UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-247-LR/50-286-LR
	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	

NRC STAFF'S RESPONSE TO THE COMMISSION'S MEMORANDUM AND ORDER OF FEBRUARY 18, 2015 (CLI-15-2), REGARDING CONTENTION NYS-12C

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TABLE OF CONTENTS

TABLE OF AUTHORITIES

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INTRODUCTION

Pursuant to the Commission's Memorandum and Order of February 18, 2015, the Staff of the U.S. Nuclear Regulatory Commission ("Staff") hereby responds to the Commission's eight questions regarding the Atomic Safety and Licensing Board's ("Board's") resolution of the State of New York ("New York") resolution of NYS-12C in favor of the Staff.[1] The Commission's questions generally relate to the Board's factual findings, and thus, these findings are entitled to more deference upon review. As more fully set forth below, the Staff submits that the Board correctly resolved NYS-12C in favor of the Staff after carefully weighing the weight of the testimony and credibility of the witnesses during the hearing. On review of the record supporting the Board's decision, there is ample evidence in the record to support the Board's resolution of each issue in the Staff's favor; thus, the Board did not commit clear error. Accordingly, the Board's decision resolving NYS-12C in favor of the Staff should be affirmed.

BACKGROUND

On February 18, 2015, the Commission issued an order directing the parties to address

[1] *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), LBP-13-13, 78 NRC 246 (2013).

eight questions related to the Board's resolution of contention NYS-12C in favor of the staff.[2] Prior to addressing each of the eight questions, *in seriatim*, below, the Staff provides an overview of the issues raised in the Commission's order and a brief overview of the SAMA process in order to place the two challenged MACCS2 code inputs, TIMDEC and CDNFRM, in perspective.

LEGAL STANDARDS

I. Scope of Commission Review

Once the Commission, in its discretion, has granted a request for review of a Board decision, the scope of the review and the standard for review is dependent on the issue being reviewed. With respect to conclusions of law, the Commission reviews those issues *de novo*.[3] The Commission's review of a Board's carefully rendered findings of fact more narrowly. The Commission defers to the Board's findings of fact absent "clearly erroneous findings."[4] Summarizing its standards of review, the Commission stated that the Board's findings must be "not even plausible in light of the record viewed in its entirety."[5] In other words, it is not sufficient that the Commission would have concluded differently had it been the finder of fact. The review should demonstrate that there is no evidence to support the Board's findings of fact.

In *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), CLI-10-5,

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[2] *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), CLI-15-2, 81 NRC ___ (Feb. 18, 2015) (slip op. at 3-4). *See also Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 and 3), CLI-15-3, 81 NRC ___ (Feb. 18, 2015) (slip op.). The Staff's response to New York's petition for review contains a more complete description of the procedural background for contention NYS-12C. NRC Staff's Answer to "State of New York Petition For Review of Atomic Safety and Licensing Board Decision LBP-13-13 With Respect to Consolidated Contention NYS-12C," at 2-10 (Apr. 28, 2014) (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML14119A001).

[3] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), CLI-10-5, 71 NRC 90, 98-99 (2010).

[4] *Id., quoting Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-06-22, 64 NRC 37 (2006).

[5] *Id.*

71 NRC 90, 98 (2010), the Commission summarized its standards for review as follows:

> . . . . We do not exercise our authority to make *de novo* findings of fact "where a Licensing Board has issued a plausible decision that rests on carefully rendered findings of fact. As we have stated on other occasions, "[w]hile [we have] discretion to review all underlying factual issues *de novo,* we are disinclined to do so where a Board has weighed arguments presented by experts and rendered reasonable, record-based factual findings." We defer to a board's factual findings and "generally step in only to correct 'clearly erroneous' findings – that is, findings 'not even plausible in light of the record viewed in its entirety'" – where there "is strong reason to believe that . . . a board has overlooked or misunderstood important evidence." "Our standard of 'clear error' for overturning a Board's factual finding is quite high."

Id. at 98-99 (footnotes omitted).[6] The Commission's questions concern the Board's findings of fact made after review of considerable testimony proffered by the parties. As such, the standard for review is quite high; the Board must have committed clear error before the Commission would normally reverse. It is not simply enough that another finding might have been made had the Commission been sitting as the finder of fact; in order to reverse the Board's factual findings there must be no support in the record.

II. NEPA Standards

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq.,* requires federal agencies, including the NRC, to take a hard look at the environmental impacts of their actions. NEPA, however, does not mandate a specific outcome or a course of action including a decision to mitigate and potential impacts.[7] The NRC fulfills its requirements under NEPA, for

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[6] Under the "clearly erroneous" standard in 10 C.F.R. § 2.341(b)(4)(i) and former § 2.786(b)(4)(i), the Commission generally declines to second-guess plausible Board decisions that rest on carefully rendered findings of fact, but will undertake review where the Board decision contains "obvious error." *See Dominion Nuclear Connecticut, Inc*. (Millstone Power Station, Unit 3), CLI-02-22, 56 NRC 213, 222 (2002); *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 382 (2001).

[7] *See, e.g., Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council*, 462 U.S. 87, 97 (1983) (quoting *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n. 21 (1976)) (stating that NEPA requires "only that the agency take a 'hard look' at the environmental consequences before taking a major action); *Sierra Club v. Army Corp of Engineers*, 446 F.3d 808, 815 (2006) (same); *Louisiana Energy Services, L.P.* (Clairborne

renewal of operating licenses, through the Generic Environmental Impact Statement ("GEIS") and the Final Supplemental Environmental Impact Statement ("FSEIS"), Exs. NYS000131A-I and NYS000133A-J.[8] The Commission stated that "[t]here is no NEPA requirement to use the best scientific methodology, and NEPA 'should be construed in light of reason if it is not to demand' virtually infinite study and resources."[9] The Commission has cautioned that "[o]ur boards do not sit to 'flyspeck' environmental documents or to add details or nuances. If the [EIS] on its face 'comes to grips with all important considerations' nothing more need be done."[10] In *Pilgrim*, the Commission stated:

> Ultimately, we hold adjudicatory proceedings on issues that are material to licensing decisions. With respect to a SAMA analysis in particular, unless a contention, submitted with adequate factual, documentary, or expert support, raises a potentially significant deficiency in the SAMA analysis—that is, a deficiency that could credibly render the SAMA analysis altogether unreasonable under NEPA standards—a SAMA-related dispute will not be material to the licensing decision, and is not appropriate for litigation in an NRC proceeding.[11]

The Commission warned that "in a highly predictive analysis such as a [severe accident mitigation alternatives] ("SAMA") analysis, there are bound to be significant uncertainties, and therefore an uncertainty analysis is performed."[12] The Commission, anticipating the wide

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Enrichment Center), CLI-98-3, 47 NRC 77, 87-88 (1998) (same); *Hydro Resources, Inc.* (P.O. Box 777, Crownpoint, New Mexico 87313), LBP-06-19, 64 NRC 53, 63-64 (2006) (same); *see also Winter v. Nat. Res. Def. Council*, 555 U.S. 7, 23 (2008) (stating that "NEPA imposes only procedural requirements" and does not mandate any particular result).

[8] 10 C.F.R. § 51.2.

[9] *Entergy Nuclear Generation Company & Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Station), CLI-10-11, 71 NRC 287, 315 (2010) (footnotes omitted).

[10] *Exelon Generation Co, LLC* (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801, 811 (2005) (citing *Systems Energy Res., Inc.* (Early Site Permit for Grand Gulf ESP Site), CLI-05-4, 61 NRC 10, 13 (2005) (footnote omitted)).

[11] *Entergy Nuclear Generation Co. & Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-12-1, 75 NRC 39, 57-8 (2012) (emphasis added).

[12] *Id.* at 58.

ranging disputes over individual aspects of the SAMA analysis, has said:

> It always will be possible to conceive of yet another input or methodology that could have been used in the SAMA computer modeling, and many different inputs and approaches may all be reasonable choices. … The SAMA analysis is not a safety review performed under the Atomic Energy Act. The mitigation measures examined are supplemental to those we already require under our safety regulations for reasonable assurance of safe operation.[13]

In other words, it is not enough to take issue with a particular aspect of the SAMA analysis; an intervenor challenging the SAMA analysis must show that it was unreasonable.[14] The Commission recently "stressed that the 'proper question is not whether there are plausible alternative choices for use in the analysis, but whether the analysis that was done is reasonable under NEPA.'"[15] A petitioner may not simply assert a deficiency. Rather to challenge an applicant's SAMA analysis "a petitioner must point with support to an asserted deficiency that renders the SAMA analysis unreasonable under NEPA."[16] Specifically, "[a] contention proposing alternative inputs or methodologies must present some factual or expert basis for why the proposed changes in the analysis are warranted…."[17] Even more, intervenors must show "why the inputs or methodology used is unreasonable, and the proposed changes or methodology would be more appropriate."[18] Recently, the First Circuit in resolving a challenge to the SAMA analysis at the Pilgrim Nuclear Power Station using the MACCS2 code remarked that "[t]he NRC uses a site-specific and plant specific PRA methodology, which answers three questions:

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[13] *Id.* at 57.

