UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
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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 STATE OF NEW YORK RESPONSE TO COMMISSION ORDER CLI-15-2 REQUESTING FURTHER BRIEFING ON CONTENTION NYS-12C CONCERNING SITE-SPECIFIC SEVERE ACCIDENT MITIGATION ALTERNATIVES

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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 State of New York (New York) Response to Commission Order CLI-15-2 (New York's Brief).[1] The Staff's response generally addresses systemic errors in New York's analysis that run through each of New York's responses to the eight Commission questions.[2] 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, 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.

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[1] State of New York Response To Commission Order CLI-15-2 Requesting Further Briefing On Contention NYS-12C Concerning Site-Specific Severe Accident Mitigation Alternatives (New York's Brief) (Mar. 30, 2015). The State of Connecticut also filed a brief in response to the Commission's Order. Connecticut's Response To The Commission's Memorandum And Order Of February 18, 2015 (CLI-15-2), Regarding Contention NYS-12C (Mar. 30, 2015). That brief and the issues raised therein are fully covered by the NRC Staff's Response To The Commission's Memorandum And Order Of February 18, 2015 (CLI-15-2), Regarding Contention NYS-12C (Staff's Response) (Mar. 30, 2015).

[2] *Entergy Nuclear Operations, Inc.* (Indian Point Nuclear Generating Units 2 & 3), CLI-15-2, 81 NRC __, __ (Feb. 18, 2015) (slip op. at 3-4).

I. New York's Singular Focus on the OECR Over-emphasizes Its Impact on the Analysis

New York's entire analysis is based on how the variables it selected change the Off-site Economic Cost Risk (OECR).[3] The costs of an accident, however, are made up of three separate sub-costs.[4] These costs include onsite costs, population dose risk, and OECR.[5] Dr. Bixler, one of the Staff's experts, explained, during the hearing, that Population Dose Risk (PDR) represented a substantial portion of the cost and should not be ignored as was done in New York's analysis.[6] The PDR represents over 40% of the offsite costs.[7] The on-site costs are estimated separately from the off-site costs and not impacted by the MACCS2 code analysis.[8] Putting aside the on-site portion of the costs, doubling the OECR would only change the total offsite costs by a maximum of 1.6 times.[9] After accounting for the onsite costs, the change in the overall benefit would be even smaller.[10]

The impact of these changes is further minimized by interaction of certain variables with the decision logic implemented in the MACCS2 code.[11] For example, increasing the TIMDEC[12]

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[3] *See generally* New York's Brief.

[4] NRC Staff Testimony of Nathan E. Bixler, S. Tina Ghosh, Joseph A. Jones, and Donald G. Harrison Concerning NYS' Contentions NYS 12/16, Ex. NRC000041, at 35 (Mar. 29, 2012) (Staff's Prefiled Testimony); Testimony of Entergy Witnesses Lori Potts, Kevin O'Kula, and Grant Teagarden on Consolidated Contention NYS-12C (Severe Accident Mitigation Alternatives Analysis), Ex. ENT000450, at 63-64 (Mar. 30, 2012) (Entergy's Prefiled Testimony).

[5] Staff's Prefiled Testimony at 35. On site costs include (1) occupational dose costs, (2) onsite decontamination, and (3) replace power costs. *Id*.; Entergy's Prefiled Testimony, at 63-64.

[6] Transcript at 2197 (Tr.); see Pre-Filed Written Rebuttal Testimony of Dr. Francois J. Lemay Regarding Consolidated Contention NYS-12C (NYS-12/12A/12B/12C), Ex. NYS000420, at 14, Table 5 (June 29, 2012).

[7] Tr. at 2197; 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, Ex. NYS000133I, at G-41 (Dec. 2010) (FSEIS). Maximum Averted Public Exposure Cost is $1.88 million and $2.04 million for IP2 and IP3 respectively. Maximum Averted Offsite Property Damage Cost is $2.28 million and $2.81 million for IP2 and IP3 respectively. FSEIS at G-40 – G-43

[8] Staff's Pre-filed Testimony at 35.

[9] *See* Tr. at 2197.

[10] *Id*.

