

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

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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

May 3, 2013

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**STATE OF NEW YORK'S REPLY TO NRC STAFF'S AND ENTERGY'S
PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW
FOR CONTENTION NYS-12/12A/12B/12C ("NYS-12C")**

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Pursuant to 10 C.F.R. § 2.712, the Atomic Safety Licensing Board's ("ASLB" or "Board") July 1, 2010 Scheduling Order at ¶ N, and the Board's February 28, 2013 Order, the State of New York hereby replies to NRC Staff and Entergy's Proposed Post-Hearing Findings of Fact and Conclusions of Law on Consolidated Contention 12/12A/12B/12C ("NYS-12C").

I. INTRODUCTION

In their Proposed Findings, NRC Staff and Entergy fail to adequately explain why their use of undocumented and unreasonable input values to estimate the severe accident costs used in the Severe Accident Mitigation Alternative ("SAMA") analysis is sufficient under the National Environmental Policy Act ("NEPA"). Instead, they present broad assertions, unsupported by any evidence in the record, and misconstrue record evidence. Their Proposed Findings concede they did not develop a site-specific estimate for decontamination costs or decontamination time for Indian Point. Instead, despite compelling evidence that site-specific inputs would yield up to a seven-fold increase in the costs of a severe accident, Entergy and NRC Staff chose to use decades-old information from "Sample Problem A," developed for the Surry reactor in rural Virginia, in the SAMA analysis for Indian Point—which is surrounded by the most densely-populated area of any U.S. nuclear power plant and sits approximately 24 miles from New York City and 38 miles from the financial center of the United States.

In defense of Sample Problem A, NRC Staff and Entergy's Proposed Findings assert that SAMA analyses for other plants use Sample Problem A, and that a site-specific population estimate is all that is needed for MACCS2 to generate site-specific cost estimates. To the contrary, the State's experts have shown that the Sample Problem A values, including those for decontamination costs and time inputs, are not rationally related to Indian Point and significantly

underestimate costs. As such, NRC Staff's and Entergy's Proposed Findings do not support an initial decision by the Board that Staff complied with NEPA.

The State's Proposed Findings of Fact and Conclusions of Law provide a sufficient basis for the Board to find for the State on all aspects of Contention NYS-12C, and persuasively refute the arguments raised in NRC Staff's and Entergy's Proposed Findings. This reply clarifies the record on a subset of NRC Staff's and Entergy's Proposed Findings that either mischaracterize the evidence, misapply the law to the facts, or are not supported by the record. Therefore, this reply does not respond to arguments raised in NRC Staff's and Entergy's Proposed Findings that were already addressed in the State's Proposed Findings.

II. LEGAL STANDARDS

The State's Proposed Findings provide a detailed explanation of NRC Staff's NEPA obligations, including the obligation to complete a SAMA analysis. *See* State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12B/12C ("NYS-12C") (Mar. 22, 2013) ("State Proposed Findings") ¶¶ 63-84. While NRC Staff and Entergy are correct that courts "afford deference to the judgment and expertise of the agency," the case law is clear that "the agency must, at a minimum, support its conclusions with studies that the agency deems reliable . . . [and] explain the conclusions it has drawn from its chosen methodology, and the reasons it considered the underlying evidence to be reliable." *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1075 (9th Cir. 2011) (quoting *Lands Council v. McNair*, 537 F.3d 981, 994 (9th Cir. 2008), *abrogated in part on other grounds*). "The agency will have acted arbitrarily and capriciously when 'the record plainly demonstrates that [the agency] made a clear error in judgment in concluding that a project meets the requirements' of NEPA." *Id.*

In short, the Board “must ensure that the agency has ‘examine[d] the relevant data and articulate[d] a satisfactory explanation for its action including a “rational connection between the facts found and the choice made.’” *Shieldalloy Metallurgical Corp. v. N.R.C.*, 624 F.3d 489, 492-93 (D.C. Cir. 2010). The D.C. Circuit recently emphasized that “[d]eference does not preclude analysis” and “the agency’s insistence on deference is misplaced . . . [because] far from substituting our judgment for that of the agency, . . . we have merely done what courts are supposed to do with regulatory language—try to explore the validity of the agency’s interpretation.” *Shieldalloy Metallurgical Corp. v. N.R.C.*, 707 F.3d 371, 382 (D.C. Cir. 2013) (internal quotation and citation omitted); *see also Bowman Transp., Inc. v. Arkansas-Best Freight Sys., Inc.*, 419 U.S. 281, 285-86 (1974); *Motor Vehicle Mfrs. Ass’n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 57 (1983).

Although NRC Staff and Entergy assert that “[t]he Commission stated that “there is no NEPA requirement to use the best scientific methodology,” *Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Station), CLI-10-11, 71 N.R.C. 287, 315 (2010) (hereinafter, *Pilgrim CLI-10-11*),¹ neither Staff nor Entergy acknowledges that Staff’s FSEIS “must contain ‘high quality’ information and ‘accurate scientific analysis.’” State Proposed Findings ¶ 74 (citing 40 C.F.R. § 1500.1(b); *Lands Council v. Powell*, 395 F.3d 1019, 1031-32 (9th Cir. 2005); *Conservation Northwest v. Rey*, 674 F. Supp. 2d 1232, 1249 (W.D.

¹ See NRC Staff's Proposed Findings of Fact and Conclusions of Law Part 5: Contention NYS-12C (Severe Accident Mitigation Alternatives Analysis Decontamination and Cleanup Costs) (Mar. 22, 2013) (“Staff Proposed Findings”) ¶ 5.15; Entergy’s Proposed Findings of Fact and Conclusions of Law for Consolidated Contention NYS-12C (Severe Accident Mitigation Alternatives Analysis) (Mar. 22, 2013) (“Entergy Proposed Findings”) ¶ 71.

Wash. 2009) (citing *Ctr. for Biological Diversity v. U.S. Forest Serv.*, 349 F.3d 1157, 1167 (9th Cir. 2003))). This requirement is a fundamental part of NEPA compliance.

Although NRC Staff correctly states that “[t]he SAMA analysis is not a safety review performed under the Atomic Energy Act,” *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-12-01, 75 N.R.C. 39, 57 (2012) (Staff Proposed Findings ¶ 5.16; *accord* Entergy Proposed Findings ¶ 68), NEPA still requires consideration of the effects on human health and safety as part of the analysis of environmental impacts. Evaluating human health and safety in terms of NEPA, not the Atomic Energy Act, was what Dr. Lemay was referring to when he used the term “safety” in discussing the SAMA analysis.² See *Limerick Ecology Action, Inc. v. N.R.C.*, 869 F.2d 719, 723 (3d Cir. 1989) (“consideration under NEPA should not be precluded by the AEA”). One of NEPA’s stated purposes is “to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the *health and welfare* of man.” 42 U.S.C. §4321 (emphasis added).³ NEPA charges the federal government

² NRC Staff’s statement that “This is not a safety analysis. Dr. Lemay’s intense focus on a safety analysis misapprehends the purpose of a SAMA analysis under NEPA” (Staff Proposed Findings ¶ 5.62) evinces Staff’s critical misunderstanding of NEPA’s requirements. NRC Staff also misinterprets Dr. Lemay’s references to “safety” in his testimony. NYS-12C is a NEPA contention and neither the State nor its experts have ever contended otherwise. Underscoring the fact that the term “safety” does not always refer to issues resolved under the Atomic Energy Act, Mr. Teagarden explained that “probabilistic safety analysis” (Tr. 1901:3-4 (Teagarden)) are performed as part of the SAMA analysis, which is required by NRC’s NEPA-implementing regulations. See also Tr. 1924:5-8, 15-17 (Teagarden) (“Entergy like every utility that I am familiar with in our industry is always looking for ways to both improve plant safety and improve efficiency at our plants. . . . The SAMA analysis is another means of highlighting some particular changes that can be made.”).

³ Senator Henry Jackson, the Senate author of NEPA, explained, “An environmental policy is a policy for people. Its primary concern is with man and his future. The basic principle of the policy is that we must strive in all that we do, to achieve a standard of excellence in man’s

“to use all practicable means, consistent with other essential considerations of national policy” to “assure for all Americans *safe, healthful*, productive and aesthetically and culturally pleasing surroundings.” 42 U.S.C. §4331 (emphasis added).

NEPA's implementing regulations also require consideration of human health and safety by calling for the analysis of “ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative” effects. 40 C.F.R. §1508.8. Furthermore, in determining whether an effect is significant, an agency must evaluate the “degree to which the proposed action affects *public health or safety*.” *Id.* §1508.27 (emphasis added). The Board should firmly reject any attempt by NRC Staff or Entergy to minimize the importance of complying with NEPA, or to diminish NEPA's mandate to consider public health and safety.