[14] *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-5, 75 NRC 301, 323-24 (2012).

[15] *FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit1), CLI-12-08, 75 NRC 393, 406 (2012)(reversing the admission of contention challenging the costs to clean-up a severe accident) (internal citations omitted).

[16] *Id.* at 406-07.

[17] *Id., quoting Seabrook,* CLI-12-5, 75 NRC at 323.

[18] *Id.* at 407, *quoting Seabrook,* CLI-12-5, 75 NRC at 323-34.

(1) what can go wrong; (2) how likely is it; and (3) what are the consequences."[19] The court emphasized the need to allow agencies "to select their own methodology as long as that methodology is reasonable …."[20] The contention at issue here likewise proposes alternative methodologies and inputs that would require altering the MACCS2 code. The Commission has indicated that alterations to the underlying MACCS2 code are not required.[21]

Finally, the Commission has previously concluded that "[u]ltimately, NEPA requires the NRC to provide a 'reasonable' mitigation alternatives analysis, containing 'reasonable' estimates …."[22] The Commission explained that Staff's FSEIS need only explain

> any known shortcomings in available methodology, … incomplete or unavailable information and significant uncertainties, and a reasoned evaluation of whether and to what extent these or other considerations credibly could or would alter the Pilgrim SAMA analysis conclusions ….[23]

III. An Overview of A SAMA Analysis

A SAMA analysis is a systemic search for potentially cost-beneficial enhancements that would further reduce nuclear power plant accident risk.[24] The SAMA analysis allows for the comparison of benefits derived from particular mitigating strategies with their cost to

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[19] *Massachusetts v. NRC*, 708 F.3d 63,75 (1st Cir. 2013) (affirming the NRC's decision to renew the license for Pilgrim Nuclear Power Station).

[20] *Id.* at 76 (citing *Town of Winthrop v. FAA*, 535 F.3d 1, 13 (2008)).

[21] *Davis-Besse*, CLI-12-08, 75 NRC at 417-18 (Mar. 27, 2012)(reversing the admission of contention challenging the costs to clean-up a severe accident) (internal citations omitted).

[22] *Entergy Nuclear Generation Co. & Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-10-22, 72 NRC 202, 208 (2010).

[23] *Id.* at 208-09.

[24] NRC Staff Testimony of Nathan E. Bixler, S. Tina Ghosh, Joseph A. Jones, and Donald G. Harrison Concerning NYS' Contention 12/16, ("Staff's Testimony on NYS-12C"), Exhibit ("Ex.") NRC000041, at 19 (Mar. 29, 2012); Transcript ("Tr.") at 1899-1900; Testimony of Entergy Witnesses Lori Potts, Kevin O'Kula, and Grant Teagarden on Consolidated Contention NYS-12C (Severe Accident Mitigation Alternatives, ("Entergy's Testimony on NYS-12C"), Ex. ENT000450, at 16-19 (Mar. 30, 2012); Prefiled Written Testimony of Dr. Francois J. Lemay Regarding Consolidated NYS-12-C (NYS-12/12-A/12-B/12-C) ("New York's Testimony on NYS-12C"), Ex. NYS000241 at 10-11 (Dec. 21, 2011).

implement.[25] SAMA analyses are generally conducted through a probabilistic risk assessment ("PRA").[26] SAMA analyses are different than a severe accident impact analysis.[27]

A SAMA analysis is used to identify and characterize the contributors to core damage frequency ("CDF") and offsite risk based on plant-specific information.[28] Analysts identify potential mitigating strategies to address these risks.[29] The mitigating strategies could potentially take the form of prevention (i.e., eliminate the accident from causing core damage or reduce the CDF) or mitigation (i.e., reduce the consequences from a particular accident scenario).[30] After identifying potential mitigating strategies, the analysts will screen the proposed strategies for whether they could ever be cost-beneficial by comparing the projected cost of implementation with the reduction in all risk to the plant.[31] Once these SAMAs that could never be cost-beneficial are eliminated, the remaining strategies are evaluated for the potential benefit that might be achieved from its impact on risk metrics (CDF, population dose risk, and offsite economic cost risk) and a more detailed cost projection is performed.[32]

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[25] Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-22; Tr. at 1900-02; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 16-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

[26] Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-21; Tr. at 1900-01; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

[27] A severe accident impact analysis, unlike a SAMA analysis, examines only the impacts from an accident at the plant. A SAMA analysis compares the difference in risk of a plant between an unmitigated and mitigated accident with the cost to implement the mitigation measure. Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-41.

[28] Staff's Testimony on NYS-12C, Ex. NRC000041, at 19; Tr. at 1908; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19.

[29] Staff's Testimony on NYS-12C, Ex. NRC000041, at 20; Tr. at 1900-02, 1909-10; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

[30] Tr. at p. 1933-34.

[31] Staff's Testimony on NYS-12C, Ex. NRC000041, at 19; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; Tr. at 2223.

[32] Staff's Testimony on NYS-12C, Ex. NRC000041, at 21-23; Tr. at 1911-15; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

The impact on risk metrics is performed by comparing the baseline PRA with a revised PRA that reflects implementing one mitigation alternative.[33] The process is repeated for each of the mitigating strategies that survived the initial screening process.[34] Those mitigating strategies for which the monetized reduction in risk is greater than the economic costs of implementation are identified as potentially cost-beneficial.[35] These potentially cost-beneficial SAMAs are identified in Entergy's environmental report, the Staff's DSEIS, and the FSEIS.[36] These potentially cost-beneficial SAMAs are then reviewed by the Staff to determine if they are related to the scope of review for license renewal, in other words do they mitigate against the aging effects for passive long-lived components with safety or safety-related functions.[37] Those SAMAs that are not related to the scope of license renewal are then dispositioned as not required for license renewal.[38] They are not imposed as part of the license renewal process, although they might be pursued as a cost-justified backfit or implemented as part of the licensee's on-going improvement process.[39]

The PRA, which forms the basis of the SAMA analysis, is divided into three discrete

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[33] Staff's Testimony on NYS-12C, Ex. NRC000041, at 20-23; Tr. at 1911-15; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

[34] Staff's Testimony on NYS-12C, Ex. NRC000041, at 21-23; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19.

[35] Staff's Testimony on NYS-12C, Ex. NRC000041, at 23; Tr. at 1910-11; Entergy's Testimony on NYS-12C; Ex. ENT000450, at 18-19; New York's Testimony on NYS-12C, Ex. NYS000241 at 10-11.

[36] *See, e.g.*, NUREG-1437, Vols. 1-3, Sup. 38, Final Report, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Indian Point Nuclear Generating Units 2 and 3*(Dec. 2010), ("FSEIS"), Ex. NYS00033B, at 5-8 – 5-9; Ex. NYS00133C, at 5-10; Ex. NYS00133I, at G-36 – G-38, G-43 – G-44, G-48 – G-49.

[37] FSEIS, Ex. NYS00133I, at G-48 – G-49.

[38] *Id.*

[39] *Id*.

elements.[40] The first portion of a PRA analysis is commonly referred to as Level 1.[41] The Level 1 portion of the analysis concentrates on the plant's responses to initiating events to identify what combinations of plant failures can lead to core damage and the frequency of each of these accident sequences.[42] Level 2 of the analysis concentrates on how each of these accident sequences may progress and lead to containment failure with a potential release into the environment.[43] The release, as characterized by timing and magnitude, is referred to as the "source term."[44] Level 2 has been primarily analyzed using one of two computer codes in the United States – Methods for Estimation of Leakages and Consequences of Releases ("MELCOR") and Modular Accident Analysis Program ("MAAP").[45] Level 3 of the analysis utilizes the source terms determined from the Level 2 analyses along with site specific information, which includes the surrounding population, meteorological data, land use and valuation, to estimate the potential off-site consequences of a particular accident scenario or scenarios.[46] The Level 3 analysis is performed with the MELCOR Accident Consequence Code System 2 ("MACCS2") in the U.S.[47] MACCS2 models the dispersion of radionuclides throughout the 50-mile radius modeled area centered on the Indian Point site.[48] It determines the dose incurred by the population and clean-up workers during the emergency and long-term phases of the

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[40] Staff's Testimony on NYS-12C, Ex. NRC000041, at 21; Tr. at 2341.

[41] *Id.*

[42] *Id*.

[43] *Id*.

[44] Tr. at 1901-2, 1949.

[45] Staff's Testimony on NYS-12C, Ex. NRC000041, at 24.

[46] *Id.* at 21, 25.

[47] *Id.* at 25; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 24-25; New York's Testimony on NYS-12C, Ex. NYS000241, at 11-12.

