NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System ("SPDES") Permit Pursuant to article 17 of the Environmental Conservation Law And Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York parts 704 and 750 *et seq*. by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee,	**DEC # 3-5522-00011/00004** **SPDES # NY-0004472**
-and-	
In the Matter of the Application by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, for a Certificate Pursuant to §401 of the Federal Clean Water Act.	**DEC # 3-5522-00011/00030** **DEC # 3-5522-00011/00031**

POST-HEARING CLOSING BRIEF OF INTERVENORS RIVERKEEPER, NATURAL RESOURCES DEFENSE COUNCIL, AND SCENIC HUDSON REGARDING ISSUE FOR ADJUDICATION NO. 3 – RADIOLOGICAL MATERIALS

April 27, 2012

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Cases

Statutes

Regulations

NYS ECL § 3-0301(i)

NYS ECL § 17-0101

NYS ECL § 17-0105(5)

NYS ECL § 17-0105(17)

NYS ECL § 17-0301

NYS ECL § 17-0501

NYS ECL § 17-0511

NYS ECL § 17-0807

6 NYCRR § 608.9

6 NYCRR § 621.10

6 NYCRR § 624.1

6 NYCRR § 624.4

6 NYCRR § 624.5

6 NYCRR § 624.8

6 NYCRR § 624.9

6 NYCRR § 624.13

6 NYCRR § 700.1

6 NYCRR § 701.1

6 NYCRR § 701.5

6 NYCRR § 701.6

6 NYCRR § 701.7

6 NYCRR § 701.8

6 NYCRR § 701.11

6 NYCRR § 701.13

6 NYCRR § 701.18

6 NYCRR § 701.15

6 NYCRR § 703.2

6 NYCRR § 750-1.2(a)(66)

6 NYCRR § 858.4

6 NYCRR § 864.6

6 NYCRR § 941.6.

Public Records

U.S. EPA, Office of Wetlands, Oceans, and Watercheds, *Clean Water Act Section 401 Water Quality Certification: A Water Quality Protection Tool for States and Tribes* (April 2010 Interim)

U.S. EPA, Radionuclides in Drinking Water: A Small Entity Compliance Guide (February 2002)

Pursuant to 6 NYCRR § 624.8(a)(5),[1] Riverkeeper, Inc., Natural Resources Defense Council, Inc. ("NRDC"), and Scenic Hudson, Inc. ("Scenic Hudson") (collectively referred to as "Riverkeeper"), hereby submit this Post-Hearing Closing Brief in conjunction with the conclusion of the adjudicatory hearings on Issue for Adjudication No. 3 -- Radiological Materials, in the above-referenced Indian Point nuclear power plant SPDES permit renewal, and Clean Water Act § 401 Water Quality Certification appeal proceedings.

BACKGROUND

The Indian Point nuclear power plant, situated on the banks of the Hudson River in Buchanan, New York, and currently owned by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. (hereinafter collectively referred to as "Entergy") consists of Units 1, 2 and 3. While Indian Point Unit 1 stopped generating electricity in 1974, various components are still used in connection with the operation of the rest of the plant, radioactive discharges from Unit 1 intermingle with discharges from the rest of the facility, and it will not be decommissioned until the entire plant stops operating. Entergy currently operates two reactors, Indian Point Unit 2 and Indian Point Unit 3, which began operating in 1973 and 1975, respectively, and were originally licensed to operate for 40 years. Accordingly, the existing operating licenses for Units 2 and 3 are set to expire in 2013 and 2015, respectively. Entergy is presently seeking to operate the two Indian Point reactors for an additional twenty years beyond the expiration of their current licenses. Entergy's application for operating license renewal for Indian Point is pending before the U.S. Nuclear Regulatory Commission ("NRC").

[1] *See* 6 NYCRR § 624.8(a)(5) ("At the concluding session of the hearing, the ALJ will determine whether to allow the submission of written post-hearing briefs").

In furtherance of Entergy's Indian Point operating license renewal effort, on April 3, 2009, Entergy applied to the New York State Department of Environmental Conservation ("DEC") for a necessary Water Quality Certification ("WQC") pursuant to § 401 of the Clean Water Act ("CWA")[2] ("Entergy's Application for WQC"). Section 401 of the CWA requires that, prior to the issuance of a federal license or permit, the State must certify that the action meets State water quality standards and other relevant state laws and standards. Thus, Entergy's Application for WQC sought certification from DEC that the proposed action of license renewal, i.e., continued operation of Indian Point Units 2 and 3 for twenty years beyond their current license terms, would not violate applicable State standards.

On April 2, 2010, DEC Staff issued a Notice of Denial of Entergy's Application for WQC ("Notice of Denial"). DEC Staff's Notice of Denial "acknowledged that radioactive material (including tritium, strontium-90, cesium, and nickel) from spent fuel pools, pipes, tanks, and other systems, structures, and components at Indian Point has reached the Hudson River via groundwater flow from the site and, moreover continues to do so" and that Entergy had mapped "two distinct radionuclide plumes" at the site.[3] DEC Staff, thus, premised its denial of Entergy's Application for WQC on, *inter alia*, the fact that "the discharge of radiological substances (including, but not limited to, radioactive liquids, radioactive solids, radioactive gases, and

[2] *See* Letter from E. Zoli (Counsel for Entergy) to M Duke (Regional Permit Administrator, DEC), NRC License Renewal, Indian Point Units 2 and 3: Application for Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act (April 3, 2009), *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/ltrtorpa.pdf.

[3] *See* Letter from William R. Adriance (Chief Permit Administrator) to Dara F. Gray (Entergy), Re: Joint Application for CWA § 401 Water Quality Certification NRC License Renewal – Entergy Nuclear Indian Point Units 2 and 3 DEC Nos.: 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3) *Notice of Denial* (April 2, 2010), *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/ipdenial4210.pdf, at 11.

stormwater) from the Indian Point site into a water of the State, here the Hudson River, are 'deleterious substances' and could impair the water for their best usage."[4]

Thereafter, on April 29, 2010, Entergy availed itself of the voluntary opportunity to request an adjudicatory hearing pursuant to 6 NYCRR § 621.10(a)(2), to contest the legal and factual bases of DEC Staff's decision ("Entergy's Hearing Request"). Entergy's Hearing Request disputed DEC Staff's determination to deny Entergy's Application for WQC based upon accidental releases of radiological materials from Indian Point to waters of New York State.[5] In particular, Entergy's Hearing Request raised two "threshold legal issues" pertaining to whether or not a denial of a CWA § 401 WQC can legally be premised upon radiological considerations, as well as a factual issue relating to whether or not DEC Staff properly denied Entergy's Request for WQC based upon radiological leaks at Indian Point.[6]

In accordance with 6 NYCRR § 624.5(b), and DEC's Environmental Notice Bulletin notice of public hearings pertaining to the Notice of Denial,[7] on or about July 10, 2010, Riverkeeper submitted a petition seeking full party status in the hearing proceedings initiated by Entergy.[8] Riverkeeper's petition, (in particular, proffered Issue 6B), supported DEC Staff's denial of Entergy's Application for WQC due to accidental radiological leaks to New York State

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[4] *See id.* (citing 6 NYCRR § 703.2). As is explained herein, the groundwater beneath Indian Point is also a water of the state. ECL § 17-0101(2). Accordingly, discharges of radioactive materials to the groundwater provide a separate and independent regulatory basis for DEC's denial of Entergy's requested CWA § 401 certification.

[5] *See* Entergy's Request for Adjudicatory Hearing on Notice of Denial (April 29, 2009), *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/ip401denialhrgreq.pdf, at 8-10, 14-16 ("Entergy's Hearing Request").

[6] *See* Entergy's Hearing Request at 8-10, 14-16.

[7] *See* Entergy Indian Point 2, LLC, Entergy Indian Point 3, LLC and Entergy Nuclear Operations Inc., Entergy Indian Point Nuclear Units 2 and 3, New York State Department of Environmental Conservation Notice of Public Comment Period and Legislative Public Hearing and Issues Conference, June 9, 2010, *available at*, http://www.dec.ny.gov/enb/65843.html.

[8] Riverkeeper, Natural Resources Defense Council, and Scenic Hudson Petition for Full Party Status and Adjudicatory Hearing (July 20, 2010) ("Riverkeeper's Petition for Party Status").

waters. Riverkeeper agreed with DEC Staff's position, and offered additional, independent, support to demonstrate, that accidental radiological leaks at Indian Point were, and would continue to be, inconsistent with relevant water quality standards applicable to the Hudson River.[9] Furthermore, Riverkeeper's petition (in particular proffered Issue 6A) offered an additional basis warranting the denial of Entergy's Application for WQC relating to accidental radiological leaks, which was not specifically relied upon by DEC Staff; in particular, that radioactive leaks at Indian Point were also inconsistent, and would continue to cause inconsistency, with State water quality standards applicable to groundwater at Indian Point.[10]

Following an Issues Conference held on July 21, 2010, and post-Issues Conference briefing, on December 13, 2010, presiding Administrative Law Judge ("ALJ") Maria E. Villa published an "Issues Ruling."[11] This ruling determined that Entergy's "threshold legal issues" relating to radiological considerations in the proceeding were not persuasive or dispositive, and advanced Entergy's factual issue pertaining to radiological leaks at Indian Point to adjudication, since, pursuant to 6 NYCRR § 624.4(c)(1)(ii), the issue related to "a matter contested by the Applicant, which was cited by Department Staff as a basis for denial."[12] The Issues Ruling also granted Riverkeeper's petition for full party status, and specifically advanced Riverkeeper's proffered issues concerning radiological leaks at Indian Point to adjudication as well.[13] The

[9] *See generally* Riverkeeper's Petition for Party Status at 43-48.

[10] *See* Riverkeeper's Petition for Party Status at 39-43.

[11] In the Matter of the Application of Entergy Indian Point Unit 2, LLC and Entergy Indian Point Unit 3, LLC for a Water Quality Certificate Pursuant to Section 401 of the Federal Clean Water Act and Section 608.9 of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York, Ruling on Proposed Issues for Adjudication and Petitions for Party Status, DEC Application Nos. 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3) (December 13, 2010) (hereinafter "Issues Ruling").

[12] *See* Issues Ruling at 25-27, 29, 40.

[13] Issues Ruling at 44 ("Riverkeeper's petition for full party status is granted. . . With respect to issues 6A and 6B [i.e., Riverkeeper's issues concerning radiological leaks at Indian Point], as discussed above in connection with Entergy's threshold legal issues 2 and 3, and factual issue 2 [i.e., Entergy's issues concerning radiological considerations in the proceeding], Entergy's objections and legal arguments are insufficient to warrant excluding

Issues Ruling explained that since Riverkeeper had raised issues with respect to the topic of radiological considerations, "those issues will be considered as part of the adjudication of [the radiological issue contested by Entergy]."[14] This outcome was also memorialized in an "Issues List," published in conjunction with the Issues Ruling on December 13, 2010.[15]

For purposes moving forward to an adjudicatory hearing on the advanced adjudicable issues, the Indian Point CWA § 401 WQC appeal proceeding was, in a narrow respect, joined with an ongoing State Pollutant Discharge Elimination System ("SPDES") permit renewal proceeding concerning Indian Point, in particular, for the limited purpose of "develop[ing] a joint record . . . which in some instances will require an examination of evidence common to both proceedings."[16]

Following document discovery among the parties and the preparation and submission of pre-filed written testimony and supporting exhibits, adjudicatory hearings pertaining to radiological leakage issues at Indian Point commenced at DEC's Central Office in Albany, NY

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these issues. Consequently, they will also be adjudicated. . . . [Riverkeeper's] Issues 6A and 6B will be advanced to hearing.").

[14] Issues Ruling at 40.

[15] Entergy Nuclear Indian Point Units 2 and 3 Section 401 Water Quality Certification Proceeding, Issues List, December 13, 2010, at ¶ 3.

[16] *See* Memorandum from Maria E. Villa (Administrative Law Judge) to Service List, Re: Entergy Indian Point SPDES Proceeding/Section 401 Permit Proceeding (July 15, 2011) at 4. *See also* Issues Ruling at 8-9 (deciding to proceed to a hearing on certain 401 specific issues as well as certain "best-technology available" matters at issue in the Indian Point SPDES permit renewal proceeding); Status Teleconference Transcript (Jan. 6, 2011) at 26-27 ("MR. SANZA: . . . Have the proceedings in some sense or for some issues been joined or consolidated in some fashion and proceeding on a joint record for some of these things? . . . ALJ VILLA: Yeah, I mean I would say with respect to BTA at least, it looks as though there would have to be some sort of joint record, because there's no sense, at least in our view, in proceeding to do BTA and then doing it again. . . . So the notion here in the scheduling order is let's proceed with the things we can do in the water quality cert proceeding, for example, radiological materials, endangered species, thermal impacts, stuff like that, and it's my hope that as we proceed and the work gets done, we can just start folding these things in as we go forward. So I guess the answer to your question is yes to a limited extent, what we are developing is sort of a joint record."). To the extent the joining of the Indian Point CWA § 401 WQC appeal with the ongoing Indian Point SPDES permit renewal proceeding was anything more than administrative and for the purpose of creating a joint record, Riverkeeper filed an appeal, contesting the appropriateness of any perceived merger and consolidation of the two proceedings. *See* Appeal of Ruling on Proposed Issues for Adjudication and Petitions for Party Status by Riverkeeper, Inc., Scenic Hudson, Inc. and the Natural Resources Defense Council, Inc. (January 21, 2011).

on November 15, 2011, continued on November 16, 2011 and January 11, 2012, and concluded on January 23, 2012. The hearing consisted of pre-filed direct and rebuttal testimony, and live examination of five witnesses in the following order: Mr. Paul J. Kolakowski, P.E. for DEC Staff; Mr. Arnold Gundersen for Riverkeeper; a panel consisting of Mr. F. Owen Hoffman and Mr. Thomas C. Esselman for Entergy; and lastly, Mr. Matthew Barvenik for Entergy. The hearings resulted in a stenographic record of approximately 1,000 pages of transcript (inclusive of prefiled written testimony)[17] and 100 exhibits received into evidence.[18]

APPLICABLE LEGAL FRAMEWORK

I. The CWA § 401 Framework

The objective of the Clean Water Act ("CWA") is to restore and maintain the chemical, physical and biological integrity of the nation's waters.[19] The CWA is implemented via a system

[17] *See* In the Matter of: Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, For a State Pollution Discharge Elimination System Permit Renewal and Modification, DEC No.: 3-5522-00011/00004, SPDES No.: NY-0004472; Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. Joint Application for CWA § 401 Water Quality Certification, DEC App. Nos. 3-5522-00011/00030 (IP2), 3-5522-00105/00031, Transcript of Adjudicatory Hearing before Daniel P. O'Connell, ALJ, Maria E. Villa, ALJ, M-F Reporting, Inc. (November 15, 2011, pages 2654-2972; November 16, 2011, pages 2973-3070); In the Matter of: Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, For a State Pollution Discharge Elimination System Permit Renewal and Modification, DEC No.: 3-5522-00011/00004, SPDES No.: NY-0004472; Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. Joint Application for CWA § 401 Water Quality Certification, DEC App. Nos. 3-5522-00011/00030 (IP2), 3-5522-00105/00031, Transcript of Arbitration before Daniel P. O'Connell, ALJ, Maria E. Villa, ALJ, Reporter: Alan H. Brock, RDR, CRR, Farmer Arsenault Brock LLC (January 11, 2012, pages 3071-3344; January 23, 2012, pages 3895-4125).

The pagination of the transcripts in the adjudicatory hearings in the Indian Point CWA § 401 WQC appeal and SPDES permit renewal proceedings held to date have been continuous. Thus, reference to the pages, and where appropriate, line number(s) of the transcripts pertaining to the "Radiological" portion of the hearing (i.e., those referenced above) will herein simply be cited as "Tr. at __." However, while the pre-filed written testimony of DEC Staff and Riverkeeper's witnesses were included in the pagination of the stenographic transcripts, the pre-filed written testimony of Entergy's three witnesses was only appended to the end of the stenographic transcripts, and were not included in the pagination. This testimony will be referenced herein as follows: "Barvenik Prefiled Testimony (July 22, 2011) at __"; "Hoffman Prefiled Testimony (July 22, 2011) at __"; and "Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at __".

[18] *See* Exhibit Chart, Matter of Entergy Indian Point Units 2 and 3 – WQC/SPDES Proceeding, Cylindrical Wedge Wire Screens/Radiological/Best Usages, October 17-20, 24-28, 2011, November 15-16, 2011, January 11, 17-18, 23, 2012.

[19] Federal Water Pollution Control Act (Clean Water Act) [hereinafter cited as "CWA"] § 101(a), 33 U.S.C. § 1251(a).

of cooperative federalism which expressly recognizes, preserves and protects the primary responsibilities and rights of States to prevent, reduce and eliminate pollution.[20] The CWA defines pollution as "the man-made or man-induced *alteration* of the chemical, physical, and *radiological integrity* of water."[21] While the National Pollutant Discharge Elimination Permit System ("NPDES") program under CWA § 402 focuses on the regulation of "pollutants"[22] the CWA does not stop at controlling the "addition of pollutants," but deals with "pollution" generally in order to achieve its goals.[23] State-issued water quality certifications ("WQC") for federally-licensed activities "are essential in the scheme to preserve state authority to address the broad range of pollution." [24]

Section 401(a) of the CWA provides that

> [a]ny applicant for a Federal license or permit to conduct any activity including . . . which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate . . . that any such discharge will comply with the applicable provisions of sections 301, 302, 303, 306, and 307 of this title.[25]

The CWA sections referenced therein relate to various sets of standards for pollution, including those water quality standards that have been adopted and implemented by the State pursuant to the CWA.[26]

Water quality standards "are the State's goals for individual water bodies and provide the legal basis for control decisions under the Act [CWA]."[27] Thus, water quality standards "serve

[20] CWA § 101(b), 33 U.S.C. § 1251(b).

[21] CWA § 502(19); 33 U.S.C. § 1362(19) (emphasis added).

[22] CWA § 401, 33 U.S.C. § 1342.

[23] *S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 385 (2006) (quoting 33 U.S.C. § 1362(19)).

[24] *S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 383 (2006).

[25] CWA § 401(a), 33 U.S.C. § 1341(a).

[26] *See* CWA § 303, 33 U.S.C. § 1313.

the dual purposes of establishing the water quality goals for a specific water body" and serve as the regulatory basis for the establishment of water-quality-based treatment controls and strategies above and beyond the technology-based levels of treatment which are also required by the CWA.[28] Water quality standards serve to protect the public health or welfare, enhance the quality of water and serve the purposes of the CWA.[29]

Water quality standards consist of designated uses (that is, management goals) for waters and water quality criteria for such waters based upon such uses.[30] Water quality standards must also include a statewide antidegradation policy.[31] As New York's' Court of Appeals has explained,

> water quality standards are provisions of State and Federal law, which define the quality goals of a water body or some portion of it, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by incorporating an antidegradation policy *designed to prevent the gradual deterioration of the quality of the water body*.[32]

Designated uses are defined by EPA as "those uses specified in water quality standards for each water body or segment *whether or not they are being attained*."[33] Water quality standards must specify appropriate water uses to be achieved and protected, "taking into consideration the use and value of water for public water supplies, protection and propagation of

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[27] 40 C.F.R. § 130.0(b)

[28] 40 CFR § 131.2.

[29] 40 C.F.R. 130.2(d).

[30] 40 CFR 131.3(i).

[31] *PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 705 (1994) (citing 40 CFR § 131.12).

[32] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993); *See also Islander E. Pipeline Co., LLC v. Conn. Dep't of Envtl. Prot.*, 482 F.3d 79, 120 (2d Cir. 2006) ("In brief, the [antidegradation] policy requires that where water quality is better than the criteria established in the Water Quality Standards, such existing high quality must be maintained except under exceptional and very limited circumstances.").

[33] 40 C.F.R. § 131.3(f) (emphasis supplied).

fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation."[34] Waste transport or waste assimilation is not a permissible use of waters.[35] When designating uses of a water body and the appropriate criteria for those uses, the State must "take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters."[36] Criteria are elements of State water quality standards which may be expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use.[37] It is well-established that during an assessment pursuant to CWA § 401, the reviewing agency must ensure compliance not simply with numerical criteria, but also with the designated uses of the subject waterway.[38] Additionally, CWA § 510 authorizes states to ". . . adopt or enforce . . . any requirement

[34] 40 CFR §§ 131.10(a), 130.3

[35] 40 C.F.R. § 131.10(a).

[36] 40 CFR 131.10(b).

[37] 40 C.F.R. 131.3(b).

[38] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 714-15 (1994) (upholding a § 401 WQC condition requiring minimum stream flows necessary to ensure consistency with the designated use of the water body as fish habitat, finding that the certifying agency has to make sure that the project is "consistent with both components [of the WQS], namely the designated use and the water quality criteria."); *see also Chasm Hydro, Inc. v. New York State Dep't of Envtl. Conservation*, 14 N.Y.3d 27, 32 (N.Y. 2010) (acknowledging that consistency with designated uses is part of § 401 WQC); *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 197, 200-01 (N.Y. 1993) (acknowledging that water quality standards consist of both designated uses and numerical criteria, and that the state's job in a § 401 certification review is to ensure compliance with such water quality standards); *Port of Oswego Auth. v. Grannis*, 897 N.Y.S.2d 736, 739 (N.Y. App. Div. 2010) (acknowledging that § 401 WQC requires ensuring that waters will not be impaired for their best usages); *In re Application for a SPDES Permit by Mirant Bowline*, 2002 N.Y. ENV LEXIS 22, *46 (2002) (DEC, in the context of issuing a permit for an electric generating facility using a cooling water intake structure, acknowledging that EPA had recognized that under § 401, a state may impose requirements "necessary to ensure attainment of water quality standards, including *designated uses*, criteria, and antidegradation requirements.") (emphasis added); *In re Application of Erie Boulevard Hydropower, L.P., for a 401 Water Quality Certification for the School Street Project*, 2000 ENV LEXIS 88, *4 (2000) (acknowledging the holding in *PUD* that a State may impose conditions on 401 certifications insofar as necessary to enforce a designated use contained in the State's water quality standard); *In re Application for a SPDES Permit by Athens Generating Co.*, 2000 N.Y. ENV LEXIS 40, *94-95 (2000) (positively acknowledging the minimum stream flow requirement imposed to maintain a designated use upheld in *PUD*).

respecting control or abatement of pollution . . . so long as the requirement is not less stringent" than federal minimum requirements under the CWA.[39]

Subsection (d) of CWA § 401 goes on to provide that

> [a]ny certification provided under this section shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, under section 301 or 302 of this title, standard of performance under section 306 of this title, or prohibition, effluent standard, or pretreatment standard under section 307 of this title, and *with any other appropriate requirement of State law* set forth in such certification, and shall become a condition on any Federal license or permit subject to the provisions of this section.[40]

It is well-settled that CWA § 401(d) expands State authority to ensure compliance with any appropriate State standards beyond the specific requirements stemming from CWA.[41] Furthermore, the Supreme Court has also clarified that, read as a whole, CWA § 401 requires a finding that proposed activity as a whole, and not simply the discharge that triggered the review, will comply with all relevant standards.[42]

Thus, in a WQC proceeding, the certifying state must assure that the project activity will comply with all relevant State water quality standards (including designated uses of the subject

[39] CWA 510, 33 U.S.C. § 1370.

[40] CWA § 401(d), 33 U.S.C. §1341(d) (emphasis added).

[41] *PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711-13 (1994) ("state water quality standards adopted pursuant to [CWA] § 303 are *among* the 'other limitations' with which a State may ensure compliance through the § 401 compliance process."); *see also S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 386 (2006) (Congress provided the States with power to enforce ''any other appropriate requirement of State law,'' 33 U.S.C. § 1341(d), by imposing conditions on federal licenses for activities that may result in a discharge.").

[42] *PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711-12 (1994).

waterway) as well as "*any* other appropriate requirement of State law."[43] As such, once a CWA § 401 is triggered, "the scope of analysis and potential conditions can be quite broad."[44]

II. New York State WQC Framework

6 NYCRR § 608.9, entitled "water quality certifications" provides in pertinent part as follows:

> Water quality certifications required by Section 401 of the Federal Water Pollution Control Act, Title 33 United States Code 1341 (see subdivision (c) of this Section). Any applicant for a federal license or permit to conduct any activity, including but not limited to the construction or operation of facilities that may result in any discharge into navigable waters as defined in Section 502 of the Federal Water Pollution Control Act (33 USC 1362), must apply for and obtain a water quality certification from the department. The applicant *must demonstrate compliance with* Sections 301-303, 306 and 307 of the Federal Water Pollution Control Act, as implemented by the following provisions:
>
> (1) effluent limitations and water quality-related effluent limitations set forth in Section 754.1 of this Title;
> (2) *water quality standards* and thermal discharge criteria set forth in Parts 701, 702, 703 and 704 of this Title;
> (3) standards of performance for new sources set forth in Section 754.1 of this Title;
> (4) effluent limitations, effluent prohibitions and pretreatment standards set forth in Section 754.1 of this Title;
> (5) prohibited discharges set forth in Section 751.2 of this Title; and
> (6) *state statutes, regulations and criteria otherwise applicable to such activities*.[45]

Thus, "[t]he granting of a water quality certification pursuant to 6 NYCRR 608.9 . . . is a function of the Applicant's ability to demonstrate compliance with applicable federal and State

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[43] 33 U.S.C. § 1341(d) (emphasis added); *see also PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711-13 (1994); *S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 386 (2006).

[44] EPA, Office of Wetlands, Oceans, and Watercheds, *Clean Water Act Section 401 Water Quality Certification: A Water Quality Protection Tool for States and Tribes* (April 2010 Interim), http://water.epa.gov/lawsregs/guidance/cwa/upload/CWA_401_Handbook_2010_Interim.pdf (hereinafter "EPA 401 Water Quality Protection Tool"); *see also S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 386 (2006) ("State certifications under § 401 are essential in the scheme to preserve state authority to address [a] broad range of pollution.").

