COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 1

New York State Department of Environmental Conservation
Division of Environmental Permits, 4th Floor
625 Broadway, Albany, NY 12233-1750
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Alexander B. Grannis
Commissioner

April 2, 2010

VIA E-MAIL AND
FIRST CLASS MAIL

Dara F. Gray
Entergy Nuclear Operations, Inc.
Indian Point Energy Center
450 Broadway, Suite 3
Buchanan, New York 10511

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

Dear Ms. Gray:

On April 6, 2009, the New York State Department of Environmental Conservation (Department or DEC) received a Joint Application for a federal Clean Water Act (CWA) § 401 Water Quality Certificate (WQC) on behalf of Entergy Indian Point Unit 2, LLC, Entergy Indian Point Unit 3, LLC, and Entergy Nuclear Northeast (collectively Entergy). The Joint Application for § 401 WQC was submitted to the Department as part of Entergy's federal license renewal and 20-year extension request to the Nuclear Regulatory Commission (NRC) for Indian Point nuclear Unit 2 and Indian Point nuclear Unit 3 (collectively, the Indian Point facilities). Pursuant to the CWA, a state must determine whether to issue a certification verifying that an activity which results in a discharge into navigable waters – such as operation of the Indian Point facilities – meets state water quality standards before a federal license or permit for such activity can be issued.

Entergy is seeking a 20-year license extension from the NRC for the continued operation of the Indian Point facilities (Units 2 and 3). It is undisputed that the operation of the facilities involves the withdrawal from, and discharge into, a navigable surface water of the State, namely the Hudson River. Consequently, Entergy has requested the Department to issue a § 401 WQC to run concurrently with any renewed nuclear licenses for the Indian Point facilities.

Over the last 12 months, Entergy has supplemented its original Joint Application for § 401 WQC at various times (a summary of those occasions is provided in Table 1 below). Based on a thorough review and consideration of the original Joint Application and all of Entergy's supplemental submissions, the Department has determined that the facilities, whether

operated as they have for the last 35 years (as proposed in the original Joint Application) or operated with the addition of a cylindrical wedge-wire screen system (as proposed in Entergy's February 12, 2010, submission), do not and will not comply with existing New York State water quality standards. Accordingly, pursuant to 6 NYCRR Part 621 (Uniform Procedures), the Department hereby provides notice to Entergy that its request for a § 401 WQC is denied. As further required by 6 NYCRR Part 621, a statement of the Department's reasons for the denial is provided below.

Background

The Facilities

As indicated, Entergy filed a Joint Application with the Department for a § 401 WQC for the continued operation of Indian Point nuclear Units 2 and 3 in April 2009.[1] Indian Point Units 2 and 3 are both Westinghouse four-loop pressurized water reactors (PWRs) with net capacities of 1078 MWe and 1080 MWe of electrical power, respectively. The facilities are located on the east bank of the Hudson River in the Village of Buchanan, Westchester County. Each Unit utilizes a once-through cooling water intake system, with the intake structures in, and a shared discharge canal to, the Hudson River. The design rate of the cooling water intake system for each Unit is 840,000 gallons of water per minute (GPM) – for a combined intake capacity of approximately 2.5 billion gallons of Hudson River water per day.

PWRs are designed to produce electrical energy by creating thermal energy from a nuclear reaction which, in turn, produces steam for steam generators. A nuclear reaction (fission) inside the reactor vessel creates heat, and pressurized water in the primary coolant loop carries the heat to steam generators. Inside the steam generators, heat from the steam is directed to the main turbine, causing it to turn the turbine generator, where it is converted into electricity. The unused steam is exhausted into the condenser where it is condensed into water. That water is then pumped out of the condenser with a series of pumps, reheated and pumped back to the reactor vessel.

Cooling water is a critical component of the nuclear plant operating system, both to create the steam for generating electricity and for cooling the reactor and associated components. Indian Point Units 2 and 3 utilize a once-through cooling water system, and each Unit has its own cooling water intake structure (CWIS) located in the Hudson River. A once-through cooling system operates by withdrawing water from its source, in this case the Hudson River, where it is passed through a steam condenser one time, and then discharged to the source at a higher temperature (*i.e.*, thermal discharge).