In addition to relevant NEPA standards, the State's Proposed Findings also set forth this proceeding's evidentiary standard and explain that unsupported reasoning, allegations, and computations should be afforded no weight.⁴ State Proposed Findings ¶¶ 85-87. It is clear that “[a] party's proposed findings and conclusions must be confined to the material issues of fact and law ‘presented on the record.’” *Pub. Serv. Elec. & Gas Co.* (Salem Nuclear Generating

relationships to his physical surroundings.” 115 Cong. Rec. 40,416 (1969) (statement of Sen. Jackson).

⁴ The State also discussed the qualifications of Staff's and Entergy's witnesses, explaining that the Board should afford less weight to the testimony of particular witnesses due to their lack of experience or lack of expertise in certain areas. *See* State Proposed Findings ¶¶ 92-107. It was appropriate for the State to address this issue in the post-hearing Proposed Findings because the Board explained that “the weight and credibility [it] give[s] to that testimony will be determined after the evidentiary hearing.” *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), Order (Granting in Part and Denying in Part Applicant's Motions in Limine) at 24 (Mar. 6, 2012) (unpublished) (ML12066A170).

Station, Unit 1), ALAB-650, 14 N.R.C. 43, *5-6 (1981) (*citing* 10 C.F.R. § 2.754(c))⁵; 10 C.F.R. § 2.712(c); 10 C.F.R. § 2.1209. In evaluating NEPA compliance, the Board must “engage in a ‘searching and careful’ inquiry of the record,” so that it may “consider whether the agency considered the relevant factors and whether a clear error of judgment was made.” *Citizens To Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 416 (1971), *abrogated in part by Califano v. Sanders*, 430 U.S. 99, 105, 97 S. Ct. 980, 51 L. Ed. 2d 192 (1977) (abrogating *Overton Park* to the extent it recognized the APA as an independent grant of subject matter jurisdiction). Therefore, the Board must reject any proposed findings that are not supported by the record.

III. RESPONSE TO ENTERGY’S AND NRC STAFF’S PROPOSED FINDINGS

A. Entergy and NRC Staff’s Justification for the Use of Sample Problem A Values Is Wholly Inadequate and Unreasonable Under NEPA

1. Whether Sample Problem A Values Have Been Used in Other Relicensing Proceedings or NRC Studies Is Not Relevant to Whether Their Use in the Indian Point SAMA Analysis Is Reasonable

Over and over again, NRC Staff and Entergy repeat the reasoning Staff articulated in the FSEIS for approving the use of Sample Problem A input values: “Entergy’s decontamination cost estimates are consistent with those used in accepted SAMA analyses performed for other nuclear power plants.” NYS00133I at G-23 – G-24; *see also* Staff Proposed Findings ¶ 5.38 (“Entergy’s SAMA analysis at issue before the Board was unremarkable, followed the established guidance, and was generally consistent with the SAMA analyses conducted in other license renewal applications.”); Entergy Proposed Findings ¶¶ 5, 22, 34, 139, 158. In fact, their argument supports the State’s basic position on the use of the Sample Problem A input values.

⁵ 10 C.F.R. § 2.754(c) is now 10 C.F.R. § 2.712(c). *See* 69 Fed. Reg. 2,182 at 2,227 (Jan. 14, 2004).

By admitting that the Sample Problem A values have been used and accepted over and over again, NRC Staff and Entergy essentially admit that they are not site-specific. It defies logic to understand how using Sample Problem A input values can be site-specific and at the same time applicable to all power plants no matter where they are located.

Relying upon decontamination costs and time estimates used for other plants, without even attempting to verify the reasonableness that data, is unreasonable under NEPA, especially given the uniquely high population and building density in the 50-mile radius surrounding Indian Point. State Proposed Findings ¶¶ 135-140. Entergy even refers to the Sample Problem A values as “default values” (Entergy Proposed Findings ¶¶ 133, 140)—ignoring the requirement to develop site-specific inputs for a site-specific SAMA analysis. *See* 10 C.F.R. § 51.53(c)(3)(ii)(L); Part 51, Subpart A, Appendix B, Table B-1; *Limerick*, 869 F.2d 719. As the State has explained throughout this proceeding, the Sample Problem A values are not default values and should not be used as such. State Proposed Findings ¶¶ 143-44. As explained in State Proposed Findings ¶ 122, the only relevant “default” values are those that would be applicable to all plants no matter where they are located, such as skin protection factors.

In addition to characterizing the Sample Problem A values as default values, Entergy and NRC Staff stress that NRC's State-of-the-Art Reactor Consequence Analysis (“SOARCA”) study, ENT000455 (NUREG-1935, SOARCA Draft Report for Public Comment, Jan. 2012), used Sample Problem A values and, therefore, supports their validity. Staff Proposed Findings ¶ 5.41;⁶ Entergy Proposed Findings ¶¶ 47, 144, 148, 163, 164. As State Proposed Findings ¶¶ 192-

⁶ In Staff Proposed Findings ¶ 5.41 NRC Staff also claims that “[t]hese NUREG-1150 values continue to be utilized in . . . the Staff's responses to tasking related to Fukushima Dai-ichi. (Transcript at 2274).” There is not, however, any evidence on the cited transcript page that Staff

94 explain, aside from the fact that the SOARCA project does not evaluate Indian Point, it also was not a SAMA analysis and did not examine costs associated with a severe accident. Thus, there is no reason for the Board to afford any weight to the fact that Sample Problem A has been used in SOARCA or for other plants; NRC Staff and Entergy's use of Sample Problem A values as default values for Indian Point is unreasonable under NEPA.

2. The Use of One Site-Specific Input—Population—Does Not Render the Decontamination Cost and Time Analysis Site-Specific

NRC Staff and Entergy would like the Board to believe that only two economic cost inputs need to be site-specific—the value of non-farm wealth, which is discussed in further detail in section III.F. below, and population. *See* Entergy Proposed Findings ¶ 171 (“And, as discussed earlier, the CDNFRM values are applied on a per-person basis by MACCS2. Therefore, they allow for site-specific decontamination cost estimates that reflect the high-population areas with the IPEC SAMA analysis region, including New York City.”); *see also* ¶¶ 137, 141, 146, 147. There is no support, however, for this proposition. Nor is there support for Staff Proposed Findings ¶ 5.42, which alleges—without citation to any analysis or proof other than unsupported testimony—that “linear scaling of costs is by its very nature conservative as the next person’s cost, especially in high density areas, is not equivalent to the first person’s marginal costs” and that “marginal costs for each additional person would be expected to decrease.”⁷

has used Sample Problem A values in “tasking related to Fukushima Dai-ichi.” Staff has pointed to no other evidence in the record to support this allegation, so it should be afforded no weight.

⁷ NRC Staff claims that using Sample Problem A values, “a home with four people residing in it would incur decontamination costs of \$20,592 and \$55,296” and “a high-rise of 1000 people would incur costs of \$5,148,000 and \$13,824,000.” Staff Proposed Findings ¶ 5.42. Although

Furthermore, Entergy Proposed Findings ¶ 147 and Staff Proposed Findings ¶ 5.38 misleadingly take a quote from Dr. Lemay out of context. While Dr. Lemay did testify that the idea of correlating decontamination costs with population as a cost per person figure was insightful, he went on to explain that while the correlation may work for “a site with individual dwellings[,] . . . where you start to question the approach is when you start to get into big buildings, high rise and the kind of city we have in New York and then you say, ‘Hm. You can’t just keep extrapolating.’” Tr. 2136:2-15 (Lemay).

Indeed, the State’s expert report from International Safety Research, Inc. (“ISR”)⁸, shows that any linear correlation between population and decontamination costs falls apart for the 50-mile radius surrounding Indian Point. State Proposed Findings ¶ 139. As building density increases and the type of buildings change from single-family homes to high rise buildings, decontamination becomes more complex and costs begin to escalate in a non-linear fashion. *Id.* Hence, while decontamination costs may scale linearly with population at other sites and in other circumstances, ISR’s analysis demonstrates it is unreasonable to use the Sample Problem A decontamination cost value for the Indian Point site, which is surrounded by uniquely high building and population densities.

NRC Staff reports these values, it does not demonstrate that they are reasonable by, for example, comparing them to data or other references. Thus, the simple reporting of these numbers does not support the claim that population and decontamination costs were linearly related.

⁸ ISR Report: Review of Indian Point Off Site Consequence Analysis (“ISR Report”) (Dec. 21, 2011) (NYS000242).