[48] Staff's Testimony on NYS-12C, Ex. NRC000041, at 25-26; Tr. at 1935; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 31-32; New York's Testimony on NYS-12C, Ex. NYS000241, at 10-11.

accident, the contamination deposited, and the clean-up efforts and costs.[49] It is important to note that MACCS2 only calculates a portion of the costs associated with an accident.[50]

The MACCS2 code, itself, is divided into three modules: ATMOS, EARLY, and CHRONC.[51] The ATMOS module utilizes the source terms generated from the Level 1 and Level 2 PRA analysis and in combination with site-specific information disperses the contamination within the 50-mile radius modeled area.[52] The EARLY module of the MACCS2 code models the radioactive dose and economic consequences during the emergency phase of an accident, typically the first seven days.[53] The CHRONC module of the MACCS2 code also uses output of the ATMOS and EARLY modules and, site-specific information to estimate the dose to population and economic costs like clean-up of the contamination, evacuation, and relocation for each meteorological condition.[54] The issue that was before the Board and

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[49] Staff's Testimony on NYS-12C, Ex. NRC000041, at 37-38; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 32-33; New York's Testimony on NYS-12C, Ex. NYS000241, at 13; Tr. at 1900-02.

[50] The SAMA analysis accounts for five types of costs (1) the monetary value of occupational doses to decontamination workers; (2) onsite decontamination costs; (3) the cost to replace lost power; 4) offsite economic costs associated with evacuation and relocation of the population, decontamination of the property, loss of use of property, and condemnation of property; (5) a monetary value associated with doses to members of the public. Staff's Testimony on NYS-12C, Ex. NRC000041, at 35. The first three items are normally referred to as on-site economic costs and are not part of the MACCS2 code analysis. Id. Items 4 and 5 are off-site economic costs and are directly calculated by the MACCS2 code or are translated into costs by a conversion factor. *Id*.; Tr. at 2056-57; 2197.

[51] Staff's Testimony on NYS-12C, Ex. NRC000041, at 25-26; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 28-30; New York's Testimony on NYS-12C, Ex. NYS000241, at 13-14.

[52] Staff's Testimony on NYS-12C, Ex. NRC000041, at 25-26; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 28-30; New York's Testimony on NYS-12C, Ex. NYS000241, at 13-14. Although New York had originally raised challenges to the atmospheric modeling portion of SAMA analysis in NYS-16B and sought summary disposition on this issue that was denied by this Board, New York subsequently dropped all challenges to the atmospheric modeling portion of the MACCS2 code by stipulation. State of New York, Entergy Nuclear Operations, Inc., and NRC Staff Joint Stipulation, at 1-2 (Jan. 23, 2012) (ADAMS Accession No. ML12023A110).

[53] Staff's Testimony on NYS-12C, Ex. NRC000041, at 25-26; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 28-30; New York's Testimony on NYS-12C, Ex. NYS000241, at 13-14.

[54] Staff's Testimony on NYS-12C, Ex. NRC000041, at 25-26, 35-37; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 28-31; New York's Testimony on NYS-12C, Ex. NYS000241, at 13-15.

presented by New York and its witness was a challenge to the selection of two inputs into the MACCS2 code namely, CDNFRM and TIMDEC.[55] These are both inputs into the CHRONC module.[56]

Typically, the external events (e.g., plant fires and seismic events) impact on the SAMA analysis is accounted for by a separate multiplier of the plant's current internal events CDF that is typically determined from the ratio between CDF including both internal and external events and a CDF including only internal events from previous risk studies that examined both internal and external events.[57] Further, uncertainties are accounted for by a separate multiplier developed from the ratio between the 95th percentile CDF and the mean CDF.[58] Sensitivity studies are also typically developed for factors that may alter the SAMA analysis conclusions given small changes in the input.[59] After applying the multipliers for external events and uncertainty and accounting for the sensitivity studies performed, mitigating strategies with monetized risk reduction that exceed the costs to implement the mitigating strategy are identified as potentially cost-beneficial. The Staff, then, considers whether the strategy falls within the scope of license renewal and should be imposed.[60] In Entergy's SAMA analysis, the external events multiplier combined with the uncertainty multiplier was 8 for both plants, and the

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[55] Tr. at 2054-55. Until New York filed its initial statement of position and Dr. Lemay's pre-filed testimony, the challenge articulated by New York was limited to the decontamination costs. New York had not previously raised a challenge to the TIMDEC through any of its previous filings.

[56] *Id.*

[57] Staff's Testimony on NYS-12C, Ex. NRC000041, at 22; FSEIS, Ex. NYS000133I, at G-17.

[58] Staff's Testimony on NYS-12C, Ex. NRC000041, at 22; FSEIS, Ex. NYS000133I, at G-45; Tr. at 2219-20, 2230-33; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 47-48.

[59] FSEIS, Ex. NYS000133I, at G-1; Staff's Testimony on NYS-12C, Ex. NRC000041, at 36; Tr. at 2076-79, 2165, 2308-09, 2311, 2516-18.

[60] *See, e.g.*, Tr. at 1923-25.

uncertainty multiplier alone was 2.1 and 1.4 for IP2 and IP3, respectively.[61] The combined multiplier added an additional order of magnitude to the potential benefit from any SAMA.[62]

NRC STAFF RESPONSE TO COMISSION QUESTIONS

QUESTION 1

> The Board in LBP-13-13 stated that the "genesis" of the decontamination time values used in the Indian Point SAMA analysis can be traced to a 1984 report (NUREG/CR- 3673) that concluded that a 90-day decontamination time period represents "an average time to complete decontamination efforts following the most severe reactor accident."
>
> > Address the underlying support and reasoning (if available) behind the report's conclusion that a 90-day time period is an "average" period of time for completing decontamination for "the most severe type of reactor accident."[63]

STAFF RESPONSE TO QUESTION 1

NUREG/CR-3673 states:

> A total of ~11,000 man-years of effort is involved in the decontamination program to reduce population exposure from the accident. Based on a mean time to completion of 90 days for the decontamination efforts, this program would require a work force of ~46,000 men. Clearly, a large decontamination program after a severe reactor accident would have some important beneficial economic impacts in an affected area. However, manpower limitations may force an extended period for completion of the offsite decontamination program after large releases of radioactive material.[64]

NUREG/CR-3673 was subject to substantial review both internally by staff members and externally by experts and members of the public.[65] This conclusion was based on the research

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[61] Entergy's Testimony on NYS-12C, ENT000041, at 47-48.

[62] *Id.*

[63] *Indian Point*, CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 3) (footnotes omitted).

[64] NUREG/CR-3673, *Economic Risks of Nuclear Power Reactor Accidents*, Ex. NRC000058 at 6-25 (May 1984).

[65] NUREG prior to publishing typically receive internal and external vetting similar to the type of vetting performed for NUREG-1150. *See* Tr. at 2370-72.

performed by others and available at the time of the NUREG's publishing.[66]

In order to understand the 90-day mean, the issues and assumptions implicitly embedded in the analysis are important.[67] A careful understanding of the MACCS2 code and the use of the mean and its implications provides an explanation, support, and reasoning for the NUREG/CR-3673's conclusion that 90 days was representative of the average clean-up time for a severe accident and the Board's findings of fact.[68] The concept of the mean runs through the majority of issues that the Board resolved in NYS-12C. Simply put, the mean, in this case, is a single number that represents a range of values weighted based on their likelihood of occurring.[69] NUREG/CR-3673 explains that it is quite possible that a clean-up during an actual severe accident could greatly exceed the 90-day mean.[70] The Staff's experts emphasized that the average times used in Indian Point's SAMA analysis are not meant to represent any actual accident and could depart significantly from times necessary for decontamination of an actual accident.[71] Actual decontamination times could both be significantly greater than the mean value and shorter than the mean value.[72] As an example of this phenomenon, Dr. Bixler, one of the Staff's experts, prepared a chart showing the area requiring decontamination for each source term used in the Indian Point SAMA analysis.[73] The range of accidents modeled in

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[66] The lack of the document's availability some 30-plus years later is not sufficient to cast doubt on the careful conclusions made at the time.

[67] The Staff provide substantial testimony over three days regarding the methodology for conducting SAMA analysis including the use of probability weighted mean input values. *See, e.g.* Tr. at 1897-2387; Tr. at 2404-2537 (discussing population inputs in the SAMA analysis).

[68] *Indian Point*, LBP-13-13, 78 NRC at 469.

[69] Tr. at 2187-2191, 2359-60; Staff's Testimony on NYS-12C, Ex. NRC000041, at 89-90.

[70] NUREG/CR-3673, Ex. NRC000058 at 6-25.

[71] Tr. at 2187-2191; Staff's Testimony on NYS-12C, Ex. NRC000041, at 89-90.

[72] Tr. at 2187-2191, 2359-60; Staff's Testimony on NYS-12C, Ex. NRC000041, at 89-90.

[73] Ex. NRC000060 at 3, 6, 9, 12, 15, 18, 21.

Indian Points' SAMA analysis produced a range of mean areas requiring decontamination from 0 square miles to 956 square miles.[74]

This same type of analysis resulted in NUREG/CR-3673's conclusion that 90 days represented the mean for severe accident decontamination. The most severe type of accident can represent a wide range of decontamination efforts; similar to how the 90-day average identified in NUREG/CR-3673 represents a range of possible decontamination times from 0 days to, potentially, years.[75]

In addition to understanding the use of a mean, it is also important to understand how this input is used in a SAMA analysis. The risk portion of the SAMA analysis, unlike a severe accident analysis, compares the difference in risk between an accident based on the current PRA model of the plant and an accident crediting the proposed SAMA in the PRA model.[76] The same inputs are used in the MACCS2 analysis for each run with the only difference being the reduction in the likelihood of the accident, the reduction in the likelihood of the release, or the reduction in the magnitude and timing of the release.[77] Increasing the TIMDEC or any other MACCS2 input variable does not necessarily result in any increased benefit from the mitigation since the altered input variable is applied equally to both the mitigated and unmitigated accident analysis.[78] The Staff's experts and Entergy's experts provided uncontroverted testimony that altering the input variables does not increase the benefit by a similar amount and may not result in any appreciable change in the benefit.[79] In fact, New York and its witness provide no

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[74] *Id*.