Units 2 and 3 have separate CWISs, and both CWISs are located along the shoreline of the Hudson River. The withdrawal of up to 2.5 billion gallons of water per day from the Hudson River by Indian Point Units 2 and 3 results in an adverse environmental impact upon aquatic organisms (a discussion of the adverse environmental impact caused by Indian Point's operations is included in greater detail below). Since the original construction and operation of the Indian

1 Indian Point Unit 1 ceased operation in 1974 and, as such, was not included as part of Entergy's Joint Application.

Point facilities in the 1970s, the CWISs have been retrofitted with certain technologies in order to mitigate some adverse environmental impact to aquatic organisms.

In that regard, both Units 2 and 3 are equipped with modified Ristroph-type traveling screens, fish handling and return systems, and low pressure screenwash systems intended to reduce the number of aquatic organisms injured and killed by being impinged by the facilities' CWISs each year.[2] The facilities have also, on occasion, reduced flow as an operational measure in an attempt to reduce, but not minimize, the adverse environmental impact of entrainment from their CWISs. [3] These flow reductions have been achieved by the operation of dual/variable-speed pumps on the CWISs and from limited outage periods for the purpose of maintaining and/or refueling the Indian Point facilities. The reductions in flow have resulted in some limited entrainment reductions, however, because Units 2 and 3 operate as baseloaded units, the reduction in water use afforded by these operational modifications is minimal, thereby resulting in only a small reduction in the number of aquatic organisms entrained by the facilities' CWISs each year.

Operation and Permitting

Nuclear Licenses

Indian Point Unit 2 was initially licensed by the Atomic Energy Commission (AEC), the predecessor to the NRC, on September 28, 1973. The AEC issued a 40-year license for Unit 2 that will expire on September 29, 2013. Unit 2 was originally licensed to the Consolidated Edison Company, which sold that facility to Entergy in September 2001.

Indian Point Unit 3 was initially licensed on December 12, 1976, for a 40-year period that will expire in December 2015. While the Consolidated Edison Company of New York originally owned and operated Unit 3, it was later conveyed to the Power Authority of the State of New York (PASNY – the predecessor to the New York Power Authority [NYPA]). PASNY/NYPA operated Unit 3 until November 2000 when it was sold to Entergy.

The licenses issued by the AEC for Units 2 and 3 initially allowed for the operation of those facilities with once-through cooling systems. However, the Final Environmental Statements issued by the AEC and NRC for Units 2 and 3, respectively, called for installation of closed-cycle cooling systems at the facilities, by certain dates, because of the potential for long term environmental impact from the once-through cooling systems on aquatic biota inhabiting the Hudson River which would result in permanent damage to and severe reduction in the fishery, particularly striped bass. *See Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247* [AEC, Directorate of Licensing]; and *Final*

2 Impingement occurs when larger aquatic organisms, like fish, are trapped and are injured or killed by the pressure from the flow of large volumes of water against a CWIS.

3 Entrainment occurs when smaller aquatic organisms, like plankton, eggs, and larvae, are drawn into a CWIS by the flow of water and are injured or killed in the process.

Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286 [NUREG-75/002].

Subsequently, the NRC sought to amend the licenses for Units 2 and 3 to terminate the use of once-through cooling and to require the facilities to construct and operate wet closed-cycle cooling systems[4] due to "the unacceptability of long-term impacts of entrainment and impingement on the Hudson River fishery." Thus, the license for Unit 2 was amended by the NRC in 1975, and the license for Unit 3 was amended by the NRC in 1976, to include requirements for the installation and operation of wet closed-cycle cooling systems at the facilities.

In conjunction with the license amendments, the NRC prepared Environmental Statements for Units 2 and 3 (based upon detailed reports filed by the licensees) in which various alternative closed-cycle cooling systems for the facilities were evaluated from an environmental and economic standpoint. *See NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 2, Consolidated Edison Company of New York, Inc., August 1976 – Docket No. 50-247* [NUREG-0042]; and *NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 3, Consolidated Edison Company of New York, Inc., and Power Authority of the State of New York, December 1979 – Docket No. 50-286* [NUREG-0574]; *see also Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Consolidated Edison Company of New York, Inc., December 1974 – Docket No. 50-247;* and *Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 3, Consolidated Edison Company of New York, Inc., January 1976 – Docket No. 50-286*.