3. Sample Problem A Is Not Consistent With
Industry Guidance Endorsed By the NRC

Entergy and NRC Staff's assertions that the use of Sample Problem A is consistent with NEI 05-01, Rev. A (NYS000287), industry guidance endorsed by NRC, is not accurate. Entergy Proposed Findings ¶ 125; NRC Staff Proposed Findings ¶ 5.38. Entergy contends that the only thing required by NEI-05-01 is the escalation of Sample Problem A values to current year dollars using the Consumer Price Index. Entergy Proposed Findings ¶¶ 138, 156. However, Entergy is selectively following NEI 05-01. While NEI 05-01 does suggest that "[e]conomic data from a past census can be converted to today's dollars," the guidance in NEI 05-01 emphasizes that the MACCS2 user should define site-specific inputs for many of the MACCS2 parameters, including decontamination cost and time. State Proposed Findings ¶¶ 121, 122, 144, 301, 302. NEI-05-01 instructs the applicant to describe the various input parameters and associated assumptions. NYS000287 at 13. NEI-05-01 provides only "[s]ample MACCS2 economic data," and nowhere does NEI-05-01 instruct the applicant to use Sample Problem A values. NYS000287 at 14. Consequently, Entergy did not follow NEI-01-05.

4. Nothing in NUREG-1150 or Related NRC Documents Renders
the Use of Sample Problem A Input Values Site-Specific for Indian Point

The State's Proposed Findings explain in great detail the lack of a documented basis for Sample Problem A's decontamination cost and time values, including the gaping hole in NUREG-1150⁹—the source of the economic cost parameters in NUREG 1150/Sample Problem

⁹ NUREG-1150, Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants (Dec. 1990) (NYS00252A-NYS00252D).

A, the Os84 reference,¹⁰ simply does not exist. Both NRC Staff and Entergy admit that Os84 cannot be located. State Proposed Findings ¶ 160. Despite this evidence, NRC Staff and Entergy continue to rely upon the pedigree of NUREG-1150 in a failed attempt to establish that the Sample Problem A values are reasonable under NEPA. Entergy misconstrues some of the points the State raised, contending that “contrary to New York’s claim, the NUREG-1150 authors did not view those [Sample Problem A] values as being applicable only to the Surry site” (Entergy Proposed Findings ¶ 69). In fact, the State did not offer any opinions on the intent of the NUREG-1150 authors; rather the State simply noted that the Sample Problem A inputs were developed for the Surry site. Whether Sample Problem A values could be applicable to sites other than Indian Point, such as the Surry site, is irrelevant to the issues presented in NYS-12C.

NRC Staff and Entergy unsuccessfully attempt to compare the area surrounding Indian Point to some of the five plants studied in NUREG-1150. For example, Mr. Jones’ testified that “two of the five sites studied in NUREG-150 are not unlike IPEC with respect to the population density within the 10-mile radius Emergency Planning Zone.” Entergy Proposed Findings ¶ 145. Mr. Jones’ comparison is of no consequence because the SAMA analysis cost estimates are for the 50-mile radius surrounding Indian Point, not just the 10-mile Emergency Planning Zone. Additionally, in Mr. Jones’ comparison of the area surrounding Indian Point to the area surrounding Zion in Chicago contains an allegation unsupported by any documented analysis in the FSEIS or elsewhere. Staff Proposed Findings ¶ 5.41, n.40; Entergy Proposed Findings ¶ 145.

¹⁰ “Os84” is listed as “Ostmeyer, R.M., and G.E. Runkle, An Assessment of Decontamination Costs and Effectiveness for Accident Radiological Releases, Albuquerque, N.M.: Sandia National Laboratories, *to be published*,” in NUREG/CR-3673’s references section. NRC00058 at p. 8-8 (emphasis added).

But even if the Board agrees with Mr. Jones that Zion has a similar population density to Indian Point, Mr. Jones has not shown that Zion has a similar building density. Because the Os84 document upon which the Sample Problem A decontamination cost values are based is missing (State Proposed Findings ¶¶ 158-60), there is no way for anyone (including NRC Staff and Entergy) to fully understand whether those values were calculated taking into account the building density and other unique aspects of Indian Point. Thus, Mr. Jones' testimony amounts to pure speculation and should be afforded no weight by the Board.

Entergy also argues that “the CDNFRM values ultimately incorporated into NUREG-1150 reflect a mixture of land uses” based on a portion of NUREG/CR-3673¹¹ that describes the missing Os84 document. Entergy Proposed Findings ¶ 160; *see also* ¶¶ 161, 171. But once again, Os84 does not exist, so there is no way to verify what that mix of land uses was and whether it is applicable to Indian Point. Relying on vague descriptions of Os84 in NUREG/CR-3673 is not reasonable.

In an effort to defend the Sample Problem A decontamination time inputs of 60 days for light decontamination and 120 days for heavy decontamination, Entergy contends that “Mr. Harrison and Dr. Ghosh noted that the NRC has been examining the decontamination times for over 37 years, beginning in 1975 with the Reactor Safety Study,” but there is no evidence in the record that anyone has examined the decontamination time MACCS2 input parameter in depth for the past 29 years—since an April 1984 document, NUREG/CR-3673.¹² Entergy Proposed

¹¹ NUREG/CR-3673, “Economic Risks of Nuclear Power Reactor Accident” (ENT000466).

¹² Additionally, the State's Proposed Findings explain that NUREG/CR-3673 describes a timeline and explains its assumptions for the duration of decontamination that is based upon

Findings ¶ 206 (“the genesis of the values used by Entergy can be traced back to NUREG/CR-3673”). Additionally, Entergy’s citation to the introductory paragraph of another study, NUREG/CR-4115, which states that “most MACCS input parameters were reviewed” is of no moment. Entergy Proposed Findings ¶ 143 (citing NYS000248 at iii/iv). Although NUREG/CR-4551 discusses many of the MACCS2 input parameters, it does not discuss how the time and cost of decontamination were obtained and, therefore, does not support their reasonableness.

5. Entergy’s Response to NRC Staff’s Request for Additional Information Does Not Provide a Rational Basis for the Use of Sample Problem A

Entergy relies heavily on its response to NRC Staff’s request for additional information (“RAI”)¹³ to supply a rational basis for the use of Sample Problem A values. *See* Entergy Proposed Findings ¶¶ 21, 138 (n. 397), 141, 146, 147. But the RAI response just recapitulates the same baseless reasoning for the use of Sample Problem A, referring to the Sample Problem A values as “default values.” ENT000460 at 37-38. The RAI response’s conclusory explanation that the values “have been used by other license renewal applicants” and that they were escalated using the Consumer Price index is not sufficient to provide a rational basis for their use under NEPA. *See id.*

unreasonable assumptions and is inconsistent with NUREG-1150. State Proposed Findings ¶¶ 176-182.

¹³ *See* February 2008 RAI Response, Attach. 1 at 25-26 (ENT000460); *see also* May 2008 RAI Response (ENT000477); FSEIS, Vol. 3, App. G at G-21, G-43, G-45 to G-46 (NYS00133I).

6. NRC Staff and Entergy's Use of the MACCS2 Code Does Not Account for All of the Costs Associated With a Severe Accident

As State Proposed Findings ¶ 132 explains, there are many categories of costs associated with a severe accident that are not included in the MACCS2 code calculations. Staff Proposed Findings ¶ 5.35 discusses this major drawback of the MACCS2 code by explaining “[i]t is important to note that MACCS2 only calculates a portion of the costs associated with an accident.” For example, the MACCS2 code does not calculate the loss of natural resources. Tr. 2285:5-8 (Ghosh). Additionally, NRC Staff's experts admitted, in response to a question from Judge McDade, that the MACCS2 code “does not account any economic value to the loss of the water” including drinking water. Tr. 2284:6-10 (Bixler). As stated in State Proposed Findings ¶ 303, given that there are many categories of costs which the MACCS2 code does not take into account, it is even more important that NRC Staff and Entergy provide a documented cost basis for a “best estimate” of the costs the code does consider. Again, reliance on unreasonable, undocumented MACCS2 input values violates NEPA.