[75] Tr. at 2241-42, 2244, 2249, 2251; Staff's Testimony on NYS-12C, Ex. NRC000041, at 89-90.

[76] Tr. at 1899-2233; *see generally* Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-31.

[77] Tr. at 1899-1920; *see generally* Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-31.

[78] Tr. at 2333, 2525-28; *see generally* Staff's Testimony on NYS-12C, Ex. NRC000041, at 19-31.

[79] Tr. at 2333, 2525-28.

evidence in the record regarding how changing the TIMDEC or CDNFRM would impact the SAMA analysis and only testified that the severe accident cost would increase.[80] The cost of a severe accident is not litigable in a license renewal proceeding absent a waiver by the Commission.[81]

QUESTION 2

> Identify from the record any peer review or similar vetting of the NUREG-1150 values for the decontamination cost inputs for nonfarm land and property (CDNFRM) and the decontamination time inputs (TIMDEC) used in the MACCS2 computer code.[82]

STAFF RESPONSE TO QUESTION 2

The Staff's and Entergy's experts testified that NUREG-1150 received substantial peer review.[83] NUREG-1150 received three independent formal peer reviews on just the first draft of the report.[84] Two were done at the behest of the NRC and one was done on behalf of the American Nuclear Society.[85] The ACRS reviewed NUREG-1150 on several occasions during its preparation.[86] For the second draft of the document, the NRC established a Peer Review Committee under the Federal Advisory Committee Act to review NUREG-1150.[87] Witnesses described the level of review and scrutiny of NUREG-1150 as "unprecedented."[88]

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[80] *See* NRC Staff's Reply to State of New York's Proposed Findings of Fact and Conclusions of Law For Contention NYS-12/12A/12B/12C ("NYS-12C"), at 16-20, (May 3, 2013) (ADAMS Accession No. ML13123A352).

[81] *Pilgrim*, CLI-12-1, 75 NRC at 57-8; 10 C.F.R. Pt. 51, Subpt. A, Appendix B, Table B-1; 10 C.F.R. § 2.335(a).

[82] *Indian Point,* CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 3).

[83] Tr. at 2028, 2034-36, and 2370-72.

[84] Tr. at 2370-72.

[85] *Id.*

[86] *Id.*

[87] *Id.* at 2371-72.

[88] *Id.*

NUREG-1150 remains the seminal study on reactor accidents including providing source material for follow-on studies including the recently completed SOARCA study.[89] NUREG-1150 looked at plants located in similarly dense urban environments to the Indian Point Site including Zion.[90] As Mr. Jones testified, the population density for Zion was greater than the area surrounding Indian Point, even though the total population was less due to its location lakeside.[91] Mr. Jones and Entergy's experts testified that the inputs for TIMDEC and CDNFRM were utilized for each plant studied even though they were located at different locations with different population densities.[92] As Dr. Lemay noted and Staff's witnesses explained the use of per capita input values allow for the appropriate scaling of costs based on the population density, which allowed a single input to be used in wide variety of situations with varying population density and valuations.[93]

New York argued that the Staff should not be able to rely on NUREG-1150 and the pedigree of the SAMA inputs because one document referenced in the Staff's previous analysis that received substantial peer review is no longer available at the NRC or Sandia National Laboratories ("Sandia").[94] While it is true that the Staff does not have possession of the particular document New York wished to review;[95] it is not clear that the Staff ever had that

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[89] Tr. at 1950-52, 2047, 2158-61, 2186-87, and 2303.

[90] *Id.* at 2379; *see also id.* at 2347-48.

[91] *Id.* at 2379.

[92] Tr. at 1950-53, 1968-69, and 2019.

[93] Tr. at 1949-51 and 2135-36;

[94] State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12b/12C ("NYS-12C") ("New York's Proposed Findings on NYS-12C") at 60 (Mar. 22, 2015).

[95] *Id*.

document in its possession.[96] To put the missing reference in perspective, NUREG-1150 references NUREG/CR-4551.[97] NUREG/CR-4551 references NUREG/CR-3673.[98] The missing reference is one of many documents referenced by NUREG/CR-3673.[99] New York's challenged the analysis and information from NUREG-1150 not because of any dispute with the analysis but because it could not trace the analysis to its original source, even though the other intervening references received their own peer reviews.[100] While the issue regarding the availability of one reference is relevant to whether the Staff's analysis was reasonable, it is not dispositive of the issue especially when the scope and number of independent peer reviews of NUREG-1150 is considered.

New York challenged the reliability of NUREG-1150 because the ultimate source of the information can be traced to a decades old paper that is no longer in the possession of the NRC or Sandia. However, that information has formed the basis of multiple public documents that received substantial internal review prior to publishing, substantial peer review, and were often provided to the public in draft form for comment.[101] While New York may complain that NUREG-1150 did not anticipate all the issues New York would later seek to raise 24 years after its publishing, that does not render the peer review conducted then ineffective nor does it taint the insights provided by NUREG-1150. NUREG-1150 received a complete peer review at the time it was published.[102] Given the nearly unprecedented scrutiny given NUREG-1150 prior to its

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[96] Email from Brian G. Harris, NRC, to Kathryn M. Liberatore, New York, Ex. NYS000421 (Apr. 25, 2012).

[97] Tr. at 2158-61; Staff's Testimony on NYS-12C, Ex. at 89-90.

[98] *Id*.

[99] *Id*.

[100] New York's Proposed Findings on NYS-12C at 60.

[101] Tr. at 2028, 2034-36, 2370-72.

[102] *Id.*

finalization including multiple independent peer reviews, review by the ACRS, and the public, the information in NUREG-1150 provides information that can be reasonably relied upon the Staff in the conduct of its SAMA analysis.[103]

QUESTION 3

> Providing references to the record, discuss the underlying reasons behind the Staff and Entergy experts' opinion that the NUREG-1150 CDNFRM and TIMDEC values continue to reflect reasonable estimates for severe accident decontamination times and costs today, including for the heavier (DF of 15) decontamination effort.[104]

STAFF RESPONSE TO QUESTION 3

The TIMDEC used in Entergy's SAMA analysis was 60 and 120 days for a decontamination factor ("DF") of 3 and 15, respectively.[105] The CDNFRM used was $5,148 per person and $13,824 per person for DFs of 3 and 15, respectively.[106] In general, these times and costs can be traced to the analysis done to support the NUREG-1150 studies after adjusting for inflation and other changes in the intervening years.[107]

As the Staff's witnesses explained the selected values need to fairly represent all the modeled accidents based on their likelihood of occurring. In support of the Staff's testimony, Dr. Bixler developed a chart showing the source terms modeled in Indian Point's SAMA analysis and the mean area contaminated by each source term.

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[103] *Davis-Besse*, CLI-12-08, 75 NRC at 417-18.

[104] *Indian Point*, CLI-15-2, 81 NRC __(Feb. 18, 2015) (slip op. at 3).

[105] Staff's Testimony on NYS-12C, Ex. NRC000041 at 88-90.

[106] *Id.* at 67-69.

[107] For example, NUREG-1150 used 60 days and 120 days. Tr. at 2241. The studies preceding NUREG-1150 used 90 days. *Id.*

Source Term Group	Probability (incident/year)	Percentage of Incidents	Area (miles^2)	Percentage of Area
1	$1.19X10^{-5}$	66.45	0	0
2	$6.5X10^{-7}$	3.6	956	48.43
3	$4.23X10^{-7}$	2.3	447	22.64
4	$1.11x10^{-7}$	0.6	93	4.7
5	$6.88x10^{-7}$	3.8	363	18.39
6	$3.43x10^{-6}$	19.16	91	4.6
7	$6.43x10^{-7}$	3.6	13	0.65
8	$5.82x10^{-8}$	3.2	11	0.55

As shown in the chart and explained in the testimony, the primary accidents modeled in Indian Point's SAMA analysis account for very little contamination.[108] Over 85%, based on likelihood, of the modeled accidents account for less than 13 square miles of land requiring decontamination of any kind.[109] For these primary, that is most likely but small consequence, accidents approximately 73.9% of the decontamination that has to be done is a DF of 3 or less.[110] The decontamination for these accidents is contained within ten miles of the plant.[111] With these low levels of contamination and limited areas of contamination, it is not unreasonable to estimate that on average 60 days is a reasonable estimate for the purpose of conducting a SAMA analysis.[112] It is important to understand that the 60 days represents an average time and not a bounding estimate.[113] NEPA does not require and the Indian Point SAMA analysis did not assert that all clean-up from an actual accident would be completed in less than 60 days.[114]

The MACCS2 code application of decontamination is an all or nothing format that also lends credibility to the selected TIMDEC. For example when determining decontamination the

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[108] Ex. NRC000060 at 6, 9, 12, 15, 18, 21.