[45] 6 NYCRR § 608.9(a) (emphasis added).

laws and regulations,"[46] and the inquiry broadly addresses whether the activity at issue "could" violate water quality standards.[47] In the context of a CWA § 401 WQC proceeding, DEC has explained that

> All provisions of the Environmental Conservation Law ["ECL"] and all the rules and regulations thereunder which relate to the prevention, reduction and elimination of pollution, as well as the development and use of land and water resources constitute "more stringent limitation[s] . . . established pursuant to any State law or regulation (under authority preserved by Section 510) . . . or required to implement any applicable water quality standard established pursuant to this Act (Section 301[b][1][C])".[48]

Notably, New York's ECL broadly prohibits any addition of materials to waters of New York State that would cause or contribute to a violation of water quality standards.[49]

III. DEC Staff's Legal Authority to Ensure Radioactive Leaks Comply with New York State Water Quality Standards and Other Applicable State Laws

Throughout the Indian Point CWA § 401 proceeding, Entergy has maintained an untenable position that DEC does not have the legal authority to premise a denial of a WQC based upon accidental radiological leaks into New York State waters. In particular, Entergy misguidedly asserts that (1) DEC is preempted from "regulating" such releases by the Federal government, which Entergy maintains "occupies the field of regulatory authority over radiological discharges from NRC-licensed nuclear power plants"; and that (2) Atomic Energy

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[46] *In the Matter of the Application of Seven Springs, LLC*, No. 3-5599-00041/00001, Ruling on Issues and Party Status (August 23, 2002) 2002 N.Y. ENV LEXIS 42 (N.Y. ENV 2002) at *96

[47] *In the Matter of the Investigatory Proceeding pertaining to operation of the CID Landfill*, Determination of the Commissioner (August 6, 1987) 1987 N.Y. ENV LEXIS 14 (N.Y. ENV 1987) at *121.

[48] *Matter of the Application of the Power Authority of the State of New York, for the Issuance of a Certification for the Construction and Operation of a Proposed Pumped Storage Project Near Breakabeen, Schoharie County, New York*, Commissioner's Direction to the Hearing Officer With Respect to Jurisdiction and Scope of Hearing (March 22, 1974), at 5.

[49] NYS ECL § 17-0501; *see also Atlantic States Legal Found. v. Eastman Kodak Co.*, 1993 U.S. App. LEXIS 35911 (2d Cir. N.Y. 1993) ("Water quality-based limits are established where the permitting authority reasonably anticipates the discharge of pollutants by the permittee at levels that have the *reasonable potential* to cause or contribute to an excursion above any state water quality criterion . . . .") (emphasis added).

Act ("AEA") materials do not fall within the regulatory sphere of a CWA § 401 WQC inquiry, since they are excluded from the definition of "discharge of a pollutant" under the CWA.[50] The Issues Ruling squarely rejected Entergy's unpersuasive arguments and found that it was appropriate to proceed to a hearing on the factual issues concerning radiological leaks at Indian Point.[51] However, to the extent Entergy continues to espouse these two "threshold legal" issues, Riverkeeper reiterates its position with respect to these matters, as follows.

A. Applying Relevant State Standards To Releases of Radioactive Materials into Groundwater and the Hudson River does not Constitute Regulation Under Independent State Law Authority and, Thus, is not Preempted by Federal Law

While direct state regulation of radiological hazards from nuclear facilities is preempted by federal law, application of relevant State standards under CWA § 401 in a federal licensing proceeding does not constitute direct regulation of nuclear facilities and, thus, is not preempted by federal regulations; even in an area of regulation typically preempted by federal law.[52]

As an initial matter, the field of federal preemption is not exhaustive. In fact, *the NRC itself* acknowledges that it does not have "expansive preemptive authority that it can exercise unilaterally."[53] For example, in relation to accidental radioactive releases, the federal agency readily observes: "*[t]he NRC has certainly never denied that States have some authority over groundwater*."[54] Moreover, Supreme Court precedent clearly indicates that states are not

[50] Entergy's Hearing Request at 8-10. But, as noted, the CWA broadly authorizes states to control "pollution" which is defined to include the alteration of the radiological integrity of water. CWA § 502(19), 33 U.S.C. § 1362(19). In any event, "pollutant" is defined under New York law to include radioactive materials. ECL § 17-0105(17).

[51] Issues Ruling at 25-29.

[52] *See, e,g,, PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711 (1994); *N. States Power Co. v. Minn.*, 447 F.2d 1143, 1154 (1971), *aff'd*, 405 U.S. 135 (1972); *Karuk Tribe of N. Cal. v. Cal. Reg'l Water Quality Control Board, N. Coast Region*, 183 Cal.App.4th 330, 359-360, 108 Cal.Rptr.3d 40, 65 (Cal. Ct. App. 2010).

[53] *See* Letter from Stephen G. Burns (General Counsel, NRC) to Jim Riccio (Nuclear Policy Analyst, Greenpeace) (July 9, 2010) at 2. This letter was introduced into the record of the proceeding in support of Riverkeeper's Petition for Party Status, and provided to all the parties, after it was discussed during the Issues Conference held on July 21, 2010.

[54] *Id.* at 1 (emphasis added).

preempted from regulating a nuclear facility in areas of traditional state concern that Congress did not intend the AEA to cover.[55]

An accurate reading of the law further indicates that states are only preempted from the *direct* regulation of radiological hazards of nuclear facilities. Courts generally hold that states are preempted from regulating nuclear facilities with respect to radiological health and safety.[56] Courts have found state health and environmental standards preempted, however, only where a state attempts to directly enforce health and environmental regulations based on independent state authority, such as when a State tries to directly impose radioactive discharge limits.[57] Courts, however, have recognized a distinction between regulation under independent state authority and application of state water quality standards in the context of a federal licensing proceeding.[58]

In general, courts have recognized a distinction between State attempts to enforce State health and safety regulations for radiation hazards versus States applying incidental regulatory

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[55] For example, Courts have upheld state regulation of nuclear plants when the state was regulating for economic purposes, and when the situation involved tort law principles. *See Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n*, 461 U.S. 190, 205, 216 (1983) (upholding statute requiring a state agency determination that there was sufficient storage for spent fuel before any new nuclear facilities were built because the State had passed the statute for economic reasons and not safety concerns, and so it fell within the states' traditional authority "of regulating utilities for determining questions of need, reliability, cost, and other related state concerns."); *see also Silkwood v. Kerr-McGee Corp.*, 464 U.S. 238, 258 (1984) (holding that principles of state tort law were not preempted by the AEA and that punitive damages could be awarded in a tort action for injuries caused by radiological contamination at a NRC-licensed facility).

[56] *See, e.g., Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n*, 461 U.S 190, 216, 103 S. Ct. 1713, 1728 (1983); *N. States Power Co. v. Minn.*, 447 F.2d 1143, 1154 (1971), *aff'd*, 405 U.S. 135 (1972).

[57] *See, e.g., United States v. City of New York*, 462 F. Supp. 604, 604-07, 14 (S.D.N.Y. 1978) (city attempted to force a university to obtain an additional permit from the city Department of Health after it had already received an operating license from the NRC; court held that the city was preempted from requiring additional licensing procedures with regard to radiological health and safety); *N. States Power Co. v. Minn.*, 447 F.2d 1143, 1154 (1971), *aff'd*, 405 U.S. 135 (1972) (court holding that federal regulations preempted a State's efforts to condition a state waste disposal permit for a nuclear power plant on compliance with radioactive discharge restrictions significantly stricter than the NRC requirements).

[58] *See, e.g., PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711 (1994); *Karuk Tribe of N. Cal. v. Cal. Reg'l Water Quality Control Board, N. Coast Region*, 183 Cal.App.4th 330, at 340 n.6, 359-60, 108 Cal.Rptr.3d 40, 65 (Cal. Ct. App. 2010).

pressure related to federally approved state standards.[59] Under *PUD No. 1*, states have substantial authority to condition a federal license on state standards in a § 401 certification, even in areas of regulation where the federal government typically retains exclusive authority.[60] New York case law supports this point. In two decisions regarding CWA § 401 certifications for hydroelectric plants, New York courts have held that, although the federal government typically retains exclusive regulatory authority for hydroelectric projects, states may impose state water quality standards within the context of a § 401 WQC proceeding.[61]

A California administrative board decision, whose reasoning was cited in a California appeals court decision, has recognized the distinction between federally preempted state regulation and the application of state water quality standards in a § 401 proceeding.[62] In particular, this board distinguished state water quality standards applied in the context of a federal licensing proceeding from direct state regulation.[63] The board explained that "[f]or purposes of federal preemption analysis, the substantive requirements of state law applied

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[59] *See Goodyear Atomic Corp. v. Miller*, 486 U.S. 174, 186, 108 S. Ct. 1704, 1712 (1988) (holding that a state worker's compensation statute applied to nuclear facilities, explaining that "Congress may reasonably determine that incidental regulatory pressure is acceptable, whereas direct regulatory authority is not."); *Karuk Tribe of N. Cal. v. Cal. Reg'l Water Quality Control Board, N. Coast Region*, 183 Cal.App.4th 330, at 340, 359-60, 108 Cal.Rptr.3d 40, 65 (Cal. Ct. App. 2010). New York State water quality standards are enacted by the State and approved by the EPA pursuant to § 303 of the CWA and applied in the federal licensing process pursuant to § 401 of the CWA.

[60] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711 (1994) (Supreme Court holding that § 401(d) expands state authority to enforce any appropriate state water quality standards beyond the specific requirements of the Clean Water Act in the context of a relicensing proceeding for a hydroelectric plant); *see also S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 386 (2006) ("State certifications under § 401 are essential in the scheme to preserve state authority to address [a] broad range of pollution.").

[61] *See Chasm Hydro, Inc. v. New York State Dept. of Envtl. Conservation*, 14 N.Y.3d 27, 30 (2010); *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 197, 200-01 (N.Y. 1993).

[62] *See Karuk Tribe of N. Cal. v. Cal. Reg'l Water Quality Control Board, N. Coast Region*, 183 Cal.App.4th 330, at 340 n.6, 340 n.6, 336-37, 359-60, 108 Cal.Rptr.3d 40, 65 (Cal. Ct. App. 2010) (reviewing administrative board denying petition to force board to regulate waste discharge from a large hydroelectric project on the Klamath River, stating the State was preempted from regulating hydroelectric dams by the Federal Power Act).

[63] *See id.* at 340 n.6 (reasoning relying on *S.D. Warren* and *PUD No. 1*)

through the water quality certification analysis become requirements of federal law."[64] The board analogized WQC for hydroelectric plants to state agency recommendations during a federal licensing process, except that in the context of a WQC the state conditions are binding on the federal agency.[65] The board recognized that, in a federally preempted area, states have a narrow procedural window to apply state conditions, but within that window a "state has broad authority to deny or condition certification based on federal or state water quality requirements."[66] The court in *Karuk Tribe*, after citing the above reasoning by the California administrative board, aptly explained:

> A determination of federal preemption does not automatically mean that state input is categorically prohibited and state opinion of no consequence. The Clean Water Act gives states what appears to be a very substantial role by requiring that an applicant for any federal license comply with state water quality procedures . . . . It is only when states attempt to act outside of this *federal* context and this *federal* statutory scheme under authority of independent state law that such collateral assertions of state power are nullified.[67]

Similarly, denying or conditioning Entergy's Application for WQC based upon concerns regarding radioactive contamination in groundwater and the Hudson River is appropriate, since the reviewing agency, DEC, is simply applying state standards in the context of a federal licensing process, not "regulating" radiation hazards or radiological health and safety at Indian Point under independent state authority. Indeed, properly applying relevant State standards in a CWA § 401 WQC proceeding is in no way an attempt to independently exert control over the operation of Indian Point. To the contrary, Entergy affirmatively applied for a WQC, in essence

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[64] *Id.* at 340 n.6.

[65] *See id.*

[66] *Id.*

[67] *Id.* at 359-60 (emphasis in original).

asking for a determination about Entergy's compliance with state water quality standards. Such an inquiry, brought on at Entergy's own request, can in no way, shape, or form reasonably be considered to be direct regulation of a nuclear power plant.

The Issues Ruling reflects the correct understanding of DEC's authority to consider radiological leaks in the context of the Indian Point WQC proceeding. In particular the ruling indicated that "it is an open question whether a State would be preempted from denying a Section 401 WQC based upon leaks of radiological materials from a facility such as Indian Point. Research has not revealed, and the parties have not cited any authority, establishing *that* proposition."[68] The Issues Ruling emphasized that radiological leaks from Indian Point are not necessarily "incident to" the operation of the plant or a "regulated" discharge, and, further, that DEC Staff's denial of a WQC was not tantamount to the regulation of effluent discharge levels for radiological materials.[69] The Issues Ruling, therefore, found that Entergy's position concerning Federal preemption was "not dispositive," and advanced the factual issue to adjudication.[70]

B. State Standards Apply to AEA Materials in the Context of a CWA § 401 Proceeding Notwithstanding the Fact that the CWA Definition of "Discharge of a Pollutant" Does Not Include Such Materials

The fact that the Supreme Court has held that the meaning of discharge of a "pollutant" under the CWA does not include AEA (radiological materials), does not preclude the application of any relevant State standards to radiological leaks at Indian Point in the context of a CWA § 401 WQC proceeding. As an initial matter, it is a mischaracterization to say that radiological

[68] Issues Ruling at 25-26 (emphasis added).

[69] Issues Ruling at 26.

[70] Issues Ruling at 25-27.

materials do not fall within the regulatory sphere of the CWA in any way.[71] In fact the term "pollution" under the CWA is defined as "the man-made or man-induced *alteration* of the chemical, physical, and *radiological integrity* of water."[72] Similarly, New York law defines "pollutant" more broadly than does the CWA, to include "radioactive materials."[73]

Nevertheless, the CWA § 401 inquiry applies to the "activity" the applicant is pursuing, not merely the discharge which triggered the review.[74] In addition, such a narrow view of the scope of a WQC inquiry is completely inconsistent with CWA § 401(d), which explicitly states that applicants must comply with "any other appropriate requirement of State Law . . . and [such requirements] shall become a condition on any Federal license or permit subject to the provisions of this section."[75] Nor does such a narrow view comport with New York State's regulation implementing CWA § 401, which similarly requires certification applicants to "demonstrate compliance" with "state statutes, regulations and criteria otherwise applicable to such activities."[76] Indeed, the Supreme Court has interpreted § 401(d) as *expanding* state authority to impose water quality standards beyond those specifically enunciated in the CWA.[77]

In addition, State water quality standards established pursuant to § 303 of the CWA are appropriate state standards to apply in a § 401 certification.[78] CWA § 303 requires that States enunciate designated usages for water sources and apply an anti-degradation policy aimed to

[71] *See* Entergy's Hearing Request at 10.

[72] CWA § 502(19); 33 U.S.C. § 1362(19) (emphasis added).

[73] *See* New York State Environmental Conservation Law ("ECL") § 17-0105(17); 6 NYCRR § 750-1.2(a)(66).

[74] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 712 (1994).

[75] CWA § 401(d), 33 U.S.C. § 1341(d).

[76] 6 NYCRR § 608.9(a)(6).

[77] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711 (1994).

[78] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 713 (1994).

ensure that the state's waters are not adversely affected for the specified usages.[79] It is completely appropriate to apply State water quality standards, including assigned designated uses, explicitly promulgated pursuant to § 303 of the CWA, to radioactive leaks that impact New York State waters.[80]

The Issues Ruling likewise determined that the exclusion of AEA materials from the definition of "discharge of a pollutant" does not preclude consideration of radiological leaks at Indian Point in a CWA § 401 WQC proceeding. In particular, the tribunal clarified that the case law articulating this exclusion "was directed to the discharge of effluent, rather than a circumstance where the focus is on leaks of radioactive substances" and concluded that "it cannot be said that uncontrolled, unintentional releases of radioactive material to the environment are analogous to a permitted discharge of radioactive effluent."[81] The Issues Ruling, therefore, found that Entergy's position concerning the regulatory scope of the CWA was "not dispositive," and advanced the factual issue to adjudication.[82]

IV. Burden and Standard of Proof

DEC regulations provide that in "hearings conducted by the department arising out . . . a request made by an applicant . . . based on department staff's denial of permit,"[83] the "applicant has the burden of proof to demonstrate that its proposal will be in compliance with all applicable laws and regulations administered by the department."[84] The standard of proof the applicant must rise to is also established by regulations: "[w]henever factual matters are involved, the

[79] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 714-18 (1994).

[80] *Matter of Eastern Niagara Project Power Alliance v. New York State Dept. of Envtl. Conservation*, 42 A.D.3d 857 (N.Y. App. Div. 3d Dep't 2007).

[81] Issues Ruling at 29.

[82] Issues Ruling at 29.

[83] 6 NYCRR 624.1(a)(2).

[84] 6 NYCRR 624.9(b).

party bearing the burden of proof must sustain that burden by a preponderance of the evidence."[85]

As discussed above, CWA § 401 dictates that the applicant's proposed activity must comply with all relevant State water quality standards and other appropriate State requirements. Thus, an applicant for a WQC from DEC must carry the burden of showing that the proposed activity complies with all such applicable requirements. This is recognized and memorialized in DEC regulations, which mirror the language of CWA § 401, and also require that a WQC applicant "must demonstrate compliance" with relevant state standards.[86] The clear language of DEC's controlling regulation dictates that applicants must make an affirmative showing of compliance, as opposed to a lesser showing of "reasonable assurance" or compliance.[87]

ADJUDICABLE ISSUE

With respect to radiological leaks at Indian Point, in view of the fact that Entergy contested a matter cited by DEC Staff as a basis for denial of the CWA § 401 WQC application, pursuant to 6 NYCRR § 624.4(c)(1)(ii), the Issues Ruling advanced the issue to adjudication, as follows: "The issue to be adjudicated is whether Department Staff properly denied the WQC application based upon radiological considerations."[88] Consistent with the extensive scope of the CWA § 401 inquiry, as discussed above, this broadly articulated issue necessarily involves an

[85] 6 NYCRR 624.9(c).

[86] 6 NYCRR § 608.9(a).

[87] In this regard, Riverkeeper notes, as matter of plain meaning of language, that merely providing a "reasonable assurance" of compliance with water quality standards is a less stringent standard than the requirement that an applicant "must demonstrate compliance" in order to satisfy 6 NYCRR § 608.9(a). The "reasonable assurance" standard, on the other hand is the standard from 40 C.F.R. § 121.24, which is contained in Subpart C of 40 CFR Part 121 and applies to certifications made by EPA rather than a State. Accordingly, providing a "reasonable assurance" of compliance with water quality standards is not only a less stringent standard than the requirement to "demonstrate compliance" with water quality standards, the "reasonable assurance" standard is the federal standard and not the New York State standard for the issuance of a CW A § 40 I WQC.

[88] *See* Issues Ruling at 40; *see also* Issues List at ¶ 3.

assessment of whether radiological leaks at Indian Point violate, or could violate, any applicable State standards, thus warranting denial of Entergy's Application for WQC.

The Issues Ruling also explicitly recognized that "Riverkeeper . . . raised issues with respect to this topic, and *those issues will be considered* as part of the adjudication of this issue."[89] In particular, as characterized by the Issues Ruling, Riverkeeper Issue 6A raised the issue of whether "radioactive materials in the groundwater will violate the State narrative standards that provides that deleterious substances may not impair waters for their best usages, which in the case of Indian Point's groundwater, is as a potable water supply."[90] Riverkeeper Issue 6A maintained "that failure to ensure compliance with this water quality standard supports Department Staff's denial, or at a minimum, the imposition of conditions to ensure compliance with NYWQS."[91] As characterized by the Issues Ruling, Riverkeeper Issue 6B "raised similar arguments [as that of DEC Staff in the Notice of Denial], asserting that the leaking of deleterious substances (specifically, radioactive materials) could impair the waters of the Hudson River for their best usages for primary contact recreational activities."[92] The Issues Ruling recognized that Riverkeeper Issues 6A and 6B were appropriate and consistent with CWA § 401 case law, since these issues questioned whether the proposed action (i.e. license renewal of Indian Point) would be "inconsistent with one of the designated uses of the water."[93]

[89] Issues Ruling at 40 (emphasis added).

[90] *See* Issues Ruling at 44; Riverkeeper's Petition for Party Status at 39-43.

[91] *See* Issues Ruling at 44; Riverkeeper's Petition for Party Status at 42.

[92] *See* Issues Ruling at 44; Riverkeeper's Petition for Party Status at 43-48.

[93] *See* Issues Ruling at 44 (citing *Chasm Hydro, Inc. v. New York State Dept. of Envtl. Conservation*, 14 N.Y.3d 27, 32 (N.Y. 2010) and *PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 714-15 (1994)).

The Issues Ruling specifically ruled that Riverkeeper's Issues 6A and 6B, "will also be adjudicated."[94] The ruling explained that "Riverkeeper seeks to adjudicate a *similar* question" to that cited by DEC Staff and contested by Entergy relating to "the nature, scope and impact of radiological contamination at the Facilities" and that "[t]herefore, Issues 6A and 6B *will be advanced to hearing*."[95] Thus, the similar, yet not identical, issues raised by Riverkeeper pertaining to radiological considerations in the proceeding were clearly deemed adjudicable. This is also reflected in the Issues List, which listed Riverkeeper Issue Nos. 6A and 6B underneath the stated umbrella issue for adjudication concerning "Radiological Materials."[96]

Based on the foregoing, the law of the case dictates that Riverkeeper's proffered issues concerning radiological leaks at Indian Point are adjudicable issues that require consideration and resolution prior any final determination on Entergy's appeal of DEC Staff's Notice of Denial. Moreover, a subsequent ruling by the ALJ confirmed that "[w]ith respect to Riverkeeper's Section 401 WQC issues, the issues as identified in the Issues Ruling are intended to include consideration of the topics articulated in Riverkeeper's petition."[97]

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[94] Issues Ruling at 44.

[95] Issues Ruling at 44 (emphasis added).

[96] *See* Issues List ¶ 3.

[97] *See* Memorandum from Maria E. Villa (Administrative Law Judge) to Service List, Re: Entergy Indian Point SPDES Proceeding/Section 401 Permit Proceeding (July 15, 2011). This ruling unequivocally clarified the relevant scope of the adjudicable issues in the proceeding, which had been the subject of various exchanges between the parties and the tribunal. In particular, statements by ALJ Villa made subsequent to the issuance of the Issues Ruling, during Status Teleconference calls among the parties, attempted to clarify the scope of issues to be adjudicated in the proceedings. On a conference call convened on January 6, 2011, Judge Villa elucidated that for the sake of simplicity, "[t]he issue [to be adjudicated] is what I've put on the issues list." Transcript of Status Teleconference, Jan. 6, 2011, Volume A, at 32. Judge Villa further explained that the Issues List "is taking into account that this issue was raised by a particular party, and that is intended to *encompass* the issues that that party raised with respect to that." Transcript of Status Teleconference, Jan. 6, 2011, Volume A, at 32 (emphasis added). According to Judge Villa, the issues for adjudication articulated in the Issues List was her effort to "just try[] to keep it simple and say okay, here is an issue that several parties flagged, here is how we are going to go after it, and that's the notion." Transcript of Status Teleconference, Jan. 6, 2011, Volume A, at 33. During a later status call held on May 19, 2011, Judge Villa once again indicated that "[w]ith respect to the statement of the issues in the issues ruling, and that's the issues that are enumerated on the list at the end of the issues ruling, I think I've stated before that those are the issues that will be adjudicated" and that "from my perspective and for our purposes now going forward . . . the issue is as I

In accordance with the foregoing, the adjudicable issue concerning radiological leaks at Indian Point is: "whether Department Staff properly denied the WQC application based upon radiological considerations." This issue necessarily includes a broad inquiry into whether radiological leaks at Indian Point will comply with any relevant State standards during the proposed extended operating period, including, but not limited to, those specifically identified in Riverkeeper's Petition for Party Status, which were advanced by the tribunal: (1) whether the radiological leaks cause, or will cause, or contribute to, inconsistency with the best use of the groundwater at Indian Point for potable purposes, and (2) whether the radiological leaks cause, or will cause, or contribute to inconsistency with the best uses of the Hudson River.

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have framed it." Transcript of Status Teleconference, May 19, 2011, Volume F, at 14-15. However, it remained clear that the tribunal's position would not foreclose the adjudication of the particular concerns raised by Riverkeeper related to radiological leaks at Indian Point, since the Issues Ruling clearly advanced Riverkeeper's issues, and, in any event, the broadly stated issue clearly encompassed the concerns raised by Riverkeeper regarding whether DEC Staff's WQC denial properly considered whether Indian Point would comply with all relevant standards in light of radiological leaks. Judge Villa's July 15, 2011 ruling once again confirmed the fact that Riverkeeper's particular concerns and issues had been advanced to adjudication. In any event, the failure to allow consideration of each of Riverkeeper's advanced issues would deprive Riverkeeper of the rights conferred upon it as a full party in the proceedings, including the right to "present relevant evidence" and to "present argument on issues of law and fact." *See* 6 NYCRR § 624.5(e) (conferring the rights to "participate as the hearing . . . present relevant evidence and to cross-examine witnesses . . . present argument on issues of law and fact . . ."). Thus, Riverkeeper has the right to provide supporting evidence and argument on matters that have been advanced to adjudication, whether they were matters raised by Riverkeeper or otherwise. As Riverkeeper has properly raised issues related to "radiological considerations," such issues cannot be disposed of based upon DEC Staff's position, or lack thereof, on such concerns. An analogous and instructive situation is that of intervenors and third-parties in judicial proceedings, where properly raised claims cannot be simply disposed of based upon other parties' resolution of the issues. *See, e.g. Local Number 93, Intern'l Assoc. of Firefighters, etc. v. Cleveland*, 478 U.S. 501, 528-529 (U.S. 1986) ("A court's approval of a consent decree between some of the parties therefore cannot dispose of the valid claims of nonconsenting intervenors; if properly raised, these claims remain and may be litigated by the intervenor"); *South Carolina v. North Carolina*, 130 S. Ct. 854, 875 (U.S. 2010) (Hon. Chief J. Roberts Dissenting) ("Intervenors do not come alone -- they bring along more issues to decide . . . . In particular, intervention makes settling a case more difficult, as a private intervenor has the right to object to a settlement agreement between the States, if not the power to block a settlement altogether.").