[11] Entergy's Prefiled Testimony at 15, 73-75, 77-80; Tr. at 2199-2202, 2273-74, 2207-09.

results in corresponding decreases in the PDR because people are precluded from returning to their homes and receiving dose until the time specified in the TIMDEC expires.[13] This would serve to reduce the overall change calculated by Dr. Lemay, New York's expert. New York's analysis demonstrated that instead of being sensitive to changes in the TIMDEC and CDNFRM, the severe accident mitigation alternatives (SAMA) analysis is largely insensitive to changes in TIMDEC and CDNFRM.[14] For TIMDEC, New York increased the input variable by 6 times to 91 times, but the resulting change in the OECR output value was only 2.06 times to 5.66 times the original value.[15] For CDNFRM, New York changed the input variable by 2.8 times to 35.4 times.[16] This substantial change only increased the OECR output value by 1.74 times and 5.57 times the original value.[17] This shows that the OECR is relatively insensitive to changes in TIMDEC and CDNFRM. When the other costs (PDR and on-site costs) are considered, the SAMA analysis is even less sensitive since OECR represents only a portion of the overall benefit.[18]

II. In Complex Systems Changes to One Variable Often Require Offsetting Changes to Other Variables

Much of New York's analysis of the potential changes to the OECR is dependent on TIMDEC and CDNFRM being completely independent variables. New York's expert looked at TIMDEC and CDNFRM separately and then combined each effect as though they were additive without looking at the model, the model's decision tree, and how changes in one variable would

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[12] TIMDEC is one input variable into the MACCS2 code; it represents the average time to complete decontamination and the minimum interdiction when decontamination is required.

[13] Entergy's Prefiled Testimony at 15, 73-75, 77-80; Tr. at 2199-2202, 2273-74, 2207-09.

[14] CDNFRM is another input variable into the MACCS2 code; it represents the costs decontamination on a per capita basis.

[15] New York's Brief at 19, Table 13.

[16] *Id*.

[17] Id.

[18] *See* Staff's Prefiled Testimony at 35; Tr. at 2197; New York's Brief at 19, Table 13.

impact other variables.[19] As New York's witness explained, he only looked for variables that would have the largest impact on the results.[20] The Staff's and Entergy's witnesses explained that TIMDEC and CDNFRM are not independent variables and that changes to the length of decontamination time should alter the costs for decontamination and other inputs in to the MACCS2 code.[21] Due to the decision tree for the MACCS2 code, decontamination decisions are made at the beginning of the period.[22] That is, the amount of decontamination selected is based on contamination present at the beginning of the period instead of the end of the period.[23] Decontamination efforts spread over 15 or 30 years would require significantly less effort due to natural decay during the intervening years.[24] Thus, extending the code beyond the assumptions in its model results in erroneous, unreliable, and overly conservative results.

CDNFRM addresses per capita decontamination costs. As the MACCS2 code functions, those costs are expended during the TIMDEC, which are limited to 1 year or less. As the population density rises, the decontamination costs should not increase linearly with population density, but steadily decrease until it reaches a point at which an additional person would not result in any additional clean-up costs.[25] Dr. Bixler testified that accounting for the extended decontamination times proposed by New York would require offsetting reductions in the CDNFRM inputs. In Dr. Bixler's expert opinion, the CDNFRM would need to be reduced by 73% to account for 30-year decontamination times, whereas the MACCS2 code expends those

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[19] Entergy's Prefiled Testimony at 63, 75-76, 79-80; New York's Brief at 19, Table 13.

[20] Tr. at 2004; Review of Indian Point Severe Accident Off Site Consequence Analysis, Ex. NYS000242 at 9-10 (Dec. 21, 2011).

[21] Entergy's Prefiled Testimony at 15, 63, 73-76, 77-80; Tr. at 2199-2202, 2207-09, 2273-74.

[22] *Id*.

[23] *Id*.

[24] Entergy's Prefiled Testimony at 15, 63, 73-78; Tr. at 2199-2202.

[25] Tr. at 2136-44.

resources only in the first year.[26]

The extended decontamination times also result in reductions to the PDR. The MACCS2 code precludes people from returning to a contaminated grid element until the TIMDEC is complete (assuming habitability can be restored).[27] During this temporary interdiction for decontamination, the resident population is assumed to get no dose.[28] Accordingly, even assuming that additional costs identified by New York from the extended TIMDEC inputs were accurate without the Staff's material corrections, they would be mainly offset by a corresponding decrease in PDR.[29] Thus, the overall off-site costs are unlikely to change materially.

III. New York Misconstrues the Impact from the Late Mr. Lee's Statement Regarding the Pedigree of Certain Inputs to the MACCS2 Code.

New York asserts that the Board erred because it did not mention one exhibit containing several emails.[30] New York also intimates that the Board somehow erred when New York argued that the Staff did not disclose it through discovery.[31] New York does not point to any requirement that the Board need discuss every exhibit presented by the parties.[32] With respect

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[26] *Id*. at 2200-01.

[27] Entergy's Prefiled Testimony, at 63-64, 77-80.

[28] *Id*.

[29] Id.

[30] New York's Brief at 12.