[109] *Id.*

[110] *Id.*

[111] *Id.*

[112] *Id.;* Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 89-90; Tr. at 2241.

[113] Tr. at 1907, 1937.

[114] *See Pilgrim*, CLI-10-11, 71 NRC at 310-311 n.121, 315.

code first identifies whether decontamination is required prior to allowing people to return a particular grid location.[115] If the levels of contamination are large enough to require decontamination, it applies the first decontamination effort, DF of 3.[116] This is done regardless of the level of decontamination required.[117] As long as an area does not need more than a DF of 3, the maximum costs are expended even if the contamination would have only required minimal or a minor decontamination effort.[118] In other words, the DF of 3 covers all the required decontamination levels up to 3 and conservatively expends the full decontamination effort even when less is required.[119] For a DF of 15, if after applying a DF of 3 it determines that additional decontamination is required, the MACCS2 code expends the full cost of a DF of 15.[120] It expends this full cost even in places that only required decontamination nominally greater than the DF of 3 effort.[121] This results in conservatively expending more resources for decontamination than is actually warranted by the modeled contamination levels. Under actual accident conditions, it would be more likely that only the required decontamination would be done instead of conducting additional unnecessary decontamination; that is the decontamination efforts would be more closely matched to the contamination levels.[122] The TIMDEC represents not just the mean time for conducting decontamination up to a DF of 3 but

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[115] Tr. at 2199-2202; *see also id.* at 1982-83, 2272-74; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 77-80.

[116] Tr. at 1982-83, 2199-2202.

[117] Transcript at 2273; *see also id.* at 1982-83, 2199-2202.

[118] *Id.*

[119] *Id.*

[120] *Id*.

[121] *Id*.

[122] *See* Tr. at 2361-62; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 89-90.

includes all those lesser DF amounts down to slightly greater than zero.[123] The DF of 15 TIMDEC represents decontamination efforts from nominally greater than 3 up to 15.[124] By having just two levels of decontamination, the MACCS2 code introduces conservatism into the analysis because it expends the full cost of decontamination even when a lesser effort is warranted.

The CDNFRM values are appropriate inputs for Indian Point's SAMA analysis. The Staff's experts have confidence in the values used by Entergy for several reasons including the per capita nature of the values, the Staff's independent assessment of New York's expert analysis,[125] and Staff's own independent look at the values in order to respond to comments on the DSEIS. The primary reason the Staff's experts believe that the CDNFRM values are representative of average clean-up costs is related to their per-capita nature.[126] This unique per-capita benefit was recognized by New York's own expert.[127] The impact of this unique method is that decontamination costs scale linearly with population density.[128] This linear no-limit scaling is very conservative because the costs for each level of decontamination are not explicitly tied to the size of the area to be decontaminated or the actual amount of decontamination work.[129] As an example, the decontamination costs for an area requiring a DF of 3 is drastically different for

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[123] Tr. at 1907, 1937.

[124] *Id.*

[125] Dr. Lemay admitted to several errors in his analysis techniques including, for example, ignoring fundamental physical principles like the conservation of mass. Tr. at 2306-07, 2310, and 2135-2138.

[126] Tr. at 2306-07, 2310, and 2136.

[127] Tr. at 2136.

[128] Tr. at 2360 (Dr. Lemay discussing how actual events can exceed and be less than the average); see also Tr. at 2361-62.

[129] *See* Tr. at 2136-44.

a single family home for four people than for a high-rise building with 1000 residents.[130] The costs would be $20,592 and $5,148,000, respectively.[131] Even though the contamination remains the same, the costs to clean-up the area escalate based on population density until they reach the full value of the property, forcing permanent interdiction.[132] In reality, the relative impact on the cost of clean-up from adding one additional person living on the contaminated property is less than linear at increasing higher population densities.[133] At a certain level of density, the cost for the next person added would not materially increase the clean-up costs.[134]

Dr. Lemay, New York's expert, utilized alternative methods to estimate the CDNFRM inputs. He used several methods to develop alternative inputs to the MACCS2 code. The Staff's and Entergy's experts identified several serious flaws in New York's analysis that needed to be accounted for and limit the ability to fully compare Dr. Lemay's analysis with the selected inputs.[135] However after applying very rough and basic corrections to Dr. Lemay's analysis, the Staff's experts concluded that New York's analysis supported the selected input variables.[136] For example, after correcting for conservation of mass, applying appropriate discounts to extended decontamination efforts, and making the other adjustments identified by the Staff and Entergy, the inputs developed by Dr. Lemay are smaller, that is less conservative, than inputs

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[130] Tr. at 1949, 2136; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 40-41.

[131] *Id.*

[132] *Id*.

[133] *See* Tr. at 2136-44.

[134] *Id.*

[135] Tr. at 2160, 2176-77, 2378, 2147-49, 2377-79, 2199-2202; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 71-72, 42-44; Ex. NRC000060, at 3, 6, 9, 12, 15, 18, 21, 24; Entergy's Testimony on NYS-12C, Ex. ENT000450, at 15, 73-75, 77-80.

[136] Tr. at 2160, 2176-77, 2378, 2147-49, 2377-79, 2199-2202.

selected by Entergy.[137] Thus, this independent development of roughly similar inputs further confirms that the selected inputs are reasonable and that the SAMA analysis is reasonable.[138]

The Staff, in response to comments on the DSEIS, performed an additional analysis comparing the costs identified in various cited references to the costs used in the SAMA analysis.[139] As result of that comparison, the Staff concluded that information in the references, when adjusted for the different contaminates, types of accident, and assumptions also confirmed that the selected inputs were reasonable for the SAMA analysis.[140] Based on these reinforcing confirmations, the Staff reasonably concluded and remains convinced that Entergy selected reasonable inputs for its analysis. Thus, the Board's order in favor of the Staff should be affirmed.

QUESTION 4

> Discuss the appropriateness of performing sensitivity analyses to account for uncertainties in the estimated decontamination times and non-farm decontamination costs, including what might be reasonable CDNFRM and TIMDEC inputs to use in sensitivity analyses for the Indian Point SAMA analysis.[141]

STAFF RESPONSE TO QUESTION 4

The SAMA analysis accounts for uncertainty by using the ratio of the mean CDF to the 95th percentile CDF as a multiplier.[142] In general, uncertainty analyses are conducted to account for unknowns, that is modeling errors, lack of information, and unknown interactions, among

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[137] *Id.*

[138] *Id.*

[139] FSEIS, Ex. NYS00133, at G-22 – G-25.

[140] *Id.*

[141] *Indian Point*, CLI-15-2, 81 NRC __(Feb. 18, 2015) (slip op. at 3).

[142] Tr. at 2230-33; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 94.

others.[143] In the Indian Point SAMA analysis, uncertainty was estimated by calculating the difference between the mean CDF and the 95th percentile CDF, 2.1 and 1.4 for IP2 and IP3 respectively.[144] This factor was then applied to the entire analysis for each plant.[145]

Sensitivity analyses, alternatively, are designed to determine how the results of a particular model are affected by small changes to the inputs, that is how insensitive the output is to small changes in the input variables.[146] In addition, sensitivity analyses typically focus on the effect of one input acting alone, whereas the output of a complex system is influenced by the combined effects of multiple inputs that have interaction effects, some of which can counteract the effects of individual inputs considered alone. In applying an overall uncertainty factor to the model outputs, the Indian Point SAMA analysis accounted for an integrated overall uncertainty, which would also account for contributions to uncertainty from selected input variables.[147]

While Dr. Lemay performed a sensitivity analysis, his analysis did not look at sensitivity as it related to a SAMA analysis but concentrated on only severe accident analysis.[148] New York's analysis was not directed at the actual issue before the Board but instead directed at the generic finding in the Commission's GEIS.[149] The change in inputs calculated by Dr. Lemay would be applicable to both the mitigated and unmitigated accidents. Any change in the potential impact is not directly applicable to the benefit that would be realized by the mitigation

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[143] *See* Tr. at 2230-33.

[144] *See* Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 94.

[145] *See id.*

[146] *See* Tr. at 2103-04.

[147] *Id.*

[148] Tr. at 2004, 2103-04.

[149] *See* New York's Proposed Findings on NYS-12C at 1. In the GEIS, the Commission determined generically that the environmental consequences of a severe accident at all nuclear power plants was SMALL. GEIS, Ex. NYS000131C, at 5-115 – 5-116; 10 C.F.R. Pt. 51, Subpt. A, Appendix B, Table B-1.

implementation.[150] New York did not show that the Staff's SAMA analysis might identify additional potentially cost-beneficial mitigation measures if its suggested changes to the input values, TIMDEC and CDNFRM, where made.[151]

Specifically, New York's arguments incorrectly framed the issue. New York's arguments and assertions mainly concentrate on a severe accident impact analysis[152] instead of a SAMA analysis.[153] New York describes the purpose of the Indian Point's SAMA analysis as "the vehicle by which the []Staff considers … the environmental impacts of a severe accident and alternative mitigation measures.[154] New York is incorrect. The NRC's GEIS for license renewal generically evaluates severe accident impacts and provides the technical basis for the NRC's conclusion in 10 C.F.R. Part 51 that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts of severe accidents are of small significance for all plants."[155] The GEIS thus addresses the impacts of severe accidents generically in bounding fashion.[156]

The Commission has limited contentions raising environmental issues in license renewal proceedings to those issues that are affected by license renewal and have not been addressed by rulemaking or on a generic basis.[157] While "severe accident mitigation alternatives" is a

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[150] Tr. at 2333, 2525-28.