FACTS

The record compiled on the adjudicable matter at issue reveals the following pertinent facts, which the tribunal should accept as "findings of fact."[98]

I. Spent Fuel Pool Leaks at Indian Point

Spent nuclear fuel at Indian Point has been and continues to be stored on racks in "spent fuel pools" (hereinafter "SFP") that are 33 feet by 36 feet wide, and 40 feet deep. Tr. at 3163:17-23, 3164:1-3 (Esselman by Rvk). The SFPs associated with Indian Point Units 1 and 2 have both experienced radioactive water leaks and have caused and continue to cause groundwater and surface water contamination, as follows:

A. Indian Point Unit 2 SFP Leaks

The Indian Point Unit 2 SFP first leaked radioactive water to the environment in the 1990s. Exh. Entergy 33 at viii; Tr. at 3965:9-11 (Barvenik by Rvk). In particular, "historic damage in 1990 to the SFP liner" resulted in the release of tritium to the environment. Exh. Entergy 33 at viii; Tr. at 3965:9-11 (Barvenik by Rvk). According to Entergy, this leak was discovered and repaired in 1992. Exhs. Entergy 33 at viii; Riverkeeper 12. Subsequently, in 2005, during the course of an excavation project, Entergy discovered additional radioactive water leaks from the Unit 2 SFP. Barvenik Prefiled Direct Testimony (July 22, 2011) at 7:20-23, 8:1-2; Tr. at 3912:-18-23 (Barvenik Direct); Tr. at 2828:12-13 (Gundersen Direct). Specifically, Entergy discovered three "hairline cracks" in the Unit 2 SFP wall. Barvenik Prefiled Direct Testimony (July 22, 2011) at 7:21-23, 8:1-2. It remains unclear when precisely when these leaks commenced. Tr. at 3949:23, 3950:1-3, 12, 15-17 (Barvenik by DEC).

[98] 6 NYCRR § 624.13(a)(1) ("The ALJ will submit a hearing report to the commissioner within 45 days after the close of the record. The report must include findings of fact, conclusions of law and recommendations on all issues before the ALJ.")

The discovery of ongoing leaks from the Unit 2 SFP prompted Entergy to hire GZA, GeoEnvironmental, Inc. (hereinafter "GZA") to conduct a hydrogeologic assessment and install monitoring wells at the Indian Point site. Exh. Entergy 33 at viii, 4; Barvenik Prefiled Direct Testimony (July 22, 2011) at 12:2-4, 19-20. GZA's investigation revealed the existence of a contamination plume consisting of tritium, which GZA attributed to the Indian Point Unit 2 SFP leaks. Exh. Entergy 33 at viii; Barvenik Prefiled Direct Testimony (July 22, 2011) at 5:22-23, 6:1.

In September 2007, during the course of the site investigation, GZA discovered an additional leak in the Unit 2 SFP: a pinhole defect in the stainless steel liner of the transfer canal. Exh. Entergy 33 at viii; Barvenik Prefiled Direct Testimony (July 22, 2011) at 8:9-13; Tr. at 2828:23-25 (Gundersen Direct). GZA was never able to determine with certainty how long this leak had been ongoing, or when it started. Tr. at 3952:8-12, 20-21 (Barvenik by DEC). According to Entergy, by December 2007, "all *then-identified* imperfections in the IP2 SPF" had been repaired. Barvenik Prefiled Direct Testimony (July 22, 2011) at 8:16-17; Tr. 3967:5-13, 16-19 (Barvenik by Rvk).

However, in 2010, Entergy discovered another active leak source from the Unit 2 SFP: "a leak path from light boxes near the top of the SFP, allowing water to get behind the stainless steel liner plates." Barvenik Prefiled Direct Testimony (July 22, 2011) at 11:7-9. This new leak path contributed additional tritium to the existing contamination plumes in the groundwater. Barvenik Prefiled Direct Testimony (July 22, 2011) at 11:3-4. While a temporary repair has been applied, a permanent repair has yet to occur. Barvenik Prefiled Direct Testimony (July 22, 2011) at 11:9-11; Tr. at 3969:5-8 (Barvenik by Rvk).

Furthermore, the evidence adduced at the hearing indicates that the Unit 2 SFP may still be actively leaking. GZA's 2008 investigation report states that "[w]ater likely remains between the Unit 2 SFP stainless steel liner and the concrete walls, and thus additional active leaks can not be completely ruled out." Exh. Entergy 33 at ix. It is additionally undisputed that a large portion of the Unit 2 SFP liner has never been inspected. Tr. at 2853:12-16 (Gundersen Rebuttal); Ex. Riverkeeper 44 at p.1-134; Tr. at 3970:12-19 (Barvenik by Rvk); Tr. at 3169:3-6 (Esselman by Rvk). According to the NRC, as documented in a Safety Evaluation Report pertaining to the license renewal of Indian Point, in 2007, Entergy completed "a *one-time* inspection of the *accessible* 40 percent of the SFP liner above the fuel racks." Ex. Riverkeeper 44 at p.1-134 (emphasis added). Entergy's witness Dr. Esselman did not dispute this, and explained that the fuel racks

> . . . are in the bottom of the pool. . . They are close to the sides of the wall, and where they are at the side of the wall and below the racks has not been inspected. . . . It's just that the racks are up against the side – they're close to the side of the wall, within 1 ½ or 2 inches of the side of the wall."

Tr. at 3163:11-14, 3164:1-7, 3165:5-9, 3169:3-6 (Esselman by Rvk). Entergy's witnesses, Dr. Esselman and Mr. Barvenik, both agree, and do not dispute that there may be active leaks in the uninspected portion of the Unit 2 SFP. Tr. at 3953:9-15 (Barvenik by DEC); Tr. at 3969:17-21, 22-23, 3971:1-5, 4-10, 4042:14-20 (Barvenik by Rvk); Tr. at 3162:20-22, 3165:10-12, 3170:11-15 (Esselman by Rvk).

In fact, according to Entergy, there were "there are hundreds of indications that would be considered unacceptable and potential leak paths by any welding standard, in the areas we have examined so far. I would not expect the quality of the floor plates or exposed wall sections to be any different." Exh. Riverkeeper 24 at 2. GZA's most recent quarterly groundwater monitoring

report in the record (pertaining to the second quarter of calendar year 2010 and dated February 11, 2011), also indicate that active leaks may exist in the uninspected portion of the Unit 2 SFP:

> [GZA's] analyses cannot definitively and completely rule out the possibility of a remaining small leak which could then also be supplying Tritium to the groundwater flow regime in addition to the Retention Mechanism(s) and surface spill from the process skid discussed above. While it is not possible to quantify the size of the minimum detectable leak with any degree of certainty, we believe that the maximum leak rate from the Unit 2 SFP that could potentially remain undetected by the groundwater monitoring system is less than 10 to 30 gpd (0.007 to 0.021 gallons per minute).

Exh. Riverkeeper 21 at p.1-3. Entergy's witness, Mr. Barvenik, further acknowledges that notwithstanding the size of any active leak mechanism, any active leaks do in fact contribute radionuclides to the groundwater. Tr. at 3970:6-10 (Barvenik by Rvk).

The record reflects that Entergy has expressed no intention or plans to conduct a full inspection of the Unit 2 SFP liner, or to proactively find and repair any active leaks that are suspected. Tr. at 3970:20-23, 3971:1-3 (Barvenik by Rvk); Tr. at 3173:1-6 (Esselman by Rvk). As NRC has explained, Entergy only committed to and completed a "one-time" inspection of the limited accessible portion of the Unit 2 SFP liner. Exh. Riverkeeper 44 at p.1-134. GZA has "certainly not been contracted to" "perform an inspection of 100 percent of the spent-fuel pool liner." Tr. at 3970:20-23, 3971:1-3 (Barvenik by Rvk). Dr. Esselman similarly confirmed that "[t]here is currently no plan for additional inspection of the liner of the pool." Tr. at 3173:1-6 (Esselman by Rvk).

Although Entergy has indicated that "[a]s a last-choice option, fuel could be shuffled to free a fuel rack one at a time where examinations could be made either through the bottom of the racks or by lifting the rack in its entirety, exposing the floor beneath," (Exh. Riverkeeper 24 at 2), Entergy's witness, Dr. Esselman, has indicated that Entergy has never pursued such an

option, and that there is no such plan to do so in the future. Tr. at 3166:8-20 (Esselman by Rvk). Mr. Barvenik likewise acknowledges that while he "can't say" that "physical or visual inspections of the uninspected portion of the pool liner" are "impossible," "I know they haven't been done with the technology that currently exists." Tr. at 3972:7-13 (Barvenik by Rvk).

Notably, Entergy's own documentation acknowledges that the Indian Point Unit 2 SFP "does not have a tell tail drain collection system." Ex. Riverkeeper 11 at 1; Tr. at 4057:16-23 (Barvenik by Rvk). A "drain collection system" is "a system that allows leakage that gets through the liner to be collected, ported to a particular place, that you can then monitor it" such that "[i]f the leaks occur through the liner, then it should help collect those leaks." Tr. at 4058:2-7, 9-11 (Barvenik by Rvk). Mr. Barvenik agreed that "the fact that the Unit 2 pool does not have a drain collection system . . . poses vulnerability for additional activity leakage," in particular, stating, "yes. . . you won't collect it . . . so it has a higher probability of getting into the environment." Tr. at 4058:12-18 (Barvenik by Rvk); Exh. Riverkeeper 11 at 1.

The record further indicates that Entergy will rely heavily upon groundwater monitoring in order to detect ongoing and current leaks from the Unit 2 SFP. The NRC has explained and, in relation to the safety of the spent fuel pool, approved Entergy's plan to simply monitor radionuclide levels in the groundwater as the method to detect any degraded condition of the Unit 2 SFP:

> Entergy made no commitment for augmented inspection during the extended period of operation. . . . To provide additional indication of potential spent fuel pool leakage, the applicant [Entergy] has committed to test the groundwater outside the IP2 spent fuel pool for the presence of tritium . . . every 3 months. . . . Tritium in the groundwater would indicate leakage from the spent fuel pool. . . . Based on . . . applicant's additional commitment to monitor the groundwater . . . there is reasonable assurance that any degradation of the IP2 spent fuel pool would be identified.

Exh. Riverkeeper 44 at pp.1-134, 1-139; Tr. at 2855:18-28, 2856:1-8, 17-28 (Gundersen Rebuttal). Entergy's witness Mr. Barvenik, repeatedly confirmed that Entergy intends to rely on groundwater sampling in order to detect future radiological leaks to the groundwater. *See* Tr. at 4054:20-23, 4055:1 (Barvenik by Rvk); Barvenik Prefiled Direct Testimony (July 22, 2011) at 1:18-22; 2:6-7; 3:1-3; 4:20-5:1; 5:8-11; 10:6-10; 13:15-21; 14:8-9;16:11-15; 21:2-23, 22:1-2. Aside from visual inspections of the accessible portion of the concrete wall of the Unit 2 SFP, Entergy will simply "continue to monitor groundwater," which "may indicate the presence of a leak." Tr. at 3172:8-10, 15-22; 3171:5-22, 3162:20-23, 3163:1-10 (Esselman by Rvk). But as Riverkeeper witness Mr. Gundersen explains, "Entergy's approach will only discover leaks *after* they occur." Tr. at 2856:10-11 (Gundersen Rebuttal).

Furthermore, Dr. Esselman explained that SFP leaks are occurrences that can be expected at a nuclear plant like Indian Point: "Leakage through liners, though, that has so many welds in it and is constructed is a part of operation that occurs here and at other power plants in the country. So your design is to prevent it, but yet the occurrence is not -- is something that you deal with and you understand and you mitigate." Tr. at 3146:15-23, 3147:1-5 (Esselman by DEC).

Lastly, the Indian Point Unit 2 SFP faces a "bathtub curve," which as explained by Mr. Gundersen, means it will face more aging and leakage issues as it continues to operate. Tr. at 2836:14-20 (Gundersen Direct). Mr. Gundersen explained that the "pool structures are going to deteriorate from the outside in because they're in contact with dirt. And the liner you put concrete in dirt, the more it degrades with time." Tr. at 2982:1-5 (Gundersen by DEC). Dr. Esselman does not dispute that the bathtub curve is in effect at Indian Point. Tr. at 3193:11-13, 3196:10-20 (Esselman by Rvk).

B. Indian Point Unit 1 SFP Leaks

Indian Point Unit 1 is owned and managed by Entergy, although it "is no longer generating and is awaiting decommissioning." Exh. Entergy 26 at 2. After electrical output from the Unit 1 reactor ceased, the owners of the plant continued to use SFPs to house the radioactive waste that had been generated from the operation of the reactor. Leakage from these Unit 1 SFPs was first discovered in the 1990s. Exhs. Entergy 33 at ix; Riverkeeper 13 at 10; Tr. at 2828:5-6 (Gundersen Direct); Barvenik Prefiled Direct Testimony (July 22, 2011) at 8:23, 9:1-2. The previous owner of Indian Point Unit 1 attempted to manage this leakage with a "leak collection system" consisting of a "reconfigured footing drain that surrounded the fuel building." Exh. Entergy 33 at ix. However, in 2006, Entergy discovered that this system was failing, and that uncollected contaminants from the Unit 1 "West Pool" had been, and were continuing to be released to the environment. Exh. Entergy 33 at ix; Tr. at 2828:22-23 (Gundersen Direct); Tr. at 4082:8-12 (Barvenik by Rvk). GZA's subsequent investigation revealed the West Pool "to currently be leaking at a rate of up to 70 gallons/day." Exhs. Entergy 33 at 102; Riverkeeper 13 at 10.

At approximately the end of 2008, Entergy completed defueling and draining the leaking Unit 1 SFP. Tr. at 4082:18-22 (Barvenik by Rvk). The Unit 1 SFP leaks that began in the 1990s were never "fully repaired until the fuel pool was completely drained." Tr. at 3953:17-23 – 3954:1 (Barvenik by DEC). Leakage of radioactive water to the environment from the Unit 1 SFP, at the approximate rate of 70 gallons per day, continued until the defueling and draining activities were completed. Tr. at 4082:13-17, 4085:5-7, 11-18 (Barvenik by Rvk); Exh. Entergy 33 at 102; *see also* Barvenik Prefiled Direct Testimony (July 22, 2011) at 9:7-8. Once the Unit 1 West Pool was defueled and drained, it was no longer a source of *new* radionuclides to the

environment. Tr. 3920:5-7 (Barvenik Direct by Entergy); Tr. 2791:12-13 (Kolakowski Re-Cross by Entergy); Exh. Entergy 34 at v.

The radionuclides attributable to Unit 1 SFP leaks that began in the 1990s and continued until the end of 2008 were released into the subsurface, including the groundwater, below Indian Point (*see* Exh. Entergy 33 at ix; Tr. at 4084:7-12 (Barvenik by Rvk)), or captured by onsite drains and eventually released into the Hudson River via the Indian Point discharge canal. Tr. at 4082:23, 4083:1-5, 4084:2-6, 3993:10-12 (Barvenik by Rvk). GZA's hydrogeologic investigation related to the Indian Point site revealed that the decades of releases from the Unit 1 SFPs had resulted in a plume of contamination in the groundwater containing Strontium-90, Nickel-63, Cobalt-60, and Cesium-137. Exh. Entergy 33 at ix, 5, fn.5, fn.61; Barvenik Prefiled Direct Testimony (July 22, 2011) at 6:6-9; Tr. at 3949:1-7, 13-15 (Barvenik by DEC).

Notwithstanding the fact that no *new* radionuclides are being introduced from the Unit 1 SFPs to the environment, GZA has explained that

> [f]rom a contaminant plume perspective, these historic releases [those from the Unit 1 SFPs] still represent an ongoing legacy source of strontium in the groundwater to the south side of Unit 1. This is because strontium partitions from the water phase and adsorbs to solid materials, including subsurface soil and bedrock. The strontium previously adsorbed to these subsurface materials then partitions back to and continues to contaminate the groundwater over time, even after the storm drain releases have been terminated

Exh. Entergy 33 at 113; Tr. at 3973:20-22 (Barvenik by Rvk). Partitioning relates to when radionuclides collect on the surface of "solid surfaces . . . natural or anthropogenic," such as "concrete foundations" or "the surface of pipes." Tr. 3975:5-11, 22-23, 3976:1-3, 7-12 (Barvenik by Rvk). As a result of partitioning, the "strontium that's leaked from the Unit 1 spent-fuel pool that's been retained in the subsurface would continue to be released to the groundwater in the

future." Tr. at 3974:2-7 (Barvenik by Rvk).[99] Partitioning also occurs in relation to the other radionuclides that have been released from the Unit 1 SFPs, including cesium. Tr. at 3977:1-12 (Barvenik by Rvk). This partitioning phenomenon is expected to "continue *at least* into the renewal period." Tr. at 3974:8-12 (Barvenik by Rvk) (emphasis added). However, GZA has never measured how much contamination is partitioned into a solid form at any given time. Tr. at 3974:13-16 (Barvenik by Rvk).

A portion of the radionuclides attributable to the Unit 1 SFPs are currently "captured" by the North Curtain Drain ("NCD") and Sphere Foundation Drain Sump ("SFDS"). Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at 23:16-15. Any such radioactive water that is "picked up" in the NCD goes through treatment and eventually discharges to the Hudson River by way of the Indian Point discharge canal. Tr. at 4099:10-23, 4100:1-2, 9-12, 19-23, 4101:1-2 (Barvenik Re-Direct by Entergy); Tr. at 3978:15-23, 3979:1-2, 6-9 (Barvenik by Rvk). While the "treatment" removes some of the strontium, the water that is eventually released to the Hudson River still contains strontium, as well as other radionuclides, including tritium, which cannot be filtered. Tr. at 4106:1-23, 4107:1-4 (Barvenik by Rvk). Radionuclides can partition to the NCD, and later unpartition, "i.e., come[] back off" and "move into the water in the drain" and eventually to the Hudson River via the discharge canal. 3978:8-14, 3979:15-20 (Barvenik by Rvk). Thus, partitioning will also result in periodic releases of Unit 1 SFP-related contamination captured by the NCD directly to the Hudson River.

DEC Staff evaluated the activities at all Indian Point reactors (Units 1, 2 and 3) that resulted in discharges and looked at impacts from the entire Indian Point facility and did not separate out the impacts from each individual Unit. Tr. at 2704:8-23 (Kolakowski by Entergy).

[99] One of Entergy's other witness, Dr. Hoffman, also acknowledges and agrees that "there is still evidence of radionuclides coming from the spent-fuel pool of Unit 1." Tr. at 3299:6-9, 16-20 (Hoffman Cross by Rvk).

As Mr. Kolakowski explained, "[w]e looked at the overall operation of the facilities and the releases from the facilities on site in the review." Tr. 2784:15-17 (Kolakowski Re-direct by DEC). Until the entire Indian Point plant stops operating, the Unit 1 reactor and attendant components and structures will not be fully decommissioned and dismantled. *See* Exh. Entergy 26 at 2; Tr. at 2779:2-11 (Kolakowski by Rvk). In fact, while Unit 1 stopped generating electricity in 1974 (Barvenik Prefiled Direct Testimony (July 22, 2011) at 8:23) components of the reactor are still used in connection with the operation of Indian Point's active reactors. For example, "cooling and service water is still drawn through the Unit 1 intake." Exh. Entergy 26 at 2; Tr. at 4061:3-11 (Barvenik by Rvk). The subsurface groundwater contamination attributable to the Unit 1 SFP leaks and the components that retain such residual contamination will not be fully remediated and cleaned until the whole plant ceases operation. *See* Exh. Entergy 26 at 2; Tr. at 2779:2-11, 19-23 (Kolakowski by Rvk).

Thus, the radioactive groundwater and surface water contamination from the Unit 1 SFPs will persist at the site. Unit 1 SFP leak-contamination already commingles with radioactive leaks from other sources at Indian Point, including the plume of tritium Entergy attributes to Unit 2 SFP leaks. Tr. at 3984:7-13 (Barvenik by Rvk). This contamination can be expected to continue to commingle, interact, and migrate with other radiological leaks at Indian Point, which are further described above and below). Tr. at 2780:1-8, 10-13 (Kolakowski by Rvk). Thus, the Unit 1 SFP leaks result in a cumulative impact. Tr. at 2780:14-23 (Kolakowski by Rvk).

II. Other Radiological Leaks and Releases at Indian Point

Over the course of Indian Point's nearly 40 years of operation, numerous radiological leaks and spills have occurred and resulted in releases of radioactivity to the groundwater

beneath the site, and/or to the Hudson River. The evidentiary record in this proceeding has revealed several examples, most of which have occurred in recent years.

A. 2009 Unit 1 Distillation Tank Valve Leak

A leak was discovered in the first quarter of 2009 from "a distillation tank valve located within the IP1 [Indian Point Unit 1] chemical systems building." Barvenik Prefiled Direct Testimony (July 22, 2011) at 10:14-15. This leak resulted in additional radionuclides being introduced into to the groundwater. Tr. at 3985:15-17; 3985:22-23, 3986:1-2, 4028:7-11 (Barvenik by Rvk). This leak event contributed to the radionuclides already present in the groundwater, and in fact "led to an increase in levels in the monitoring well." Tr. at 3968:3-8, 4028:7-11 (Barvenik by Rvk). Some of the radioactive water emanating from this leak also was "collected" by the NCD and eventually released to the Hudson River via the discharge canal. Tr. at 3986:3-19 (Barvenik by Rvk).

B. 2009 Refueling Water Storage Tank Filter Leak

During the fourth quarter of 2009, leakage from a Refueling Water Storage Tank ("RWST") filter, or RO skid, occurred, releasing radioactive water that entered the groundwater. Barvenik Prefiled Direct Testimony (July 22, 2011) at 10:20-22; Tr. at 3987:3-10; 2988:2-7 (Barvenik by Rvk). In November of 2009, a RWST "processing skid" spilled "RWST water to the . . . yard adjacent to the Unit 2 PAB [Primary Auxiliary Building]." Exh. Riverkeeper 18 at 1, 3 (an Entergy Groundwater Monitoring Program Quarterly Integrated Review Checklist). Mr. Barvenik acknowledged that this event contributed to the radionuclides present in the groundwater. Tr. at 3988:8-11, 4028:13-18 (Barvenik by Rvk). In fact, Entergy documentation characterized the level of tritium detected in the groundwater as a result of this event as "greatly elevated." Exh. Riverkeeper 18.

GZA's most recent quarterly groundwater monitoring report in the record (pertaining to the second quarter of calendar year 2010 and dated February 11, 2011), indicated that 70% of samples taken in April of 2010, approximately five or six months after the RWST skid spill, had "exhibited an increase in Tritium levels as compared to the previous Q1 2010 quarter" due to the leak event. Exh. Riverkeeper 21 at p.1-2 (excerpt of GZA Quarterly Monitoring Report for quarter 2 of 2010); Tr. at 4030:6-10 (Barvenik by Rvk). The November 2009 radiological water spill was still manifesting in monitoring wells at least five months after the event took place. Tr. at 4030:11-16 (Barvenik by Rvk). GZA's quarterly monitoring report further indicated that the spill would "decrease over the next several quarter," which Mr. Barvenik confirmed. Exh. Riverkeeper 21 at p.1-2; Tr. at 4030:19-23 (Barvenik by Rvk). The RWST filter spill "resulted in an increase in the Unit 2 plume total Tritium activity," that is to say, and "overall increase" in the plume. Exh. Riverkeeper 21 at p.1-2. Mr. Barvenik confirmed this fact. Tr. at 4031:1-6 (Barvenik by Rvk).

C. 1988 RWST Heating Coil Leak

In 1988, 8,400 gallons of radioactively contaminated water was released to the Hudson River as the result of a crack in the condenser blowdown line from the RWST heating coil of Unit 2. Tr. at 2829:21-24 (Gundersen Direct); Exh. Riverkeeper 6 at 15. Neither Mr. Barvenik nor Dr. Esselman dispute that this event occurred or that it resulted in releases of radioactivity to the Hudson River. Tr. at 3988:20-23, 3989:1-6 (Barvenik by Rvk); Tr. at 3176:9-14, 3177:5-7, 11-23, 3178:1-3 (Esselman by Rvk).

D. 2011 Recirculation Pump Leak

An NRC Inspection Report dated November 7, 2011, memorializing an inspection completed on September 30, 2011, indicates that "[o]n June 27, 2011 while reviewing the second

quarter 2011 groundwater monitoring well sample results, Entergy personnel identified an increase in tritium concentrations in Unit 1 monitoring wells MW-56 and MW-57 (76,000 pCi/L and 20,000 pCi/l, respectively). Exh. Riverkeeper 55 at 15. (Second quarter samples are taken in the month of April. Tr. at 4030:8-10 (Barvenik by Rvk)). The NRC report indicated that "[c]urrently, [i.e., at the time of the report], the source of the contamination has not been identified" but explained that "several possible causes are being evaluated by Entergy staff." Exh. Riverkeeper 55 at 16.

At the hearing in this proceeding in January 2012, Entergy's witness, Mr. Barvenik indicated that while "[w]e don't have 100 percent definitive understanding," he believed that the cause "was a leak in a recirculation pump." Tr. at 4003:5-21 (Barvenik by Rvk). Mr. Barvenik explained how Entergy took a "graded approach" to determining the source of the elevated levels of tritium found in the groundwater near Unit 1, including narrowing down potential sources and doing "additional groundwater sampling" to determine the source with certainty. Tr. at 4074:4-15, 4077:8-18 (Barvenik by Rvk).

E. 2009 Buried Pipe Leak

In February 2009, a pipe buried eight feet underground at Indian Point developed a leak. Exhs. Riverkeeper 16; *see also* Exh. Riverkeeper 17; Tr. at 2829:14-16 (Gundersen Direct). This leak "was discovered by the observation of water at the ground level." Tr. at 3175:2-5 (Esselman by Rvk); *see also* Exh. Riverkeeper 17. The leak resulted in an estimated 100,000 gallons of radioactive water being released to the groundwater. Tr. at 3175:6-23, 2176:1-3 (Esselman by Rvk).

Notably, Dr. Esselman also indicated that he was "aware that there have been *leaks* from piping *systems* that have leaked to the environment." Tr. at 3174:14-20 (Esselman by Rvk) (emphasis added).