[31] New York's Brief at 13; s*ee also* State of New York's Motion for Leave to File an Additional Exhibit and Additional Cross-Examination Questions Concerning Consolidated Contention NYS-12C at 5 (Sep. 18, 2012). As addressed *infra*, New York continues to complain about Staff's disclosures related to Mr. Lee's email, the Spent Fuel Scoping Study, and Dr. Tawil's draft analysis. These issues have been examined by the Board with respect to Mr. Lee's email and Dr. Tawil's analysis. Both were presented during the hearing and New York had an opportunity to conduct cross-examination on these issues. With respect to the Spent Fuel Scoping Study, New York waited almost 5 months after the document was released to the public to raise the issue with the Board and New York only raised the issue after the Board had rendered its partial initial decision in favor of the Staff. The Board in examining the Spent Fuel Scoping Study that was raised 5 months after the document was released York and determined that it was not likely that if the Board had heard the issue, it would have changed the outcome. Order (Denying New York's Motion to Reopen the Record; Setting Deadline for New or Amended Contention) at 3 (April 1, 2014) (ADAMS Accession No. ML14091A319) (unpublished).

[32] The Board's Order expressly lists the evidence considered including Mr. Lee's email. *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 & 3), LBP-13-13, 78 NRC 246, 267 (2013); s*ee also*

to this exhibit, the Staff provided a thorough discussion of the exhibit prior to its admission and during cross-examination by New York.[33] The Staff explained that the late Mr. Lee's email represents a single staff member's view.[34] Mr. Lee's views regarding inputs into the MACCS2 code are not that the pedigree is unknown, but that the inputs could be "[r]eview[ed] and update[d] or upgrade[d] as necessary."[35] The Staff explained that Mr. Lee's email was submitted for evaluation by the Long Term Research Program (LTRP).[36] The LTRP evaluated Mr. Lee's proposal as "one of the lowest scores of all proposals that year" and the lowest score for the technical gap, i.e. there was very little reason to pursue the proposal in light of other more pressing and technically justified proposals.[37] Based on this evaluation, the LTRP Review Committee rejected the proposal.[38] The LTRP Review Committee's rejection of Me. Lee's proposal is entirely consistent with the Staff's testimony that TIMDEC and CDNFRM values selected by Entergy are reasonable and reliable.

IV. The Spent Fuel Pool Scoping Study Is Consistent with the Staff's Testimony Regarding TIMDEC and Confirms the Reasonableness of 60 and 120 Day Inputs

New York asserts that the Staff recently changed its practice of using 60 and 120 days for TIMDEC because the Staff used 365 days in its analysis to determine whether additional resources should be devoted to analyzing whether transfers of spent fuel from the pool to dry

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Entergy Nuclear Operations, Inc. (Indian Point, Units 2 & 3), Appendix B at B-56 (unpublished).

[33] Affidavit of S. Tina Ghosh Concerning State of New York Motion for Leave to File an Additional Exhibit and Additional Cross-Examination Questions Concerning Consolidated Contentions NYS-12C at 3-4 (Sep. 28, 2012) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12272A352) (Affidavit of S. Tina Ghosh); Tr. at 2286-88, 2327-32.

[34] Affidavit of S. Tina Ghosh at 3-4; Tr. at 2327-30.

[35] See Ex. NYS000441 at 5 (emphasis added).

[36] Affidavit of S. Tina Ghosh at 3. The LTRP is mean to identify potential research that would fill technical gaps that the NRC may need 5 to 10 years. *Id*. at 2-3. The LTRP is discussed more fully in Dr. Ghosh's affidavit. *Id.*

[37] *Id*. at 4

[38] *Id*. at 3-4.

casks should be expedited.[39] The State's discussion and reliance on the Staff's Spent Fuel Pool Scoping Study is misplaced for two primary reasons. First, New York did not raise the issue of the Spent Fuel Pool Scoping Study until after the Board closed the record and after the Board rendered its decision.[40] The Board on reviewing New York's Motion to Reopen the Record and Reconsider Contention NYS-12C determined that the Spent Fuel Pool Scoping Study was unlikely to result in a materially different outcome had the Board considered it during the hearing.[41]

As addressed by the Board, the Spent Fuel Pool Scoping Study utilized different inputs for the TIMDEC variable than those used in the SAMA analysis.[42] The Staff explained that the Spent Fuel Pool Scoping Study was not being conducted as a SAMA analysis and represented a single accident scenario with a source term that represented multiple reactor cores located outside of containment.[43] The single accident scenario results in a large area of contamination instead of a spectrum of accident scenarios representing a wide variety of contamination levels.[44] The Staff's selection of a 1-year for TIMDEC in the Spent Fuel Pool Scoping Study is fully consistent with the Staff's testimony at the Indian Point hearing. The Spent Fuel Pool Scoping Study was used to support a bounding analysis provide an appropriate screening analysis to determine if the Staff should take additional actions with respect to transferring spent fuel from the pools to dry cask storage under the backfit requirements. Alternatively, the Indian Point SAMA analysis was designed to provide a reasonable and realistic estimate of the costs

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[39] New York's Brief at 8-9.

