Mistake No. 2 – Misapplication of Different Decontamination Factors

The term "Decontamination Factor" (or DF) is a ratio that expresses the effectiveness of a radiological cleanup. A Decontamination Factor is the ratio of the radiological contamination before the cleanup and the radiological contamination after the cleanup. It is represented by the following equation:

$$\text{DF} = \text{contamination before cleanup} / \text{contamination after cleanup}$$

By way of example, a DF of 2 means that 50% of the radiological contamination has been removed; a DF of 3 means 67% of the radiological contamination has been removed, a DF of 7 means that 85% of the radiological contamination has been removed, and a DF of 10 means that 90% of the radiological contamination has been removed. A DF of 20, an effectiveness standard that had been assumed in WASH-1400, means that 95% of the radiological contamination has been removed.

Site Restoration provides costs estimates of decontamination strategies that would yield decontamination factors of 2 to 5, 5 to 10, and greater than 10 for urban areas under an expedited decontamination schedule. *Site Restoration*, p. 6-4, Table 6-2. NRC's WASH-1400 report

identified various types of decontamination activities:

- deep plowing of farms (10" or more)
- fire-hosing structures and urban areas
- industrial vacuum or sweepers

WASH-1400, Appendix 6, Appendix K.¹¹ The *Code Manual for MACCS2* identified deep plowing of farm areas and fire-hosing of structures and urban areas to transport or wash contamination down into the ground as decontamination activities. NUREG/CR-6613, p.7-10. The *Code Manual* notes that the MACCS2 computer model does not assume that plowing will move the radiation to below the root zone for crops or reduce root uptake and food doses to the consumer of such crops. *Id.* Thus, it cannot be said that the decontamination strategies identified remove the radiation from the environment.

Generally, the more effective a radiological decontamination is (*i.e.*, the more radiation removed), the more difficult and expensive it will be. Also, as a radiological decontamination becomes progressively more effective, one would expect there to be more impacts on the physical environment and existing structures (partial deconstruction to demolition). For instance, a Decontamination Factor of 3 could entail, among other things, the removal of lawns and gardens and the removal of roofs on structures. Additionally, radiological decontamination efforts also require sufficient disposal capacity for the radioactive waste that is to be removed (*e.g.*, soil, crops, building debris).

As recognized by the 1987 OECD *Pathway Parameter* report and the *Site Restoration* report, a Decontamination Factor of more than 10 would likely involve the removal and disposal

¹¹ The decontamination strategies identified in WASH-1400 were based on then contemporary guidance documents for recovery actions following nuclear explosions of warfare. *Site Restoration*, at 2-9.

of large amounts of soil and the wholesale removal (or demolition or razing) of many types of structures and the disposal of the resulting building wastes. Both *Pathway Parameter* and *Site Restoration* recognize that achieving Decontamination Factors greater than 10 in both farm and non-farm areas would require the demolition of all structures, the removal and disposal of all the rubble, scraping of the remaining surface soil until the selected cleanup level was reached, and disposal of all rubble and scraped soil as radioactive waste. The acute difficulty (if not impossibility) of achieving Decontamination Factors greater than 10 for more than a few, select “vital facilities” was known to the NRC as far back as the mid-1970s, as reflected in the 1975 WASH-1400 report. See *Site Restoration*, Section 2.8 (discussing WASH-1400). The difficulties of achieving Decontamination Factors greater than 10 likely explain NRC Staff’s avoidance of *Site Restoration*’s \$398 M/sq-km value for “heavy contamination” areas, which would such Decontamination Factors.

Instead of confronting the many difficulties attendant with a $DF > 10$, the Indian Point FSEIS attempts use a Decontamination Factor associated with a relatively more moderate radiological dispersion event as a proxy for a Decontamination Factor for a relatively more heavy radiological dispersion event. NRC’s approach masks the true economic and societal costs associated with a Decontamination Factor of more than 10. In my opinion, not only does this approach by NRC Staff produce non-conservative results, it is not defensible.

Particle Size and Mass Loadings

As a general rule, larger particles with higher mass loadings are easier to cleanup than smaller particles with lower mass loadings. NRC Staff’s FSEIS (at G-22 – G-24) does not address one of the central points of the SAND96-0957 *Site Restoration* report, namely that NRC-

sponsored estimates of reactor accident costs going back to the 1975 WASH-1400 report¹², are mistakenly based on cleanup cost estimates for the large particles and high mass loadings of nuclear explosions and weapons tests. *Site Restoration* concluded:

Data on recovery from nuclear explosions that have been public available since the 1960s appear to have been misinterpreted, which has led to long-standing underestimates of potential economic costs of severe reactor accidents.