F. Elevated Levels of Radioactivity in Indian Point Storm Drains

Around March of 2009, elevated levels of tritium were detected in storm drain system "A" at Indian Point. Exh. Riverkeeper 19 at 1. Tritium was detected at varying elevated levels, and as high as 94,200 pCi/L. Exh. Riverkeeper 19 at 1. Entergy performed an investigation to determine the cause of these elevated levels, and concluded that "the most likely cause" was the phenomenon of "washout." Exh. Riverkeeper 19 at 1, 3. Additional investigations confirmed that the cause was in fact washout. Tr. at 3994:8-13, 21-23, 3995:3 (Barvenik by Rvk).

"Washout" relates to "airborne tritium releases . . . caused by hot radioactive water or radioactive steam leaking from components in the nuclear facility." Tr. at 2830:23-26 (Gundersen Direct). Leaks from aged components "contaminate the air inside the plant with radioactivity" and that the "contaminated air is then released through vents in the roof or out the exhaust stack of the plant." Tr. at 2831:2-7 (Gundersen Direct). Washout is when "moist, humid tritiated water" "will evaporate" and "condense" and "form a cloud . . . or be entrained in rain, and then it could land, for instance, on the top of the roof." Tr. at 3995:4-16 (Barvenik by Rvk). Such moist, tritiated water could come from leaking components, or from SFPs. Tr. at 3995:17-22 (Barvenik by Rvk). Washout "has the potential to migrate wherever the wind carries it before it drops out." Tr. at 3998:9-13 (Barvenik by Rvk). Washout can migrate offsite and deposit tritium in the Hudson River, depending on the weather. Tr. at 2831:9-14 (Gundersen Direct). In relation to the elevated levels found in storm drain system "A" around March 2009, there was a "vent fan" failure, during which "there was increased condensation on the roof, which resulted in

roof water moving down the roof drain system into that manhole, where we detected it." Tr. at 4081:19-23, 4082:1-4 (Barvenik by Rvk).

An Entergy condition report from 2010 memorialized that "elevated tritium was observed in storm drain A-2 and the new roof drain sample point." Exh. Riverkeeper 45 at 1. The cause of this elevated tritium in the same storm drain system investigated in 2009 was also washout. Tr. at 4000:13-20 (Barvenik by Rvk). An Entergy condition report dated around March of 2011 memorialized the fact that the "Unit 3 Storm Drain B system has slightly increased tritium above their baselines." Exh. Riverkeeper 45 at 3. Mr. Barvenik was not aware of this finding, and could, thus, not indicate what the cause of this elevated finding was. Tr. at 4001:21-23, 4002:1-3 (Barvenik by Rvk). Though a precise source has apparently not yet been discovered, Entergy's witness, Dr. Esselman, agreed that elevated levels of radionuclides in a storm drain could be an indication of leaking buried pipes. Exh. Riverkeeper 19 at 2; Tr. at 3182:2-13 (Esselman by Rvk).

III. Status and Behavior of Radiological Contamination Plumes in the Groundwater at Indian Point

"Due to the size of the plumes, the varied range or radionuclides present in the groundwater, the dangerous toxicity of various radionuclides in the plumes . . . and the persistence of the plumes," "the contamination at Indian Point, makes it one of the most contaminated operating nuclear power plant sites in the United States." Tr. at 2860:3-9 (Gundersen Direct). Indeed, the evidence on the record, as described further below, demonstrates that the radiological contamination persists at high levels in the groundwater at Indian Point, and will continue to do so.

A. The Level of the Contamination Plumes at Indian Point

As GZA has explained, the U.S. Environmental Protection Agency ("EPA") Maximum Contaminant Levels ("MCLs"), established under the Safe Drinking Water Act ("SDWA") for radionuclides in drinking water "provide a recognized, and highly conservative, benchmark for comparison purposes." Exh. Entergy 33 at 90, fn.64. Entergy's witness Dr. Hoffman has similarly indicated his understanding that EPA MCLs "are used as a comparison benchmark for screening purposes." Tr. at 3257:2-8 (Hoffman by Rvk). Riverkeeper's witness, Mr. Gundersen, also indicated that such limits are "a yardstick throughout the industry." Tr. at 2925:12-15 (Gundersen by Zoli). Likewise, the NRC has indicated that referencing EPA's MCLs for radionuclides in drinking water in relation to the groundwater at Indian Point "permits perspective." Exh. Entergy 32 at 3. A U.S. Government Accountability Office's ("GAO") June 2011 report concerning underground piping systems at nuclear power plants similarly refers to exceedances of on-site groundwater tritium contamination over EPA MCLs. Exh. Riverkeeper 7 at 10.

The contamination plumes at Indian Point have been discussed in terms of EPA MCLs Tr. at 4010:7-23, 4011:1-23, 4012:1-15 (Barvenik by Rvk). The record shows that radionuclide concentrations in the groundwater at Indian Point resulting from leaks of radiological materials which exceed those levels established by EPA as MCLs for radionuclides in drinking water, may be considered "significant" or "high." For example, an industry organization, the Nuclear Energy Institute has also issued guidance which classifies any leaks that "[r]esult in concentrations that could exceed the regulatory concentrations or limits established by the NRC or EPA" as "significant leakage." Exh. Entergy 112 at 11. In addition, Mr. Barvenik has explained that a "primary determinant" for "determining what constitutes a high level of

contamination" "is if we found radionuclides at a level . . . significantly above what we would expect them to be in a particular location." Tr. at 4014:20-23 (Barvenik by Rvk). Furthermore, GAO has referred to radionuclide levels in excess of EPA MCL's as "high concentrations." Exh. Riverkeeper 7 at 3. NRC has also referred to tritium groundwater levels at Indian Point that were greater than the EPA drinking water standards as "relatively high." Exh. Entergy 32 at A1-7.

EPA MCLs, measured in picocuries per liter (which is a measure of radioactivity based on the observed decay rate of radium), for radionuclides that have been detected in the groundwater at Indian Point are as follows: Tritium, 20,000 pCi/l; Strontium-90, 8 pCi/l; Cesium-137, 200 pCi/1. Tr. at 2824-2825, fn. 4 (Gundersen Direct).[100] Mr. Barvenik explains that "[w]hen we first started our investigation, we found levels that were higher than 20,000 for tritium." Tr. at 4015:5-13 (Barvenik by Rvk). Further, NRC monitoring well data from the 2005/2006 timeframe during GZA's investigation efforts, shows that the levels in many wells for various radionuclides were far in excess of EPA MCL values. Exh. Riverkeeper 14; *see also* Entergy Exhibit 32 at 3. Since the conclusion of GZA's initial investigation, radionuclides have been detected in the groundwater above the EPA MCL values. Tr. at 4019:9-14 (Barvenik by Rvk).

Entergy's groundwater well data from the third sampling quarter of 2010 showed that numerous groundwater samples exceeded EPA MCLs. Exh. Riverkeeper 22. Entergy's groundwater well data from the second sampling quarter of 2011, (which was the most recent data which Mr. Gundersen received and reviewed at the time he provided his testimony in this proceeding), shows that "Entergy continues to detect excessive levels of contamination in

[100] Citing U.S. EPA, Radionuclides in Drinking Water: A Small Entity Compliance Guide (February 2002), *available at*, http://www.epa.gov/ogwdw/radionuclides/pdfs/guide_radionuclides_smallsystems_compliance.pdf, at 13

numerous sample locations." Tr. at 2861:3-5 (Gundersen Direct). In particular, Mr. Gundersen observed the following:

> Cesium-137 was detected in monitoring well ("MW")-42 at 21,500 pCi/l, more than 100 times the EPA MCL set at 200 pCi/l; Tritium was detected in MW-30, MW-56, and MW-57 at 113,000 pCi/l, 76,4000 pCi/l, and 20,300 pCi/l, respectively, all in excess of the EPA MCL for tritium set at 20,000 pCi/l; Nickel-63 was detected in MW-42 at 190 pCi/l, almost four times the EPA MCL set at 50 pCi/l; and Strontium-90 was detected in eight monitoring wells and an additional sampling location in excess of the EPA MCL for Strontium-90 set at 8 pCi/l: MW-37 (8.72 pCi/l), MW-49 (12.6 pCi/l, 15.7 pCi/l and 16.2 pCi/l), MW-50 (9.53 pCi/l and 26.3 pCi/l), MW-53 (35.5 pCi/l), MW-54 (12 pCi/l and 19 pCi/l), MW-57 (31.1 pCi/l), MW-66 (10.6 pCi/l), MW-67 (12.5 pCi/l), and at sample location U1-CSS (16.1 pCi/l).

Tr. at 2861:5-14 (Gundersen Direct).

The most recent Entergy groundwater sampling data provided in the record was data from the third sampling quarter of 2011. Tr. at 4020:8-16, 4021:5-16 (Barvenik by Rvk). This most recent data showed that concentrations of radionuclides for tritium, strontium, and cesium had, again, been detected at levels over EPA MCL values. Tr. at 4020:8-23, 4021:1-2 (Barvenik by Rvk). Entergy's witness, Dr. Hoffman does not dispute that concentrations detected in monitoring wells at Indian Point have exceeded EPA MCL levels. Tr. at 3264:2-11 (Hoffman by Rvk).

Thus, the evidence shows that the contamination plumes at Indian Point continue to persist at high levels, that is, those above EPA MCL values and "[t]his trend is likely to continue in the foreseeable future." Tr. at 2832:15-16 (Gundersen Direct).

B. Future Contamination Plume Fluctuations

It is undisputed that the contamination plumes at Indian Point will periodically increase in the future, even in the absence of new radioactive leakage to the groundwater. As GZA

explains, [p]eaks in Tritium levels have been observed in multiple sampling ports of MW-31 and MW-32 since Q1 2009, and to a lesser extent since monitoring began. This long-term variability appears to be consistent with episodic releases of Tritium historically stored in the subsurface via natural and anthropogenic Retention Mechanism." Exh. Riverkeeper 21 at p.1-2. Similarly, legacy contamination attributable to the Unit 1 SFP leaks that is retained in the subsurface, and which partitions to and from a solid phase, will continue to periodically release to the groundwater. Exh. Entergy 33 at 113; Tr. at 3973:20-22, 3974:2-7 (Barvenik by Rvk).

Periodic increases in radionuclide levels will occur in the future at Indian Point, which is "normal," according to Mr. Barvenik. Tr. at 4024:11-18 (Barvenik by Rvk). "[C]ontaminants from prior leaks can be stored in the subsurface and then they show up in the groundwater at a later time," such as "during rain events." Tr. at 4025:7-15 (Barvenik by Rvk). Such releases would cause increases in the concentrations found in monitoring wells. Tr. at 4025:16-19, 4027:20-23, 4028:1-2 (Barvenik by Rvk). This is consistent with GZA's finding that the "additional saturated zone source recharge will likely be manifested in the future as additional non-specific peaks in radionuclide levels due to episodic releases to the groundwater." Exh. Riverkeeper 21 at p.1-3. Such releases can be expected to occur with all the radionuclides that are present in the groundwater at Indian Point. Tr. at 4025:20-23 (Barvenik by Rvk).

In addition, the parties agree a number of years of monitoring is necessary to determine if the contamination plumes at Indian Point are definitively decreasing or not. GZA has indicated in its most recent quarterly monitoring report in the record (pertaining to the second quarter of 2010, dated February 2011) that "monitoring over a number of years" is required to confirm whether the contamination plumes are continuing to decrease. Exh. Riverkeeper 21 at p.1-3. Mr. Barvenik confirmed this position, stating that "it will take more years to confirm that they

continue to continue to decrease." Tr. at 4022:5-10 (Barvenik by Rvk). Nonetheless, "the few years of monitoring that have been completed are not likely to be enough to establish a definitive trend." Tr. at 2861:23-26 (Gundersen Rebuttal). The contamination at issue spreads wider and deeper over time, which may also "cast an inaccurate picture of the rate of any overall decline of . . . the plumes. Tr. at 2861:27-28, 2862:1-2 (Gundersen Rebuttal); 2986:3-7 (Gundersen by DEC).

In any event, the evidence on the record unequivocally demonstrates that *new* radioactive leaks since the SFP leaks (which Entergy attributes the two existing contamination plumes to) contribute to the radionuclides in the groundwater, and can cause the detection of elevated levels of radionuclides in monitoring wells, including those above EPA MCL values. Numerous leaks discussed above that occurred after the GZA investigation concerning the SPF leaks added to the existing groundwater contamination. *See, e.g.*, Tr. at 3970:6-10; 4028:7-11; 4028:13-18 (Barvenik by Rvk); Exh. Riverkeeper 55 at 15; Tr. at 4003:5-21 (Barvenik by Rvk); *see also* Tr. at 2862:25-26, 2863:1 (Gundersen Direct). This was particularly evident after a RWST skid spill in 2009, which caused an overall increase in the tritium plume underneath Indian Point for numerous monitoring quarters. Exh. Riverkeeper 21 at p.1-2; Tr. at 4031:1-6 (Barvenik by Rvk).

If leaks from components occur in the future at Indian Point, they could also contribute to the existing groundwater contamination, and potentially cause increases in the overall plume activity. Tr. at 4031:7-10, 15-21 (Barvenik by Rvk).

C. Entergy's Approach to Radioactive Plume Management

The record shows that Entergy's approach for managing the radiological contamination plumes at Indian Point will allow the contamination to remain the groundwater, continue to fluctuate as well as grow in the event of new radiological leaks, and flush to the Hudson River.

i. Entergy's Use of Monitored Natural Attenuation

Entergy currently employs Monitored Natural Attenuation ("MNA") to the radiological contamination at Indian Point. Tr. at 4032:15-18 (Barvenik by Rvk). At the conclusion of the site hydrogeologic investigation which began in 2005, GZA recommended MNA "as the preferred remedial measure." Exh. Entergy 33 at 127; Tr. at 4032:2-8 (Barvenik by Rvk). Entergy took GZA's recommendation, and, as Mr. Barvenik confirms, is currently using MNA to manage the contamination. Tr. at 4032:11-18 (Barvenik by Rvk). Entergy is currently planning to continue to employ MNA during the proposed license renewal period for Indian Point. Tr. at 4032:19-23 (Barvenik by Rvk).

Mr. Barvenik explains that "MNA basically is a remedial technique that relies on natural processes to cause plume attenuation." Tr. at 4033:1-6 (Barvenik by Rvk). Dr. Hoffman similarly indicated his understanding that MNA involves leaving contaminated groundwater "undisturbed, and the radiation would be allowed to decay in place and/or be diluted by freshwaters. . . And the present concentrations would be allowed to diminish with time." Tr. at 3269:7-13 (Hoffman by Rvk).

In relation to Indian Point, Mr. Barvenik acknowledges that with MNA, the contamination will remain in the groundwater until it releases to the Hudson River, decays from natural processes, or partitions to solid surfaces. Tr. at 4033:7-12 (Barvenik by Rvk). Mr. Gundersen, similarly explains that with MNA, contamination at Indian Point will "remain[] in the ground until it migrates to [the] Hudson River and/or decays." Tr. at 2840:18-19 (Gundersen Direct).

Mr. Barvenik acknowledges that attenuation can be a slow process. Tr. at 4033:13-15 (Barvenik by Rvk). Mr. Gundersen's testified that Strontium-90 has a 30 year half-life and will

persist in the environment for 300 years. Tr. at 2841:17-20 (Gundersen Direct). Mr. Gundersen's nearly 40 years of experience as a nuclear engineer led him to conclude that "the process to completely eliminate any radioactive contamination by simply hoping it will eventually 'flush' out into a nearby body of water will take many decades if not an entire century after the shutdown and dismantlement of Indian Point before the site is free of radioactive contamination." Tr. at 2862:11-16 (Gundersen Rebuttal).

In light of Entergy's approach of allowing the contamination to sit in the groundwater, and potentially grow due to new leaks, the level of contamination in the groundwater "will likely remain high for the foreseeable future." Tr. at 2832:27-31 (Gundersen Direct).

ii. Entergy's Refusal to Use Extraction Wells

Extraction wells can be an effective technology to "mitigate the volume and spread of radiation and draw contaminants out of the ground in order to prevent their movement to nearby bodies of water, the existing water table, or to prevent aquifer contamination." Tr. at 2841:12-14 (Gundersen Direct). Entergy's witness, Mr. Barvenik, testified that groundwater extraction wells at Indian Point could "contain the[] radionuclides on-site by establishing a groundwater gradient reversal." Combined Prefiled Rebuttal Testimony (October 4, 2011) at 41:15-16. One potential advantage of employing extraction is that the contamination plume is not left to grow in the event of future radiological leaks. Tr. at 2872:15-17 (Gundersen Direct).

No party disputes that extraction of the radiological contamination at Indian Point is feasible: Mr. Barvenik testified numerous times that "it could be done." Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at 41:11-22; Tr. at 3957:13-16, 22-23, 3958, 3961:13-19 (Barvenik by DEC); Tr. at 4038:10-15, 4087:19-22, 4089:16, 4092:6-11 (Barvenik by Rvk). In fact, Mr. Barvenik confirmed that by 2006, GZA had conducted a pilot test and

determined that extraction was feasible at Indian Point. Tr. at 4039:21-23, 4040:1-12, 16-17, 4040:18-23, 4041:1 (Barvenik by Rvk); Exh. Riverkeeper 34; 4040:3-8, 4087:9-13 (Barvenik by Rvk). However, GZA never recommended extraction, and, to date, Entergy has never implemented extraction. Tr. at 3957:13-16 (Barvenik by DEC); Tr. at 2843:20-23 (Gundersen Direct).

In particular relation to Indian Point, the record contains conflicting and ambiguous testimony regarding how effective extraction could be at actually reducing the contamination in the groundwater and preventing migration of the contamination from reaching the Hudson River. Mr. Barvenik indicated that that extraction wells "*could* be effective" at extracting the radioactive elements from the groundwater. Tr. at 4094:22-23, 4095:1-2 (Barvenik by Rvk) (emphasis added). While Mr. Barvenik testified that "[s]ome level of extraction in certain locations is feasible," (Tr. at 4087:19-22 (Barvenik by Rvk)), that multiple wells could be sited in varying locations including potentially directly over the strontium plume such that extraction would not shift the plume, (Tr. at 4092:12-18, 4094:22-23, 4095:1-2 (Barvenik by Rvk)), and that extraction would result in less contamination existing in the groundwater (Tr. at 4041:2-6 (Barvenik by Rvk)), Mr. Barvenik could not quantify the volume of contaminated water that could actually be extracted. Tr. at 4095:3-7 (Barvenik by Rvk). Nor did Mr. Barvenik indicate the level of efficacy in reducing the groundwater plumes at Indian Point that could be achieved by extraction. In addition, data from Entergy's pilot test in 2006 showed that the level of contamination in the groundwater was reduced, though not eliminated. Exh. Riverkeeper 34.

Mr. Barvenik further testified that Entergy "could" install a sufficient number of groundwater extraction wells so as to contain the strontium and tritium contamination on-site, which would provide "*reasonable assurances* that groundwater containing . . . radionuclides will

not reach the Hudson River. Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at 41:7-16, 22-23; 42:1-2. At the adjudicatory hearing, Mr. Barvenik testified that extraction wells "could" prevent contamination from reaching the river (Tr. at 4041:11-14 (Barvenik by Rvk), and later that extraction could "completely" prevent the migration of radionuclides to the Hudson River "through the groundwater pathway." Tr. at 4094:1-2, 18-21 (Barvenik by Rvk). However, Mr. Barvenik clarified that an investigation regarding an actual plan to install extraction wells had not been done. Tr. at 4092:6-11, 4095:3-7 (Barvenik by Rvk).

IV. Expected Future Radiological Leaks and Releases at Indian Point

DEC's denial of Entergy's Application for WQC was supported by the conclusion that radiological discharges from Indian Point could impair the Hudson River for its best usages. Tr. at 2743:15-23 (Kolakowski by Entergy). DEC based its conclusion on the discharge history from the facility, unauthorized discharges or unexpected discharges to the groundwater, and the resultant in movement of those contaminants to the Hudson River Tr. at 2744:1-13 (Kolakowski by Entergy).

As DEC's witness Mr. Kolakowski explained, the CWA § 401 certification denial took into consideration "the track record of operation and housekeeping" at Indian Point in evaluating whether future releases could occur which would cause or contribute to a violation of water quality standards. Tr. at 2744:14-18 (Kolakowski by Entergy). As Mr. Kolakowski explained, "[w]e have to look at the performance history of that facility and make appropriate judgments based on the discharges historically and potential future discharges as to that impact. . ." Tr. at 2746:21 to 2747:2 (Kolakowski by Entergy). The analysis which Mr. Kolakowski conducted "indicated a high likelihood of a contravention of water quality standards from future releases

from spent fuel pools, and the additives used in those pools that are non-radiological." Tr. at 2751:18-21 (Kolakowski by Entergy).

The record includes ample evidence demonstrating a high potential for future radiological releases from systems, structures, and components at Indian Point, to the groundwater and/or Hudson River, as follows:

A. Entergy's AMP For Buried Pipes and Leaks at Indian Point

In response to the growing problem of radiological leaks at nuclear power plants across the country, in June 2011, the U.S. GAO issued a report assessing underground piping systems at nuclear plants. Exh. Riverkeeper 7 at 1. GAO explained that:

> As nuclear power plants age, their underground piping systems tend to corrode, but since these systems are largely inaccessible and difficult to inspect, the condition of many underground piping systems at plants across the country is unknown. Further, as pipes continue to age and further corrosion occurs, the likelihood and severity of leaks could increase without mitigating actions.

Exh. Riverkeeper 7 at 1. GAO further concluded that "[t]he occurrence of leaks at nuclear power plants from underground piping systems is expected to continue as nuclear power plants age and their piping systems corrode." Exh. Riverkeeper 7 at 22.

Notably, Entergy's witness, Dr. Esselman, does not dispute GAO's conclusions. Dr. Esselman agreed that "[t]he hardest part about inspecting them [buried components] is that they're buried," and indicated that a major difficulty presented by a pipe being buried is that it "is more difficult to inspect." Tr. at 3213:18-23, 3214:1, 3233:16-23 (Esselman by Rvk). Dr. Esselman further did not dispute GAO's conclusion that as buried components continue to age, the occurrence of corrosion and leaks could increase. In particular, Dr. Esselman agreed that "if you don't take any mitigating action and if you just wait for natural processes to occur, age will eventually cause corrosion." Tr. at 3198:11-14; 3196:10-23, 3197:1 (Esselman by Rvk). Dr.

Esselman agreed with GAO that without mitigating efforts, the occurrence of leaks at nuclear plants is expected to continue. Tr. at 3199:15-18 (Esselman by Rvk).

Indian Point components, such as those that are buried, face a "bathtub curve," whereby the likelihood of failures "rises strongly towards the end" of the component lifecycle. Tr. at 2836:15-20 (Gundersen Direct). Over time, buried pipes at Indian Point are subject to wear and breakage from surrounding rock, followed by rust, and microbiologically induced corrosion, and that the potential for leakage is increasing with time. Tr. at 2981:17-20, 2982:6-23, 2983:1-12 (Gundersen by DEC). Dr. Esselman similarly explained that "what happens at the back end, the closing of the bathtub, is that eventually, based on what degradation mechanisms you have active, there may be a time when your likelihood of failure, your probability of a failure at any given time will increase." Tr. at 3192:4-9 (Esselman by Rvk). Dr. Esselman acknowledged that "[i]f you look at Indian Point as an example, the bathtub curve works all over the place." Tr. at 3193:11-13 (Esselman by Rvk). Entergy's documentation indicates that numerous components at the plant were deemed to have a "high" potential for leakage for purposes of installing monitoring wells to be able to detect such future leakage. Exh. Riverkeeper 27; Tr. at 3187:1-15 (Esselman by Rvk). Dr. Esselman further acknowledges that Entergy's northern plants all experienced radiological leaks, with maximum concentrations detected around the 36th year of operation. Tr. at 3201:18-21, 3205:1-12 (Esselman by Rvk).

Entergy's programs for managing buried components are inadequate to ensure that leaks will not occur in the future (during the proposed relicensing term) from increasingly aging buried components. Mr. Gundersen explains that Entergy's program is insufficient because it does not require inspections of 100% of buried components. Tr. at 2838:14-18 (Gundersen Direct). Mr.

Gundersen elucidates that because leakage mechanisms, including microbiologically induced corrosion occurs

> randomly on the pipe[,] [i]t's not predictable. And ultrasonically, if you look for it, you're going to miss it because it's – it's small and localized. And unless you do a 100 percent inspection of the entire pipe, you're not going to find it. So all those things are occurring at Indian Point and will continue to occur over the next 20 years.

Tr. at 2983:2-12 (Gundersen by DEC). Yet, Entergy does not dig up every buried pipe to inspect it for flaws. Tr. at 3218:13-15, 17-19 (Esselman by Rvk). Notably, Dr. Esselman indicated that it "certainly is [technically] feasible" to move piping that is buried at Indian point above ground, and that, if this occurred, the piping at Indian Point could be more regularly inspected. Tr. at 3232:9-11, 14-17, 3234:1-3 (Esselman by Rvk). Placing the pipes above ground would be a more proactive approach to managing leakage from now-buried pipes at Indian Point. Tr. at 3024:6-13 (Gundersen Re-Direct by Rvk).

Dr. Esselman's testimony confirms that Entergy does not intend to perform inspections on 100% of the components that are buried at Indian Point. Dr. Esselman's testimony indicates that, to the contrary, Entergy is implementing a inspection prioritization scheme, whereby only a small "representative sample" of all buried pipes and components will ever be inspected. Tr. at 3213:13-17, 3214:16-18, 3221:1-3, 3231:21-23, 3232:1-8 (Esselman by Rvk). Particular inspections are only of a section of a pipe, and not the entire piping component. Tr. at 3231:21-23, 3232:1-8 (Esselman by Rvk). Furthermore, the prioritized inspection schedule involves an evolving set of inspections based on prior inspections, as opposed to regularly scheduled inspections of varying, previously uninspected pipe locations. Tr. at 3220:1-16 (Esselman by Rvk).

Entergy's program for managing aging pipes relies in large part on physical and opportunistic inspections of buried components that happen to be excavated during the course of operation. Tr. at 3114:6-19 (Esselman Direct by Entergy); Tr. at 3217:17-23, 3218:1-4, 13-16 (Esselman by Rvk). Such inspections "are completely inadequate to detect a leak before it occurs." Tr. 2838:18-19, 2839:1-4 (Gundersen Direct).