On the basis of the evaluation and analysis set forth in the NRC's Final Environmental Statements for Units 2 and 3, and after weighing the environmental, economic, technical, and other benefits against environmental costs and risks and considering available alternatives, the NRC concluded that the operating licenses for the facilities should be amended to authorize construction of natural draft cooling towers (*i.e.*, a closed-cycle cooling system) at each Unit. *See id.* Prior to the respective deadlines for installation of closed-cycle cooling at the Indian Point facilities, however, the NRC's authority to require the retrofit under federal nuclear licenses was superseded by comprehensive amendments to the federal Water Pollution Prevention and Control Act (a/k/a the Clean Water Act [CWA]) and creation of the National Pollutant Discharge Elimination System (NPDES) program. *See* 33 U.S.C. §§ 1251 to 1387.

4 Wet closed-cycle cooling systems re-circulate water, after allowing it to cool off in a reservoir or tower before being reused, and add water to the system only to replace that which is lost through evaporation. Wet closed-cycle cooling systems, therefore, withdraw far less water than once-through systems. In fact, wet closed-cycle cooling systems use approximately 90 to 96 percent less water than similarly situated once-through systems. Thus, use of a wet closed-cycle cooling system substantially reduces the number of aquatic organisms impinged and entrained by a CWIS.

NPDES/SPDES Permits

Much like NRC's nuclear licenses, the U.S. Environmental Protection Agency (USEPA) issued separate NPDES permits for Units 2 and 3, pursuant to provisions of the CWA, chiefly § 316 (33 U.S.C. § 1326), that required both facilities to discontinue discharging heated effluent from the main condensers. The NPDES permits provided that "heat may be discharged in blowdown from a re-circulated cooling water system." The intent of these conditions was to require the facilities to install closed-cycle cooling systems in order to reduce the thermal and adverse environmental impact from the operation of Indian Point's CWISs upon aquatic organisms in the Hudson River. In 1977, the facilities' owners, Consolidated Edison Company of New York and PASNY/NYPA, requested administrative hearings with the USEPA to overturn these conditions.

In October 1975, the Department received approval from the USEPA to administer and conduct a State permit program pursuant to the provisions of the federal NPDES program under CWA § 402. Since then, the Department has administered that program under the State Pollutant Discharge Elimination System (SPDES) permit program. *See* Environmental Conservation Law (ECL) Article 17, Title 8; and implementing regulations at 6 NYCRR Part 750. As a result, the Department has the authority, under the CWA and independent State law, to issue SPDES permits for the withdrawal of cooling water for operations at the Indian Point facilities and for the resulting discharge of waste heat and other pollutants into the Hudson River. *See id.* In order to obtain a SPDES permit from the Department, the facilities must demonstrate that their CWISs use the best technology available to minimize environmental harm. *See Matter of Entergy Nuclear Indian Point v New York State Dept. of Envtl. Conservation,* 23 AD3d 811 (3d Dept. 2005), *appeal dismissed in part and denied in part* 6 NY3d 802 (2006); *see also Hudson Riverkeeper Fund, Inc. v Orange and Rockland Utilities, Inc.,* 835 F.Supp. 160 (S.D.N.Y. 1993).

As previously noted, in 1977 the then-owners of the Indian Point nuclear facilities sought an adjudicatory proceeding to overturn the USEPA-issued NPDES permit determinations that limited the scope of the facilities' cooling water intake operations. The USEPA's adjudicatory process lasted for several years before culminating in a multi-party settlement known as the Hudson River Settlement Agreement (HRSA).[5] The HRSA was initially a ten-year agreement (from December 1980 to December 1990) whereby the owners of certain once-through cooled electric generating plants on the Hudson River, including Indian Point, would collect biological data and complete analytical assessments to determine the scope of adverse environmental impact caused by those facilities.

The intent of the HRSA was that, based upon the data and analyses provided by the facilities, the Department could determine, and parties could agree upon, the best technology available (BTA) to minimize adverse environmental impact on aquatic organisms in the Hudson

5 The signatory parties to the HRSA were USEPA, the Department, the New York State Attorney General, the Hudson River Fishermen's Association, Scenic Hudson, the Natural Resources Defense Council, Central Hudson Gas & Electric Co., Consolidated Edison Co., Orange & Rockland Utilities, Niagara Mohawk Power Corp., and PASNY. Entergy was not a party to the HRSA because it did not own the Indian Point facilities at any time during the period covered by the HRSA.