Although the State does not challenge Entergy's use of the MACCS2 code, it is important to note that there is no requirement, regulatory or otherwise, that the MACCS2 code be used in a SAMA analysis. See Tr. 2339:4-2340:10 (J. McDade/Liberatore/Harrison/Ghosh) (The NRC has not promulgated a regulation pursuant to the Administrative Procedure Act rulemaking procedures that mandates the use of the MACCS2 code.). Entergy suggests the contrary by mischaracterizing a decision in the *Pilgrim* relicensing proceeding. Entergy cites the *Pilgrim* decision for the proposition that “[NEI-0501] guidance endorses using the MACCS2 computer code to estimate the offsite dose and economic impacts that result from postulated radioactive material releases to the environment.” Entergy Proposed Findings ¶5 (citing *Pilgrim* CLI-10-11,

71 N.R.C. at 291). The cited *Pilgrim* decision, however, actually states “NRC guidance documents conclude that the MACCS2 code (a version of the MELCOR Accident Consequence Code System code) *is acceptable* for performing SAMA analyses, and NRC licensees commonly use the MACCS2 code for performing SAMA analyses.” *Pilgrim* CLI-10-11, 71 N.R.C. at 291 (emphasis added). Thus, the MACCS2 code is not required.¹⁴

7. Uncertainty Factors Do Not Account for NRC Staff and Entergy's Failure To Develop Site-Specific Inputs

The record does not support a Board finding that Entergy's uncertainty factors account for the failure to develop site-specific decontamination cost and time inputs. Entergy Proposed Findings ¶ 237. As an initial matter, the uncertainty factors of 2.1 for Indian Point Unit 2 and 1.4 for Unit 3, cited by NRC Staff, were calculated to account for event uncertainty—the uncertainty of predicting the frequency with which internal events leading to core damage will occur (*i.e.* core damage frequency or “CDF”). ENT000459 (IP-RPT-09-00044, Rev. 0, Re-Analysis of IP2 and IP3 Severe Accident Mitigation Alternatives, Dec. 3, 2009) at 9-10. Thus, NRC Staff's argument that these factors can somehow also account for an inaccurate cost estimate is incorrect. NRC Staff confuses mistakes Entergy and Staff made in the MACCS2 inputs with the concept of uncertainty. By relying upon Sample Problem A, Entergy and Staff have underestimated the costs associated with a severe accident, and the corresponding SAMA benefits, in the FSEIS. Site-specific MACCS2 inputs can be—and have been—calculated; they

¹⁴ Regarding NRC Staff's description of the SAMA analysis, the State notes that portions of Staff Proposed Findings ¶¶ 5.34 and 5.37 are outside the scope of NYS-12C and related to issues raised in NYS-35/36. See Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), (Ruling on Motion and Cross-Motions for Summary Disposition of NYS-35/36), LBP-11-17, 74 N.R.C. 11 (Jul. 14, 2011).

are not uncertainties. The correct decontamination cost and time values should be input to the MACCS2 code to calculate the severe accident costs before uncertainty is applied, *i.e.* in the calculation of the mean value.¹⁵

Furthermore, NRC Staff has not presented any analysis or documents to support its argument that the uncertainty factors used by Entergy somehow account for mistakes in MACCS2 input values. Other than unsupported allegations from NRC Staff's witnesses, nothing in the record states that the uncertainty factors account for mistakes in MACCS2 input values.¹⁶ See State Proposed Findings ¶¶ 152, 345-46. Indeed, the uncertainty factors of 2.1 for Indian Point Unit 2 and 1.4 for Unit 3 were calculated to account for uncertainties in predicting the frequency of internal events that lead to severe accidents causing reactor core damage in the Level 1 and Level 2 PRA. See ENT000459 at 9-10. They do not account for uncertainty in the Level 3 PRA (where the MACCS2 code is used). Tr. 2324:10-20 (Lemay). In fact, nothing in the record suggests that Entergy or Staff even considered uncertainty in the Level 3 PRA. See

¹⁵ Entergy presents two calculations of benefits in its tables comparing the costs and benefits of SAMA candidates: "Benefit" and "Benefit with Uncertainty." ENT000459 at 21-32, 34-35. Entergy should correct any MACCS2 input errors before calculating the severe accident costs. These costs are included in the "Benefit" column. The uncertainty factor is applied to the "Benefit" to then calculate the "Benefit with Uncertainty."

¹⁶ Furthermore, the external event multipliers (3.8 for Indian Point Unit 2 and 5.5 for Unit 3), Entergy used are not even uncertainty factors. See NYS00133I at G-44 - G45. These multipliers were calculated to take into account external events that lead to core damage, not uncertainty. See *id.* Thus, the multiplier of 8 represents a combination of the uncertainty factors for the Level 1 and 2 PRA and the external events multipliers. It does not account for uncertainties in the Level 3 PRA. Tr. 2324:10-20 (Lemay). According to the FSEIS, "[t]he multiplier of 8 slightly exceeds the product of the external-event multiplier and the uncertainty factor for each unit (*i.e.*, $3.80 \times 2.10 = 7.98$ for IP2, and $5.53 \times 1.40 = 7.73$ for IP3) and adds a small amount of additional conservatism" (0.02 for Indian Point Unit 2 and 0.27 for Unit 3). NYS00133I at G-45.

ENT000459 at 9-10; Tr. 2324:10-20 (Lemay). Consequently, there is no support for NRC Staff's notion that these uncertainty factors account for any and all potential uncertainty in the SAMA analysis—including errors in estimating MACCS2 input parameters.

NUREG/BR-0184 (ENT00010A-D), "Regulatory Analysis Technical Evaluation Handbook," was cited by Entergy and NRC Staff as providing guidance on how to perform SAMA analyses. *See* Tr. 2198:11-16 (O'Kula) and 2285:9-22 (Ghosh). That guidance addresses uncertainty, explaining that "NRC's Final Policy Statement on the use of probabilistic risk assessment (PRA) in nuclear regulatory activities (NRC 1995b) states that sensitivity studies, uncertainty analysis, and importance measures should be used in regulatory matters, where practical within the bounds of the state-of-the-art." ENT00010A at 5.3. NUREG/BR-0184 describes seven categories of uncertainties in PRAs including data, analyst assumptions, modeling, scenario completeness, accident frequencies, accident consequences, and interpretation. ENT00010A at 5.3 to 5.4. Entergy's uncertainty factors of 2.1 and 1.4 account only for uncertainty in accident frequency (*i.e.* core damage frequency). ENT000459 at 9-10. As noted, nothing in the record suggests that NRC Staff or Entergy considered uncertainty in the Level 3 PRA. *See* Tr. 2324:10-20 (Lemay). Accounting for uncertainty in the Level 3 PRA, however, could account for some of the other categories listed in NUREG/BR-0184, such as uncertainty in accident consequences.

Despite Entergy's and Staff's failure to do so, it is possible to account for some of the uncertainty in the Level 3 PRA by following the method used to quantify uncertainty in the Level 1 and 2 PRA and using the exhibits submitted by Entergy (*e.g.* ENT000464, Entergy Calculation No. IP-CALC-09-00265, Rev. 0, Re-analysis of MACCS2 Models for IPEC, Dec. 2, 2009). As explained in NEI 05-01, uncertainty may be quantified through the use of an

uncertainty factor, which is derived from the ratio of the 95th percentile to the mean point estimate. NYS000287 (NEI 05-01 [Rev A], Severe Accident Mitigation Alternatives Analysis, Guidance Document, Nov. 2005) at 30. For PRA Levels 1 and 2, Entergy calculated an uncertainty factor by taking the ratio of the 95th percentile to the mean value of the core damage frequency. ENT000459 at 9-10. In the same way, for Level 3 PRA, an uncertainty factor could be derived from the 95th percentile and mean values of the population dose and the offsite economic cost.¹⁷

B. The Development of Site-Specific MACCS2 Input Values for Indian Point Is Not Only Possible, But Entirely Reasonable

At bottom, Entergy asks the Board to excuse its failure to develop site-specific MACCS2 inputs, arguing that “[t]here is certainly no evidence that the NRC expects licensees to engage in an extensive, world-wide research project to find alternate MACCS2 input values not previously reviewed or approved by the NRC.” Entergy Proposed Findings ¶ 164; *cf.* Staff Proposed Findings ¶ 5.15. Entergy’s hyperbole aside, there is no evidence to suggest that developing site-specific MACCS2 input values would require “an extensive, world-wide research project,” or the “virtually infinite study and resources” bemoaned in *Pilgrim*, CLI-10-11, 71 N.R.C. at 315-16. To the contrary, the State’s evidence, including the ISR Report (NYS000242) and Dr. Lemay’s testimony (NYS000241, NYS000420), conclusively demonstrate that developing site-specific

¹⁷ The 95th percentile and mean values for the population dose and offsite economic cost are already available as they are calculated by the MACCS2 code. *See* ENT000464. Thus, accounting for some uncertainty in the Level 3 PRA is possible and could change the outcome of the SAMA analysis.

MACCS2 inputs is not only realistically possible, but also the only reasonable way of estimating the costs associated with a severe accident at Indian Point.