Site Restoration, Section 2.8, p. 2-10. WASH-1400 Appendix K to Appendix VI makes clear that the source of the data on decontamination effectiveness is based on nuclear explosion events, experimental data from pre-1963 Comprehensive Test Ban atmospheric nuclear testing, and evaluations of these data for purposes of civil defense planning.

WASH-1400, Appendix VI, Appendix K, at K-13, K-14.

Site Restoration explains in detail, with references to Appendix VI of WASH-1400,¹³ that NRC-sponsored estimates of reactor accident costs going back to that 1975 report are mistakenly based on cleanup cost estimates for the large particles and high mass loadings of nuclear explosions:

Prior to the 1986 Chernobyl accident, reactor accident risk assessments in the U.S. and Europe relied heavily on the economic cost model of WASH-1400, in which the decontamination of residential property was modeled as achieving a DF of 20 in urban areas at a minimal cost, that is, one-tenth of the value of the affected property.

The use of a DF of 20 in WASH-1400 was apparently based on contemporary guidance documents for anticipated recovery actions following nuclear explosions of warfare. Nuclear explosions produce fallout with large particles and high mass loadings on surfaces. The DF of 20 was widely used in planning documents addressing such events. Furthermore, data presented within WASH-1400 give strong weight to this supposition in its presentation of decontamination data for mass loadings of 5 and 25 g/ft² (*ibid.*: pp. K-23 through K-32).

The WASH-1400 model now appears to have been unduly optimistic in the broad

¹² *Calculation of Reactor Accident Risks*, Appendix VI, WASH-1400, Nuclear Regulatory Commission, 1975.

¹³ *Id.*

application of a DF of 20 to large-scale urban areas, when, according to Cowan and Meinhold (1969), in their discussion of the importance of pre-planning for the post-attack recovery of vital **selected** facilities such as power plants, water works, medical installations, and transportation systems,

*Radiation levels inside of selected structures can be reduced by a factor of 5.
Radiation levels outdoors in selected areas can be reduced by a factor of 20.*

and,

These results can be achieved without excessive exposure to individuals carrying out the decontamination.

Data on recovery from nuclear explosions that have been publicly available since the 1960s appear to have been misinterpreted, which has led to long-standing underestimates of potential economic costs of severe reactor accidents.

Site Restoration, Section 2.8 (italics and bold text in original, footnote omitted).

Notably, a similar conclusion was reached in a 1987 workshop in Paris convened by the Organisation for Economic Co-operation and Development (OECD).¹⁴ OECD's section on decontamination and reclamation concludes:

Unfortunately, the substantial amount of information available on reclaiming of areas contaminated with fall-out from nuclear weapons cannot always be used to give reliable information on the results of a similar reclamation procedure in connection to nuclear [reactor] accidents.

This is due to the different distribution of particle sizes from the two different sources.

Pathway Parameter Evaluation, at p. 8.

The underestimation of cleanup costs, which was identified in *Pathway Parameter Evaluation* and *Site Restoration*, continued on from WASH-1400, through the NUREG-1150 process, and on to the MACCS2 code, itself, via Sample Problem A and its Decontamination Data Block.¹⁵

¹⁴ *Pathway Parameter Evaluation*, A Survey Conducted by an OECD/NEA Group of Experts, CSNI Report 139, Committee on the Safety of Nuclear Installations, OECD Nuclear Energy Agency, Paris, France, July 1987.

¹⁵ The FSEIS mistakenly asserts that Contention 12 "argues that the size of the particles

Plutonium Versus Cesium and Other Fission Products

Second, Staff's attempt to distinguish plutonium from cesium or other fission products to derive lower cost numbers is misguided. In some respects, cesium has attributes that make it more difficult to cleanup than plutonium. The FSEIS correctly states that it is easier to "characterize" a plutonium release than a cesium release. This reference and discussion of site characterization is a red herring since site characterization is a relatively small portion of the overall cost of a remediation project.

Moreover, the FSEIS does not acknowledge that a major difficulty associated with decontamination of a cesium (or other fission products) contaminated environment is the need to protect cleanup workers against penetrating gamma radiation from cesium. Because the radiation from plutonium is non-penetrating alpha radiation, less health physics protections are required to protect cleanup workers, who would need to protect their skin and wear respirators; cleanup workers assigned to a plutonium decontamination need not take additional (and more expensive and complicated) measures needed to protect against penetrating radiation, like that which comes from cesium. All things being equal, the FSEIS fails to acknowledge that decontamination of a cesium (or fission product) contaminated environment is likely to be more expensive and less feasible when compared to decontamination of a plutonium contaminated environment – due to radiation hazards to cleanup workers. While the FSEIS suggests that plutonium poses a greater health hazard than does cesium or other fission products, the health effects depend on the dose of the exposure. For example, for large doses, acute radiation sickness can result from the gamma radiation associated with cesium and other fission products.

dispersed from a severe reactor accident would be comparable to those released in nuclear weapons tests." FSEIS at G-22. To the contrary, Contention 12 submits that the size of particles dispersed into the atmosphere from a severe reactor accident would be smaller than those released in nuclear weapons tests.