River from these facilities in accordance with 6 NYCRR § 704.5. The terms of the 1980 HRSA were extended through a series of four separate stipulations of settlement and judicial consent orders that were entered in Albany County Supreme Court [Index No. 0191-ST3251]. The last of these stipulations of settlement and judicial consent orders, executed by the parties in 1997, expired on February 1, 1998. Consequently, as a result of the HRSA and subsequent consent orders, final compliance determinations for the BTA requirement of 6 NYCRR § 704.5 for the facilities subject to the HRSA, including Indian Point, were effectively postponed for nearly 20 years.

In accordance with the provisions of the HRSA, in 1982 the Department issued a SPDES permit for Indian Point Units 2 and 3, and other Hudson River electric generating facilities, as well as a § 401 WQC for the facilities. The 1982 SPDES permit for Units 2 and 3 contained special conditions for reducing some of the adverse environmental impact from the facilities' CWISs but, based upon provisions of the HRSA, the permit did not require the installation of any technology for minimizing the number of organisms entrained by the facilities each year. Similarly, based upon provisions of the HRSA, the 1982 § 401 WQC did not make an independent determination that the facilities complied with certain applicable State water quality standards at that time, including 6 NYCRR Part 704 – Criteria Governing Thermal Discharges.

In accordance with the provisions of the HRSA, the Department renewed the SPDES permit for the Indian Point facilities in 1987 for another 5-year period. *See* ECL § 17-0817. As with the 1982 SPDES permit, the 1987 SPDES permit for Units 2 and 3 contained certain measures from the HRSA that were intended to mitigate, but not minimize, the adverse environmental impact caused by the operation of the facilities' CWISs. The 1987 SPDES permit expired on October 1, 1992. Prior to the expiration date, however, the owners of the facilities at that time, Consolidated Edison and NYPA, both submitted timely SPDES permit renewal applications to the Department and, by operation of the State Administrative Procedure Act (SAPA), the 1987 SPDES permit for Units 2 and 3 is still in effect today. Entergy purchased Units 2 and 3 in 2001 and 2000, respectively, and the 1987 SAPA-extended SPDES permit for the facilities was subsequently transferred to Entergy.

In November 2003, the Department issued a draft SPDES permit for Units 2 and 3 that required Entergy, among other things, to retrofit the Indian Point facilities with closed-cycle cooling or an equivalent technology in order to minimize the adverse environmental impact caused by the CWISs in accordance with 6 NYCRR § 704.5 and CWA § 316(b).[6] In 2004, Entergy requested an adjudicatory hearing with the Department on the draft SPDES permit. That SPDES permit adjudicatory process is presently ongoing.

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6 6 NYCRR § 704.5, a State water quality standard enacted by the Department in 1974, provides: "The location, design, construction and capacity of cooling water intake structures, in connection with point source thermal discharges, shall reflect the best technology available for minimizing adverse environmental impact."

For comparison, CWA § 316(b), enacted in 1972, provides: "Any standard established pursuant to section 301 [33 U.S.C. § 1311] or section 306 [33U.S.C. § 1316] of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

Currently, the facilities are still subject to the provisions of the 1987 SAPA-extended SPDES permit. As previously noted, however, the 1987 SPDES permit did not assess the need for, nor did it require the installation of, any technology for minimizing the adverse environmental impact (*i.e.*, entrainment) caused by the facilities' CWISs each year. *See Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation; June 25, 2003*. Therefore, as a result of the now-expired HRSA, the 1987 SPDES permit does not contain the "best technology available" (BTA) determination that is required by 6 NYCRR § 704.5 and CWA § 316(b).[7]

§ 401 WQC

As indicated, the Department, in accordance with CWA § 401, is required to certify that a facility meets state water quality standards prior to a federal agency issuing a federal license or permit in conjunction with its proposed operation. At the time Indian Point Units 2 and 3 were proposed for operation and went through the initial federal nuclear license processes in the 1970s, the Department did issue a § 401 WQC for both facilities. The combined § 401 WQC for Unit 1 (now closed) and Unit 2 was issued on December 7, 1970, with limited conditions. The Department issued a revised § 401 WQC in 1973 that encompassed only Unit 2, and on May 2, 1975, the Department issued a revised § 401 WQC to also encompass Unit 3. The 1975 § 401 WQC incorporated by reference the NPDES permit previously issued by the USEPA that required retrofitting of the facilities with a closed-cycle cooling system.