Entergy tries to blame NRC as an agency for Entergy's failure to develop site-specific values, stating "we assume that if the Commission expected licensees to use new values in their SAMA analyses as a result of Fukushima or Chernobyl, it would have issued such guidance on a generic basis, but it has not." Entergy Proposed Findings ¶ 215. Entergy further laments that "there is no NRC- and industry-accepted alternative to the NUREG-1150 values." Entergy Proposed Findings ¶ 144; *see also* ¶ 160 (incorrectly contending that "the CDNFRM value was intended to be a 'global value.'"). However, given the fact that decontamination costs do not scale linearly with population (*see* section III.A.2 above), there is no "global value" that the Commission could issue to be site-specific for all plants. NRC's regulations are clear—as is *Limerick*—that the SAMA analysis must be site-specific.

The fact that a site-specific SAMA analysis will involve some effort is not an excuse to ignore the regulatory requirement and mandate from *Limerick* to develop a site-specific SAMA analysis for Indian Point. Indeed, NRC and Entergy are accustomed to dealing with complex issues, as demonstrated by Entergy's efforts to verify the reasonableness and robustness of the Level 1 and Level 2 PRA, and to quantify and account for to uncertainties in Level 1 and Level 2, as described in Attachment I to NL-08-028 (ENT000460). *See* Rebuttal Pre-filed Testimony of New York State Expert Dr. François Lemay of ISR regarding Contention NYS-12C at 9 ("Lemay Rebuttal Test.") (June 29, 2012) (NYS000420). Although the data available to develop site-specific inputs is not perfect and may need to be derived from varied sources including unfolding events at Fukushima, nuclear weapons testing, and other imperfect sources, "agencies are often called upon to confront difficult administrative problems armed with imperfect data."

Mont. Wilderness Ass'n v. McAllister, 666 F.3d 549, 559 (9th Cir. 2011) (“We also acknowledge that the [Forest] Service does not possess complete historical data But the proper response to that problem is for the Service to do the best it can with the data it has, not to ignore the [statutory requirement] completely.”). SAMA analyses are not performed generically for all plants. There is no excuse for NRC Staff or the Board to sanction a SAMA analysis that fails to rely on site-specific costs for Indian Point.

C. NRC Staff and Entergy Misrepresent the State's Arguments Regarding NUREG/CR-5148 (Tawil 1990), a Site-Specific Case Study Commissioned by NRC to Estimate the Costs Associated with a Severe Accident at Indian Point

Entergy Proposed Findings ¶ 169 incorrectly claims that NUREG/CR-5148 Property-Related Costs of Decontamination, Feb. 1990 (“Tawil 1990”) (NYS000424A-NYS000424BB) “is not the ‘site-specific’ analysis New York and Dr. Lemay first claimed it to be.” But Entergy’s explanation focuses on whether the proper source terms were used and misses the point that the State first raised in its pre-filed submissions—that NRC has actually conducted a site-specific analysis of the decontamination costs associated with a severe accident at Indian Point, without using NUREG-1150 values, and, therefore, without relying upon Sample Problem A. *See* NYS000420 Lemay Rebuttal Test. at 28; *see also* State’s Proposed Findings ¶ 202-205. In pre-filed testimony and at the hearing, Dr. Lemay readily acknowledged that the Tawil 1990 study was not a substitute SAMA analysis for Indian Point because Tawil 1990 “use[d] different habitability criteria, different decontamination factors (DFs) and different source terms.” NYS000420 Lemay Rebuttal Test. at 28; *see also* Tr. 2257:8-14 (Lemay). Thus, Entergy’s criticism is of no moment.

Entergy also argues that Dr. Lemay should have explained how Tawil 1990, and the DECON code discussed therein, “could be used to develop a site-specific decontamination cost

estimate, and in a form suitable for use in MACCS2.” Entergy Proposed Findings ¶ 170. But here too Entergy misses the point. What is important about Tawil 1990 is its methodology of developing site-specific decontamination costs using site-specific data, instead of improperly using the Sample Problem A values as default values supposedly applicable to every nuclear reactor. *See* NYS000420 Lemay Rebuttal Test. at 26 (explaining that the methodology behind the DECON model and database is similar to the CONDO model and database, which ISR used to calculate MACCS2 input values). In short, none of this diminishes the fact that Tawil 1990 represents an actual case study of the economic impacts of severe accident costs at Indian Point, using data to develop site-specific values, that both NRC Staff and Entergy failed to disclose, let alone discuss. Tawil 1990 supports the State's position that site-specific values can be developed and therefore, should have been developed for Indian Point.

D. Entergy's SAMA Analysis Is the First Time Site-Specific Severe Accident Impacts For Indian Point Have Been Evaluated Under NEPA

It is important to remember that the very reason a SAMA analysis is required during relicensing is that an analysis of severe accident mitigation design alternatives was never conducted for Indian Point. *See* 10 C.F.R. § 51.53(c)(3)(ii)(L) (requiring that the applicant include a SAMA analysis in its environmental report “[i]f staff has not previously considered severe accident mitigation alternatives for the applicant's plant”). NRC Staff's characterization of a SAMA analysis as “a systemic search for potentially cost-beneficial *enhancements*” (Staff Proposed Findings ¶ 5.32 (emphasis added)) falsely implies that the SAMA analysis is an enhancement of some previous analysis. It is not. Despite Judge Wardwell's statement that “[t]he plant has been designed to be safe” (Tr. 2072:15 (J. Wardwell)), Indian Point Units 2 and 3 were designed, licensed, and constructed many decades ago when NRC thought severe

accidents were so low that they did not even have to be considered. *Limerick*, 869 F.2d at 726.

As the Third Circuit explained,

In sum, the NRC originally thought severe accidents too unlikely to justify consideration of their likelihood in reviewing and determining the safety of nuclear plants. It retreated from that viewpoint following the TMI [Three Mile Island] accident and subsequently set safety goals with respect to severe accidents. However, it refused to set quantitative limits; it provided that severe accident mitigation design alternatives should not be studied on a case-by-case basis; and it excluded environmental considerations under NEPA in the case *sub judice*.

Limerick, 869 F.2d at 728. For the first time, *Limerick* required a site-specific analysis of severe accident mitigation alternatives. *Id.* at 738-41. *Limerick* is the genesis of the requirement that applicants perform SAMA analyses.

Thus, while NRC Staff and Entergy are correct in noting that NRC examined the impacts of severe accidents of a generic basis for all plants (Staff Proposed Findings ¶ 5.6; Entergy Proposed Findings ¶ 6),¹⁸ because the SAMA analysis involves the quantification of costs associated with severe accidents, it must analyze severe accident impacts on a plant-specific basis. Accordingly, the only way NRC Staff and Entergy comply with *Limerick*'s mandate is through the SAMA analysis, which necessarily involves an analysis of severe accident impacts.

¹⁸ NEPA requires the analysis of impacts that "have catastrophic consequences, even if their probability of occurrence is low." 10 C.F.R. § 1502.22.

E. Entergy's and NRC Staff's Criticisms of ISR Demonstrate Why the Lack of a Documented Basis for the Sample Problem A Input Values Is Unreasonable Under NEPA

1. Entergy's Failure to Present a Documented Basis for Its Decontamination Cost and Time Estimates Is Unreasonable Under NEPA and Frustrates NEPA's Purpose of Informing the Public

Standing in stark contrast to the lack of documented, rational basis for relying upon Sample Problem A's decontamination cost (CDNFRM) and time (TIMDEC) values, the ISR Report (NYS000242) and Dr. Lemay's testimony (NYS000241) transparently disclosed how ISR calculated site-specific decontamination cost and time values without relying upon Sample Problem A. *Compare* Tr. 2357:18-21 (Lemay) (Entergy's critique "illustrate[s] the value of having documented basis for the cost of decontamination, because we can get a peer review and identify mistakes, and then correct them."), *with* Tr. 2134:8-10 (Lemay) ("And I wish I could scrutinize and examine the way they came up with the cost that we have in the Entergy sample Problem A.").

Far from the mere suggestion of alternative input parameters the Commission was wary of in *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 N.R.C. __ slip op. at 29 (Mar. 8, 2012) (Entergy Proposed Findings ¶ 74),¹⁹ the State challenged specific input parameters used by Entergy and disclosed in an expert report various methods and calculations for developing site-specific values that would comply with the requirement to complete a site-

¹⁹ Nor is the State's challenge at all similar to the rejected contention in *Davis-Besse* (Staff Proposed Findings ¶ 5.17), which "neither directly challenged relevant cost estimates set forth in the Davis-Besse SAMA analysis, nor explained why or how the estimates or framework of other studies were appropriate for use in the Davis-Besse site-specific reactor accident SAMA analysis, or would lead to more accurate estimates than those reached in the Davis-Besse analysis." *FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-08, 75 NRC ___, (slip op. at 34) (Mar. 27, 2012).

specific SAMA analysis.²⁰ Because ISR's documentation of their work was so detailed, Entergy and NRC Staff had the opportunity in their pre-filed testimony to offer a critique of some aspects of ISR's calculations.