[40] *See* NRC Staff's Response to State of New York Motion to Reopen the Record and for Reconsideration on Contention NYS-12C at 4-7 (Dec. 23, 2013) (Staff's Response to Motion to Reopen).

[41] Order (Denying New York's Motion to Reopen the Record; Setting Deadline for New or Amended Contention) at 3 (April 1, 2014).

[42] *Id*.

[43] Staff's Response to Motion to Reopen at 12.

[44] *Id*. at 13.

and benefits of selected mitigation measures.[45] The Board determined that New York's references to the Spent Fuel Pool Scoping Study's use of a TIMDEC of 1-year is "insufficient to show that the NRC Staff's acceptance of TIMDEC inputs of 60 days and 120 days for the Indian Point SAMA was not reasonable."[46]

V. Significant Conservatism Exists in the Overlapping Mitigation Alternatives that Reduce Substantially the Same Risks

New York argues that the Board's findings contain only conclusory statements unsupported by the record.[47] New York faults the Staff for not addressing uncertainty factors in the FSEIS.[48] New York reiterates its untimely argument that the Staff's witnesses are not qualified to render an opinion regarding how the SAMA analysis is performed and how the analysis accounts for uncertainties.[49] New York also argues the uncertainty of the Level 3 PRA analysis cannot be accounted for by using the ratio between the mean core damage frequency and the 95th percentile core damage frequency.[50]

New York's assertions that the Staff and Entergy witnesses' testimony should be disregarded were waived and cannot support New York's petition for review. New York did not seek to limit the pre-filed testimony through motions to strike or motions *in limine*.[51] During the hearing and in its pre-filed testimony, the Staff's witnesses provided substantial evidence on these conservatisms and how these conservatisms impacted the SAMA analysis.[52] New York

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[45] *Id*. at 13.

[46] Order (Denying New York's Motion to Reopen the Record; Setting Deadline for New or Amended Contention) at 3 (April 1, 2014).

[47] New York's Brief at 30.

[48] *Id*. at 31.

[49] *Id*. at 32.

[50] New York's Brief at 32.

[51] 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 1-4 (May 3, 2013) (Staff's Reply to New York's Findings of Fact).

[52] Tr. at 2220, 2230-33, 2163-66, 2225-28; Staff's Prefiled Testimony at 2, 94-95, 22, 36, 20, 14-

did not object to their testimony.[53] Even when New York had the rare opportunity to conduct cross-examination of the Staff's and Entergy's witnesses, it did not explore their qualifications during the cross-examination and did not object to their qualifications at the conclusion of the cross-examination.[54] Thus, New York waived any challenge to the witnesses' expertise and their ability to opine on the SAMA analysis, its uncertainties, and its conservatisms.[55]

The Staff's witnesses explained that although the SAMA analysis was meant to represent a best estimate of whether a particular mitigation measure would be cost beneficial; it retained a level of conservatism that could account for reasonable changes to its inputs. Dr. Ghosh, one of the Staff's experts, explained that if the averted risk for each of the cost-beneficial SAMAs was applied to the Indian Point units, the total risk of the plant would be completely eliminated twice.[56] Continuing her explanation, she stated that the SAMAs that tend to be identified as potentially cost-beneficial cluster around certain types of accidents – steam-generator tube rupture and interfacing system accidents with containment bypass.[57] Thus, the potentially cost-beneficial SAMAs tend to mitigate the same accidents but at progressively greater costs. In her expert opinion, if changes were made to the analysis that identified additional potential cost-beneficial mitigation measures, those mitigation measures would reduce the risk from accidents that already have potentially cost-beneficial mitigation measures identified.[58]

20; Entergy's Prefiled Testimony at 47-48, FSEIS at G-45, G-21.

[53] Tr. at 2163-66, 2220, 2225-28, 2230-33.

[54] *Id*.

[55] Staff's Reply to New York's Findings of Fact at 1-4.

[56] Tr. at 2222-25. Eliminating the entire risk of the plant twice over is, of course, impossible. Thus, there is considerable conservatism in the possible benefit that can be achieved from the modeled mitigation measures. *Id.*

[57] *Id*.

[58] *Id*.