[151] NRC Staff's Reply to State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12B/12C ("NYS-12C") at 14-20.

[152] *See* n. 25, *supra.*

[153] *See, e.g.,* NYS Findings of Fact on NYS-12C at 23.

[154] *See, e.g.,* NYS Findings of Fact on NYS-12C at 23.

[155] GEIS, Ex. NYS000131A, at xliv; GEIS, Ex. NYS000131C, at 5-115 – 5-116; 10 C.F.R. Pt. 51, Subpt. A, Appendix B, Table B-1.

[156] *Id.*

[157] *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 11, 16 (2001).

Category 2 issue, New York's argument is a direct challenge to the Commission's regulations in 10 C.F.R. Part 51, Table B-1, and is therefore not within the scope of this licensing proceeding. 10 C.F.R. § 2.309(f)(1)(iii).[158]

The narrow issue raised by the contention is the reasonableness of the cost-benefit analysis. The Commission stated that the impact finding of "small" for societal, environmental, and economic impacts from severe accidents is a generic determination for all plants.[159] This generic finding, codified in NRC's regulations, is not subject to challenge absent a waiver.[160] New York has not petitioned the Commission for a waiver. "Ultimately, we hold adjudicatory proceedings on issues that are material to licensing decisions. With respect to a SAMA analysis in particular, unless a contention, submitted with adequate factual, documentary, or expert support, raises a potentially significant deficiency in the SAMA analysis—that is, a deficiency that could credibly render the SAMA analysis altogether unreasonable."[161]

The Commission warned that "in a highly predictive analysis such as a SAMA analysis, there are bound to be significant uncertainties, and therefore an uncertainty analysis is performed." [37] The Commission, anticipating the wide ranging disputes over individual aspects of the SAMA analysis, has said:

> It always will be possible to conceive of yet another input or methodology that could have been used in the SAMA computer modeling, and many different inputs and approaches may all be reasonable choices. … The SAMA analysis is not a safety review performed under the Atomic Energy Act. The mitigation measures examined are supplemental to those we already require under our safety regulations for reasonable assurance of safe operation.[162]

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[158] *Pilgrim*, CLI-12-1, 75 NRC at 56-7 .

[159] *See* 10 C.F.R. Pt. 51, Subpt. A, Appendix B, Table B-1.

[160] *See* 10 C.F.R. § 2.335(a).

[161] *Pilgrim*, CLI-12-1, 75 NRC at 57 (emphasis omitted).

[162] *Id.*

In other words, it is simply not enough to take issue with a particular aspect of the SAMA analysis, an intervenor challenging the SAMA analysis must show that it was unreasonable on the whole.[163] The Commission recently "stressed that the 'proper question is not whether there are plausible alternative choices for use in the analysis, but whether the analysis that was done is reasonable under NEPA.'"[164] A petitioner may not simply assert a deficiency. Rather to challenge an applicant's SAMA analysis a petitioner "must point to a deficiency that renders the SAMA analysis unreasonable under NEPA."[165] Specifically, "[a] contention proposing alternative inputs or methodologies must present some factual or expert basis for why the proposed changes in the analysis are warranted…."[166]

New York incorrectly claims that Dr. Ghosh testified that as the costs of a severe accident increases the cost-beneficial candidates become more cost-beneficial. During questioning, Dr. Ghosh testified that if the benefit of a SAMA was increased and the cost was held constant, then a mitigation measure would become more cost-beneficial.[167] Dr. Ghosh, however, never opined on the impact of an increase in costs of severe accident that would be applicable to both the unmitigated accident and the mitigated accident.[168] Quite simply, New York did not address the ultimate issue before the Board and the subject of the contention.[169]

Even assuming that New York's assertions regarding TIMDEC and CDNFRM are true, Entergy's experts and the Staff's expert uncontroverted testimony explained that no conclusions

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[163] *Id.*

[164] *Indian Point*, LBP-13-13, 78 NRC at 454.

[165] *Id.*

[166] *Seabrook,* CLI-12-5, 75 NRC at 323.

[167] Tr. at 2333.

[168] *See generally* Tr. at 2333, 2525-28.

[169] NRC Staff's Reply to State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12B/12C ("NYS-12C") at 14-20.

regarding whether a particular SAMA is potentially cost-beneficial when the impact of severe accident increases for both the mitigated and unmitigated accidents.[170] New York and its witness stopped short of challenging the SAMA analysis' conclusions.

Putting aside New York's failure to address the ultimate issue in the contention, the MACCS2 code has certain hard-coded limitations built into the code. With respect to TIMDEC and CDNFRM, the limitations on the acceptable inputs are 1-year or less and $100,000 per person or less, respectively.[171] Without making modifications to the code and performing all the necessary quality checks, those hardcoded limitations represent the limit of alternative inputs that can be reliably entered into the MACCS2 code. As the courts and the Commission have indicated, NEPA does not require the NRC to engage in research in order to satisfy its hard look requirements.[172] Nor does NEPA require the Staff to develop new codes and analytical tools to conduct its analysis.[173] Utilizing any input outside of the allowed range would require the Staff to engage in just the type of research not required under NEPA and would be inappropriate.[174] The Staff maintains that a sensitivity analysis is not necessary or appropriate here. If a sensitivity analysis was to be performed, it should examine the impact of small changes in best estimate of TIMDEC and CDNFRM on the SAMA analysis conclusions rather than the order of magnitude changes suggested by New York.

In this situation, the inputs selected by Entergy for TIMDEC and CDNFRM and reviewed by the Staff do not warrant the need for an additional sensitivity analysis. New York's expert independently tried to determine the appropriate inputs. Dr. Lemay's calculations once corrected

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[170] Tr. at 2333, 2525-28.

[171] Entergy's Testimony on NYS-12C, Ex. ENT000450at 77-80; Tr. at 2199-2202

[172] *Seabrook,* CLI-12-5, 75 NRC at 341.

[173] *Indian Point,* LBP-13-13, 78 NRC at 453-4.

[174] *See Pilgrim*, CLI-12-1, 75 NRC at 57.

for the failure to conserve mass, application of appropriate discount factors to account for extended decontamination, and the impact of natural decay during extended decontamination times, among others are substantially the same as the inputs selected by Entergy.[175] In fact, Entergy's inputs were slightly more conservative than Dr. Lemay's inputs after being corrected for the errors.[176] Thus, as the trier of facts including technical matters, the Board's order in favor of the Staff should be affirmed.

QUESTION 5

> Would it be appropriate to treat decontamination times and decontamination costs (and related decontamination factors) from an uncertainty analysis standpoint, using a range of values—e.g., smaller values for smaller release accident categories and larger values for the larger release categories? Why or why not?[177]

STAFF RESPONSE TO QUESTION 5

The Staff's method determined a TIMDEC and CDNFRM, per DF category (3 or 15), that would be applicable for the entire analysis.[178] In other words, the mean times and costs selected represent the full range of accidents.[179] The Staff explained that under certain actual conditions it is overestimating the times and costs and under other actual situations the times and cost may be underestimated.[180] The Commission's order contemplates that instead of utilizing universal set of averages for the entire analysis a set of averages could be developed for each accident source term. The method for determining the appropriate average for each source term would

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[175] Tr. at 2378-79; see also *id.* at 2115, 2160, 2176-77, 2147-49, 2199-2202; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 44-48, 69-74.

[176] Transcript at 2378-79; see also *id.* at 2115, 2160, 2176-77, 2147-49, 2199-2202; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 44-48, 69-74.

[177] *Indian Point*, CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 3).

[178] Tr. at 1907-08, 2200-02, 2209; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 16, 30-31, 90.

[179] *Id.*

[180] *Id.*

utilize the same method used to determine an average for all the source terms.[181] Once those values are determined for all the release categories, they would be used to calculate the consequences for each release category.[182] The consequences of each accident would be multiplied by the likelihood of each accident.[183] After accounting for the likelihood of each accident, the average TIMDEC and CDNFRM weighted for likelihood should result in similar values and outcomes. While the additional effort to develop source term specific input values could produce additional granularity, it should not result is substantial differences in the Staff's overall conclusions.

Although Dr. Lemay, New York's expert, urges an average be developed for each accident source term, he also urged the Board to essentially ignore the impact from the more likely accidents with lower consequences and utilize only inputs that reflected the high consequence events that are considerably less likely. As discussed above, the lower consequence events account for more than 85% of the modeled accidents.[184] Under New York's arguments, the values selected for the inputs would only be applicable to the worst of the accidents being modeled.[185] Following Dr. Lemay's suggestion with respect to weighting the inputs based on the conditional consequences, the analysis would be transformed from one designed to realistically model the potential risks from a severe accident to a worst-case kind of

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[181] *See generally* Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 19-31.