ISR reviewed Entergy and NRC Staff's critique and found that most of Entergy's and NRC Staff's criticisms did not alter ISR's overall conclusion. In some instances, however, ISR revisited its calculations to determine whether the ultimate calculation of OECR would change based on the assumptions Entergy and NRC Staff provided in their testimony. NYS000420 Lemay Rebuttal Test. at 35-37. Significantly, ISR concluded that, even when these assumptions were taken into consideration, Entergy has still underestimated OECR by up to a factor of at least seven. *Id.* Thus, there is absolutely no support for NRC Staff's conclusion that "New York's own analysis, once it is corrected for errors, confirms that Entergy's selections were not only reasonable but perhaps conservative." Staff Proposed Findings ¶ 5.39.

Entergy also admitted that it needed to correct some of its testimony based on Dr. Lemay's rebuttal: In response to a question from Judge Kennedy regarding the costs that accrue while decontamination is underway and individuals are away from their homes, Mr. Teagarden replied, "This is an area that I'll make a correction on in our original testimony, where we had a reference to per diem costs while decontamination activities were occurring, and Dr. Lemay in his rebuttal pointed out that actually it's not per diem; it is the depreciation and deterioration, and that is correct." Tr. 2050:4-10 (Teagarden).

²⁰ NRC Staff's argument that the State's challenged inputs "represent a miniscule fraction of the inputs necessary to perform a reasonable SAMA analysis" (Staff Proposed Findings ¶ 5.38) is of no consequence because it is not the number of parameters that matter, but their effect on the outcome. Two of the challenged input parameters—decontamination cost and time—are highly sensitive and have very significant impacts on the MACCS2 code's calculated costs.

In sum, by focusing on highly technical, and largely unfounded, criticisms of ISR's calculations Entergy and NRC Staff miss the fundamental point—reliance on Sample Problem A is unreasonable when the values lack a documented basis and site-specific inputs are available from many data sources outside of NUREG-1150. Without a documented rational basis for the SAMA cost estimates, NRC Staff has failed to “provid[e] a springboard for public comment,” frustrating one of NEPA's two purposes: public information. *Balt. Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 97 (1983). The environmental analysis is not just a bureaucratic burden—it should inform the NRC's decision. *See* 40 C.F.R. § 1500.1(c) (“Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.”); *see also See Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 768-69 (2004). For these reasons, NRC Staff has violated NEPA.

2. NRC Staff and Entergy's Criticisms of ISR's Decontamination Cost (CDNFRM) Calculation Lack Merit

Entergy and NRC Staff misapprehend the purpose of ISR's analysis. Entergy Proposed Findings ¶ 174; Staff Proposed Findings ¶ 5.64. The ISR Report is not, and should not, be an independent SAMA Analysis; nor is it a substitute for a proper SAMA analysis that satisfies NEPA. NYS000420 Lemay Rebuttal Test. at 5-8. Instead, ISR assessed whether the MACCS2 input values related to economic costs at Indian Point were reasonable and, because those values were not reasonable, ISR calculated a reasonable range of input values. *Id.* at 5. The ISR Report

explains various ways of using the available data to develop MACCS2 inputs for Indian Point.

See NYS000242 ISR Report; NYS000430 (updating certain tables from ISR Report).

NRC Staff cannot shift the burden of ensuring that its environmental analysis is adequate onto Entergy, intervenors, or any other entity. *See Harlem Val. Transp. Ass'n v. Stafford*, 500 F.2d 328, 336 (2d Cir. 1974) (An agency cannot be "content to place the burden on intervenors whose resources might be limited to challenge any environmental statements that the [applicants] might make in their applications . . . [Such a] passive approach . . . shifts to intervenors a large part of the burden of evaluating environmental issues which Congress placed on agencies of the government"); *Greene County Planning Board v. FPC*, 455 F.2d 412, 419-20 (2d Cir. 1972), *cert. denied*, 409 U.S. 849 (1972) (a federal agency cannot abdicate its responsibility independently to evaluate federal actions proposed to it by other, non-federal entities).

Dr. Lemay's rebuttal testimony addressed, in detail, NRC Staff and Entergy's criticisms regarding the CDNFRM calculations. *See* NYS000420 Lemay Rebuttal Test. at 35-47. For example, in response to NRC Staff's point regarding surface water and farmland (Staff Proposed Findings ¶ 5.66), ISR recalculated the values for CDNFRM, subtracting surface water and farmland from the area. NYS000420 Lemay Rebuttal Test. at 35. The impact of this change is a decrease of 13% at the low end of the range for the OECR and no change at the high end of the range. NYS000430 at Table 13. On the other hand, NRC Staff's claim that ISR incorrectly accounted for parkland in the calculation of CDNFRM (Staff Proposed Findings ¶ 5.66) is inaccurate. NYS000420 Lemay Rebuttal Test. at 37. The ISR Report also contains a detailed evaluation of Staff's discussion of NYS-12C in Appendix G to the FSEIS, portions of which Staff repeat in their Proposed Findings. *See* NYS000242 ISR Report at 36-40.

With respect *Sandia Site Restoration*,²¹ ISR's first approach to calculating decontamination costs, despite NRC Staff and Entergy's attempts to discredit this reference (Staff Proposed Findings ¶¶ 5.46, 5.53; Entergy Proposed Findings ¶ 175), the State's Proposed Findings describe its importance in detail. The State explained that *Sandia Site Restoration* is a robust source of important information that can be modified to be more applicable to a nuclear reactor accident and, ultimately, to develop site-specific inputs for estimating decontamination costs at Indian Point. *See* State's Proposed Findings ¶¶ 248-252. Use of such data sources is reasonable and appropriate. *See Mont. Wilderness Ass'n*, 666 F.3d at 559 ("the proper response to that problem is for the Service to do the best it can with the data it has, not to ignore the [statutory requirement] completely.").

NRC Staff grossly mischaracterizes Dr. Lemay's testimony on the relevance of *Sandia Site Restoration* in claiming that "New York's testifying expert agreed that the Site Restoration Study and other information related to nuclear weapon accident clean-up was not particularly useful for evaluating whether the decontamination values used by Entergy were appropriate." Staff Proposed Findings ¶ 5.10, n.10 (citing Transcript at 2012); *see also* ¶ 5.52 (citing Transcript at 2012). The State used *Sandia Site Restoration* as "a point of reference in a benchmarking exercise that illustrates various approaches to determining the cost of decontamination (\$/km²) and the resulting CDNFRM (\$/person)." NYS000420 Lemay Rebuttal Test. at 40. In their expert report, ISR took great pains to explain the adjustments necessary to use *Sandia Site Restoration* to predict costs resulting from a nuclear reactor accident.

²¹ D. Chanin & W. Murfin, SAND96-0957, *Site Restoration: Estimation of Attributable Costs From Plutonium-Dispersal Accidents* (May 1996) (NYS000249).

NYS000242 ISR Report at 16-18. ISR's work, combined with the fact that the Sample Problem A values were likely based on the cost of decontaminating plutonium from nuclear weapons (*see* State Proposed Findings ¶¶ 172-74), shows that Entergy's criticism of Sandia *Site Restoration* is contradictory and lacks merit.

Furthermore, Entergy's statement that "[t]he Site Restoration Report's focus on plutonium significantly increases the decontamination costs estimated therein, because the report's authors assumed that any area requiring a DF [decontamination factor] greater than 10 would require complete demolition of contaminated structures" (Entergy Proposed Findings ¶ 177), is unsupported. To prove this, Entergy states "[a]s the record evidence shows, this runs counter to actual remediation experience, where DFs [decontamination factors] of up to 15 have been achieved without resorting to complete demolition." *Id.* The "record" makes no such showing. As Dr. Lemay explained, the other methods cited by Entergy and NRC Staff to achieve high levels of decontamination are inconclusive at best, and have no ultimate bearing on ISR's calculations. NYS000420 Lemay Rebuttal Test. at 52-53. For example, ISR agrees that burying contaminants in place (Entergy Test. at A91) "could work well in farmland where deep-plowing can bury the contamination, but it is less applicable to the urban areas of NYC where concrete and paved surfaces are predominant." NYS000420 Lemay Rebuttal Test. at 52. Dr. Lemay explained, "no matter what the decontamination technique, it is difficult to achieve a high dose reduction factor (DRF=15) where cesium is present, even if some surfaces can be decontaminated perfectly (DF [decontamination factor] >100)." *Id.* Dr. Lemay provided the following example:

it may be easy to decontaminate the glass surfaces with a DF [decontamination factor] >100. However it may not be possible to decontaminate the brick to a DF [decontamination factor] >5. The actual DRF achieved near the building will be

much less than $DF > 100$ and closer to the DF [decontamination factor]=5. The lowest DF [decontamination factor] determines the achievable DRF [dose reduction factor], so even though the glass is thoroughly decontaminated, the dose reduction factor will not be as high due to the remaining cesium contamination in the brick.