With respect to uncertainty, the Staff's witnesses explained that the ratio of the mean core damage frequency to the 95th percentile core damage frequency is used to account for the overall uncertainty in the analysis.[59] New York's claim that this ratio only accounts for uncertainty in the Level 1 PRA is not accurate. For SAMAs, uncertainty is not applied to each internal step, but only to the final results. The Staff explained that a SAMA analysis is very complex with interrelated inputs;[60] these are not completely independent variables and tend have offsetting effects on the analysis.[61]

New York's last argument that Staff should have addressed this uncertainty in the FSEIS is not relevant. This argument was not raised against the FSEIS[62] but only against the Staff's testimony regarding the reasonableness of the selected input variables and conservatism provided by the analysis. As such, the FSEIS only generally discussed the uncertainty analysis and its applicability to the SAMA analysis.[63] The Staff's experts addressed the concerns raised by Dr. Lemay during the hearing directly.[64] It is not material to New York's contention whether uncertainty was addressed in the FSEIS, in pre-filed testimony, at the hearing, or on cross-examination.[65] As the Board held in this proceeding, the hearing supplements the Staff's FSEIS.[66]

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[59] Staff's Prefiled Testimony at 22-23, 93-94.

[60] Transcript at 2251-52.

[61] *Id*.

[62] A careful examination of the comments submitted on the FSEIS, including comments submitted by New York, did not identify or question the Staff's uncertainty analysis. *See, e.g.*, FSEIS at Appendix A, at A1022-A1032. The Staff's discussion in the FSEIS simply explained the uncertainty analysis that was performed and how it impacted the overall results. FSEIS at G-45 (uncertainty factors of 2.1 and 1.4 for IP2 and IP3, respectively).

[63] *Id*.

[64] Tr. at 2251-52; 2230-33.

[65] *Indian Point*, LBP-13-13, 78 NRC at 387.

[66] *Id*.

VI. The Use of Only Two Decontamination Factors Produces Conservative Results

The MACCS2 code, as currently configured, can model three different decontamination factors (DF).[67] The Indian Point SAMA analysis, however, used only two DFs, 3 and 15.[68] This means that the MACCS2 code often expends significantly more resources for decontamination than would be called for under an actual accident scenario.[69] The code iteratively determines the appropriate decontamination effort.[70] First, it determines whether any decontamination is necessary prior to allowing people to return.[71] If the decontamination is necessary to meet the habitability requirements, the code implements a DF of 3 even when the decontamination could have been accomplished with less effort.[72] If a DF of 3 is not sufficient to restore habitability, the code implements a DF of 15.[73] It does so even if the necessary DF is much less than 15.[74] Finally, the code will interdict the property for 30 years after the completion of decontamination, if that would restore habitability.[75] The code balances these decontamination costs and interdiction costs against the value of the property and once the costs of clean-up and interdiction exceed the property's value, the code condemns the property immediately.[76] Thus, the MACCS2 code conservatively expends the full cost for each DF regardless of the decontamination necessary.[77] Thus, the benefits from any mitigation measure tend to be

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[67] Staff's Prefiled Testimony at 40.

[68] *Id*. at 40-42.

[69] *Id*. at 40-42; Tr. at 2273, 2362, 2130, 2188-89.

[70] Staff's Prefiled Testimony at 40-42.

[71] *Id*. The code makes this determination based on the habitability requirements. Id.

[72] Staff's Prefiled Testimony at 40-42.

[73] *Id*.

[74] *Id*.

[75] *Id*. at 68. Under New York's assertions, this 30-year interdiction period would be on top of a 30-year decontamination effort or up to 60-years during which no one could return or use the property. *Id*.

[76] *Id*. at 68.

[77] *Id*. at 40-42.

conservatively estimated compared to the expectation that the decontamination efforts would be carefully tailored to the actual contamination found.[78]

VII. The History of Modeling SAMAs Provides a Reasonable and Complete Explanation of the Decision to Move from a Single Timeframe of 90-Days to Two Timeframes of 60-days and 120-days

The Staff's experts explained that when 90-days were selected, the model only imposed a single decontamination factor, and thus, only one time period was necessary.[79] As computers became more powerful and allowed for additional customization, two DFs were implemented and provide more realistic results and needed two different time periods, 60-days and 120-days.[80]

These changes were made in documents that received substantial internal and external peer review and were provided to the public for comment.[81] The Staff's and Entergy's witnesses explained that NUREG-1150, which used the 60-day and 120-day TIMDEC, received an unprecedented level of review and remains the seminal study on severe accident modeling.[82] New York's argument that the substantial peer review did not specifically address its concerns raised nearly 25-years after publication is not material to whether the Staff was entitled to reasonably rely on the seminal study contained in NUREG-1150.

VIII. New York's Inability to Locate a 35-Year Old Document Does Not Alter or Invalidate the Substantial Research and Peer Review Completed Subsequently

New York, without citation, asserts that the "parties agree that Os84[83] is missing and

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[78] *Id*. at 40-42.

[79] Tr. at 2249, 2241.

[80] Transcript at 2249, 2241.

[81] *Id*. at 2028, 2034-36, 2370-72.

[82] *Id*. at 2047-49, 2370-75.