Notably, Dr. Esselman acknowledges that Entergy's aging management program related to buried pipes will not eliminate the probability radiological leaks. Tr. at 3209:5-12 (Esselman by Rvk). This is consistent with the evidence in the record reflecting that Entergy's program is primarily a safety related program concerned about the safety function of relevant plant components during and after accidents. *See* Exh. Riverkeeper 46; Tr. at 2859:13-20 (Gundersen Direct); *see also* Exh. Entergy 44 at 4 (stating that NRC regulations are "not intended to ensure pipes are leak-tight"). In addition, other Entergy documentation has acknowledged the virtual impossibility of identifying and stopping all leaks from buried components at Indian Point. For example, in response to the February 2009 buried pipe leak, a plant spokesperson stated: "[i]t's eight feet underground, so there's no way of knowing when you have to replace it." Exh. Riverkeeper 17.

Dr. Esselman also testified that Entergy is in the process of installing cathodic protection as a preventative measure. Tr. at 3113:10-19, 22-23, 3114:1-2 (Esselman Direct by Trach). Though this technology is well developed and been around for decades, (Tr. at 3225:9-19, 20-22 (Esselman by Rvk)), Entergy has chosen to apply it to buried pipes now, nearly 40 after these components were initially installed and buried. Tr. at 3225:23, 3226:1-9, 3228:3-11 (Esselman by Rvk). Applying cathodic protection at this point, this is problematic because cathodic protection may have limited usefulness if local corrosion has already begun. For example, Mr.

Gundersen testified that once a section of a component is worn and already being attacked by rust, "cathodic protection doesn't work anymore." Tr. at 3982:1-5 (Gundersen by DEC). While cathodic protection may be able to slow down if it is already occurring, "[s]ome degree of corrosion may continue." Tr. at 3229:6-8, 11-14 (Esselman by Rvk). Furthermore, cathodic protection may provide protection from external corrosion, but has a limited ability to prevent internal pipe corrosion. Tr. at 3231:14-19 (Esselman by Rvk).

Entergy's aging management "plans are not sufficient to identify and stop all potential radiological leaks from buried components," and, thus, "future leaks from such components are very likely." Tr. at 2859:13-15, 19-20 (Gundersen Rebuttal)

B. Entergy's Reactive and Inadequate Approach to Leak Management

The evidence on the record demonstrates that Entergy employs a reactive approach to the management of radiological leaks at Indian Point, and that, as a result, radioactivity habitually release into the groundwater at the plant and/or to the Hudson River.

Primary evidence of a generally reactive approach is Entergy's use of and reliance on groundwater monitoring to detect water leaks. Entergy's witness, Mr. Barvenik, has testified at numerous locations in the record that the ground water monitoring will be used to detect future radiological releases. Barvenik Prefiled Direct Testimony (July 22, 1011) at 1:18-22; 2:6-7; 3:1-3; 4:20-5:1; 5:8-11; 10:6-10; 13:15-21; 14:8-9;16:11-15;21:2-23 – 22:1-2.

At the adjudicatory hearing, Mr. Barvenik again reiterated that the groundwater monitoring system will "detect future releases." Tr. at 3928:2-7 (Barvenik by DEC); Tr. at 4054:16-19 (Barvenik by Rvk); *See also* Riverkeeper 27 (list of components for which monitoring wells were proposed in order to detect future leakage from components characterized as having a "high" potential for leakage). Mr. Barvenik characterized the groundwater

monitoring program at Indian Point as being a "significant part of detecting leaks, should they occur." Tr. at 4096:16-23; 4097:1 (Barvenik by Rvk).

Monitoring wells "are not a predictive tool" and will, therefore, not "detect *whether* releases or leaks are *going to* occur." Tr. at 3958:9-15 (Barvenik by DEC) (emphasis added). Instead, a groundwater sampling program involves detecting leaks *after* they occur. Tr. at 4061:15-18 (Barvenik by Rvk); *see also* Tr. at 2856:10-11 (Gundersen Rebuttal); Tr. at 2987:19-21 (Gundersen by DEC). Mr. Barvenik agreed that groundwater monitoring by itself constituted a "reactive approach" to determining sources of radiological leakage. Tr. at 4065:18-21, 4066:3-6 (Barvenik by Rvk). The use of monitoring wells is reactive, and may result in identifying leaks months after they have occurred. Tr. at 3020:1-11 (Gundersen Re-Direct by Rvk). DEC prefers a more "proactive measure" such as "secondary containment," as opposed to reactive groundwater monitoring wells, in response to facility leaks. Tr. at 2775:1-13 (Kolakowski by Entergy).

The record demonstrates various examples of Entergy relying up the groundwater monitoring system at Indian Point to discover a new radiological leak source For example, elevated radionuclide levels in samples taken from the second quarter of 2011 resulted in an investigation by Entergy to determine the source. *See* Exh. Riverkeeper 55. Several months after detecting the elevated levels, Entergy determined, though not definitively, that the likely source of the leak was a recirculation pump. Tr. at 4003:5-21 (Barvenik by Rvk).

Notably, the evidence in the record shows that Entergy's reliance upon the groundwater monitoring system for purposes of detecting future radiological leaks is problematic for two additional reasons. First, Mr. Barvenik testified that GZA does not "sample over the entire length of a [sampling] quarter." Tr. at 4030:8-10, 4071:17-20 (Barvenik by Rvk). For example,

"typically in Quarter 2 samples are taken in April." Tr. at 4030:8-10 (Barvenik by Rvk). Should a leak start during the discrete weeks for which no sampling is performed, "[i]t would not be detected by the monitoring program" "[u]ntil samples were taken." Tr. at 4071:21-23, 4072:1, 13-18, 4073:2-4, 8-15 (Barvenik by Rvk). Second, Mr. Barvenik testified that the monitoring wells at Indian Point are not sensitive enough to be able to detect all sizes of leaks, and, accordingly, "small" leaks may persist undetected (all depending on the size, duration, radionuclide level, and location), though continue to add radionuclides the environment. Tr. at 4067:8-15, 17-20, 4068:3-23, 4069:1-3 (Barvenik by Rvk); *see also* Exh. Riverkeeper 21 at fn.6. In addition, normal fluctuations in the radionuclide levels in the groundwater may make it harder for the groundwater monitoring network to detect an active leak. Tr. at 4069:6-7, 10-16 (Barvenik by Rvk). Moreover, while Mr. Barvenik testified that the groundwater monitoring system at Indian Point would allow Entergy to respond "rapidly," Mr. Barvenik clarified that by "rapid response" he meant "a response that happens prior to any kind of significant dose impact that happened." Tr. at 4073:16-22 (Barvenik by Rvk).

In addition to the use of a reactive groundwater monitoring system, the record demonstrates that Entergy's general approach to site maintenance is likewise reactive, as well as slow. In particular, the evidence in the record shows that Entergy habitually responds to operational events, instead of preventing them. Tr. at 2839:8-25 (Gundersen Direct). Numerous examples of this have been developed on the record: (1) the discovery of active leakage from the Unit 1 SFP in 2006, which Entergy never fully repaired until the pool was drained in 2008 (Tr. at 4082:18-22 (Barvenik by Rvk); 3953:17-23, 3954:1 (Barvenik by DEC)); (2) the discovery in 2010 of a new leak path involving the light path boxes of the Unit 2 SFP, which, as of the date of the adjudicatory hearing in this proceeding, Entergy had yet to apply a permanent repair to

(Barvenik Prefiled Direct Testimony (July 22, 2011) at 11:9-11; Tr. at 3969:5-8 (Barvenik by Rvk)); (3) the discovery of elevated levels or radionuclides in monitoring wells near Unit 1 in June of 2011, which resulted in an investigation in the actual source which took place over the course of at least several months (Exh. Riverkeeper 55 at 16; Tr. at 4003:5-21 (Barvenik by Rvk)); (4) the February 2009 buried pipe leak, which was only discovered when water was observed to have reached the surface from 8 feet below, and only after which future inspections were scheduled (Tr. at 3175:2-5 (Esselman by Rvk); Tr. at 2964, 2965, 2968:1-23, 2969:1-4 (Gundersen by Zoli)); (5) unabated detections of radionuclides in Indian Point storm drains, including the detection of elevated radionuclides in March 2011, from over a year ago, which Mr. Barvenik could not explain the cause of (Exh. Riverkeeper 45 at 3; Tr. at 4001:21-23, 4002:1-3 (Barvenik Cross at Rvk)); and (6) the implementation of cathodic protection in response to leaking buried pipes at the plant, despite the fact that the technology is decades old, and would have been more effective if installed earlier. Tr. at 3225:9-19, 20-23, 3226:1-9, 3228:3-11 (Esselman by Rvk); Tr. at 3982:1-5 (Gundersen by DEC).

Lastly, the record shows that Entergy has failed to adequately fund its maintenance programs, which also contributes to insufficient leak management. Tr. at 2839:27-28, 2840:4-9 (Gundersen Direct); 3018:14-23, 3019:1-2 (Gundersen Re-Direct by Rvk); 2943:20-23, 2944:4-6, 8-16 (Gundersen by Zoli). Entergy's inadequate maintenance has resulted in numerous incidents at Indian Point, including two transformer explosions, as well as many of the radiological leakage events discussed elsewhere herein. Tr. at 3235:3-23, 3236:1-4, 7-22 (Esselman by Rvk). One notable ongoing operational and maintenance issue is habitual leakage relating to the refueling cavity liner, which, though it does result in releases to the environment, has been an ongoing problem for years and has yet to be stopped or fully addressed. Tr. at

3239:17-23, 3240:10-12, 3241:3-8, 3242:2-10 (Esselman by Rvk). Notably, Dr. Esselman acknowledged that Entergy had employed unacceptable maintenance practice in connection with this leakage, in relation to plant workers having to wear raincoats as radioactive water rained down upon them. Tr. at 3238:22-23, 3239:1-2; 3241:10-19; Exh. Riverkeeper 15.

The evidence, as discussed above, demonstrates that because Entergy implements inadequate aging managing with respect to problematic leaking components, future leaks are likely to occur. Moreover, because Entergy relies heavily on a reactive groundwater monitoring program, any such future releases at Indian Point will in all likelihood result in additional contamination in the groundwater and/or Hudson River.

V. Release and Migration of Radiological Leaks to the Hudson River

The record plainly establishes that radioactive water leaks that have occurred, or will occur, at Indian Point eventually release to the Hudson River, either through the groundwater, or via the discharge canal. In relation to the contamination that is in the groundwater at Indian Point, there is no dispute that the groundwater onsite flows to the west toward the Hudson River, and that "[t]he plumes ultimately discharge to the Hudson River," and have done so to date. Exh. Entergy 33 at viii, ix; *see also* Barvenik Prefiled Direct Testimony (July 22, 1011) at 5:14-17, 6:15-18, 9:15, 14:2-7, 20:20-22; Tr. at 3925:23, 3926:1-7, 12-18, 22-23, 3927:1 (Barvenik by DEC); Tr. at 4043:12-17 (Barvenik by Rvk); Tr. at 3124:14-19 (Hoffman by DEC); Tr. at 3268:6-11, 3293:5-9 (Hoffman by Rvk); Tr. at 2663:4-22 (Kolakowski Direct by DEC).

The hydraulic gradient for the groundwater flow at the Indian Point site is from east to west, from the locations of Indian Point units 1, 2, and 3 to the Hudson River. Tr. at 2663:4-11 (Kolakowski by DEC). According to the GZA Report, groundwaters at or near the Indian Point nuclear facilities and surface waters of the Hudson River at or near the Indian Point nuclear

facilities have been contaminated by or from radiological leaks from the Indian Point nuclear facilities. Tr. at 2675 (Kolakowski Direct); Exh. Entergy 33 (GZA Report at Executive Summary; and Sections 1.0, 8.0, 9.0, and 10.0). Radiological materials in the plumes from the Unit 1 SFP and Unit 2 SFP travel through the groundwater and then discharge to the Hudson River. Tr. 2996:22-23 to 2997:1-7 (Barvenik by DEC). Strontium, cesium and cobalt have been released to the Hudson River as a result of the past release to groundwater from IP1 SFP. Hoffman Prefiled Testimony (July 22, 2011) at 12. Both Mr. Barvenik and Dr. Hoffman, acknowledged that the radiological contamination releasing to the River from Indian Point constitutes an independent source of radiological material that adds radioactivity to the Hudson River, that is separate from the background radiation that exists in the river. Tr. at 4044:5-17 (Barvenik by Rvk); Tr. 3268:12-16 (Hoffman by Rvk).

Radiological leaks at Indian Point are "in strong hydraulic communication with the Hudson River" and "the rate of groundwater discharge to the river at IPEC [Indian Point Energy Center] is continuous and fairly constant." Exh. Entergy 33 at 63, 49; Tr. at 2675:6-10 (Kolakowski Prefiled Direct). The contaminated groundwater "flushes through the subsurface to the river." Barvenik Prefiled Direct Testimony (July 22, 1011) at 9:15. Notably, the use of MNA at Indian Point will not prevent radionuclides from reaching the Hudson River, and will result in the "additional transport of strontium to the Hudson River" as well as tritium, and potentially cesium. Tr. at 4036:7-12, 17-21 (Barvenik by Rvk). Dr. Hoffman concurred that the use of MNA will result in radionuclides continuing to reach the Hudson River. Tr. at 3270:2-9 (Hoffman by Rvk). In addition, the record indicates that any future radiological leaks that contribute to the existing groundwater contamination plumes at Indian Point will also migrate to the Hudson River, and may increase the level of radionuclides that reach the river. Tr. at

2785:18-22 (Kolakowski Re-Direct by DEC); Tr. at 2683:14-23, 2686:14-17 (Kolakowski Rebuttal).

The record demonstrates that radionuclides in the groundwater are currently discharging into the Hudson River and will continue to do so throughout Entergy's proposed period of extended operation, and likely well beyond, (should MNA continue to be the chosen strategy for managing the radiological contamination at Indian Point). Strontium and tritium in the groundwater contamination plumes have "not been completely flushed to the river," and could not say when that would occur. Tr. at 3955:11-20, 21-23 (Barvenik by DEC); Tr. at 2784:18-23, 2785:1-6. Dr. Hoffman could not say when discharges of the contamination plumes to the river would stop. Tr. at 3126:22-23, 3127:1-2 (Hoffman by DEC). Mr. Kolakowski testified that, based on his review of GZA monitoring reports "it is expected that uncontrolled or unintended releases of radiological materials to groundwater at Indian Point will continue to reach the Hudson River for the foreseeable future, including during the nuclear license extension period currently being sought by Entergy." Tr. at 2684:1-10 (Kolakowski Rebuttal). Mr. Kolakowski also testified that based upon his review of Entergy's Application for WQC, he determined that "based on the track record of operation and housekeeping at the facility" "there could be additional [radiological] releases," and that "there was a potential for future releases to continue," and that in the course of DEC Staff's review, "it was clear there were releases" and "[t]here was concern over future releases and impacts on water quality." Tr. at 2744:8-21 (Kolakowski by Entergy); Tr. at 2788:20-23, 2789:1-10 (Kolakowski Redirect by DEC); Tr. at 2793:12-15 (Kolakowski Re-Cross by Entergy). Mr. Gundersen also opined that radiological releases from the groundwater to the Hudson River will occur throughout the proposed

relicensing term and well beyond. Tr. at 2840:29-31, 2841:1 (Gundersen Direct); Tr. at 2862:11-16 (Gundersen Rebuttal).

The GZA report further explains that portions of the groundwater flow at Indian Point are "intercepted by the cooling water intake and Discharge Canal." Exh. Entergy 33 at 10. Mr. Barvenik's testimony confirmed that the contamination does enter the discharge canal via the groundwater. Tr. at 4047:22-23, 4048:1-3 (Barvenik by Rvk); Exh. Entergy 33 at 48. The GZA site investigation report indicates that the groundwater discharge to the cooling water discharge canal is approximately 18 gallons per minute. Exh. Entergy 33 at 76. Mr. Barvenik explained that radioactive materials in the groundwater "could be pulled in by the cooling water intake" and subsequently "go through the cooling loop" and "assuming they weren't partitioned, they would end up in the discharge canal." Tr. at 4049:21-23, 4050:3-6, 16-23, 4051:1-2 (Barvenik by Rvk). The GZA report more definitively states that "[w]hen the river is near high tide, the cooling water intake draws river water that contains discharge water." Exh. Entergy 33 at 65. Mr. Barvenik explained that as a result, radionuclides from the groundwater that end up to the discharge canal may end up back in the intake structure, and then back in the discharge canal. Tr. at 4051:13-22 (Barvenik by Rvk).

In addition to radionuclides in the groundwater migrating and releasing to the Hudson River, the record demonstrates that radioactive water leaks at Indian Point have, and will likely continue to, enter the Hudson River via the discharge canal. For example, the residual contamination attributable to Unit 1 SFP leaks that is collected by the NCD is eventually discharged to the Hudson River by way of the discharge canal. Tr. at 4084:2-6, 3993:10-12 (Barvenik by Rvk). Similarly, elevated levels of radionuclides in Indian Point storm drains, (attributable to washout, or as yet unknown component leaks, as discussed above) eventually end

up in the Hudson River via the discharge canal. Tr. at 3983:5-10, 21-23, 3984:2-6, 3991:13-19, 3993:10-12 (Barvenik by Rvk); Tr. at 4101:20-23, 4102:1 (Barvenik Re-Direct by Entergy). Notably, Mr. Barvenik explains that "[c]ertain radionuclides can partition to the surface of those [storm] drains." Tr. at 3982:5-9 (Barvenik Cross by Rvk). The evidence indicates that any such partitioned radionuclides may transition back to liquid form and release to the Hudson River via the discharge canal at a later date. *See* Exh. Entergy 33 at 113; Tr. at 3973:20-22, 3974:2-7 (Barvenik by Rvk).

VI. Entergy's Appraisal of the Impact of Radiological Leaks on the Public

Entergy's witness, Dr. Hoffman, evaluated Entergy's offsite dose calculation relating to accidental radioactive groundwater and stormwater releases to the environment. Hoffman Prefiled Testimony (July 22, 2011) at 8, 10-11; Tr. at 3091:8-15 (Hoffman Direct by Entergy). Entergy performed this calculation using its Offsite Dose Calculation, which Dr. Hoffman testified, follows the requirements contained in NRC guidance. Hoffman Prefiled Testimony (July 22, 2011) at 10:4-8, 11:1-10, 13:3-17; Tr. at 3092:6-18 (Hoffman Direct by Trach).

It is undisputed that in relation to Indian Point, Entergy's "[l]iquid offsite dose calculations involve fish and invertebrate consumption pathways only." Exh. Riverkeeper 48; Tr. at 3277:9-17 (Hoffman by Rvk). Dr. Hoffman acknowledges that "swimming is not considered to be a relevant activity at that location, nor is drinking water." Tr. at 3277:9-17 (Hoffman by Rvk). Dr. Hoffman further explains that, [t]he calculation is made specifically for fish because the other pathways have been considered to not be actively present at the site." Tr. at 3278:1-10 (Hoffman by Rvk). Dr. Hoffman explicitly recognized that Entergy's dose calculation does not examine exposure through recreational purposes or for drinking water pathways. Tr. at 3281:8-12 (Hoffman by Rvk). Dr. Hoffman also explained that on an absolute

scale, the consideration of other pathways in addition to a fish consumption exposure pathway, would affect the overall dose to an individual. Tr. at 3290:3-19, 2391:2-6.

Notably, Dr. Hoffman testified about his familiarity with a proposal for a desalination plant to be cited approximately 2.5 miles downstream of Indian Point in Haverstraw Bay. Tr. at 3282:4-12 (Hoffman by Rvk). Dr. Hoffman's testimony indicates that radionuclides from Indian Point could migrate to the proposed intake location for this desalination project, and be taken up by the facility. Tr. at 3282:15-18, 3283:10-23, 3284:1-2 (Hoffman Cross by Rvk). Dr. Hoffman also acknowledged that tritium cannot be filtered out of water. Tr. at 3284:3-5 (Hoffman by Rvk).

VII. The Biological Effects of Ionizing Radiation VII Report

Riverkeeper's witness, Mr. Gundersen, testified about the Biological Effects of Ionizing Radiation Report, volume VII ("BEIR VII"), issued by the National Academy of Sciences in 2005. The conclusion of the BEIR VII was that every exposure to radiation, regardless of how small, and no matter what pathway, produces a corresponding increase in the likelihood of cancer. Exhs. Entergy 101; Riverkeeper 23; Tr. at 2866:1-4 (Gundersen Rebuttal); Tr. at 2921:4-12, 2923:14-17, 2976:3-12 2921:4-122921:4-12 (Gundersen by Entergy); Tr. at 3001:14-22 (Gundersen Re-Direct by Rvk). Entergy's witness, Dr. Hoffman, also acknowledged the conclusion of this report that "risk is basically linear with dose" and that there is no level of exposure below which there is no proportional risk. Tr. at 3099:4-13, 3100:308 (Hoffman Direct by Entergy); 3134:21-23, 3135:1 (Hoffman by DEC); Tr. at 3286:3-7, 12-13 (Hoffman by Rvk). Dr. Hoffman further testified that "[t]he higher the dose, the higher the risk," and agreed that the higher the cumulative exposure, the higher the risk of cancer. Tr. at 3143:7-8, 21-22 (Hoffman by DEC); Tr. at 3313:6-10 (Hoffman Re-Cross by Rvk).

Dr. Hoffman testified about the risk posed under the BIER VII model from a specific dose, calculated by Entergy pursuant to its OCDM, from accidental radiological leaks from Indian Point in 2010. Tr. at 3286:17-18, 20, 22-23, 3287:1-3 (Hoffman by Rvk). Dr. Hoffman recognized that future, as well as past, doses from radiological leaks at Indian Point increase an individual's lifetime risk. Tr. at 3287:18-23, 3288:1-10, 16-20, 3289:1-8 (Hoffman by Rvk). Dr. Hoffman explained that "for each additional year of exposure there would be a commensurate additional risk." Tr. at 3289:1-3 (Hoffman by Rvk). While, Dr. Hoffman indicated his belief that future releases to the environment would occur, he could not predict how many years' exposures would continue from accidental radioactive leaks from Indian Point, or what the concentrations of any such prospective dosages would be. Tr. at 3131:8-9, 3310:20-23, 3311:1-5 (Hoffman Re-Cross by DEC). Nor could Dr. Hoffman determine how many years of past exposures may have occurred from accidental radioactive leaks at Indian Point, prior to monitoring. Tr. at 3130:15-19 (Hoffman by DEC).

Dr. Hoffman further agreed that any exposure to the radiological leaks from Indian Point constituted a source of radiation in addition to "an already radioactive environment" and the "background" radiation sources individuals are exposed to. Tr. at 3175:6-11, 3126:13-17, 20-21 (Hoffman by Rvk). Dr. Hoffman acknowledged that accidental leaks of radiological materials from Indian Point are just one additional source of radiation exposure, which, on an absolute scale adds to what a person is already exposed to on an annual basis elsewhere. Tr. at 3274:21-23, 3275:1-5, 14-20 (Hoffman by Rvk); Tr. at 3312:21-23, 3313:1-5, 3314:1-4 (Hoffman Re-Cross by Rvk).

Notably, Dr. Hoffman also recognized that "[i]n the last 15 years there's been almost an explosion of literature dealing with investigation of potential effects of radiation at doses that are

small fractions of natural background. And that evidence indicates that the risks might increase . . ." Tr. at 3291:16-21 (Hoffman by Rvk).

In any event, Riverkeeper's witness, Mr. Gundersen, testified that, based upon the BEIR VII model, accidental radioactive releases in the Hudson River from Indian Point leaks could increase the incidence of cancer to those who recreate in the river. Tr. at 2866:4-7 (Gundersen Rebuttal); Tr. at 2997:4-12 (Gundersen Re-Direct by Rvk). Strontium-90 is a bone seeker, which, if ingested, mimics calcium and is absorbed by bone where it can cause cancer, which Cesium-137 mimics potassium, and is absorbed by muscle. Tr. at 2834:5-10 (Gundersen Direct); Tr. at 2996:3-13 (Gundersen Re-Direct by Rvk). Tritium behaves like water, and can be ingested, inhaled, or absorbed through the skin. Tr. at 2834:10-13 (Gundersen Direct). Dr. Hoffman's testimony concurred with these radionuclide characterizations. Tr. at 3243:23, 3244:1-6, 20-23, 3245:1-9 (Hoffman by Rvk). According to the BEIR VII report, these deleterious substances from accidental leaks at Indian Point have the potential to affect individuals recreating in the Hudson River. Tr. at 2833:26-30 (Gundersen Direct); Tr. at 2866:1-7 (Gundersen Rebuttal).

VIII. The Potential Impact of Radiological Leaks on the Aquatic Ecology of the Hudson River[101]

Entergy's witness, Dr. Hoffman, opines that SFP leaks at Indian Point have not, to date, had an impact on the aquatic ecosystem of the Hudson River. Hoffman Prefiled Testimony (July 22, 2011) at 16:13-14. However, Dr. Hoffman acknowledges that his assessment focused on

[101] An Entergy document dated November 2011, but disclosed *after* the conclusion of the adjudicatory hearing on the "Radiological" issue, entitled "IPEC CWW Dredging Step 1 – Draft White Paper Postulated Contamination Characterization" indicates that Cesium-137 is present in Hudson River sediment. Evidence, as discussed herein, indicates that Cesium-137 found in the Hudson River sediments may be attributable to leaks from the Unit 1 SFP. However, due to Entergy's failure to timely disclose this document, Riverkeeper has not had the opportunity to provide testimony and/or cross examine Entergy's witnesses in relation to information contained in the document. As such, Riverkeeper respectfully reserves the right to submit this document as further evidence that Indian Point may have resulted in impacts to the aquatic ecology of the Hudson River.

population impacts, and not on single organisms, and that he had not taken into account how radiological exposures to individual members of a species could contribute to mortality, the failure to mature, or reproductive failures. Tr. at 3150:11-23, 3151:1-6 (Hoffman by DEC). Notably, U.S. GAO has acknowledged that

> very little information exists on the sensitivity of other organisms to the impact from environmental tritium contamination. Consequently, subtle effects on other organisms that have not been identified could exist. A few experts pointed out that even though offsite environmental impacts are not discernable, the on-site ground water contamination from the leaks may have degraded the on-site environment, potentially limiting the site's future use

Exh. Riverkeeper 7 at 10. Importantly, Indian Point is in adjacent to Haverstraw Bay, a NYS designated essential fish habitat and Significant Coastal Fish and Wildlife Habitat, which is a major nursery and feeding area for may critical fish species in the Hudson River. Tr. at 2867:2-5 (Gundersen Rebuttal).