[182] *Id*.

[183] *Id.* at 29-31.

[184] *See* Section IV, *supra*.

[185] Dr. Lemay makes these arguments because he is examining the analysis from a safety perspective. Tr. at 2179-80. However, The Commission has indicated that the SAMA analysis is not being performed for safety. The Commission's regulation provide for the appropriate level of safety. *Pilgrim*, CLI-12-1, 75 NRC at 57. Under NEPA, the Commission has said: "The SAMA analysis is not a safety review performed under the Atomic Energy Act. The mitigation measures examined are supplemental to those we already require under our safety regulations for reasonable assurance of safe operation." *Id.*

accident scenario that is not required under NEPA or the Commission's precedent.[186] Although it is possible to model each accident source term separately with its own inputs, NEPA has no such requirement and the method selected by the Staff is reasonable under NEPA.[187]

The Commission has explained that the acceptability of the Staff's SAMA analysis is not whether an alternative model might produce different results but whether the analysis performed by the Staff was reasonable.[188] The Staff is free to choose its analytical method, as long it is reasonable and any limitations with the chosen technique are disclosed.[189] With respect to the SAMA analysis, the Staff has picked a reasonable method, discussed the benefits of the chosen technique, and discussed the limitations of the method.[190] Given that the Staff has utilized a reasonable analysis, there is no reason to use an alternative analysis. Thus, it is not necessary to use a range of values to account for uncertainty in TIMDEC and CDNFRM especially when considering the overall uncertainty factor applied to whole analysis and other conservatisms.

QUESTION 6

> Discuss whether, and, if so, how, the SAMA analysis should account for the possibility of potential decontamination times longer than one year.[191]

STAFF RESPONSE TO QUESTION 6

In order to understand how decontamination times greater than 1-year are accounted for in the SAMA analysis, it is important to understand how the MACCS2 code conducts its analysis. A key aspect of the input values used in Entergy's SAMA analysis and the MACCS2

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[186] *Pilgrim*, CLI-12-1, 75 NRC at 57-8.

[187] *Davis-Besse*, CLI-12-08, 75 NRC at 417-18.

[188] *Pilgrim*, CLI-12-1, 75 NRC at 57.

[189] *Id.*

[190] *Id.*

[191] *Indian Point*, CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 3).

code results from its time-weighted, spatially-weighted, probability-weighted analysis.[192] Simply, the MACCS2 code and the SAMA analysis are not designed to reflect any actual accident, but represent the smearing of hundreds of accidents modeled over thousands of initial weather conditions.[193] The TIMDEC input value, like all averages represents a range of possible TIMDECs, and is weighted based on the likelihood of occurrence.[194] Any representative input variable would be expected to reflect the events being modeled, and thus, it should represent the probability-weighted average of all the accidents being modeled.[195] These extended decontamination times are accounted for in the input selected for the MACCS2 model by Entergy.[196] Dr. Lemay's testimony regarding the appropriate method to weight the input values for the MACCS2 code is often inconsistent and contradictory.[197] Early in the proceeding, Dr. Lemay, consistent with the other experts, indicates that averages should be based on their probabilities. Later, Dr. Lemay switches from advocating a probability weighted average to a consequence weighted average as a safety analysis.[198]

The Commission's question raises two different issues. The first issue is how input values greater than 1 year could be utilized in the MACCS2 code, i.e. probability-weighted

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[192] Tr. at 1927-28.

[193] Tr. at 2187-91.

[194] As discussed in Section IV *supra*, the majority of accidents modeled in the SAMA analysis result in very little contamination, requiring no decontamination or only light decontamination. Tr. at 2242; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 89-90; Ex. NRC000060 at 6, 9, 12, 15, 18, 21. As a result, in order to properly weight the inputs to account for the likelihood, the decontamination times must be weighted to account for these limited releases as well as the larger releases. Tr. at 2187-91.

[195] Tr. at 2187-91.

[196] *See id*. at 2190.

[197] Tr. at 2178. *But cf.* Tr. at 2359-63.

[198] Tr. at 2178-79. As discussed, the SAMA analysis is not being performed as a safety analysis and is instead meant to inform the decision maker regarding the expected environmental impacts from license renewal including potential measures that might mitigate any impact. *See id.* at 2072.

averages greater than one year. The second issue is how selected averages represent the possibility that some decontamination could exceed one year.

With respect to the first issue, the MACCS2 code has explicit hard coded limits that preclude TIMDEC values from exceeding one year. As the Staff explained, changing the MACCS2 code to allow for extended decontamination times would require considerable work, research, and testing to validate any changes to the code for functionality.[199] Under the current decontamination methodology implemented in the code, the limit of one year coordinates well with the other decontamination decisions implemented in the code. For example, the one year limit is consistent with the full decontamination effort and expense occurring during the first year of the model.[200] Similarly, the MACCS2 code bases the decontamination effort on the contamination present immediately after the accident, which is consistent with the one year decontamination time limit.[201] This relationship breaks down as average times are increased beyond 1-year because natural decay begins to impact the amount of decontamination necessary.[202] The process of extending the decontamination over multiple years would need to account for the appropriate discount factors for later years, depreciation and interdiction would need to be revisited to ensure that properties being decontaminated are not pre-maturely interdicted, the decision to relocate populations would need to be modified, and the level of decontamination required would need to modified to account for the natural decay of the contaminants over multiple years, among other problems.[203] This kind of original research and

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[199] Entergy's Testimony on NYS-12C, Ex. ENT000450at 15, 73-75, 77-80; Tr. at 2199-2202, 2272-74, 1982-83.

[200] Tr. at 2199-2203, 2272-74, 1982-83.

[201] *Id*.

[202] *Id*.

[203] *Id*.

development of new tools and new analysis techniques is not required under NEPA.[204]

With respect to the second issue and as explained above, the TIMDEC input for the MACCS2 code represents a probability weighted average decontamination time for the modeled accident.[205] As a probability-weighted average or mean, the TIMDEC values selected represent a range of values that implicitly include longer decontamination including times that may exceed a year.[206] As explained above, decontamination times in excess of one year are already accounted for by the Indian Point SAMA analysis. Entergy used 60- and 120-days for probability weighted average decontamination times for DF of 3 and 15.[207] As the Staff's and Entergy's experts explained, these times are not meant to represent any specific accident and any actual accident would be expected to depart from inputs used for a SAMA analysis.[208] As Board concluded and witnesses explained, including New York's witness, the values selected should represent all the accidents being modeled. New York's arguments would weight the input values to such that they would only represent the highest consequence events. This would result in an overly conservative analysis that would be unreasonable under NEPA. Thus, the Board's ruling in favor of the Staff should be affirmed.

QUESTION 7

> Discuss whether the Indian Point analysis contains conservatisms that bound or otherwise compensate for the uncertainty in the decontamination times and non-farm decontamination costs inputs used in the analysis.[209]

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[204] *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350-51 (1989).

[205] Tr. at 1907, 1922, 2359-60; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 89-90.

[206] *Id*.

[207] Tr. at 2048.

[208] Tr. at 2187-2191; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 89-90.

[209] *Indian Point*, CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 4).

STAFF RESPONSE TO QUESTION 7

Even though the SAMA analysis is not meant to be conservatively biased, the SAMA analysis is conservative in that the benefits tend to be maximized within reason and the cost to implement mitigations are minimized. In other words, Indian Point's SAMA analysis tends to make the SAMA analysis more likely to identify mitigation measures as potentially cost-beneficial. As the Staff's and Entergy's experts testified, Entergy's SAMA analysis applied an uncertainty factor of 2.1 and 1.4 for IP2 and IP3, respectively.[210] This was based on the ratio between the mean and the 95th percentile CDF.[211] In addition to the uncertainty factor, the separate multipliers of 3.8 and 5.5 for IP2 and IP3, respectively, likely overestimate the effects of external events and provide additional conservatism.[212] Further, SAMA analysis generally and conservatively assumed that the mitigation completely eliminate the risk from the accident being mitigated or eliminated a substantial portion of the risk. By assuming that the entire risk was eliminated, the benefit from the mitigation is maximized making the likelihood of finding a cost-beneficial mitigation measure more likely. It is very unlikely that any particular mitigation measure is perfectly effective.[213] As an additional level of conservatism that maximized the benefit, Entergy assumed the population present during any accident was the maximum population during the modeled time period.[214] This served to raise both the population dose risk and the costs to decontaminate each contaminated area. An additional conservatism is the

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[210] *See* Entergy's Testimony on NYS-12C, Ex. ENT000450 at 47-48; Tr. at 2220, 2230-33; FSEIS, Ex. NYS00133 at G-45.

[211] Entergy's Testimony on NYS-12C, Ex. ENT000450 at 47-48; Tr. at 2220, 2230-33; FSEIS, Ex. NYS00133 at G-45.; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 2.

[212] FSEIS, Ex. NYS00133 at G-45; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 94.

[213] See Tr. at 2163-66; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 22.

[214] Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041 at 94-95.

modeling of no evacuation within the 10-mile emergency planning zone, which l [215]contrary to emergency planning provisions and results in an overestimate of the population dose risk.