In 1982, in accordance with provisions of the HRSA, the Department issued a modified § 401 WQC that incorporated by reference the SPDES permit that had been issued, also in accordance with provisions of the HRSA, that same year. The 1982 § 401 WQC for Units 2 and 3 did not include a determination that the facilities' complied with certain applicable State water quality standards at that time, including 6 NYCRR Part 704 – Criteria Governing Thermal Discharges. Moreover, the 1982 § 401 WQC for Units 2 and 3 did not assess whether any technology for minimizing the adverse environmental impact (*i.e.*, entrainment) caused by the facilities' CWISs each year was needed and, as such, did not render a "best technology available" (BTA) determination required by 6 NYCRR § 704.5 and CWA § 316(b). The 1982 § 401 WQC is the last WQC that was issued by the Department for Units 2 and 3.

The Hudson River Resource

The Hudson River is one of the most biologically diverse estuarine water bodies in North America. It has long been recognized as a valuable national, state, and local resource, as well as an integral part of the North Atlantic coastal environment. Traditionally, the Hudson River has functioned as an abundant temperate estuary, rich in high fish biodiversity – with more than 210 species recorded from its entire watershed; 140 of which live within the estuary. The estuary, particularly the area around the Indian Point facilities, serves as a spawning and nursery ground

7 "Adverse environmental impact" is the number of organisms killed or injured through entrainment or impingement by cooling water intakes structures (CWISs). *See Riverkeeper, Inc., et al. v U.S. Envtl. Protect. Agency*, 358 F.3d 174 (2d Cir. 2004).

for important fish and shellfish species, such as striped bass, American shad, Atlantic and shortnose sturgeon, and river herring. As a result, the Hudson has been a popular and, at times, prosperous commercial and recreational fishing environment.

While the Hudson once supported rich commercial fisheries throughout its tidal waters, today its commercial fisheries are almost extinct. Because of the historical significance and importance of the Hudson River, it has been designated an American Heritage River by the USEPA in accordance with Executive Order 13061 issued by President Clinton on September 11, 1997. *See http://www.epa.gov/rivers/initiative.html.* The Hudson has also been afforded numerous special protections in State law, in addition to those for other water bodies of the State. *See e.g.*, ECL § 11-0306, and ECL Art. 44.

Cooling Water Intake Structures

Like the Department, the USEPA has found that CWISs cause multiple types of undesirable and unacceptable adverse environmental impacts, including entrainment and impingement; reductions of threatened, endangered or other protected species; damage to critical aquatic organisms, including important elements of the food chain; diminishment of a population's compensatory reserve; losses to populations including reductions of indigenous species population, commercial fisheries stocks, and recreational fisheries; and stresses to overall communities and ecosystems as evidenced by reductions in diversity or other changes in system structure and function. *See* 66 Fed. Reg. 65,256, 65,292 (Dec. 18, 2001); 69 Fed. Reg. 41,576, 41,586 (July 9, 2004). The USEPA has recognized that the loss of large numbers of aquatic organisms may affect not only stocks of various species and their compensatory reserve, but also the overall health of ecosystems. *See* 66 Fed.Reg. 65,292 (Dec. 18, 2001).

Significantly, in 2004, the USEPA approvingly cited the Department's analysis of such ecosystem effects in connection with the permitting of three Hudson River power plants, including the Indian Point nuclear facilities. *See* 69 Fed.Reg. 41,587-88 (July 9, 2004) *(citing the Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation; June 25, 2003).* The Department's FEIS found that entrainment not only reduces the number of adult fish species whose eggs and larvae are entrained by a CWIS, but also depletes the species' ability to survive unfavorable environmental conditions and, perhaps most significantly, diminishes the forage base, which disrupts the food chain, transferring energy from higher to lower trophic levels and compromising the health of the entire aquatic community.[8] *See id.*

Entergy's Current § 401 WQC Application

Entergy initiated the § 401 WQC application review process by submitting a Joint Application and supporting documentation received by the Department on April 6, 2009. Pursuant to the CWA, the Department must act upon the Joint Application within a reasonable amount of time, but not to exceed one year. *See* 33 U.S.C. § 1341(a)(1). Since April 6, 2009,

8 "Trophic" refers to the feeding habits or food relationship of different organisms in a food chain.

Entergy has supplemented its Joint Application for a § 401 WQC at various times in conjunction with requests for additional information from the Department. *See* ECL Article 70 and 6 NYCRR Part 621 (Uniform Procedures). For ease of reference, the Department provides a list and brief summary of the correspondence, requests, and submittals associated with the Joint Application over the last 12 months in Table 1 below.