In contrast, acute radiation sickness is unlikely from plutonium because plutonium's specific activity is lower than that of Cs-137.

Another material difference between cesium (and other fission products) and plutonium is that cesium and fission products are generally soluble whereas plutonium from weapons accidents is not soluble. Given its soluble nature, cesium and other fission products could be more readily dispersed and could more readily bind to different materials and structures as compared to plutonium. Thus, a rain storm or fire-hosing are likely to make ultimate remediation more difficult and expensive because of cesium's solubility. If cesium were fire-hosed into the storm drains, it would be carried throughout the storm sewers and the waters to which the sewers ultimately discharge. The FSEIS's failure to acknowledge this key difference in chemical properties between cesium and plutonium led the FSEIS to materially underestimate cleanup costs associate with a release of fission products from the Indian Point reactors.

The FSEIS claims that decontamination activities for a moderate plutonium contamination event "align more closely" with decontamination activities for heavy cesium contamination. FSEIS at G-24. The FSEIS, however, has it backwards. As discussed in *Site Restoration* and the documents it references, it can be more difficult to decontaminate a structure contaminated with cesium (or other fission products) than one contaminated with plutonium. *See Site Restoration*, at 2-3. This relative difficulty stems from a variety of factors, including:

- the fact that cesium is soluble, which means that precipitation events or fire-hosing (a common decontamination strategy) can actually facilitate its binding to structural surfaces or spread it into a community's infrastructure (e.g., sidewalks, gutters, drains, sewer pipes) and ecosystem (e.g., groundwater, streams, lakes, reservoirs), *Site Restoration*, at E-12; The ability of cesium and other fission products to bind to surfaces is especially pronounced for porous or rough surfaces, *Site Restoration*, at 5-8, E-1, E-3, E-4, E-8, E-11;

- the fact that cesium (and other fission products) are gamma emitters, which necessitates rigorous health safety precautions for cleanup workers, *Site Restoration*, at E-1
- the fact that the quantities of radioactive material in nuclear weapons are a tiny fraction of the quantities present in an operating nuclear power plant, *Site Restoration*, at 2-3, 2-4.

These relative difficulties posed by cesium (and other fission products) are likely to be particularly salient in the site-specific Indian Point severe accident scenario, because those reactors have the most densely developed 50 mile EPZ of any reactor in the country, and there are more buildings and structures that would have to be decontaminated when compared to other reactor sites. Given the sheer volume of such structures in the New York metropolitan area, it is unrealistic to assume that all contaminated structures could be effectively and expeditiously decontaminated within 30 days of a contamination event or before a rain storm (whichever was earlier).¹⁶ Contrary to the view expressed in the FSEIS that the cleanup costs would “align more closely” with the moderate contamination cost number in *Site Restoration* Table 6-2, it is quite likely that the decontamination activities associated with a heavy cesium contamination event would exceed the heavy contamination cost number in Table 6-2.¹⁷

¹⁶ The ability of decontamination to remove contaminants decreases rapidly with time if cleanup is delayed for more than a few weeks. *Site Restoration*, pp. x, 2-7, 5-7, 5-8, E-8, E-11.

¹⁷ It should also be noted that the December 2010 FSEIS did not scale up the costs derived from the *Site Restoration* report, which were in 1995 year dollars, to 2005 dollars – the benchmark used by Entergy in its Environmental Report. Thus, the FSEIS’s “side by side” comparison of Entergy’s cost numbers to the cost numbers generated by Sandia in this proceeding is not meaningful or informative as the numbers involve different base years. Although NRC Staff acknowledges that “If the Site Restoration study values were escalated to 2005 dollars, as were the values used in the [Entergy] SAMA analysis, the difference would be greater, but would still be within a factor of about 2” (G-24, lines 26-28), the FSEIS fails to specify the resultant number. This failure makes it difficult for decision makers, reviewers, and the public to understand the cost comparison conducted by NRC Staff. This failure also is inconsistent with Entergy and Sandia’s treatment of the 1986 Surry numbers. In any event, given cost escalation trends, the cost number generated by Sandia from the *Site Restoration* report would be higher if the costs were expressed in 2005 dollars.