Moreover, Dr. Hoffman did not dispute that radiological exposures to aquatic organisms in the Hudson River, and the biological uptake of radioactivity in such organisms, may occur in the future. Tr. at 3151:7-18 (Hoffman by DEC). Nor does Dr. Hoffman dispute that radionuclides from leak at Indian Point have, and will continue to release to the Hudson River. Tr. at 3124:14-19 (Hoffman by DEC); Tr. at 3268:6-11, 3293:5-9 (Hoffman by Rvk). These radionuclides have the potential to impact fish in the river during Entergy's proposed period of extended operation. Tr. at 2866:19-21 (Gundersen Rebuttal). Notably, NRC data indicates that in the 1980s, both Strontium-90 and Strontium-89, a shorter-lived isotope that is not attributable to background radiation, were detected in fish sample, indicating a "fresh" source of strontium. Tr. at 2866:21-27, 2867:1-5 (Gundersen Rebuttal); Tr. at 2977:13-23, 2978:1 (Gundersen by Entergy).

In addition, Dr. Hoffman relied upon a 2007 fish study performed by DEC, which involved enhancements to Entergy's regular sampling efforts, and concluded that there were no spatial differences in strontium concentrations in fish samples from 3 sample locations. Hoffman Prefiled Testimony (July 22, 2011) at 16-17. However, Dr. Hoffman was not aware of whether DEC, NRC, or Entergy intended to undertake any future enhanced fish sampling studies. Tr. at 3302:15-20-23, 3303:1-19 (Hoffman Cross by Rvk). Nor was Dr. Hoffman aware of strontium releases from an upstream facility, the Knolls Atomic Power Lab, which Riverkeeper's witness, Mr. Gundersen, indicated may have affected DEC's assessment relating to what was attributable to fallout and non-fallout sources. Tr. at 3294:14-16 (Hoffman by Rvk); Tr. at 2867:7-9 (Gundersen Rebuttal).

Moreover, Dr. Hoffman recognized that bioaccumulation occurs in relation to several of the radionuclides present in the contamination at Indian Point, including Strontium-90 and Cesium-137. Tr. at 3279:23, 3280:1-18 (Hoffman by Rvk). Dr. Hoffman explained that bioaccumulation results in higher concentrations of radionuclides in organisms in the ecological food chain. Tr. at 3279:23, 3280:1-18, 3298:17-23, 3299:1 (Hoffman by Rvk). Bioaccumulation "is a routine process where isotopes work their way up the food chain," and that will occur with the radionuclides that have been and will continue to be released to the Hudson River from Indian Point. Tr. at 2996:18-19 (Gundersen Re-Direct by Rvk). Radionuclides are absorbed by sediments and the leafy vegetation at the bottom of the river, and as those materials are consumed the concentration of radionuclides builds up over time. Tr. at 2996:23, 2997:1-3 (Gunderson Re-Direct by Rvk).

ANALYSIS

The following unequivocally demonstrates not only that DEC Staff properly denied Entergy's Application for WQC based upon radiological considerations, but that separate and independent regulatory grounds pertaining to Indian Point's radiological discharges to groundwater also mandate denial of Entergy's requested CWA § 401 WQC. In particular, the ample record compiled on this adjudicable issue reveals that Entergy has failed to demonstrate Indian Point's compliance with state water quality standards and other applicable provisions of state law, as follows.

I. Denial of Entergy's Application for WQC is Appropriate Because Entergy has Failed to Demonstrate that Radioactive Leaks at Indian Point will Comply with New York State's Water Quality Standard Designating the Best Use Of Groundwater for Potable Purposes During a Period of Extended Operation

In accordance with CWA § 303, New York State has promulgated and currently implements State water quality standards consisting of water classifications and corresponding best usage and narrative standards.[102] In adopting such water classifications, DEC gave due consideration to the uses which not just "have been made, [or] are being made," but also to those uses which "may be made" of the water.[103] The standards of quality assigned to each water classification were those "necessary for the *public use or benefit contemplated* by such classification."[104] DEC was directed to adopt water standards that "prescribe what qualities and properties of water shall indicate a polluted condition of the waters of the state which is *actually or potentially* deleterious, harmful, detrimental, or injurious to the public health, safety or

[102] *See* ECL § 17-0301; 6 NYCRR Part 701.

[103] ECL § 17-0301(3)(c).

[104] ECL § 17-0301(4) (emphasis added).

welfare, to terrestrial or aquatic life . . . or *to the use of such waters* . . . with respect to the various classes established."[105]

In relation to groundwater, as Entergy has acknowledged and explained, "[a]ccording to 6 NYCRR §701.18(a), the groundwater classifications defined in §701.15 (GA - for fresh groundwater) and §701.16 (GSA - for saline groundwaters) are assigned to *all the groundwaters of New York State*."[106] While "fresh groundwater" is defined as "those groundwaters having a chloride concentration equal to or less than 250 mg/L or a total dissolved solids concentration equal to or less than 1,000 mg/L,"[107] "saline groundwater means groundwater having a chloride concentration of more than 250 mg/L or a total dissolved solids concentration of more than 1,000 mg/L."[108] Entergy has stated on the record of this proceeding, (as well as in a Response to a Request for Information from DEC Staff Concerning Entergy's Application for WQC), that "[t]he groundwater at the Indian Point site is fresh groundwater and, therefore, is classified as GA."[109] Thus, it is undisputed that the water classification of the groundwater beneath Indian Point is "Class GA Fresh Groundwater."

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[105] ECL § 17-0301(4) (emphasis added).

[106] *See* Entergy's Detailed Responses to the New York State Department of Environmental Conservation's Request for Information, dated May 13, 2009) at 8, *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/elecbdrdetresp.pdf (last accessed July 9, 2010) (emphasis added); 6 NYCRR § 701.18(a) ("The groundwater classifications defined in sections 701.15 and 701.16 of this Part are assigned to *all the groundwaters of New York State*") (emphasis added); *see also* Riverkeeper's Petition for Party Status at 3-4; *see also* Tr. 2781:10-14 (Kolakowski by Rvk); Tr. at 2674: 4-15 (Kolakowski Direct).

[107] 6 NYCRR § 700.1(a)(20).

[108] 6 NYCRR § 700.1(a)(52).

[109] *See* Entergy's Detailed Responses to the New York State Department of Environmental Conservation's Request for Information, dated May 13, 2009) at 8, *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/elecbdrdetresp.pdf (last accessed July 9, 2010); *see also* Riverkeeper's Petition for Party Status at 3-4; *see also* Tr. 2781:10-14 (Kolakowski by Rvk); Tr. at 2674: 4-15 (Kolakowski Direct).

DEC has set forth a narrative water quality standard applicable to Class GA waters, which dictates that that deleterious substances not "impair the waters for their best usages."[110] In addition, a "general condition[] applying to all water classifications" further prescribes that the discharge of industrial or other wastes "not cause impairment of the best usages of the receiving waters as specified by the water classifications at the location of the discharge and *at other locations that may be affected by such discharge*."[111] The best usage of "GA fresh groundwater" is "as a source of potable water supply."[112] "Potable water" is defined as "those fresh waters usable for drinking, culinary or food processing purposes."[113]

Despite DEC Staff's understanding that the Federal CWA applies to discharges to "navigable waters," which do not encompass groundwater,[114] in the context of a certification proceeding pursuant to CWA § 401, it is critical and necessary to examine the activity as a whole,[115] and to determine the applicants compliance with all relevant State water quality standards.[116] In fact, both CWA § 401 as well as the parallel New York State implementing provision indicate that certification applicants must demonstrate compliance with other

[110] 6 NYCRR § 703.2.

[111] 6 NYCRR § 701.1.

[112] 6 NYCRR § 701.15.

[113] 6 NYCRR § 700.1(a)(48).

[114] Tr. at 2762:6-12 (Kolakowski by Entergy); As noted, the CWA §510 (33 U.S.C. §1370) provides that a State is authorized to adopt stricter standards than the federal minimum respecting discharges of pollutants, or any requirement respecting control or abatement of pollution. Accordingly, New York State has promulgated water quality standards for groundwater as well as surface waters.

[115] DEC Staff has explicitly recognized this (Tr. at 2780:20-23, 2781:1-5 (Kolakowski by Rvk)), as well as the fact that "the activity" in this case clearly implicates an impact to groundwaters of the State of New York. Tr. at 2683:6-11 (Kolakowski Rebuttal) (recognizing that "radiological materials, consisting primarily of strontium and tritium, but also other radionuclides such as cesium, cobalt and nickel, have leaked from or at the Indian Point nuclear facilities and entered waters of the State (*i.e.*, groundwater and, eventually, migrating to Hudson River surface water").

[116] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 711 (1994).

appropriate State laws.[117] State water quality standards established pursuant to § 303 of the CWA, that is designated uses for water sources and the state's anti-degradation policy, are undoubtedly considered appropriate standards to apply in a § 401 certification.[118] It is, thus, appropriate to apply State water quality standards, including assigned designated uses, criteria, and antidegradation policies, explicitly promulgated pursuant to § 303 of the CWA, to radioactive leaks that impact New York State waters.[119] In this proceeding, DEC Staff recognizes that the best usage designation applicable to the groundwater at Indian Point plainly "constitutes a water quality standard of the State of New York."[120] Thus, there remains no question that Entergy's must demonstrate that relicensing Indian Point will comport with the designated best use of New York State groundwaters at Indian Point, the narrative water quality criteria that serve to protect the use of GA groundwaters, and the State's antidegradation policy.

Based on the foregoing, in order to comply with New York State's water quality standards pertaining to the groundwater at Indian Point, deleterious substances cannot "impair the waters for their best usages"[121] and the discharge of industrial waste or other wastes must "not cause impairment of the best usages of groundwater.[122] Furthermore, New York Law mandates that [i]t shall be unlawful for any person, directly or indirectly . . . discharge into such waters organic or inorganic matter that shall *cause or contribute* to a condition in contravention of the standards by the department pursuant to section 17-0301,"[123] (i.e., the water

[117] CWA § 401(d); 33 U.S.C. § 1341(d); 6 NYCRR § 608.9(a)(6).

[118] *See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 713-18 (1994).

[119] *Matter of Eastern Niagara Project Power Alliance v. New York State Dept. of Envtl. Conservation*, 42 A.D.3d 857 (N.Y. App. Div. 3d Dep't 2007)

[120] Tr. at 2781:15-17 (Kolakowski by Rvk).

[121] 6 NYCRR § 703.2.

[122] 6 NYCRR § 701.1.

[123] ECL § 17-0501.

classifications and corresponding usage and narrative standards). As such, deleterious substances and industrial or other wastes also must not cause or contribute to an impairment of best usages of the groundwater.

Thus, at Indian Point, deleterious substances and industrial or other wastes must not impair, or cause or contribute to an impairment of, the groundwater for use as drinking, culinary, or food processing water during the proposed extended operating period. Pertinent parameters for assessing whether water is drinkable include the U.S. Environmental Protection Agency's ("EPA") Maximum Contaminant Levels ("MCLs"), established under the Safe Drinking Water Act, for radionuclides in drinking water.[124] Importantly, Entergy must comply with the applicable groundwater best usage standard notwithstanding whether the groundwater is *actually* used for such purposes. This is clear under Federal law, which defines designated uses as "those uses specified in water quality standards for each water body or segment *whether or not they are being attained*,"[125] as well as under NYS law, which indicates that applicable water quality standards protect the use "contemplated" by the classification.[126] As noted, water quality standards "are the State's *goals* for individual water bodies and provide the legal basis for control decisions under the Act [CWA]"[127] and serve to protect the public health or welfare.[128]

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[124] EPA regulations implementing the Safe Drinking Water Act provide that "[t]he average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year)." 40 C.F.R. § 141.66(d). This dose converts to a maximum limit of radionuclides in water in terms of picocuries per liter (pCi/l), for particular radionuclides as follows: Tritium: 20,000 pCi/l; Strontium-90: 8 pCi/l; Cesium-137: 200 pCi/l; Nickel-63: 50 pCi/l. *See* 40 C.F.R. § 141.66(d) (Table A); *See also* U.S. EPA, Radionuclides in Drinking Water: A Small Entity Compliance Guide (February 2002), *available at*, http://www.epa.gov/ogwdw/radionuclides/pdfs/guide_radionuclides_smallsystems_compliance.pdf, at 13.

[125] 40 C.F.R. § 131.3(f) (emphasis supplied).

[126] ECL § 17-0301(4).

[127] 40 C.F.R. § 130.0(b)

[128] 40 C.F.R. 130.2(d).

Accordingly, the designated use itself must be protected, regardless of whether such is use is actually being made of the waters at issue.

The record in this proceeding demonstrates that Entergy has failed to show that the groundwater at Indian Point will satisfy the relevant New York State water quality requirements.

A. Radioactive Contamination at Indian Point Constitute Deleterious Substances, as well as Industrial or Other Waste as Contemplated by NYS Standards

The evidence in this proceeding undisputedly shows that decades of accidental radioactive water leaks from components at Indian Point have resulted in at least two extensive groundwater plumes underlying the site.[129] One plume consists mostly of Tritium, while the second plume contains a variety of highly toxic radionuclides, including Strontium-90, Cesium-137, Nickel-63, and Cobalt.[130] Entergy attributes the contamination plumes to past leaks from spent fuel pools associated with Indian Point Units 1 and 2.[131] To be sure, the Unit 1 and Unit 2 spent fuel pools did leak for years.[132] However, the record includes evidence of a number of other component leaks have also occurred at Indian Point and contributed to the groundwater plumes. For example: in 2009 a buried pipe leak resulted in more than 100,000 gallons of tritiated water releasing to the environment and groundwater;[133] a Refueling Water Storage Tank "processing skid" contributed to the radioactive plumes, causing the detection of "greatly elevated" levels of tritium in the groundwater;[134] in 2011, elevated concentrations of radionuclides were detected in monitoring wells, which Entergy later determined the most likely

[129] *See* Exh. Riverkeeper 12 at 1; Tr. at 2831:29-31 (Gundersen Direct); Barvenik Prefiled Testimony (July 22, 2011) at 5:20-22.

[130] *See* Tr. at 2832:1-3 (Gundersen Direct); Barvenik Prefiled Testimony (July 22, 2011) at 5:21-22; 6:7-9.

[131] *See* Exhibit Riverkeeper 12 at 1; Barvenik Prefiled Testimony (July 22, 2011) at 5:23-6:1; 6:6-7.

[132] *See* Tr. at 2828:5-25 (Gundersen Direct); Exh. Riverkeeper 12 at 1-2; Exh. Riverkeeper 11; Ex. Riverkeeper 13.

[133] *See* Exh. Riverkeeper 16; Exh. Riverkeeper 17; Tr. at 3175:6-23, 2176:1-3 (Esselman by Rvk).

[134] Barvenik Prefiled Direct Testimony (July 22, 2011) at 10:20-22; Tr. at 3987:3-10; 2988:2-7, 3988:8-11, 4028:13-18 (Barvenik by Rvk).

cause to be a leaking recirculation pump.[135] It is undisputed that these other leaks at Indian Point have contributed to the contamination plumes in the groundwater, as demonstrated by spikes in concentrations of radionuclides in monitoring wells in response to such leaks.

The radionuclides present in the groundwater as a result of accidental radiological leaks plainly constitute deleterious substances, as well "industrial" or other waste under New York State law.[136] The radionuclides that have accidentally leaked to the groundwater are clearly "deleterious" since they are toxic, carcinogenic, harmful radioactive isotopes.[137] The radionuclides in the groundwater at Indian Point are also "industrial waste," which is defined by DEC as

> any liquid, gaseous, solid or waste substance or a combination thereof resulting from any process of industry, manufacturing, trade, or business or from the development or recovery of any natural resources, which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards adopted as provided herein.[138]

The radiological contamination at issue falls within this definition, as it is clearly a waste substance resulting from an industrial operation a nuclear power plant, which can reasonably be expected to cause, and in fact has caused, pollution, which the CWA defines as the alteration of the, *inter alia*, the radiological integrity of the water.[139] The radiological material in the groundwater an Indian Point can otherwise be classified as "other waste" as used in 6 NYCRR §

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[135] Exh. Riverkeeper 55 at 15-16; Tr. at 4003:5-21 (Barvenik by Rvk).

[136] 6 NYCRR § 703.2; 6 NYCRR § 701.1.

[137] Tr. at 2834:5-10 (Gundersen Direct); Tr. at 2996:3-13 (Gundersen Re-Direct by Rvk); Tr. at 3243:23, 3244:1-6, 20-23, 3245:1-9 (Hoffman by Rvk).

[138] ECL §17-0105(5) and 6 NYCRR § 750-1.2(a)(44) provide that: "'Industrial waste' means any liquid, gaseous, solid or waste substance or a combination thereof resulting from any process of industry, manufacturing, trade, or business or from the development or recovery of any natural resources, which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards adopted as provided herein."

[139] CWA § 502(19); 33 U.S.C. § 1362(19).

701.1, since it is essentially the unwanted byproduct of various processes that go on at the plant, such as spent fuel storage.

B. Deleterious Radioactive Contamination at Indian Point Currently Impairs the Best Use of Groundwaters of New York State by Exceeding Levels Allowable for Drinking Water

Notwithstanding whether or not the groundwater at Indian Point is used as a drinking water source (which is of no moment for purposes of assessing compliance with New York's clear water quality standard designating the best use of the groundwater for such purpose[140]) no party to this proceeding disputes the fact that since monitoring began at Indian Point in 2005, the levels of radionuclides in the groundwater have *regularly* been found to be in excess of the MCL values established by EPA for radionuclides in drinking water: initial sample effort shows that levels of radionuclides were well over EPA MCLs, and over the course of the past seven years, the sampling has continued to consistently detect levels of tritium, strontium, cesium, cobalt, and/or nickel, at levels above EPA MCLs.[141] The most recent Entergy groundwater sampling data provided in the record was data from the third sampling quarter of 2011 indicated that tritium, strontium, and cesium had, again, been detected at levels over EPA MCL values.[142]

As noted, the designated best usage for Class GA groundwaters is as a source of potable water supply.[143] "Potable waters" mean those fresh waters usable for drinking, culinary or food processing purposes."[144] Yet, the record unquestionably demonstrates the groundwater under Indian Point is not "usable" for drinking as a result of Indian Point's discharges of radioactive

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[140] 40 C.F.R. § 131.3(f); ECL § 17-0301(4).

[141] Exhs. Riverkeeper 14; Riverkeeper 22; Riverkeeper 63; Tr. at 4020:8-23, 4021:1-2, 5-16 (Barvenik by Rvk).

[142] Tr. at 4020:8-23, 4021:1-2 (Barvenik by Rvk).

[143] 6 NYCRR § 700.1

[144] 6 NYCRR § 701.1(48).

materials, as is evidenced by Entergy's own monitoring data which shows exceedences of EPA's MCL values. Thus, Entergy has failed to demonstrate that Indian Point is currently operating in compliance with the New York State's designated best use standard applicable to groundwater at the plant.

As the Third Department has observed, under CWA § 401, States "can regulate any activity altering the integrity of water."[145] Thus, even in the absence of data establishing that the groundwater under Indian Point is not usable as drinking water, DEC would have ample authority (as well as evidence in this case) to deny Entergy's requested CWA § 401 water quality certification based upon violations of state groundwater water quality standards. Here, the evidence clearly shows that the integrity of the groundwater has not only been altered, but has reached a point where it no longer suitable for the designated use. The Tribunal should accordingly uphold with the Department's denial of water quality certification on separate and independent grounds pertaining to groundwater quality.

C. Deleterious Radioactive Contamination at Indian Point Will Continue to Impair the Best Use of Groundwaters of New York State by Causing Ongoing Exceedances of Levels Allowable for Drinking Water

Entergy has failed to demonstrate that deleterious material, i.e., the radioactive contamination plumes in the groundwater, will not impair the groundwaters of New York for their best usage as a potable water supply *for the duration of the proposed activity*, that is, twenty additional years of operating Indian Point. The bases for DEC's conclusion that radiological discharges from Indian Point could impair the Hudson River for its best usages[146] are equally

[145] *Matter of Eastern Niagara Project Power Alliance v. New York State Dept. of Envtl. Conservation*, 42 A.D.3d 857, 860 (N.Y. App. Div. 3d Dep't 2007), citing *S.D. Warren Co. v Maine Bd. of Envtl. Protection*, 547 US 370 (2006).

[146] Tr. at 2743:15-23 (Kolakowski by Entergy).

applicable in the context of Class GA groundwaters. In light of the discharge history from the facility, unauthorized discharges or unexpected discharges to the groundwater,[147] "the track record of operation and housekeeping" at Indian Point[148] and historical and potential future discharges from the facility,[149] there is an equally "high likelihood of a contravention of water quality standards"[150] for groundwater as well as the Hudson River.

i. Residual Radiological Contamination May Cause Radionuclides in Groundwater to Exceed Standards Allowable for Drinking Water

The record demonstrates that the existing residual contamination that is currently in the groundwater will, even in the absence of new radioactive leakage to the groundwater, periodically increase in the future, and Entergy has failed to demonstrate that such periodic increases in the concentrations of radionuclides in the groundwater will never exceed EPA MCLs throughout the proposed period of extended operation.[151] The evidence is undisputed that spikes in radionuclide concentrations is normal plume behavior, since contaminants are stored in the subsurface at Indian Point, and intermittently release to the groundwater, and expected to "continue *at least* into the renewal period."[152] This is particularly relevant in relation to the contamination Entergy attributes to "past releases" from the Indian Point Unit 1 SFP: those past releases "partition" in and out of solid form and will continue contributing radionuclides to the groundwater in the future.[153] Entergy could not even articulate how much of the legacy

[147] Tr. at 2744:1-13 (Kolakowski by Entergy).

[148] Tr. at 2744:14-18 (Kolakowski by Entergy).

[149] Tr. at 2746:21 to 2747:2 (Kolakowski by Entergy).

[150] Tr. at 2751:18-21 (Kolakowski by Entergy).

[151] Tr. at 4024:11-18, 4025:7-15, Tr. at 3977:1-12 (Barvenik by Rvk)

[152] Tr. at 3974:8-12 (Barvenik by Rvk) (emphasis added).

[153] Exh. Entergy 33 at 113; Tr. at 3973:20-22, 3974:2-7 (Barvenik by Rvk).

contamination is partitioned in solid form (and therefore able to transition as a release to the groundwater) at any given time.[154] Releases from residual subsurface contamination can manifest in increased concentrations in monitoring wells, including concentrations in excess of EPA MCLs.[155] Entergy has failed to demonstrate that future upward fluctuations of the contamination plumes will not violate, or cause or contribute, or have the reasonable potential to cause or contribute to a violation of, DEC's designated best use of the groundwater at Indian Point.[156]

ii. Additional Future Radiological Leaks from the Indian Point Unit 2 Spent Fuel Pool and Other Systems, Structures, and Components are Likely and May Cause Radionuclides in the Groundwater to Exceed the Standards Allowable for Drinking Water

The record persuasively shows that additional future radiological leaks from systems, structures, and components at Indian Point will contribute to the existing groundwater contamination plumes, and Entergy has failed to demonstrate that any such additional releases would not increase concentrations of radionuclides in the groundwater over EPA MCLs at any time during the proposed relicensing term.

To begin with, the evidence in the record demonstrates that the Indian Point Unit 2 SFP is likely still leaking radionuclides to the environment, and in any event, is likely to leak in the future. In particular, the evidence shows that a large portion of the pool liner has never been, and will not be inspected, and that leak mechanisms may exist in such uninspected portions of the pool, which would contribute radionuclides to the groundwater.[157] Although an inspection is

[154] Tr. at 3974:13-16 (Barvenik by Rvk).

[155] Tr. at 4025:16-19, 4027:20-23, 4028:1-2 (Barvenik by Rvk); Exh. Riverkeeper 21 at p.1-2.

[156] NYS ECL § 17-0501.

[157] Tr. at 2853:12-16 (Gundersen Rebuttal); Ex. Riverkeeper 44 at p.1-134; Tr. at 3970:12-19 (Barvenik by Rvk); Tr. at 3169:3-6 (Esselman by Rvk); Tr. at 3163:11-14, 3164:1-7, 3165:5-9, 3169:3-6 (Esselman by Rvk); Tr. at 3953:9-15 (Barvenik by DEC); Tr. at 3969:17-21, 22-23, 3971:1-5, 4-10, 4042:14-20 (Barvenik by Rvk); Tr. at 3162:20-22,

physically feasible, Entergy does not plan to perform a full inspection to determine any active leak sources, or proactively prevent any future leaks from developing.[158] In addition, the pool lacks technology to collect contamination and prevent radionuclides from reaching the environment.[159] Furthermore, Entergy intends to rely on groundwater monitoring to determine if future leaks are occurring, all but ensuring that additional radionuclides will reach the groundwater and add to the existing contamination.[160] The evidence further demonstrated that the Indian Point Unit 2 SFP is facing further aging and degradation as the plant continued to operate, and that leaks through spent fuel pool liners are not unexpected events.[161] Thus, future leaks related to the Unit 2 SFP are likely, and would add to the existing groundwater contamination. In any event, Entergy has failed to rebut the overwhelming evidence in the record and demonstrate that any such future leaks would not cause or contribute, or have the reasonable potential to cause or contribute to concentrations in the groundwater in excess of EPA MCL values.[162]

In a similar vein, the evidence shows that additional future leaks from other systems, structures, and components at Indian Point are likely, and would contribute to the existing

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3165:10-12, 3170:11-15 (Esselman by Rvk); Exh. Riverkeeper 24 at 2; Exh. Riverkeeper 21 at p.1-3; Tr. at 3970:20-23, 3971:1-3 (Barvenik by Rvk); Tr. at 3173:1-6 (Esselman by Rvk).

[158] Exh. Riverkeeper 24 at 2; Tr. at 3166:8-20 (Esselman by Rvk); Tr. at 3972:7-13 (Barvenik by Rvk).

[159] Ex. Riverkeeper 11 at 1; Tr. at 4057:16-23 (Barvenik by Rvk); Tr. at 4058:12-18 (Barvenik by Rvk); Exh. Riverkeeper 11 at 1.