Table 1

Prepared By	**Date**	**Summary**
Entergy	April 6, 2009[1]	§ 401 WQC Joint Application and Attachments
DEC	May 13, 2009	Request For Information #1 (RFI)
Entergy	June 12, 2009	Partial Response to RFI #1: Thermal Study Protocol
DEC	July 3, 2009	RFI #2: Thermal Study & Demonstration of Thermal Standards
Entergy	July 9, 2009	Partial Response to RFI #1: Permission to Inspect Property Form
Entergy	September 9, 2009	Partial Response to RFI #1: Table of Documents to be Submitted
DEC	September 23, 2009	RFI #3: Clarification of Information
Entergy	October 19, 2009	Partial Response to RFI #1: Delivery of Information
DEC	October 28, 2009	Letter regarding hand delivery of documents at 625 Broadway
Entergy	November 3, 2009	Partial Response to RFI #2: Thermal Study response
Entergy	November 13, 2009	Partial Response to RFI #1: Submission of historical Documents in accordance with previous WQC
DEC	December 4, 2009	RFI #3: Comment regarding thermal study
DEC	December 10, 2009	RFI #4: Comment on November 13, 2009 submission
Entergy	December 23, 2009	Partial Response to RFI #1 and #4: 1982 WQC
DEC	December 30, 2009	RFI #5: Comment on 1982 WQC
Entergy	February 12, 2010	Response to RFI #1: Letter and Attachment (Detailed Responses to DEC RFI #1 dated May 13, 2009)
Entergy	February 12, 2010	Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration[2]
Entergy	February 12, 2010	Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3[3]
Entergy	March 15, 2010	Partial Response to RFI #2: Tri-axial thermal study requirement at Indian Point Units 2 and 3
Entergy	March 22, 2010	Partial Response to RFI #1 and #2: Hydrothermal Modeling of the Cooling Water Discharge from the Indian Point Energy Center to the Hudson River

[1] Cover letter dated April 3, 2009. Document received by DEC on April 6, 2009.

[2] Incorporated by reference as Appendix L in the document titled Detailed Responses to DEC RFI #1 dated May 13, 2009.

[3] Incorporated by reference as Appendix M in the document titled Detailed Responses to DEC RFI #1 dated May 13, 2009.

Statement of Reasons for Denial

Pursuant to 6 NYCRR § 621.10, should it decide to deny an application, the Department must provide an explanation for the denial with the notice to the applicant. Provided below are the Department's reasons for the denial of Entergy's application for a § 401 WQC for the relevant and applicable sections of New York State's environmental laws, regulations or standards related to water quality.

6 NYCRR Part 701 – Classifications – Surface Waters and Groundwaters;
and 6 NYCRR Part 703 – Surface Water and Groundwater Quality Standards

6 NYCRR § 701.11 Class SB Saline Surface Waters

The Department's May 13, 2009 Request for Information (RFI) stated that the § 401 WQC for Units 2 and 3 must address compliance with 6 NYCRR Parts 701 and 703. Accordingly, the facilities must demonstrate compliance with the standards and designated uses set forth in regulations to maintain the best usage of the waters. Pursuant to 6 NYCRR § 701.11, the area of the Hudson River where the Indian Point facilities are located is classified as an SB saline surface water. *See* 6 NYCRR § 864.6. The "best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival." *See* 6 NYCRR § 701.11.

"Primary contact recreation" means "recreational activities where the human body may come in direct contact with raw water to the point of complete body submergence. Primary contact recreation includes, but is not limited to, swimming, diving, water skiing, skin diving and surfing." *See* 6 NYCRR § 700.1(a)(49). "Secondary contact recreation" means "recreational activities where contact with the water is minimal and where ingestion of the water is not probable. Secondary contact recreation includes, but is not limited to, fishing and boating." *See* 6 NYCRR § 700.1(a)(56).

The historical data that has been collected on the Hudson River by the owners of the Indian Point facilities (and others) over the past 35 years demonstrates that the withdrawal of cooling water by Units 2 and 3 cause significant adverse environmental impact upon aquatic organisms, particularly fish eggs, larvae, and fish. *See Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation on June 25, 2003*; *see also Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247* [AEC, Directorate of Licensing]; and *Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286* [NUREG-75/002].