Consequences of the Mistakes

As discussed above, the FSEIS's reliance on cleanup cost estimates for a city with 1,344 persons/sq-km with no adjustment to New York City with an assumed 12,000 persons/sq-km, leads to an underestimation by a factor of 8.93, and its acceptance of moderate decontamination costs in place of heavy decontamination costs leads to an additional underestimation factor of 2.23. The combination of multiplicative factors of 8.93 and 2.23 from above demonstrates that NRC underestimated costs by an error factor of 19.9. Even if the moderate-versus-heavy discrepancy were to be ignored, the FSEIS analysis supposedly presenting Site Restoration cost estimates is an order of magnitude too low, because it ignores the population density in calculating a per-capita cost. Although the FSEIS does not escalate the 1995-based dollars of Site Restoration to 2005, over the period from January 1995 to January 2005 the CPI increased by 27% (producing an inflator of 1.27),¹⁸ which increases the *Site Restoration* costs to \$226 M and \$505 M, respectively, for moderate and heavy decontamination actions.

Thus, for heavy contamination cleanup in 2005 dollars: \$505 M/sq-km times 8.93 divided by 12,000 person/sq-km yields a per-capita cost of \$376,000/person, which is 28.3 times higher than the \$13,284/person used by Entergy for a DF of 15.

Likewise, for moderate contamination, the \$178 M/sq-km in Site Restoration 1995 dollars is escalated by the same inflator of 1.27 to yield a 2005-based cleanup cost of \$226 M/sq-km times 8.93 divided by 12,000 person/sq-km yields a per-capita cost of \$168,000/person, which is 12.6 times higher than the \$13,284/person used by Entergy for a DF of 15. So, even ignoring the apples/oranges error with respect to moderate versus heavy decontamination costs,

¹⁸ Information about the Consumer Price Index is available at the U.S. Bureau of Labor Statistics web site, www.bls.gov.

the FSEIS's application of *Site Restoration* is too low by more than an order of magnitude.

The FSEIS's errors identified in this report lead to an significant underestimation of costs that, in turn, undermine the Severe Accident Mitigation Alternatives analysis for the Indian Point reactors.

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Dated: February 3, 2011

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Summary of Experience

1. I have more than 25 years of professional experience in the development, application, maintenance, and verification/validation of large scientific codes, primarily for assessing the environmental impacts of radiological releases, and have worked with various federal agencies and contractors, including the United States Department of Energy (DOE), the United States Nuclear Regulatory Commission (NRC), and Sandia National Laboratories, as a senior risk analyst, project leader, and as a consulting expert, to review, evaluate, and develop risk models to assess the economic and environmental impacts of radiological releases in commercial, military, and government sectors.

2. I also consult as an independent expert to assess the consequences of accidental or intentional releases of radioactive materials to the atmosphere.

3. Through Sandia National Laboratories, I was an architect and developer of the MACCS2 computer code, and I am familiar with the code. MACCS2 is used by the DOE, NRC staff, and NRC licensees to model the doses, health effects, and economic consequences that result from unintended radiological releases into the atmosphere. NRC and its licensees use the MACCS2 code as part of the Severe Accident Mitigation Alternatives (SAMA) analysis.

4. As a consultant to DOE, I was involved in the review and finalization of the MACCS2 Guidance Document and the Final MACCS2 SQA Gap Analysis. I also wrote the User's Guide Code Manual for MACCS2.

5. Along with a colleague, Walter Murfin, I pioneered a model for analyzing the economic impacts if land and structures were contaminated with plutonium from a weapons accident. *Site Restoration: Estimation of Attributable Costs from Plutonium-Dispersion Accidents*, SAND96-0957 (1996).

Summary of Experience

6. I have been the principal or collaborating author of a number of scientific and technical publications concerning nuclear risk modeling on behalf of Sandia National Laboratories, Los Alamos National Laboratory, American Nuclear Society Transactions, as well as for private industry and technical workshops.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

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In re: Docket Nos. 50-247-LR and 50-286-LR
License Renewal Application Submitted by ASLBP No. 07-858-03-LR-BD01
Entergy Nuclear Indian Point 2, LLC, DPR-26, DPR-64
Entergy Nuclear Indian Point 3, LLC, and
Entergy Nuclear Operations, Inc. February 3, 2011
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CERTIFICATE OF SERVICE

I hereby certify that on February 3, 2011, copies of the (1) State of New York's Motion for Leave to File New and Amended Contention 12, including a Certification of Consultation by AAG John J. Sipos pursuant to 10 C.F.R. § 2.323 and ASLB Scheduling Order, (2) Contention 12, and attachment thereto, the February 2011 report of David I. Chanin, and (3) Supplement to Motion for Leave to File New and Amended Contentions Concerning Chapter 8 of the December 3, 2010 Final Supplemental Environmental Impact Statement were served upon the following persons via U.S. Mail and e-mail at the following addresses:

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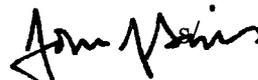
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