[83] Ostmeyer, R.M. and G.E. Runkle, An Assessment of Decontamination Costs and Effectiveness for Accident Radiological Releases, (Sandia National Laboratories to be published).

wholly unavailable."[84] New York requested a copy of Os84. After searching the NRC archives and Sandia's archives, the Staff was not able to locate the document.[85] However, the Staff never indicated that the document was wholly unavailable, only that the document was not in the possession or control of NRC such that it could be provided to the State in discovery.[86] As the Staff explained, it is not clear the article was ever in the Staff's possession, custody, or control.[87] To the extent that the State wanted to challenge the Staff's reasonable reliance on NUREG-1150 based on the analysis contained in a reference to a reference of NUREG-1150, it was incumbent on the State to present its evidence. The mere fact that New York was not able to locate one article, after so many years, is not remarkable or sufficient to cast doubt on the pedigree of NUREG-1150 or the Staff's reliance on the information developed therein.

IX. New York's Exhibits Demonstrate that a DF of 15 Is Achievable with Relatively Inexpensive Techniques

New York argues that achieving high DF is nearly impossible without incurring great expenses or complete demolition of the structure.[88] The Staff explained that New York's own exhibits showed decontamination techniques that greatly exceed DFs of 15.[89] As part of that explanation, the Staff demonstrated that decontaminating cesium is often easier than decontaminating plutonium with equal activity levels.[90] The Staff explained the difficulty with plutonium in the FSEIS and provided additional explanation in its pre-filed testimony and during the hearing.[91] New York argued that clean-up will be especially difficult on high-rise buildings in

[84] New York's Brief at 7.

[85] Ex. NYS000421 at 1 (Apr. 25, 2012).

[86] *Id*.

[87] Staff's Reply to New York's Findings of Fact at 29.

[88] New York's Brief at 14-15, 35-36.

[89] Staff's Prefiled Testimony at 43-44.

[90] Staff's Prefiled Testimony at 46-48. Entergy's Prefiled Testimony, at 68-69.

[91] FSEIS at Appendix G at G-23 – G-24; Staff's Prefiled Testimony at 46-48; Entergy's Prefiled Testimony, at 68-69.

and around New York City.[92] The Staff identified clean-up techniques including: (1) chemical treatment, (2) pressure washing, (3) Blast N'Vac, (4) sandblasting, (5) peelable coatings, (6) vacuums, (7) razors, (8) manual scraping, (9) brushes, and (10) detached polymer pastes that are very effective in removing contamination at high DFs.[93] The Staff's expert explained that with respect to high-rises, the actual decontamination from an accident is unlikely to need to be applied uniformly across the entire building.[94] In fact the contamination above certain floors on the outside of the building would often require no decontamination because people within the building would receive significant shielding from the external walls.[95] Similarly, people traversing along the street would not receive significant doses from contamination on elevated floors due to the separating distance.[96]

New York asserted that "if complete removal of the road is justified on the basis of the presence of plutonium, it will also result in the full decontamination of cesium."[97] While true, it does not provide any evidence of the minimum effort necessary to decontaminate the road with cesium as the primary contaminate. The Staff's experts explained that plutonium requires more decontamination than similar activity levels of cesium.[98] Specifically, plutonium requires 50 times more decontamination than cesium.[99] New York's reasoning that cesium requires at least

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[92] Staff's Prefiled Testimony at 51-52.

[93] Staff's Prefiled Testimony at 44. The DF achievable by these techniques range from a DF of 30 to >100.

[94] *See* Tr. at 1993 (increase shielding for large buildings); 2119 (reduction of contamination levels due to increasing surface area), 2151 (non-uniform deposition); Staff's Prefiled Testimony at 75-76, 83-84.

[95] Tr. at 2361-63; Entergy's Prefiled Testimony, at 68-69.

[96] *Id*.

[97] New York's Brief at 36.

[98] Staff's Prefiled Testimony at 86-88; Entergy's Prefiled Testimony, at 68-69.

[99] Staff's Prefiled Testimony at 46-48.

the same level of effort as plutonium is simply not supported even in New York's own exhibits.[100] The Staff's experts explained that in all likelihood, less clean-up would be necessary.

The Staff and its experts demonstrated that high DFs can be achieved at a reasonable cost and that clean-up to levels that would be required following primarily plutonium dispersal events would not be required for reactor accidents.