[160] Exh. Riverkeeper 44 at pp.1-134, 1-139; Tr. at 2855:18-28, 2856:1-8, 17-28 (Gundersen Rebuttal); Tr. at 4054:20-23, 4055:1 (Barvenik by Rvk); Barvenik Prefiled Direct Testimony (July 22, 2011) at 1:18-22; 2:6-7; 3:1-3; 4:20-5:1; 5:8-11; 10:6-10; 13:15-21; 14:8-9;16:11-15; 21:2-23, 22:1-2; Tr. at 3172:8-10, 15-22; 3171:5-22, 3162:20-23, 3163:1-10 (Esselman by Rvk).

Tr. at 2856:10-11 (Gundersen Rebuttal).

[161] Tr. at 3146:15-23, 3147:1-5 (Esselman by DEC); Tr. at 2836:14-20 (Gundersen Direct); Tr. at 2982:1-5 (Gundersen by DEC); Tr. at 3193:11-13, 3196:10-20 (Esselman by Rvk).

[162] NYS ECL § 17-0501; *see also In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8 (observing that "[e]xacerbation of such contamination is environmentally unacceptable, particularly in view of the availability of a measure to control such contamination.").

radiological contamination in the groundwater. In particular, Entergy has inadequate programs in place to adequately manage the aging and degradation of buried components such that additional radiological leaks during the proposed extended operating term will not occur. The evidence demonstrates that aging and degradation of plant components, and leaks as a result thereof, are expected to continue at nuclear power plants in the future.[163] Such leaks have already occurred at Indian Point and contributed to the groundwater contamination; for example, in February 2009, a pipe buried eight feet underground leaked, and was only discovered when water had reached the surface level.[164]

The record further demonstrates that Entergy intends to employ a program for managing the effects of such aging and degradation that is not capable of preventing *all* radiological leaks that may occur.[165] Notably, although Entergy could move all buried piping above-ground and thereby inspect it all, instead, Entergy's program involves only a selective inspection of the vast amount of piping and structures that are buried at Indian Point, instead of inspection of 100% of buried pipes and structures.[166] Because corrosion occurs so randomly, in the absence of inspections of 100% of the buried components, it is highly likely that not all future leaks will be

[163] Exh. Riverkeeper 7 at 1, 22; Tr. at 3213:18-23, 3214:1, 3233:16-23 (Esselman by Rvk); Tr. at 3198:11-14; 3196:10-23, 3197:1; Tr. at 2836:15-20 (Gundersen Direct); Tr. at 2981:17-20, 2982:6-23, 2983:1-12 (Gundersen by DEC); Tr. at 3192:4-9, 3193:11-13 (Esselman by Rvk).

[164] Exhs. Riverkeeper 16; *see also* Exh. Riverkeeper 17; Tr. at 2829:14-16 (Gundersen Direct); Tr. at 3175:2-23, 3176:1-3 (Esselman by Rvk). Notably, Entergy's witness Dr. Esselman also indicated that he was "aware that there have been *leaks* from piping *systems* that have leaked to the environment." Tr. at 3174:14-20 (Esselman by Rvk) (emphasis added). This is indicative of other pipe leaks at Indian Point, in addition to the one documented in February 2009.

[165] Tr. at 3209:5-12 (Esselman by Rvk); *See* Exh. Riverkeeper 46; Tr. at 2859:13-20 (Gundersen Direct); *see also* Exh. Entergy 44 at 4 (stating that NRC regulations are "not intended to ensure pipes are leak-tight"); Exh. Riverkeeper 17 (in response to February 2009 buried pipe leak, Entergy spokesperson explaining that "[i]t's eight feet underground, so there's no way of knowing when you have to replace it.").

[166] Tr. at 2838:14-18 (Gundersen Direct); Tr. at 3213:13-17, 3214:16-18, 3218:13-15, 17-19, 3220:1-16, 3221:1-3, 3231:21-23, 3232:1-11, 14-17, 3234:1-3 (Esselman by Rvk); Tr. at 3024:6-13 (Gundersen Re-Direct by Rvk).

prevented.[167] In addition, Entergy's prospective installation of cathodic protection will have a limited ability to prevent future leaks.[168] Overall, the evidence demonstrated that Entergy's aging management "plans are not sufficient to identify and stop all potential radiological leaks from buried components," and, thus, "future leaks from such components are very likely."[169]

In addition, the record shows that, generally, Entergy employs a reactive approach to leak management at Indian, namely by significantly relying upon groundwater monitoring in order to detection of component leaks.[170] This method only detects leaks *after* they occur, thus allowing radioactivity to enter the groundwater when any new leaks happen.[171] The evidence shows that the groundwater monitoring system at Indian Pont can take weeks, months, or even longer, to detect new radiological leaks that remain undiscovered through other methods of detection.[172] This is evident at the plant, where there are already discrete instances where the monitoring wells have detected leaks months after they occur, i.e., well after radionuclides have entered the groundwater.[173] Furthermore, Entergy contemplates that a "rapid" response is a response that happens before any dose impact occurs.[174] This indicates that Entergy is willing to allow significant periods of time to elapse in responding to new leaks, during which time radionuclides would release and contribute to the contamination in the groundwater. Finally, the record shows

[167] Tr. at 2983:2-12 (Gundersen by DEC).

[168] Tr. at 3982:1-5 (Gundersen by DEC); Tr. at 3229:6-8, 11-14, 3231:14-19 (Esselman by Rvk).

[169] Tr. at 2859:13-15, 19-20 (Gundersen Rebuttal).

[170] Barvenik Prefiled Direct Testimony (July 22, 1011) at 1:18-22; 2:6-7; 3:1-3; 4:20-5:1; 5:8-11; 10:6-10; 13:15-21; 14:8-9;16:11-15, 21:2-23 – 22:1-2; Tr. at 3928:2-7 (Barvenik by DEC); Tr. at 4054:16-19, 4096:16-23; 4097:1, 4065:18-21, 4066:3-6 (Barvenik by Rvk).

[171] Tr. at 3958:9-15 (Barvenik by DEC) (emphasis added); Tr. at 4061:15-18 (Barvenik by Rvk); *see also* Tr. at 2856:10-11 (Gundersen Rebuttal); Tr. at 2987:19-21 (Gundersen by DEC).

[172] Tr. at 4030:8-10, 4071:17-23, 4072:1, 13-18, 4073:2-4, 8-15, 4067:8-15, 17-20, 4068:3-23, 4069:1-3, 6-7, 10-16 (Barvenik by Rvk); *see also* Exh. Riverkeeper 21 at fn.6.

[173] *See* Exh. Riverkeeper 55; Tr. at 4003:5-21 (Barvenik by Rvk) (describing the months long process to identify a leak source that caused elevated concentrations of radionuclides to be detected in groundwater monitoring wells).

[174] Tr. at 4073:16-22 (Barvenik by Rvk).

that, generally speaking Entergy's approach to site maintenance is reactive, slow, and inadequate.[175] This necessarily increases the likelihood that (a) future leaks will occur, and (b) they will result in additional radioactivity reaching New York State groundwaters.

Based on the ample evidence in the record, it is clear that Entergy has failed to demonstrate that likely future radiological leaks at Indian Point will not violate, or cause or contribute, or have the reasonable potential to cause or contribute to a violation of, DEC's designated best use of the groundwater at Indian Point, as drinkable.[176] The evidence clearly establishes that the various leaks that have occurred at Indian Point since the "discovery" of the two extensive contamination plumes in the groundwater, have contributed and added to the level of contamination and resulted in the detection of concentrations of radionuclides in the groundwater in excess of EPA MCLs.[177] Any additional future leaks of radioactive water, which the record shows are likely, will continue to do so.[178] Such leaks, which Entergy has failed to demonstrate are not reasonably likely to occur, unacceptably result in the "gradual deterioration of the quality of the water," which the State's antidegradation policy, as incorporated into the use designation assigned to the water, is "designed to prevent."[179]

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[175] Tr. at 2839:8-25 (Gundersen Direct); Tr. at 4082:18-22 (Barvenik by Rvk); 3953:17-23, 3954:1 (Barvenik by DEC); Barvenik Prefiled Direct Testimony (July 22, 2011) at 11:9-11; Tr. at 3969:5-8 (Barvenik by Rvk); Tr. at 3175:2-5 (Esselman by Rvk); Tr. at 2964, 2965, 2968:1-23, 2969:1-4 (Gundersen by Zoli); Exh. Riverkeeper 45 at 3; Tr. at 4001:21-23, 4002:1-3 (Barvenik Cross at Rvk); Tr. at 3225:9-19, 20-23, 3226:1-9, 3228:3-11 (Esselman by Rvk); Tr. at 3982:1-5 (Gundersen by DEC); Tr. at 2839:27-28, 2840:4-9 (Gundersen Direct); 3018:14-23, 3019:1-2 (Gundersen Re-Direct by Rvk); 2943:20-23, 2944:4-6, 8-16 (Gundersen by Zoli); Tr. at 3235:3-23, 3236:1-4, 7-22 (Esselman by Rvk); Tr. at 3239:17-23, 3240:10-12, 3241:3-8, 3242:2-10 (Esselman by Rvk); Tr. at 3238:22-23, 3239:1-2; 3241:10-19; Exh. Riverkeeper 15.

[176] NYS ECL § 17-0501.

[177] Barvenik Prefiled Direct Testimony (July 22, 2011) at 10:20-22; Tr. at 3987:3-10; 2988:2-7, 3988:8-11, 4028:13-18 (Barvenik by Rvk); Exh. Riverkeeper 55 at 15-16; Tr. at 4003:5-21 (Barvenik by Rvk); Exhs. Riverkeeper 14; Riverkeeper 22; Riverkeeper 63; Tr. at 4020:8-23, 4021:1-2, 5-16 (Barvenik by Rvk).

[178] *See* Tr. at 2832:15-16 (Gundersen Direct) (stating that trend of radionuclide concentrations being detected in excess of EPA MCL values is likely to continue).

[179] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993).

Notably, the "exacerbation" of "contamination is environmentally unacceptable, particularly in view of the availability of a measure to control such contamination."[180] In this case, the record establishes that Entergy could voluntarily avail itself of a number of feasible mitigation alternatives to "control" the potential for future radiological leaks, including (1) moving spent fuel out of the overcrowded Unit 2 SFP in order to allow for a complete inspection of the liner, and perform additional inspections of the Unit 2 SFP liner throughout the proposed relicensing term,[181] and (2) moving all of the decades old buried components above ground to allow for inspections of 100% of all such components, and regularly performing such inspections.[182]

iii. Entergy's "Remediation" Approach to the Radiological Contamination at Indian Point Fails to Prevent Radionuclides in the Groundwater from Exceeding the Standards Allowable for Drinking Water

Lastly, the record demonstrates that Entergy's approach to "remediating" the radiological contamination, that is, Monitored Natural Attenuation ("MNA"), will fail to prevent the concentration of radionuclides in the groundwater from increasing due to normal upward fluctuations and/or any new leaks. The evidence clearly establishes that Entergy has chosen to employ MNA in relation to the radiological contamination at Indian Point, and intends to continue using MNA during the proposed relicensing term.[183] It is undisputed that using MNA the contamination will remain in the groundwater until it decays, releases to the Hudson River, or partitions to solid surfaces.[184] To completely eliminate the contamination at Indian Point

[180] *In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8.

[181] Exh. Riverkeeper 24 at 2; Tr. at 3166:8-20 (Esselman by Rvk).

[182] Tr. at 3232:9-11, 14-17, 3234:1-3 (Esselman by Rvk); Tr. at 3024:6-13 (Gundersen Re-Direct by Rvk).

[183] Tr. at 4032:15-23 (Barvenik by Rvk)

[184] Tr. at 4033:7-12 (Barvenik by Rvk); Tr. at 2840:18-19 (Gundersen Direct).

using MNA will take centuries.[185] As discussed above, the evidence shows that the normal behavior to be expected of the contamination plumes will result in upward fluctuations due to residual subsurface contamination storage, and any new radiological leaks, which are likely to occur, will simply add to the existing contamination. Thus, as a result of allowing the contamination to simply sit and attenuate in the groundwater, the level of contamination is likely to remain high, (that is, be detected in concentrations that exceed EPA MCLs), throughout the proposed period of extended operation, and into the foreseeable future.[186]

Therefore, Entergy has failed to demonstrate that the use of MNA will not violate, or cause or contribute, or have the reasonable potential to cause or contribute to, a violation of, DEC's designated best use of the groundwater at Indian Point as drinkable.[187] This is especially so since there is a clear measure available to potentially control the contamination:[188] the use of extraction wells. Indeed, the use of extraction *could* result in a reduction in the contamination plumes, and could prevent the plumes from growing the event of new radiological leaks.[189] The record clearly establishes that extraction is feasible at Indian Point, and could potentially result in less contamination existing in the groundwater.[190]

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[185] Tr. at 4033:13-15 (Barvenik by Rvk); Tr. at 2841:17-20 (Gundersen Direct); Tr. at 2862:11-16 (Gundersen Rebuttal).

[186] *See* Tr. at 2832:15-16, 27-31 (Gundersen Direct).

[187] NYS ECL § 17-0501.

[188] *In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8.

[189] Tr. at 2872:15-17 (Gundersen Direct).

[190] Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at 41:11-22; Tr. at 3957:13-16, 22-23, 3958, 3961:13-19 (Barvenik by DEC); Tr. at 4038:10-15, 4087:19-22, 4089:16, 4092:6-11 (Barvenik by Rvk);Tr. at 4039:21-23, 4040:1-12, 16-17, 4040:18-23, 4041:1 (Barvenik by Rvk); Exh. Riverkeeper 34; 4040:3-8, 4087:9-13 (Barvenik by Rvk); Tr. at 4094:22-23, 4095:1-2 (Barvenik by Rvk); Tr. at 4087:19-22 (Barvenik by Rvk); Tr. at 4092:12-18, 4094:22-23, 4095:1-2 (Barvenik by Rvk); Tr. at 4041:2-6 (Barvenik by Rvk); Tr. at 4095:3-7 (Barvenik by Rvk).

While, to be sure, there has been no site-specific investigation into how effective employing extraction at Indian Point could actually be,[191] Entergy's refusal and failure to employ extraction wells, and thereby potentially reduce the amount of radiological materials in the groundwater at Indian Point in order to attempt to demonstrate compliance with New York State's best use standard for the groundwater, constitutes unacceptable "exacerbation" of the radiological contamination.[192] Notably though, the evidence on the present record fails to show that unacceptable impairment of classified groundwaters of New York State would cease *if* extraction wells were implemented. Rather, radiological leaks would continue to discharge to the groundwater and commingle with existing contamination, and the evidence does not establish that extraction wells would reduce and/or eliminate the radiological contamination in the groundwater so as to avoid ongoing impairment.[193] Thus, based on the present record, groundwater impacts remain a valid and independent regulatory basis for denying Entergy's Application for WQC.

Additionally, Entergy's choice to rely upon MNA, and refusal to extract the radiological contamination from the groundwater at Indian Point also unacceptably results in "gradual deterioration of the quality of the water," which the State's antidegradation policy, as incorporated into the use designation assigned to the water, is "designed to prevent."[194] Moreover, MNA, which Entergy's consultants have characterized as "flushing" the groundwater

[191] Tr. at 4095:3-7, 4092:6-11, 4095:3-7 (Barvenik by Rvk).

[192] *In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8.

[193] Tr. at 4094:22-23, 4095:1-2 (Barvenik by Rvk) (Mr. Barvenik testifying that extraction wells "*could* be effective" (emphasis added); Tr. at 4087:19-22 (Barvenik by Rvk); Tr. at 4041:2-6 (Barvenik by Rvk); Tr. at 4095:3-7 (Barvenik by Rvk) (failing to quantify volume of water that actually be extracted at Indian Point with extraction wells); Exh. Riverkeeper 34 (showing reduction in plume, but not elimination, from pilot pumping test).

[194] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993).

contamination to the Hudson River[195] constitutes a de facto and unlawful unpermitted use of the Hudson River for waste transport and assimilation.[196]

The foregoing shows Entergy's undeniable failure to demonstrate that the continued operation of Indian Point will comply with relevant water quality standards applicable to the groundwater at the plant. For this reason, denial of Entergy's Application for WQC was appropriate and justified.

II. Denial of Entergy's Application for WQC is Appropriate Because Entergy has Failed to Demonstrate that Radioactive Leaks at Indian Point will Comply with New York State's Water Quality Standard Designating The Best Uses of the Hudson River

DEC's classifications of surface waters for their best uses dictate that the Hudson River "shall be suitable for fish, shellfish, and wildlife propagation and survival."[197] Moreover, for all portions of the Hudson River, DEC has consistently designated fishing as a "best usage."[198] In the particular region where Indian Point is located, the Hudson River is classified as "SB saline surface waters."[199] The "best usages" of this class of water are "primary and secondary contact recreation and fishing."[200] The former includes "recreational activities where the human body may come in direct contact with raw water to the point of complete body submergence," such as

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[195] Tr. 2996:22-23 to 2997:1-7 (Barvenik by DEC); Exh. Entergy 33 at 63, 49; Tr. at 2675:6-10 (Kowlakowski Prefiled Direct); Barvenik Prefiled Direct Testimony (July 22, 1011) at 9:15

[196] 40 C.F.R. § 131.10(a).

[197] DEC has assigned varying classifications to different portions of the Hudson River including "Class I saline surface waters," "Class SB saline surface waters," "Class A fresh surface waters," "Class B fresh surface waters," "Class C fresh surface waters," and "Class AA fresh surface waters." *See* 6 NYCRR §§ 864.6, 858.4, 941.6. All of these classifications state that such "waters shall be suitable for fish, shellfish, and wildlife propagation and survival." *See* 6 NYCRR §§ 701.5, 701.6, 701.7, 701.8, 701.11, 701.13.

[198] The varying classifications of the Hudson River (*see supra* Note 3), all designate fishing as a "best usage." *See* 6 NYCRR §§ 701.5, 701.6, 701.7, 701.8, 701.11, 701.13.

[199] *See* 6 NYCRR § 864.6 (classifying the portion of the Hudson River from the New York State Bronx County line to Bear Mountain Bridge as "Class SB saline surface waters").

[200] 6 NYCRR § 701.11.

"swimming, diving, water skiing, skin diving and surfing,"[201] while the latter includes "recreational activities where contact with the water is minimal and where ingestion of the water is not probable," such as "fishing and boating."[202] Varying portions of the rest of the Hudson River have also been designated for such primary and/or secondary contact recreational purposes.[203] As with New York State's classification for groundwaters, the designated uses of the Hudson River were adopted with due consideration for the uses which "may be made" of the water.[204]

DEC has set forth a narrative water quality standard applicable to Class SB saline surface water, which dictates that that toxic or other deleterious substances not "impair the waters for their best usages."[205] This narrative standard was prescribed as necessary for the "public use or benefit *contemplated*" by the classification.[206] In addition, a "general condition[] applying to all water classifications" further prescribes that the discharge of industrial or other wastes "not cause impairment of the best usages of the receiving waters as specified by the water classifications at the location of the discharge and at other locations that may be affected by such discharge."[207]

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[201] *Id.* § 700.1(a)(49).

[202] *Id.* § 700.1(a)(56).

[203] The portion of the Hudson River from the mouth at the New York Harbor to the New York State Bronx County line is classified as "Class I saline surface waters," the best uses of which are for secondary contact recreation and fishing. *See* 6 NYCRR §§ 864.6; 701.13. Upstream of Indian Point, the Hudson River is classified as either "Class A fresh surface waters," "Class B fresh surface waters," "Class C fresh surface waters," or "Class AA fresh surface waters." *See* 6 NYCRR §§ 858.4, 941.6. The "best usages" for all of these classes of water include "primary and secondary contact recreation." *See* NYCRR § 701.5, 701.6, 701.7, 701.8.

[204] ECL § 17-0301(3)(c); *see also* 40 C.F.R. § 131.3(f) (EPA defining designated uses as "those uses specified in water quality standards for each water body or segment *whether or not they are being attained*").

[205] 6 NYCRR § 703.2.

[206] ECL § 17-0301(4) (emphasis added); *see also id.* (directing DEC to adopt standards that "prescribe what qualities and properties of water shall indicate a polluted condition of the waters of the state which is *actually or potentially* deleterious, harmful, detrimental, or injurious to the public health, safety or welfare, to terrestrial or aquatic life . . . or *to the use of such waters* . . . with respect to the various classes established.")

[207] 6 NYCRR § 701.1.

Thus, in order to comply with New York State's water quality standard designating the best use of the Hudson River, deleterious substances and industrial or other wastes must not impair, or cause or contribute to the impairment of, the use of the river for primary and secondary contact recreation, or as suitable aquatic habitat, during the proposed extended operating period. Entergy's must demonstrate that relicensing Indian Point will comport with the designated best use of Hudson River, notwithstanding whether the river is *actually* used for such purposes.[208] Once again, in order to make the required demonstration, the radiological leaks at Indian Point must not "*cause or contribute* to a condition in contravention of the standards by the department pursuant to section 17-0301,"[209] (i.e., the water classifications and corresponding usage and narrative standards).

As discussed above, the radiological contamination at Indian Point patently constitutes a deleterious substance, and also falls within DEC's definition of "industrial waste."[210] The record establishes that Entergy has failed to show that the deleterious radiological material from accidental leaks at Indian Point will not violate, or cause or contribute to a violation of, relevant New York State water quality requirements throughout the duration of the proposed license renewal term.[211]

[208] 40 C.F.R. § 131.3(f); ECL § 17-0301(4)

[209] ECL § 17-0501.

[210] 6 NYCRR § 703.2; 6 NYCRR § 701.1; Tr. at 2834:5-10 (Gundersen Direct); Tr. at 2996:3-13 (Gundersen Re-Direct by Rvk); Tr. at 3243:23, 3244:1-6, 20-23, 3245:1-9 (Hoffman by Rvk); ECL §17-0105(5), 6 NYCRR § 750-1.2(a)(44).

[211] Tr. at 2743:15-23 (Kolakowski by Entergy); Tr. at 2744:1-13 (Kolakowski by Entergy); Tr. at 2744:14-18 (Kolakowski by Entergy); Tr. at 2746:21 to 2747:2 (Kolakowski by Entergy); Tr. at 2751:18-21 (Kolakowski by Entergy).

A. Radioactive Material from Accidental Leaks at Indian Point Indisputably Release, and will Continue to Release, to the Hudson River

It is incontrovertible that radioactive water leaks that have occurred, and those that will occur, at Indian Point eventually release to the Hudson River, either through the groundwater, or via the discharge canal. Radiological materials in the groundwater plumes travel through the groundwater and then discharge, or "flush" to the Hudson River.[212] Entergy's use of MNA, as discussed above, will unquestionably result in the "additional transport" of toxic radionuclides to the Hudson River.[213] In addition, the evidence demonstrates that, with the continued use of MNA, releases of radionuclides to the Hudson River through the groundwater will occur *throughout* the period of extended operation, and beyond.[214] The record further shows that accidental radioactive water leaks at Indian Point may also reach the Hudson River via the discharge canal, after collecting in certain onsite drains, including some of the contamination attributable to Unit 1 SFP leaks, as well as excessive "washout."[215] Though Entergy claims that all releases through the discharge canal are "monitored," it is patent that radionuclides attributable to accidental leaks are not contemplated as "planned" releases, and they constitute additional contamination (from radioactive leaks rather than "planned discharges") to the river than otherwise would have been discharged pursuant to Entergy's actual planned releases.[216]

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[212] Tr. 2996:22-23 to 2997:1-7 (Barvenik by DEC); Exh. Entergy 33 at 63, 49; Tr. at 2675:6-10 (Kolakowski Prefiled Direct); Barvenik Prefiled Direct Testimony (July 22, 1011) at 9:15

[213] Tr. at 4036:7-12, 17-21 (Barvenik by Rvk); Tr. at 3270:2-9 (Hoffman by Rvk); (Kolakowski Re-Direct by DEC); Tr. at 2683:14-23, 2686:14-17 (Kolakowski Rebuttal)

[214] Tr. at 3955:11-20, 21-23 (Barvenik by DEC); Tr. at 2784:18-23, 2785:1-6; Tr. at 3126:22-23, 3127:1-2 (Hoffman by DEC); Tr. at 2684:1-10 (Kolakowski Rebuttal); Tr. at 2744:8-21 (Kolakowski by Entergy); Tr. at 2788:20-23, 2789:1-10 (Kolakowski Redirect by DEC); Tr. at 2793:12-15 (Kolakowski Re-Cross by Entergy); Tr. at 2840:29-31, 2841:1 (Gundersen Prefiled Direct); Tr. at 2862:11-16 (Gundersen Prefiled Rebuttal).

[215] Tr. at 4084:2-6, 3993:10-12 (Barvenik by Rvk); Tr. at 3983:5-10, 21-23, 3984:2-6, 3991:13-19, 3993:10-12 (Barvenik by Rvk); Tr. at 4101:20-23, 4102:1 (Barvenik Re-Direct by Entergy); Tr. at 3982:5-9 (Barvenik Cross by Rvk); Exh. Entergy 33 at 113; Tr. at 3973:20-22, 3974:2-7 (Barvenik by Rvk).

[216] *See* 3146:1-7 (Hoffman by DEC); 3146:18-23, 3147:1-2, 3147:6, 3148:12-15 (Esselman by DEC); 3177:16-23, 3178:1-3.

Furthermore, as discussed above, Entergy refuses to pursue the feasible and available remediation technique of extraction. The record demonstrates that the use of extraction *could potentially* prevent the migration of radionuclides from the groundwater at Indian Point into the Hudson River.[217]

B. *Deleterious Radioactive Leaks May Impact the Public Engaging in Recreational Activities in the Hudson River During the Proposed Period of Extended Operation of Indian Point*

Entergy has not demonstrated that accidental radiological releases to the Hudson River throughout the proposed period of extended operation of Indian Point will necessarily comply with the designated use of the river as suitable for recreational activities, including swimming. In particular, Entergy's assessment of the potential impact of radiological leaks from Indian Point stems directly from guidelines which do not take into account potential exposure to the public through swimming in the Hudson River.[218] Notably, there is no dispute that the radionuclides that leach from the groundwater to the Hudson River are toxic, carcinogenic, and can be ingested and absorbed through the skin.[219]

However, Entergy's calculations performed to assess the potential impact of the radiological releases to the Hudson River involve "fish and invertebrate consumption pathway only."[220] While the "dose" calculation performed by Entergy "is made specifically for fish

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[217] Entergy Combined Prefiled Rebuttal Testimony (October 4, 2011) at 41:7-16, 22-23; 42:1-2; Tr. at 4041:11-14 (Barvenik by Rvk); Tr. at 4094:1-2, 18-21 (Barvenik by Rvk); Tr. at 4092:6-11, 4095:3-7 (Barvenik by Rvk). As noted above, even if extraction wells were implemented at Indian Point, radiological leaks would still discharge and cause an impact to, and potential ongoing impairment of, classified groundwaters of New York State. As such, groundwater impacts remain an independent regulatory basis for denying Entergy's Application for WQC.