Id. at 52-53.²²

Entergy claims that “[t]he Site Restoration Report focused on relatively small areas for remediation and did not fully investigate attributes that would be pursued for a significantly larger-scale cleanup effort” such as “segregating nonradiological waste from radiological waste, employing waste volume reduction techniques, and minimizing the costs associated with on-site disposal” (Entergy Proposed Findings ¶ 178; *see also* Staff Proposed Findings ¶ 5.54); this is not a valid reason for dismissing the relevance of *Sandia Site Restoration*. Entergy’s statement seems to assume that large-scale decontamination results in economies of scale that are not present in decontamination of a small area. However, as Dr. Lemay explained while “[i]t is reasonable that economies of scale are possible during the decontamination of large areas, such as farmland[,] . . . a large part of the cost of decontamination in urban areas is related to the labor intensive tasks of cleaning the buildings’ contents [and] [t]here appears to be no practical way to scale these tasks economically.” NYS000420 Lemay Rebuttal Test. at 41. Furthermore, other aspects of large-scale decontamination—including budget approval, approval for waste repositories, and set up times—may make it more complicated and costly than decontamination of a small area. *Id.* at 41. Thus, Entergy’s assumptions regarding economies of scale lack an evidentiary basis.

²² Dose reduction factor is similar to, but not the same as the decontamination factor. NYS000242 ISR Report at viii, 11-12; NYS000241 Lemay Initial Test. at 17; Tr. 2301:23-25 (J. McDade/Teagarden).

The State's Proposed Findings rebut Entergy and NRC Staff's criticisms of the other three approaches ISR used to calculate decontamination cost. The Reichmuth reference²³ is an important data source because it actually addresses decontamination in major metropolitan centers in the U.S. NYS000242 ISR Report at 18; *see also* State Proposed Findings ¶¶ 238, 239, 248-52. For CONDO approach,²⁴ the State's Proposed Findings explain, at length, why NRC Staff's and Entergy's allegations regarding conservation of mass are unfounded (Staff Proposed Findings ¶ 5.40; Entergy Proposed Findings ¶¶ 241-43, 259-63). *See* State Proposed Findings ¶¶ 258-263. Contrary to NRC Staff's and Entergy's assertions, Dr. Lemay was not confused by the MACCS2 code's conservation of mass. *Id.* With respect to the last approach, the RISO report,²⁵ a detailed explanation was provided in the ISR Report. NYS000242 ISR Report at 19-22. Dr. Lemay's testimony rebuts, in specific and technical detail, Entergy's allegations and explains why the use of RISO was sound. NYS000420 Lemay Rebuttal Test. at 42-47. *See also* State Proposed Findings ¶¶ 244, 253.

3. NRC Staff and Entergy's Criticisms of ISR's Decontamination Time (TIMDEC) Calculations Lack Merit

NRC Staff and Entergy take issue with ISR's discussion of potential ranges of decontamination times (TIMDEC). It is important to remember, however, that even when using

²³ B. Reichmuth, S. Short, T. Wood, Economic Consequences of a Rad/Nuc Attack: Cleanup Standards Significantly Affect Risk, Pacific Northwest Laboratory, Working Together Conference, Apr. 28, 2005, Boston, MA(NYS000256)

²⁴ CONDO: Software for estimating the consequences of decontamination options, Report for CONDO version 2.1, T Charnock, J Brown, AL Jones, W Oatway and M Morrey, NRPB-W43, May 2003 (NYS000250).

²⁵ J. Roed, K.G. Anderson, H. Prip. 1995. Practical Means for Decontamination 9 Years after a Nuclear Accident. RISO National Laboratory, Roskilde, Denmark. RISO-R-828(EN), Dec. 1995) (NYS000251).

the lower bounds of reasonable values—1 year for light decontamination and 2 years for heavy decontamination—while keeping Entergy's values for all other inputs, the offsite economic cost risk (OECR) more than doubles. NYS000430 at 6, Table 13; Tr. 2181:23-25 (Lemay); *see also* State's Proposed Findings ¶ 269. The State's Proposed Findings discuss the reasons why Entergy's values of 60 and 120 days are unreasonable. *Id.* ¶¶ 264-272.

In defense of 60 and 120 days, Entergy and NRC Staff argue that data from two real-world severe accidents—Fukushima and Chernobyl—is irrelevant. Entergy Proposed Findings ¶ 203;²⁶ Staff Proposed Findings ¶ 5.57. Entergy then asserts that “the assumption that decontamination activities will be performed in an expedited manner is integral to the MACCS2 decontamination and interdiction model.” Entergy Proposed Findings ¶ 213. Unfortunately, data from two real-world severe accidents—Fukushima and Chernobyl—renders that assumption untenable, and the only reasonable way to proceed is to develop more realistic cost estimates that are compatible with the MACCS2 code. State Proposed Findings ¶¶ 264-268.

Both Entergy and NRC Staff argue that the State's decontamination time values represent a worst case scenario and that appropriate time inputs should be “‘average’ values intended to reflect the full spectrum of severe accident scenarios examined in a SAMA analysis.” Entergy Proposed Findings ¶ 248; Staff Proposed Findings ¶ 5.62. Entergy selected a range of eight

²⁶ Furthermore, Entergy misstates Dr. Lemay's testimony regarding Chernobyl. Dr. Lemay did not state that “decontamination of the area affected by the Chernobyl accident took four years” (Entergy Proposed Findings ¶ 202); rather, Dr. Lemay testified that “large-scale decontamination of the area affected by the accident terminated four years after the accident,” making the point that “[s]ince large-scale decontamination efforts stopped prematurely is not possible for anyone to estimate what the total duration of a clean-up for the Chernobyl accident could have been.” Initial Pre-filed Written Testimony of New York State Expert Dr. François Lemay of ISR regarding Contention NYS-12C at 52 (Dec. 21, 2011) (NYS000241) (‘Lemay Initial Test.’).

categories of severe accidents, *i.e.*, release categories, to model in the MACCS2 code. Some have higher probabilities and lower consequences while others have lower probabilities and higher consequences. As the State explains, the MACCS2 code calculates costs for each release category. The user must then weight those costs by their probability to calculate the offsite economic cost risk (OECR) and the population dose risk (PDR) used in the SAMA analysis. Thus, the SAMA analysis takes the probability (or frequency²⁷) of each category of severe accidents into account *after* the costs are calculated. As the State's Proposed Findings described in detail, using Entergy's values, three release categories "EARLY HIGH," "EARLY MEDIUM," and "LATE HIGH," contribute over 90% to the total OECR. State Proposed Findings ¶ 283. Therefore, it is appropriate that the input values should reflect these more severe accidents.²⁸ *Id.* ¶ 284; *see also* Tr. 2178:17-2179:14, 2196:14-2196:3 (Lemay) (providing a detailed explanation). Neither NRC Staff nor Entergy meaningfully respond to the State's argument on this point.²⁹

In a final attempt to discredit the State's proposed decontamination times, NRC Staff and Entergy argue that decontamination times in excess of one year are unreasonable because the

²⁷ The frequency of a release category represents the likelihood that the release category is postulated to occur within one year. Essentially, frequency is a probability expressed on a per year basis.

²⁸ At the hearing, Dr. Lemay explained that, although it has not been the practice, a MACCS2 user could input a separate set of input values for each release category (*i.e.*, smaller TIMDEC values for less severe categories and larger TIMDEC values for more severe release categories). Tr. 2196:24 - 2197:3 (Lemay).

²⁹ NRC Staff presents a confusing and misleading table in Staff Proposed Findings ¶ 5.47, but this does not controvert the State's arguments. NRC Staff's table attempts to take the probabilities related to each release category into account before the OECR and PDR are calculated—accounting for probability twice. The Board should afford this table, and its equally confusing description, no weight.

MACCS2 code limits TIMDEC inputs to one year Staff Proposed Findings ¶ 5.59. There is no evidence as to why the code places such a limit on TIMDEC. *See* State Proposed Findings ¶ 271. As Dr. Lemay explained, TIMDEC represents the average time from evacuation of a population to return to their original home in a given grid element. NYS000420 Lemay Rebuttal Test. at 50. Dr. Lemay agrees that it is possible that within that grid element, some people will return to their property more quickly than TIMDEC, and that decontamination efforts may continue long after TIMDEC. *Id*; *see also* Tr. 2181:9-16 (Lemay). Dr. Lemay explained that MACCS2 contains three phases, but “MACCS is blind to how you split the time between the intermediate phase relocation, the decontamination time or the interdiction because in the equation where it calculates the cost it sums the three times and it multiplies by the depreciation rate.” Tr. 2193:15-20 (Lemay).