X. The Analysis Conducted by Dr. Tawil Is Not a SAMA Analysis

New York asserts that Dr. Tawil's[101] draft analysis is an example of a site-specific SAMA analysis that developed site-specific decontamination costs for the Indian Point site[102] and that the Commission should give this draft analysis particular weight because the Staff did not disclose this document in its hearing files.[103] Beginning with that second issue first, New York, by its own filings, discovered this document only after contacting its author.[104] It is unclear where New York obtained its copy of Dr. Tawil's draft report. Regardless, this document was not under the control or custody of the Staff at the time mandatory disclosures were required. Thus, the Staff was under no obligation to produce it. Nor is the Staff, notwithstanding New York's implication, under any obligation to search for and to produce documents that are not in its possession but somehow relevant to New York's theory. At no point has New York provided any evidence or testimony in support of its now baseless allegations regarding the Staff's disclosures.

New York's own witness does not refer to Dr. Tawil's analysis as SAMA analysis.[105] Dr. Lemay's pre-filed rebuttal testimony seems to only cite Dr. Tawil's analysis to support his

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[100] *Id*. at 86-88

[101] Dr. Tawil appears to have worked for Pacific Northwest Laboratory in the late 1980's and early 1990's and produced a draft report in 1990.

[102] New York's Brief at 20 n. 66.

[103] *Id.*

[104] Ex. NYS000420 at 26-27.

[105] Tr. at 2256-58; *see also id*. at 2252-55.

analysis utilizing the CONDO code.[106] Upon Board questioning, the Staff's witnesses and Entergy's witnesses explained that Dr. Tawil's draft analysis was not a site-specific SAMA analysis because it did not properly account for variability of the weather or the likelihood of all the accident scenarios.[107] The Staff's experts explain that Dr. Tawil's analysis assumes one of the worst accident source terms and forces the weather to blow the radioactive plume directly to New York City.[108] New York arguments regarding Dr. Tawil's analysis is based on a mistaken reliance on his email rather than the draft report. In his email, Dr. Tawil mistakenly stated that the report used the SST5 (siting source term event), which New York claimed constitutes "'[l]imited core damage' and '[c]ontainment functions as designed with minimal leakage.'"[109] The draft report contradicts Dr. Tawil's email and New York's assertion. The draft report states that it used three SSTs.[110] Each of the source terms utilized in Dr. Tawil's analysis involve severe core damage and significant breaches to containment or bypass of containment scenarios.[111] The source terms used in Dr. Tawil's report were SST1, SST2, and SST3.[112]

> SST1: Severe core damage. Essentially involves loss of all installed safety features. Severe direct breach of containment.
>
> SST2: Severe core damage. Containment fails to isolate. Systems to mitigate fission product release … operate to reduce release.
>
> SST3: Severe core damage. Containment fails by basemat melt-through. All other release mitigation systems function as designed.

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[106] Ex. NYS000420 at 27-28. New York's witness seemingly points to the Dr. Tawil's report for the unremarkable proposition that decontamination costs may be estimated using a variety of means. *Id.*

[107] Tr. at 2252-55; 2258-59.

[108] Tr. at 2252-55.

[109] State of New York's Proposed Findings of Fact and Conclusions of Law for Contention NYS-12/12A/12B/12C ("NYS-12C") at 74, n.43 (Mar. 22, 2013).

[110] Ex. NYS000424H at 5.3 (Feb. 28, 1990).

[111] *Id*.

[112] *Id*.

Dr. Tawil's draft report contains unreasonable assumptions for a SAMA analysis, and if uncorrected, renders any meaningful comparison to the SAMA analysis actually conducted for Indian Point baseless and of little, if any, probative merit. Notably, New York chose not to make Dr. Tawil available for Board questioning despite relying on his unsubstantiated email.

XI. The Board Did Not Prevent New York From Presenting Its Case Including Conducting Cross-Examination of Entergy's and the Staff's Witnesses

New York states that "During the hearing on NYS-12C, the Board sustained Entergy's objection when the State attempted to question Entergy's witnesses regarding how the conclusions in their purported sensitivity analysis for NYS-16B would apply to NYS-12C."[113] While the Board did not allow questions on NYS-16B during the portion of the hearing on NYS-12C, it did not preclude New York from conducting an examination on these questions during the portion of the hearing devoted to NYS-16B. During the cross-examination on NYS-16B, New York questioned Ms. Pott's, Entergy's expert on IP2-025.

> MS. LIBERATORE: Thank you. This question is directed to Entergy, specifically to Entergy's sensitivity analysis, disclosed on Friday, October 12th, that has been offered as an exhibit. Isn't it true that Entergy has determined that to render IP2 SAMA 025 cost-effective, its benefit would only have to increase by 11 percent?
>
> MS. POTTS: This is Lori Potts for the applicant. Yes, with the current implementation cost estimate, if we increased the benefit of SAMA IP2 025 11 percent it would show potentially cost beneficial. Yes.[114]

As explained in the Staff's response to New York's Petition for Review and the Staff's Initial Response to the Commission's questions, New York, even with the rare opportunity to conduct cross-examination, failed to address the ultimate issue of whether changes in the TIMDEC and CDNFRM input variables would change the Staff's conclusions regarding which SAMAs are

[113] New York's Brief at 16.