The continued operation of Units 2 and 3 in once-through cooling mode for an additional 20 years, as proposed by Entergy in its Joint Application, would continue to exacerbate the adverse environmental impact upon aquatic organisms caused by the facilities' CWISs. Consequently, the continued operation of Units 2 and 3 would be inconsistent with the best usage of the Hudson River in 6 NYCRR § 701.11 for fish, shellfish, and wildlife propagation and survival.

6 NYCRR § 703.2 Narrative Water Quality Standards

More recently, Entergy has 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. The Department is aware of previous and ongoing leaks from spent fuel pools and other systems, structures, and components at the Indian Point site that have been referenced in Entergy's submissions filed in conjunction with its pending NRC relicensing proceeding for Units 2 and 3 (including two distinct radionuclide plumes mapped by Entergy).

While Entergy maintains that radiological assessments of ongoing radioactive leaks to the Hudson River have not yielded an indication of potential adverse environmental or health risk, the discharge of radiological substances (including, but not limited to, radioactive liquids, radioactive solids, radioactive gases, and 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. *See* 6 NYCRR § 703.2. In addition, noncompliant "thermal discharges" (6 NYCRR Part 704 – *see* further discussion below) into a class SB water also impair the water for its best usage, particularly where, as here, primary and secondary contact recreation is concerned. *See id*.

Based upon all of this information, the Department has determined that the adverse environmental impact from the operation of Indian Point's CWISs to the Hudson River impair the best use of the water designated in 6 NYCRR § 701.11. In particular, the withdrawal of approximately 2.5 billion gallons of Hudson River water per day and the mortality of nearly one billion aquatic organisms per year from the operation of Units 2 and 3 are inconsistent with fish propagation and survival. In addition, radiological leaks have the potential to impair the best use of the water designated in 6 NYCRR § 701.11. Accordingly, the Department has made a determination to deny the § 401 WQC application for Units 2 and 3 based upon a failure to comply with this State water quality standard and designated best use of the water. *See PUD No. 1 of Jefferson Cty v Washington Dept. of Ecology,* 511 U.S. 700 (1994).

6 NYCRR Part 704 – Criteria Governing Thermal Discharges

6 NYCRR § 704.1 Water Quality Standards for Thermal Discharges; and 6 NYCRR § 704.2 Criteria Governing Thermal Discharges

The Department's May 13, 2009 RFI stated that Entergy's § 401 WQC application must demonstrate compliance with the thermal discharge water quality standards and criteria set forth

in 6 NYCRR Part 704, including §§ 704.1 and 704.2. Section 704.1 requires that "All thermal discharges to the waters of the State shall assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water." *See* 6 NYCRR §704.1(1). Section 704.2 contains special criteria for estuaries or portions of estuaries such as the Hudson River. *See* 6 NYCRR §704.2(b)(5)(i)-(iv).

The Department indicated in its May 13, 2009 RFI that the only means to demonstrate compliance with these standards and criteria for purposes of the Joint Application was for Entergy to submit the results of a current, completed triaxial thermal study. Entergy initially objected to this requirement based upon a previous agreement entered with the Department in conjunction with the administrative proceeding for the 2003 draft SPDES permit (commenced in 2004) whereby a triaxial study would be deferred until after a final SPDES permit for the facilities was issued by the Department.

The Department rejected Entergy's assertion because the § 401 WQC application is subject to a separate and distinct process that requires an entirely independent evaluation and regulatory determination from the SPDES permit proceeding. Furthermore, given the length of the ongoing SPDES permit proceeding (commenced in 2004, with no final SPDES permit decision in the near future) and the applicable one-year time period under the CWA for the Department to render a decision on the Joint Application, the Department needed a triaxial thermal study of current conditions to make all of the necessary findings or determinations required by law.

Entergy, in contravention of the Department's recommendation, completed a collection of Hudson River thermal data outside of the known, critical environmental period. While the Department understands that factors beyond Entergy's control may have prevented the mobilization of field work during the summer months, nevertheless, the Detailed Responses submitted February 12, 2010, included only the raw thermal data collected in the river from September through November 2009. Entergy had yet to develop a model from the data to demonstrate compliance with the thermal standards and criteria during the warm summer months. Even if Entergy had included the model it would still need to be verified through the collection of additional thermal data during the summer of 2010. This is consistent with how the Department has handled other facilities that have collected initial thermal data outside the critical environmental period.