[218] Tr. at 3277:9-17 (Hoffman Cross by Rvk).

[219] Tr. at 2834:5-10 (Gundersen Prefiled Direct); Tr. at 2996:3-13 (Gundersen Re-Direct by Rvk); Tr. at 2834:10-13 (Gundersen Prefiled Direct); Tr. at 3243:23, 3244:1-6, 20-23, 3245:1-9 (Hoffman by Rvk).

[220] Exh. Riverkeeper 48; Tr. at 3277:9-17 (Hoffman by Rvk).

because the other pathways have been considered to not be actively present at the site,"[221] this is of no moment in the context of an evaluation of compliance with the designated best use of the Hudson River. That is, the designated use is a management goal pertaining to water quality that must be complied with "*whether or not they are being attained*."[222] Indeed, such uses have been established "*to prevent the gradual deterioration of the quality of the water body*."[223]

In addition, the record plainly recognizes the credible and undisputed scientific view espoused in Biological Effects of Ionizing Radiation VII report, that every exposure to radiation, regardless of how small, and no matter what pathway, produces a corresponding increase in a person's risk of developing cancer.[224] Entergy's witness, Dr. Hoffman acknowledged that the more an individual is exposed to radiation, the higher the risk, and that the exposures resulting from the accidental radiological leaks at Indian Point result in a cumulative exposure on top of what individuals are exposed to through other sources.[225] For the narrow pathway that Entergy does consider relevant and assess (i.e., fish consumption), Entergy could not predict how many years of exposure would continue as a result of the leaks, what concentrations any such prospective doses would be, nor what past exposures may have occurred, prior to monitoring, all

[221] Tr. at 3278:1-10 (Hoffman by Rvk).

[222] 40 C.F.R. § 131.3(f) (emphasis supplied); *see also See PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 714-15 (1994) (upholding a § 401 WQC condition necessary to ensure consistency with the designated use of the water body as fish habitat, finding that the certifying agency has to make sure that the project is "consistent with both components [of the WQS], namely the designated use and the water quality criteria.")

[223] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993) (emphasis added; *see also Islander E. Pipeline Co., LLC v. Conn. Dep't of Envtl. Prot.*, 482 F.3d 79, 120 (2d Cir. 2006) ("In brief, the [antidegradation] policy requires that where water quality is better than the criteria established in the Water Quality Standards, such existing high quality must be maintained except under exceptional and very limited circumstances.").

[224] Exhs. Entergy 101; Riverkeeper 23/AG-Rad-23; Tr. at 2866:1-4 (Gundersen Prefiled Rebuttal); Tr. at 2921:4-12, 2923:14-17, 2976:3-12 2921:4-122921:4-12 (Gundersen by Entergy); Tr. at 3001:14-22 (Gundersen Re-Direct by Rvk).

[225] Tr. at 3143:7-8, 21-22 (Hoffman by DEC); Tr. at 3313:6-10 (Hoffman Re-Cross by Rvk); Tr. at 3175:6-11, 3126:13-17, 20-21 (Hoffman by Rvk)

Tr. at 3274:21-23, 3275:1-5, 14-20 (Hoffman by Rvk); Tr. at 3312:21-23, 3313:1-5, 3314:1-4 (Hoffman Re-Cross by Rvk).

information necessary to determine a person's lifetime, cumulative, long-term health risk.[226] The record reflects that no such assessment has been done to account for the pathway that is relevant for determining compliance with the designated best use of the Hudson River, i.e., swimming.[227] Thus, the BEIR VII report dictates that there is the potential for the accidental radiological leaks from Indian Point to adversely impact a person's ability to swim and recreate in the Hudson River.[228]

Based upon the facts adduced at the hearing, it is simply impossible to conclude that Entergy has demonstrated that radiological leaks would comply with the designated uses of the river throughout the entire proposed period of extended operation. The evidence shows that there is reasonable potential for the radiological contamination that is seeping into the Hudson River to cause or contribute to an impairment of the use of the river for swimming purposes.[229] Entergy simply hasn't definitely shown otherwise. This conclusion is supported by the fact that there is a reasonable measure that could potentially prevent the contamination from reaching the Hudson River, i.e., extraction, as discussed above.[230]

Notably, Entergy's assessment of the impact of accidental radiological leaks on the public also fails to account for a potential drinking water exposure pathway that is reasonably foreseeable to arise during the proposed period of extended operation, namely a desalination plant to be sited just a few miles away downstream of Indian Point, and which Entergy's witness

[226] Tr. at 3131:8-9, 3310:20-23, 3311:1-5 (Hoffman Re-Cross by DEC); Tr. at 3130:15-19 (Hoffman Cross by Little).

[227] Tr. at 3281:8-12 (Hoffman by Rvk).

[228] Tr. at 2833:26-30 (Gundersen Direct); Tr. at 2866:1-7 (Gundersen Rebuttal).

[229] NYS ECL § 17-0501.

[230] *See In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8 (observing that causing or contributing contamination was environmentally unacceptable, where a measure to control the contamination was available).

acknowledged would take up radionuclides attributable to accidental leaks from the plant.[231] This likewise undermines Entergy's alleged assurances relating to the potential impact of the radiological leaks from Indian Point on the public.

C. Deleterious Radioactive Leaks May Impact the Aquatic Ecology of the Hudson River During the Proposed Period of Extended Operation of Indian Point

In a similar vein, Entergy has failed to demonstrate that accidental radiological releases to the Hudson River throughout the proposed period of extended operation of Indian Point will necessarily comply with the designated use of the river as suitable for fish habitat. This is primarily because Entergy relies heavily upon past and/or current assessments related to whether radionuclides from Indian Point have impacted aquatic organisms in the river.[232] However, in the face of indisputable evidence that the radionuclides attributable to accidental leaks at Indian Point bioaccumulate in the environment,[233] have been releasing to the Hudson River for years, are currently discharging to the river, and will continue to leach into the river throughout the entire proposed relicensing term,[234] it simply cannot be said that there will be no impact to the aquatic ecosystem in the future. [235]

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[231] Tr. at 3277:9-17, 3281:8-12, 3282:15-18, 3283:10-23, 3284:1-2 (Hoffman Cross by Rvk); Tr. at 3284:3-5 (Hoffman by Rvk).

[232] Hoffman Prefiled Testimony (July 22, 2011) at 16-17.

[233] Tr. at 3279:23, 3280:1-18, 3279:23, 3280:1-18, 3298:17-23, 3299:1 (Hoffman by Rvk); Tr. at 2996:18-19, 23, 2997:1-3 (Gundersen Re-Direct by Rvk).

[234] Tr. 2996:22-23 to 2997:1-7 (Barvenik by DEC); Exh. Entergy 33 at 63, 49; Tr. at 2675:6-10 (Kolakowski Prefiled Direct); Barvenik Prefiled Direct Testimony (July 22, 1011) at 9:15; Tr. at 4036:7-12, 17-21 (Barvenik by Rvk); Tr. at 3270:2-9 (Hoffman by Rvk); (Kolakowski Re-Direct by DEC); Tr. at 2683:14-23, 2686:14-17 (Kolakowski Rebuttal); Tr. at 3955:11-20, 21-23 (Barvenik by DEC); Tr. at 2784:18-23, 2785:1-6; Tr. at 3126:22-23, 3127:1-2 (Hoffman by DEC); Tr. at 2684:1-10 (Kolakowski Rebuttal); Tr. at 2744:8-21 (Kolakowski by Entergy); Tr. at 2788:20-23, 2789:1-10 (Kolakowski Redirect by DEC); Tr. at 2793:12-15 (Kolakowski Re-Cross by Entergy); Tr. at 2840:29-31, 2841:1 (Gundersen Prefiled Direct); Tr. at 2862:11-16 (Gundersen Prefiled Rebuttal).

[235] *See* Tr. at 2866:9-27, 2867:1-5 (Gundersen Prefiled Rebuttal).

This is especially given the proximity of Indian Point to Haverstraw Bay, a critical and significant habitat for many important fish species that reside in the Hudson River.[236] Entergy's witness, Dr. Hoffman, did not dispute that radiological exposures to aquatic organisms in the Hudson River, and the biological uptake of radioactivity in such organisms, may occur in the future.[237] Notably, there has been no assessment focused on impacts of the radiological leaks to individual members of the fish species in the river.[238] In addition, very little information exists on the sensitivity of other organisms to the impact from environmental tritium contamination.[239]

Critically, there is no evidence in the record to show that Entergy will undertake regular enhanced fish monitoring or otherwise engage in concerted efforts to determine whether radiological leaks may be impacting the aquatic resource of the river during the proposed relicensing term.[240] As such, it is impossible to conclude that the continued operation of Indian Point and ongoing radiological releases to the Hudson River as a result thereof, will not violate, or cause or contribute to a violation of, the designated use of the river as a suitable for fish habitat.[241] Once again, this is supported by the fact that there is a reasonable measure to potentially prevent the contamination from reaching the Hudson River in any amount, i.e., extraction, as discussed above.[242] Moreover, the record indicates that the potential impact of the radiological releases from Indian Point over time on the aquatic ecology of the Hudson River is

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[236] *See* Tr. at 2866:9-27, 2867:1-5 (Gundersen Prefiled Rebuttal).

[237] Tr. at 3151:7-18 (Hoffman by DEC); Tr. at 3124:14-19 (Hoffman by DEC); Tr. at 3268:6-11, 3293:5-9 (Hoffman by Rvk).

[238] Tr. at 3150:11-23, 3151:1-6 (Hoffman by DEC).

[239] Exh. Riverkeeper 7 (GAO Report) at 10.

[240] Tr. at 3302:15-20-23, 3303:1-19 (Hoffman Cross by Rvk).

[241] NYS ECL § 17-0501

[242] *See In the Matter of the Applications of Orange and Rockland Utilities, Inc*., Decision of the Commissioner (April 13, 1982), 1982 N.Y. ENV LEXIS 29 (N.Y. ENV 1982) at *7-8 (observing that causing or contributing contamination was environmentally unacceptable, where a measure to control the contamination was available).

inconsistent with the State's anti-degradation policy, which is incorporated into the applicable water quality standards and designated use of the river, since such impacts may result in the "gradual deterioration of the quality of the water body."[243]

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The foregoing shows Entergy's failure to demonstrate that the continued operation of Indian Point will comply with relevant water quality standards applicable to the Hudson River. For this reason, denial of Entergy's Application for WQC was appropriate and justified.

III. Denial of Entergy's Application for WQC is Appropriate Because Entergy has Failed to Demonstrate Compliance with NYS DEC Standards Prohibiting the Discharge of Unpermitted Radiological Material

NYS ECL §17-0807(1) prohibits "the discharge of any radiological, chemical or biological warfare agent or high-level radioactive waste," while §17-0807(4) prohibits "any discharge not permitted by the provisions of this article, rules and regulations adopted or applicable pursuant hereto, the Act, or provisions of a permit issued hereunder." NYS ECL § 17-0511 further prohibits the discharge of industrial or other wastes into waters of the state "unless such use is in compliance with all standards, criteria, limitations, rules and regulations promulgated or applied by" DEC. Moreover, as cited elsewhere herein, NYS ECL § 17-0501 states that it "shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of the standards adopted by the department pursuant to section 17-0301," i.e., DEC's water classifications and corresponding usage and narrative standards.

First, Entergy has failed to demonstrate compliance with NYS ECL § 17-0807(1) as a result of the following. Entergy attributes the contamination plumes at Indian Point to leaks

[243] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993)

from the spent fuel pools. The spent fuel housed in such pools classifies as "high-level radioactive waste."[244] Thus, the radionuclides that are discharged into the groundwater and/or into the Hudson River from these accidental leaks, (which are now commingled with radionuclides from other component leaks and spills, and will continue to commingle with any radionuclides from future component leaks and spills) emanate directly from high-level radioactive waste. This kind of release is necessarily encompassed by DEC's prohibition. As discussed at length above, these remnants of the high-level radioactive waste stored at Indian Point will continue to discharge to the waters of NYS throughout the proposed relicensing term (both due to ongoing releases of radionuclides attributable to SFP leaks into the Hudson River, as well as because of ongoing and likely future leaks from the Unit 2 SFP to the groundwater and Hudson River).

Entergy likewise has failed to demonstrate compliance with NYS ECL§17-0807(4), since the accidental radiological releases from Indian Point to the groundwater and to the Hudson River are unpermitted discharges, and not otherwise in compliance with applicable laws, as discussed elsewhere herein. Similarly, Entergy has failed to show compliance with NYS ECL § 17-0511: as noted above, the radionuclides from accidental leaks are plainly encompassed by DEC's definition of "industrial waste," which states the following:

> Industrial waste' means any liquid, gaseous, solid or waste substance or a combination thereof resulting from any process of industry, manufacturing, trade, or business or from the development or recovery of any natural resources, which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards adopted as provided herein."[245]

[244] *See* 10 CFR 60.2 (defining High-Level Radioactive Waste as "(1) Irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted"

[245] ECL §17-0105(5); 6 NYCRR § 750-1.2(a)(44).

As discussed at length herein, the radiological materials discharging to the groundwater and the Hudson River can be reasonably expected to cause "pollution," which includes the alteration of the radiological integrity of water,[246] that contravenes relevant state water quality standards, including the designated best uses of the water. The radiological contamination can, thus, be classified as "industrial waste." As the discharge of this waste is not "in compliance with all standards, criteria, limitations, rules and regulations promulgated or applied by" DEC, as discussed at above, Entergy has failed to show compliance with NYS ECL § 17-0511.

Lastly, Entergy has also failed to demonstrate compliance with NYS ECL § 17-0501, since the discharge of radiological materials into New York State's groundwaters and surface waters causes or contributes, or has the reasonable potential to cause or contribute, to various violations of State standards,[247] as discussed at length above.[248]

For the foregoing reasons, denial of Entergy's Application for WQC was appropriate and justified.

IV. Denial of Entergy's Application for WQC is Appropriate Because Radioactive Leaks at Indian Point Improperly Alter the Radiological Integrity of the Groundwaters of NYS and the Hudson River

Entergy's Application for WQC was also appropriately denied because radiological leaks from Indian Point alter the radiological integrity of the groundwaters of NYS and the Hudson River. NYS ECL § 3-0301(i) provides that DEC has the power to "[p]rovide for prevention and

[246] CWA § 502(19); 33 U.S.C. § 1362(19).

[247] Tr. at 2743:15-23 (Kolakowski by Entergy); Tr. at 2744:1-13 (Kolakowski by Entergy); Tr. at 2744:14-18 (Kolakowski by Entergy); Tr. at 2746:21 to 2747:2 (Kolakowski by Entergy); Tr. at 2751:18-21 (Kolakowski by Entergy).

[248] *Atlantic States Legal Found. v. Eastman Kodak Co.*, 1993 U.S. App. LEXIS 35911 (2d Cir. N.Y. 1993) ("Water quality-based limits are established where the permitting authority reasonably anticipates the discharge of pollutants by the permittee at levels that have the *reasonable potential* to cause or contribute to an excursion above any state water quality criterion . . . .") (emphasis added).

abatement of all water, land and air *pollution* including but not limited to that related to . . . radiation." Furthermore, CWA § 502 defines "pollution" as "the man-made or man-induced *alteration* of the chemical, physical, and *radiological integrity* of water."[249]

It is undisputed that the radiological leaks from Indian Point to the groundwaters of NYS and the Hudson River "alters" the "radiological integrity" of such waters. These releases clearly add to the level of radioactivity that the receiving waters would otherwise contain.[250] Entergy's witnesses, Mr. Barvenik and Dr. Hoffman, both explicitly acknowledged that the radiological contamination releasing to the Hudson River from Indian Point constitutes an independent source of radiological material that adds radioactivity to the Hudson River, that is separate from the background radiation that exists in the river.[251]

As discussed at length above, this pollution fails to comply with New York State's narrative water quality standards pertaining to the best usages of the groundwater at Indian Point and the Hudson River, or with the State's anti-degradation policy, which is designed to prevent the gradual deterioration of the quality of the water."[252] Given DEC's wide latitude in preventing pollution and violations of State water quality standards, the inappropriate alteration of the radiological integrity of State groundwater and the Hudson River is an appropriate and warranted basis for the denial of Entergy's Application for WQC.

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[249] CWA § 502(19); 33 U.S.C. § 1362(19).

[250] Tr. at 2986:9-16 (Gundersen by DEC) (testifying that the levels contributed to the environment from Indian Point radiological leaks are additive, and are "much higher than the environment around it").

[251] Tr. at 4044:5-17 (Barvenik by Rvk); Tr. 3268:12-16 (Hoffman by Rvk).

[252] *Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 (N.Y. 1993); *See also Islander E. Pipeline Co., LLC v. Conn. Dep't of Envtl. Prot.*, 482 F.3d 79, 120 (2d Cir. 2006) ("In brief, the [antidegradation] policy requires that where water quality is better than the criteria established in the Water Quality Standards, such existing high quality must be maintained except under exceptional and very limited circumstances.").

APPEAL OF ALJ EVIDENTIARY RULINGS

At the November 11, 2011 evidentiary hearing, the Tribunal granted a motion in limine by Entergy to exclude testimony and supporting documents proffered by Riverkeeper's radiological expert witness, Mr. Arnold Gunderson, with respect to Indian Point's planned discharges of radiological materials as liquid effluent and with respect to radiological discharges from other Entergy facilities.[253] Pursuant to 6 NYCRR § 624.8(d)(1), Riverkeeper herein appeals those aspects of the Tribunal's ruling, for the reasons that follow.

I. The Tribunal Erred in Excluding From Evidence Relevant and Material Testimony and Documents Proffered by Riverkeeper With Respect to Entergy's Planned Radiological Discharges

The evidence indisputably shows that Indian Point discharges radiological materials to the Hudson River via both its planned effluent releases and accidental leaks. It is the stated policy of the State of New York "to maintain reasonable standards of purity of the waters of the state consistent with . . . the propagation and protection of fish and wild life, including birds, mammals and other terrestrial and aquatic life" and "to require the use of all known available and reasonable methods to prevent and control the pollution of the waters of the state. . ."[254] Section 17-0501 of the Environmental Conservation Law flatly prohibits the discharge of any matter into waters which will cause or contribute to a condition in contravention of water quality standards. Department Staff has cited ECL § 17-0501 as a basis for the conclusion that the continued operation of the Facility could impair the Hudson River for its best usages.[255]

By excluding evidence of the Facility's planned radiological discharges, the Tribunal foreclosed further inquiry by Riverkeeper into the effect of the combined, that is cumulative,

[253] Tr. at 2806:19 to 2807:1.

[254] NYS ECL § 17-0101.

[255] Tr. at 2742:4 to 2743:19.

contribution of Indian Point's accidental and planned radiological discharges to the Hudson River. Notably, some of the radiological contamination from Indian Point's accidental leaks intermingles with the radiological effluents in the Facility's discharge canal before being discharged to the Hudson River.[256]

Accordingly, Riverkeeper respectfully seeks reversal of the Tribunal's exclusion of the following proffered testimony of Riverkeeper expert witness Arnold Gunderson: Direct at Page 12, lines 16 through 23,[257] Page 14, lines 15 through 16, line 19, and line 21[258] Page 26, line 12,[259] Page 26 Line 14 and 17;[260] and Rebuttal Page 8, lines 6 through 13.[261]

II. The Tribunal Erred in Excluding From Evidence Relevant and Material Testimony and Documents Proffered by Riverkeeper With Respect to Other Leaking Nuclear Facilities Owned and Operated by Entergy

Riverkeeper similarly respectfully seeks reversal of the Tribunal's ruling to exclude Mr. Gunderson's testimony pertaining to other facilities, including Entergy's Vermont Yankee and Pilgrim reactors. The excluded testimony is relevant and material. Moreover, given the Tribunal's receipt of numerous documents pertaining to other facilities proffered by Entergy to support its radiological case, the exclusion of Mr. Gunderson's testimony implicates questions of fundamental fairness in the hearing process.

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[256] Tr. at 4047:22-23 to 4048:1-3; 4050:16-23, 4051:1-2; 4051:13-22 and Exh. Entergy 33 p.65 quoted at Tr. at 4051:6-10.

[257] Ruling at Tr. at 2807:10-11; excluded testimony at Tr. at 2830:1-23.

[258] Ruling at Tr. at 2807:11 and 2807:23 to 28081-2; excluded testimony at Tr. at 2832: 15-16, 19 and 21.

[259] Ruling at Tr. at 2808: 4-5; excluded testimony at 2845:12 and 14.

[260] The Tribunal reserved its ruling on Page 26, line 14 and 17 and, to Riverkeeper's knowledge, never ultimately ruled to exclude this section of Mr. Gunderson's testimony. Tr. at 2808: 15-16. Accordingly, Riverkeeper understands that such testimony, found at Tr. at 2845: 14 and 17, was admitted and not excluded. To any extent this is not the case Riverkeeper seeks reversal of the ALJ's ruling with respect to that testimony as well.

[261] Ruling at Tr. at 280819-20; excluded testimony at Tr. at 2858:6-13.

By way of example and not of limitation, Entergy's engineer Matthew J. Barvenik testified that releases of contamination "occur at any large industrial facility,[262]" and that Indian Point was no more susceptible to tritium "washout" than other facilities.[263] Entergy cross-examined Riverkeeper's engineer Mr. Gunderson on a comparison of Indian Point's organizational structure with similar-sized nuclear plants.[264] Mr. Barvenik supported its testimony with references to case studies which included other nuclear facilities and industry-wide groundwater and buried pipes initiatives, other plants' buried piping programs,[265] a June 2011 NRC report to show that the age of a plant is not correlated with leak with leakage[266] (which Mr. Barvenik used to create a chart comparing Indian Point to other facilities with respect to tritium leakage[267]) and Entergy's (fleet-wide) aging management program for nuclear facilities.[268]

Fairness considerations aside, Mr. Gunderson's testimony with respect to other nuclear facilities—and in particular other nuclear facilities owned and operated by Entergy, is squarely relevant to the question of whether Entergy can demonstrate compliance with water quality standards and other applicable provisions of state law over the twenty-year term of its NRC license renewal. Entergy's aging management program, as noted, is a fleet-wide program. Evaluating the efficacy of this program is directly relevant to the questions of accidental leaks going forward at Indian Point.[269] The use of extraction wells to remove contaminated

[262] Barvenik Prefiled Testimony (July 22, 1011) at 11:19-21.

[263] Barvenik Prefiled Testimony (July 22, 1011) at 27:4-6.

[264] Tr. at 2941:10-13 (Gundersen by Entergy).

[265] Barvenik Prefiled Testimony (July 22, 1011) at 10:5-23.

[266] Barvenik Prefiled Testimony (July 22, 1011) at 17:9-22 and 18:1-13.

[267] Barvenik Prefiled Testimony (July 22, 1011) at 18:1.

[268] Barvenik Prefiled Testimony (July 22, 1011) at 35:18 to 36:13.

[269] Tr. at 2799:8-11.

groundwater is another issue in dispute in this matter.[270] Accordingly, Entergy's use of extraction wells at Vermont Yankee goes directly to Entergy's willingness and ability to employ extraction wells at Indian Point to attempt to prevent the migration of radionuclides in the groundwater to the Hudson River.

By excluding testimony pertaining to other facilities, the Tribunal has precluded Riverkeeper from making a record with respect to disputed issues of fact pertaining to the proper methodology for addressing the prevention and remediation of radiological contamination of groundwater and surface water by the Facility. Accordingly, Riverkeeper respectfully seeks reversal of the Tribunal's exclusion of the following proffered testimony of Riverkeeper expert witness Arnold Gunderson: Direct at Page 7 lines 1 through 29 and Page 8,lines 1 through 21,[271] Page 26, line 29;[272] Rebuttal at Page 19, lines 15 through 27[273] and Page 20, lines 1 through 31.[274]

[270] *See*, *e.g.*, Tr. at 2841:8 to 2843:16, Exh. Riverkeeper 30 (May 19, 2006 e-mail from David Winslow to Donald Mayer and Gary Hinrichs re: Remedial Report); Exh. Riverkeeper 31 (November 15, 2006 letter from Paul M. Bruck, Director, ABS Consulting to Gary Hinrichs, Entergy Nuclear re: Proposal for Development of ER Response Nuclear Change Necessary for Mechanical Portion of Remediation Well RW-1); Exh. Riverkeeper 32 (Unit 1 Status for ENC presentation notes); Exh. Riverkeeper 33 (Groundwater Investigation: '06 Quarter 4 Activities and Results) and Exh. Riverkeeper 34 (December 21, 2006 e-mail from Kathleen McMullin to James Baranski, et al. re: IPEC Status Report for Dec. 21). *See also* Tr. at 4038:10 to 4041:14 (Barvenik by Rvk).

[271] Ruling at Tr. at 2807:6-9, excluded testimony at Tr. at 2826:1 through 2827:21, ruling restoring question and testimony on Page 7 lines 30-31 (Tr. at 2826:30-31) at 3063:11-23.

[272] Ruling at Tr. at 2808:17-18, excluded testimony at Tr. at 2845:29.

[273] Ruling at Tr. at 2809:6-7, excluded testimony at Tr. at 2869:15-27.

[274] Ruling at Tr. at 2809:6-7, excluded testimony at Tr. at 2870:1-31.

CONCLUSION

For the foregoing reasons, DEC Staff's denial of Entergy's Application for WQC related to the relicensing of Indian Point was appropriate and warranted, and Entergy's appeal contesting the legal and factual bases thereof should be denied.

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Respectfully submitted,

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