[114] Tr. at 2525.

potentially cost beneficial.[115] New York, not the Board, failed to fully develop its case. The Board did not preclude New York from asking questions on SAMA IP2 025; it only delayed it to the portion of the hearing that was concentrated on NYS-16B.[116] This mere delay in questioning cannot give rise to a claim of error.

XII. New York's Expert Did Not Verify the Code's Functionality in the Extended Ranges for TIMEDEC and CDNFRM

New York continues to argue that it made modest changes to the code but failed to verify its changes in the new expanded ranges.[117] As demonstrated by New York's failure to appreciate the MACCS2 code's conservation of mass and its decontamination logic including when it determines how much decontamination is necessary, these minor changes to explicit hard coded limits are perilous to preserving MACCS2's functionality and reliability. Changing the MACCS2 code to allow for extended decontamination times requires considerable work, research, and testing to validate any changes to the code for functionality.[118] 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.[119] 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.[120] This relationship breaks down as average times are increased

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[115] Staff's Reply to New York's Findings of Fact at 14-20.

[116] Tr. at 2337-39; *but see* Tr. at 2525-28.

[117] Tr. at 2268-69; Decl. of Dr. Francois J. Lemay In Support of the State of New York's Answer to Entergy's Motion in Limine to Exclude Portions of Pre-filed Testimony and Exhibits for Consolidated Contention NYS-12C at 5 (Feb. 17, 2012) (Dr. Lemay only checked his modifications with inputs that were acceptable prior to the modifications.).

[118] Entergy's Prefiled Testimony, at 15, 73-75, 77-80; Tr. at 2199-2203, 2272-74; *see also id.* at 1982-83.

[119] Tr. at 2199-2203, 2272-74; *see also id.* at 1982-83.

[120] *Id*.

beyond 1-year because natural decay begins to impact the amount of decontamination necessary.[121] The process of extending the decontamination over multiple years would need to account for the appropriate discount factors for expenses occurring in later years, depreciation and interdiction would need to be revisited to ensure that properties being decontaminated are not permanently interdicted pre-maturely, 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 equally vexing problems with making these "minor" modifications to the code.[122] This kind of original research and development of new tools and new analysis techniques is not required under NEPA and likely to require years of research and testing before a new code with different modeling techniques could be validated.[123]

XIII. A Variety of Different Techniques Produced Substantially Identical Inputs for TIMDEC and CDNFRM

The reason behind the Staff's continuing confidence in the inputs selected for TIMDEC and CDNFRM is the result of the Staff's analysis of these inputs utilizing several different techniques that generally resulted in consistent results despite widely varying starting positions. The Staff looked at several documents submitted as comments on the DSEIS that questioned certain inputs into the MACCS2 code. The Staff, with the help of its experts including contractors from Sandia National Laboratories, examined the data in the documents and developed adjustments to account for the different primary contaminate.[124] As explained in the FSEIS and after making the appropriate adjustments to the analysis, it produced input values

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[121] *Id*.

[122] *Id*.

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

[124] FSEIS at G-23 – G-24.

consistent with the values selected by Entergy.[125]

The Staff performed the same general types of adjustments for the analysis performed by New York's expert.[126] The Staff also corrected for errors in the analysis due to misapplying conservation of mass principles and adjusting inputs to reflect the decision logic implemented in the code.[127] The end result of making these necessary adjustments to New York's analysis is that the inputs selected by Entergy were slightly conservative to the inputs that resulted from Dr. Lemay's analysis.[128] Dr. Lemay's analysis essentially confirms the reasonableness of the selected inputs to the MACCS2 code and reinforces the reasonableness and reliability of the analysis done to support the seminal severe accident consequence study, NUREG-1150.[129]

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 29th day of April, 2015

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[125] *Id*.

[126] Staff's Prefiled Testimony at 44-48, 69-74; Tr. at 2115, 2147-49, 2160, 2176-77, 2199-2202, 2378-79.

[127] Staff's Prefiled Testimony at 44-48, 69-74; Tr. at 2115, 2147-49, 2160, 2176-77, 2199-2202, 2378-79.

[128] *Id*.

[129] *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 STATE OF NEW YORK RESPONSE TO COMMISSION ORDER CLI-15-2 REQUESTING FURTHER BRIEFING ON CONTENTION NYS-12C CONCERNING SITE-SPECIFIC SEVERE ACCIDENT MITIGATION ALTERNATIVES" dated April 29, 2015, have been served upon the Electronic Information Exchange, the NRC's E-Filing System, in the above-captioned proceeding, this 29th day of April, 2015.

/Signed (electronically) by/

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Date of Signature: April 29, 2015