The method Entergy used to calculate its costs for the mitigation measures, prior to the Board's decision on NYS-35/36, minimized the costs used to determine whether any mitigation was cost-beneficial.[216] For example, lifetime costs of the new equipment including maintenance and repairs are not included in cost estimates.[217] Thus, Entergy's SAMA analysis is sufficiently conservative and bounding for the purpose of conducting an adequate mitigation analysis under NEPA.[218] Thus, as the trier of facts including technical matters, the Board's decision in favor of the Staff should be affirmed because there is sufficient conservatism for the purposes of a NEPA mitigation analysis.

A SAMA analysis, however, is not meant to be a worst case type of analysis or bounding;[219] the SAMA analysis is, instead, ultimately focused "on the mean annual consequences (both off-site population dose and economic costs) over the examined 50-mile region.[220] The analysis uses the 'mean values' of the accident consequence distributions for each accident category."[221] As such, the SAMA analysis is not required to bound all possible

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[215] FSEIS, Ex. NYS00133, at G-21; Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 36 and 94.

[216] Staff's Prefiled Testimony on NYS-12C, Ex. NRC000041, at 20.

[217] *Id.*

[218] Some of New York's assertions represent a fundamental misunderstanding of the issue before the Board. NRC Staff's Reply to State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12B/12C ("NYS-12c") at 14-20. New York's concern regarding the overall cost estimate of an unmitigated accident rather than the benefit derived from a mitigation measure. *Id.* As explained above, the impact from changing a selected input variable for the MACCS2 code does not have predictable effects on the mitigation analysis because those input changes are applied to both the unmitigated and mitigated accidents. Tr. at 2333, 2525-28.

[219] *Pilgrim*, CLI-12-1, 75 NRC at 53.

[220] *Id*.

[221] *Id.* at 53-54 (emphasis omitted).

outcomes.[222] The SAMA analysis implicitly contemplates that there are both modeled accidents that could result in higher consequences than the model indicates and lower consequences than the model indicates.

QUESTION 8

> The Indian Point SAMA analysis states that the methodology for cleaning up a nuclear weapons accident that was described in a 1996 Sandia National Laboratory study is "not relevant to clean-up following" a nuclear reactor accident. Nonetheless, the SAMA analysis goes on to describe a comparison of decontamination cost values derived from the study with the decontamination cost values used in the Indian Point analysis. Address to what extent (if any) the comparison to the weapons accident study explains or otherwise substantiates the decontamination cost parameters used in the Indian Point analysis.[223]

STAFF RESPONSE TO QUESTION 8

The Staff has consistently indicated in its testimony and its discussion in the FSEIS that a weapons accident is not a good analogue for developing reactor accident clean-up.[224] New York's own expert agreed with the staff's experts and Entergy's experts that weapon's accidents do not provide a good analogue for estimating decontamination costs or times.[225]

In the FSEIS, the Staff discussed and compared certain studies related to decontamination after a weapons accident because those issues were submitted as comments on the Staff's DSEIS.[226] As the Staff explained in the FSEIS and its testimony, the dominant

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[222] *Id.*, at 57.

[223] *Indian Point*, CLI-15-2, 81 NRC __ (Feb. 18, 2015) (slip op. at 4) (footnotes omitted)..

[224] FSEIS, Ex. NYS00133, at G-23; Staff's Testimony on NYS-12C, Ex. NRC000041, at 27-28, 46-49.

[225] Tr. at 2102.

[226] The comments regarding weapons accidents were submitted by New York and essentially copied the submissions of New York's arguments regarding contention admissibility. Many of the issues raised in those submissions were ultimately dropped by the State prior to the hearing. Because the issues were addressed to the decontamination costs after a nuclear reactor accident, the Staff did address this issue under two explanations. First, the Staff indicated that the differences between a weapons accident and nuclear reactor accident were great enough to cause difficulty with direct

contaminant from a weapons accident is plutonium, whereas a nuclear reactor accident produces cesium as the primary contaminant.[227] As a result of the differences between cesium and plutonium, the costs for decontaminating plutonium are vastly greater than the costs for a similar amount of cesium.[228] For example, plutonium is highly toxic, has different exposure pathways, and produces alpha particles, which are more dangerous when plutonium is inhaled or ingested.[229] Even the required decontamination levels for adequate clean-up are significantly greater for plutonium than cesium.[230] Concentrating only on the clean-up requirements, plutonium requires 50 times more material be removed prior to releasing the area.[231] The clean-up criteria in 10 C.F.R. § 835, Appendix D, requires plutonium to be reduced to 20 disintegrations per minute ("dpm") for a transuranic like Pu and allows 1,000 dpm for beta-gamma emitters like Cs. In other words for the same level of activity, plutonium requires 50 times the effort, which is not without additional costs including the additional protective measures required to work around plutonium.[232]

Further adding to increased clean-up costs for a weapons accident are the vastly

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comparison. FSEIS, Ex. NYS00133 at G-22-G-29. Second, the Staff and its experts attempted to adjust the estimates from the weapons accident studies to account for the differences. *Id.* at G-22-G-29. The Staff concluded that after adjusting for the differences between the two different types of accidents the weapons accident studies generally supported the input values selected by Entergy in the SAMA analysis. *Id.* at 29.

[227] See Staff's Testimony on NYS-12C, Ex. NRC000041at 44-48; FSEIS, Ex. NYS00133 at G-22 – G-24.

[228] The Site Restoration Study indicated that plutonium inhalation is the dominant exposure pathway for a weapons accident. Staff's Testimony on NYS-12C, Ex. NRC000041at 46-48. Even the author of the Site Restoration Study recognized that his work was not reasonable applicable to a reactor accident due to the material difference in the types of source terms. Staff's Testimony on NYS-12C, Ex. NRC000041at 46-47; Ex. NYS000249 at 2-3.

[229] Staff's Testimony on NYS-12C, Ex. NRC000041, at 27-28, 46-48.

[230] Staff's Testimony on NYS-12C, Ex. NRC000041, at 47.

[231] Staff's Testimony on NYS-12C, Ex. NRC000041, at 48.

[232] Staff's Testimony on NYS-12C, Ex. NRC000041, at 47-48.

different half-lives for the primary contaminate.[233] Plutonium's half-life of 24,000 years essentially means that all of the contaminant needs to be removed because natural decay will not result in any decrease in exposure to the public.[234] Cesium, unlike plutonium, is not an inhalation risk, has a relatively short half-life of 30 years, and is quickly eliminated from the body when ingested.[235]

In the FSEIS, the Staff examined the comments submitted on the DSEIS and provided reasoned responses to the comments including trying to adjust the costs for a weapons accident to a reactor accident.[236] The Staff explained that in order to compare the cost factor for decontaminating a weapons accident the costs would need to be adjusted to account for types of contaminant, half-life of the contaminants, health and safety effects of the contaminant, the types of decontamination required, and methods used in the Site Restoration Study to develop cost values.[237] As previously noted, weapons accidents consist primarily of Pu-239 contaminants which require larger clean-up, have considerably longer half-lives and present radiation safety concerns and toxicity concerns that serve to increase their clean-up costs beyond a reactor accident event.[238] Based on these issues, the Staff identified that moderate plutonium clean-up costs were most closely related to the heavy cesium clean-up modeled in the Indian Point SAMA analysis.[239] After converting the costs into comparable units, the

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[233] Staff's Testimony on NYS-12C, Ex. NRC000041at 47-48.

[234] Staff's Testimony on NYS-12C, Ex. NRC000041at 47.

[235] Staff's Testimony on NYS-12C, Ex. NRC000041, at 27-28, 48.

[236] FSEIS, Ex. NYS00133 at G-22 – G-29.

[237] I*d.* at G-23 – G-24.

[238] *Id.*

[239] *Id.*

moderate plutonium clean-up costs were $14,900 per person.[240] Entergy's SAMA analysis alternatively used $13,824 per person.[241] The roughly comparable costs determined by this alternative method reinforced the Staff's conclusion that costs used by Entergy were reasonable.[242] Thus, the Board's ruling in favor of the Staff should be affirmed.

CONCLUSION

For the foregoing reasons, the Staff respectfully submits that the Board's findings of fact are well-supported by the record, that the Board did not commit clear error, and the Board's decision in favor of the Staff on NYS-12C should be affirmed.

/Signed (electronically) by/

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Dated at Rockville, Maryland
this 30th day of March, 2015

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[240] *Id.* at G-24.

[241] *Id.*

[242] *Id.*

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-247-LR/50-286-LR
	)	
(Indian Point Nuclear Generating Units 2 and 3)	)	

CERTIFICATE OF SERVICE

Pursuant to 10 C.F.R. § 2.305, I hereby certify that copies of the foregoing "NRC STAFF'S RESPONSE TO THE COMMISSION'S MEMORANDUM AND ORDER OF FEBRUARY 18, 2015 (CLI-15-2), REGARDING CONTENTION NYS-12C" dated March 30, 2015, have been served upon the Electronic Information Exchange, the NRC's E-Filing System, in the above-captioned proceeding, this 30th day of March, 2015.

/Signed (electronically) by/

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