NRC Staff argues that because the code “assumes that all of the costs of decontamination are spent in the first year after the accident. . . the costs incurred in future years would need to be discounted back to their present value.” Staff Proposed Findings ¶ 5.60. Without providing any underlying calculations or analysis, NRC Staff reports that “accounting only for the time value of these yearly outlays for decontamination would potentially reduce Dr. Lemay’s CDNFRM by 73% of his asserted values.” *Id*. This argument was not presented in NRC Staff’s pre-filed submissions, and expands upon testimony offered by Dr. Bixler at the hearing based on a 30-year TIMDEC—the largest TIMDEC considered by ISR for heavy decontamination. Tr. 2200:15-2201:5 (Bixler). For these reasons, this is an unsupported allegation that should be afforded no weight by the Board. Still, Dr. Lemay explains that along with the time value of money, longer TIMDEC values would also need to consider the fact that the decontamination worker costs

would be increasing over time and that these effects would likely cancel each other out. *See* Tr. 2202:17-22 (Lemay).

NRC Staff also argues that extending TIMDEC past 15 years would “need to account for the intervening decay, weathering, and other natural removal mechanisms.” Staff Proposed Findings ¶ 5.59. Again, ISR only considers TIMDEC values greater than 15 years on the upper end of its bounding estimate for reasonable TIMDEC values. NYS000430 at Table 13. It is not necessary to use TIMDEC values of 15 or 30 years in order to see very significant impacts on the cost outputs. *Id.* While decay, weathering, and other natural removal mechanisms would occur, there is no evidence in the record quantifying how this would impact the time it takes to achieve various levels of decontamination. Thus, their effect, if any, is not apparent from the record.

4. Neither NRC Staff Nor Entergy Have Demonstrated That ISR's Minor Changes to the Source Code Were Improper or Unreasonable

NRC Staff admits that “Dr. Lemay is likely correct that modification of the code to allow inputs outside the acceptable ranges is trivial in nature.” Staff's Proposed Findings ¶ 5.40. Entergy, on the other hand, states that “Dr. O’Kula and Mr. Teagarden maintained that altering the MACCS2 source code without an independent verification of proper code functionality is ill-advised and counter to standard industry configuration control and software quality assurance practices.” Entergy Proposed Findings ¶ 205; *see also* ¶ 183. Entergy goes so far as to claim, “Even putting that concern aside, the Board finds it unreasonable to expect applicants like Entergy to self-modify the MACCS2 code, particularly given the Commission's recent characterization of MACCS2 as the standard, NRC-endorsed tool for SAMA analyses.” Entergy Proposed Findings ¶ 205.

Entergy's statement, however, rings hollow given the fact that there is no evidence in the record that even suggests that Dr. Lemay's minor changes were improper in any way. In fact, more than a month before Entergy's pre-filed submissions were due, Dr. Lemay submitted a declaration expanding in great detail upon the description of the MACCS2 code modifications first disclosed in the State's December 2011 pre-filed submissions. *See* Decl. of Dr. François J. Lemay (Feb. 17, 2012) (ML12048B413). If Entergy had legitimate concerns about "configuration control" and "quality assurance" it should have relied upon its MACCS2 experts to articulate those concerns.

F. Neither NRC Staff nor Entergy Has Shown That Other Input Parameters, Including VALWNF and POPCST Are Reasonable

Although the hearing focused on the decontamination cost and time parameters, ISR also evaluated other sensitive MACCS2 code parameters. *See* State's Proposed Findings ¶¶ 273-75. Of these parameters, Entergy's Proposed Findings focused on the value of nonfarm wealth (VALWNF) and the per capita costs of relocation (POPCST).³⁰ *See* Entergy's Proposed Findings ¶¶ 223-34. As described in further detail below, NRC Staff and Entergy have failed to show that Entergy's values for these parameters were reasonable.

The MACCS2 manual defines VALNFW as including "all public and private property not associated with farming that would be unusable if the region was rendered either temporarily

³⁰ Entergy's Proposed Findings ¶ 235 and the ISR report (NYS000242 at 28-30) discuss two additional parameters, societal discount rate for property (DSRATE) and fraction of nonfarm property due to improvements (FRNFIM). Although Entergy unreasonably relied upon Sample Problem A values for these values, ISR's evaluation of more appropriate, site-specific values resulted in a 8-12% decrease in OECR due to DSRATE and a 3% increase in OECR due to FRNFIM. *See* NYS000242 at 28, 30. The ISR report discusses a third additional parameter, the property depreciation rate (DPRATE) (NYS000242 at 27), which Entergy does not address.

or permanently uninhabitable.” NYS000242 ISR Report at 30. The MACCS2 manual specifies that VALWNF “should include the cost of land, buildings, infrastructure, and the cost of any non recoverable equipment or machinery.” *Id.* Entergy’s VALWNF input value is made up of two components: (1) the 1997 value of tangible possessions such as houses and automobiles, calculated using a program called SECPOP2000, which 1997 economic data; and (2) lost tourism and business based on the 2004 Gross County Product (GCP)³¹. NYS000420 Lemay Rebuttal Test. at 53; *see also* Tr. 2031:11-15 (Teagarden) (“Entergy did another calculation for economic impacts associated with loss of business income and loss of tourism on this county product perspective, and then added the two values together to achieve this value here in number 8 [on Table 4, ENT000450 at 54].”).

Entergy admits that “Dr. Lemay correctly noted that Entergy did not scale up the 1997 SECPOP2000 values to 2005 values.” Entergy Proposed Findings ¶ 229. Although Entergy concludes “that this omission is not material” (Entergy Proposed Findings ¶ 229), ISR’s calculations show that it is material because scaling up the VALWNF values results in an 18% increase in OECR (NYS000430 at Table 13).³²

With respect to POPCST, the MACCS2 input for the per capita cost of long-term relocation, Entergy’s value was based on Sample Problem A. Although NRC Staff did not discuss this parameter in the FSEIS, ISR located an explanation of the Sample Problem A value

³¹ The GCP is the total value of goods and services produced. NYS00270A-NYS00270B.

³² Although neither Entergy nor NRC Staff undertook an analysis to determine the effects that ISR’s calculated ranges of reasonable, site-specific input values would have on the SAMA analysis, Entergy did, however, purport to analyze the effect that population flaws discussed in NYS-16B would have on the required SAMA analysis. *See* State’s Proposed Findings ¶¶ 285-89. In that analysis for NYS-16B, the State concluded that an 11% increase in costs would render IP2 SAMA 025 cost-beneficial and, therefore, meet Entergy’s materiality test. *Id.*

in NUREG/CR-4551, which accounted for the average between a moving cost of \$4,500 and the cost of 140 days of lost wages estimated as \$5,600. NYS000242 ISR Report at 29. Entergy adjusted the Sample Problem A value using the Consumer Price Index to obtain a value of \$8,640. NYS000241 Lemay Initial Test. at 59.

As Dr. Bixler explained, POPCST accounts for the losses sustained until a person is able to find another job. Tr. 1973:10-14 (Bixler). Given New York State's current unemployment benefits policies—which normally last for 26 weeks (182 days) and had been extended to 93 weeks (651 days)—ISR determined that 140 days of lost wages was likely too low. *Id.* at 60. ISR calculated the cost of long-term relocation (POPCST) by multiplying the 2005 average income per capita (\$76/day) by a range of duration for the lost wages. *Id.* at 60. The resulting cost \$10,640/person (for 140 days of lost wages) to \$49,857/person (for 93 weeks of lost wages). *Id.* at 60. Using this range of values, the final cost (OECR) would increase by 5% to 108%. NYS000242 ISR Report at 29.

Entergy disagreed with ISR's evaluation of the length of time that workers are assumed to be out of work. Entergy Proposed Findings ¶ 232. NRC Staff did not discuss this parameter in the its Proposed Findings. ISR's evaluation of a range of durations specific to New York State, however, is more reasonable than the Sample Problem A value. It is, thus, reasonable to rely on New York State unemployment as an estimate.

IV. CONCLUSION

For the foregoing reasons, and those expressed in the State's Proposed Findings, NRC Staff's and Entergy's proposed Findings of Fact and Conclusions of Law provide no basis in fact or law for the Board to find in favor of Entergy and/or NRC Staff on Contention NYS-12C. The

Board should find for the State of New York on Contention NYS-12C and remand to NRC Staff to correct the deficiencies in the FSEIS.

Respectfully submitted,

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