On March 22, 2010, Department staff met with representatives from Entergy and its consultants, and were provided with a presentation on a report submitted that day entitled "Hydrothermal Modeling of the Cooling Water Discharge from the Indian Point Energy Center to the Hudson River" (Thermal Report). The Thermal Report, prepared by Applied Science Associates, Inc., consists of in-stream data that were collected from the Hudson River between September 24, 2009, and November 3, 2009, as well as a discussion of the BFHYDRO model used to predict thermal discharge characteristics from the Indian Point Energy Center. The data used to calibrate the BFHYDRO model was taken well past the typical high-temperature season of the Hudson River (July-August).

The scenario simulation presented in the Thermal Report for the "worst-case scenario" used a joint probability analysis of data in the vicinity. The conservative approach used by Department staff to predict "worst-case" is the MA7CD10 (7 day, 10 year low flow) and the

lowest flow for the available record period, background temperature in the river of 90 degrees Fahrenheit (at "slack ebb begin" and "slack flood begin" tide conditions), and during thermal stratification periods. This was discussed at the meeting on March 22, 2010. Moreover, and as noted in its July 3, 2009 letter to Entergy, the Department requires the model to be run at these critical conditions, and the results compared to the thermal criteria in 6 NYCRR § 704.2. Furthermore, in-stream data must be gathered during July-September critical periods and used to verify correct calibration of the model. All predictions are to be performed at All Plants at Capacity (APAC) conditions.

Based on the foregoing, the Department has determined to deny Entergy's application for a § 401 WQC because the supporting materials do not currently demonstrate compliance with the referenced thermal standards and criteria. The Department could reconsider its position on this issue should Entergy provide a verified thermal model that demonstrates compliance with the applicable thermal standards and criteria.

6 NYCRR § 704.5 Intake Structures (BTA Requirement)

As indicated previously, 6 NYCRR § 704.5 states that "[t]he location, design, construction and capacity of cooling water intake structures, in connection with point source thermal discharges, shall reflect the best technology available for minimizing adverse environmental impact." *See also* CWA § 316(b) [33 U.S.C. § 1326(b)].

As currently licensed and operated, Indian Point Units 2 and 3 both utilize once-through cooling water systems. Collectively, Units 2 and 3 withdraw nearly 2.5 billion gallons of water per day from the Hudson River, constituting the greatest single industrial use of water in New York State, and far exceeds the amount of water withdrawn by any other industrial facility located on the Hudson River. While Units 2 and 3 do employ certain technological measures to reduce impingement mortality from operations of the CWISs at Indian Point, the facilities have not, consistent with 6 NYCRR § 704.5, installed any technology to minimize the amount of entrainment caused by the CWISs. Consequently, it is well documented that operation of the facilities' CWISs results in the entrainment mortality of approximately one billion aquatic organisms each year.[9]

Entergy's Joint § 401 WQC Application submitted to the Department in April 2009 sought approval for the continued operation of Units 2 and 3 as they have for the last 35 years, namely, in once-through cooling mode. Given that current measures and operations at Indian Point do not minimize the adverse environmental impact of entrainment from the CWISs, the facilities are currently not in compliance with, and do not meet the BTA requirements of, 6 NYCRR § 704.5.

With regard to addressing the facilities' compliance with 6 NYCRR § 704.5, there were three submissions by Entergy that the Department considered to be critical in its determination

9 Based on in-plant abundance sampling from 1981-1987. *See Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation on June 25, 2003.*

for purposes of the § 401 WQC application. These three documents consisted of the following: (i) Entergy's initial § 401 WQC application received by the Department on April 6, 2009; (ii) Entergy's December 23, 2009, letter which included a 1982 § 401 WQC issued by the Department for Indian Point Units 1, 2 and 3; and (iii) Entergy's February 12, 2010, report entitled "Detailed Responses to the New York State Department of Environmental Conservation's Request for Information, dated May 13, 2009" (Detailed Responses).[10]

Relying primarily upon these documents, Entergy maintains that Units 2 and 3 have demonstrated compliance with the BTA requirement of 6 NYCRR § 704.5 through the following: (1) compliance with the provisions of the 1987 SAPA-extended SPDES permit;

(2) compliance with the 1982 § 401 WQC for the facilities; (3) a February 12, 2010, report entitled "Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration" that concluded conversion to a closed-cycle cooling system was a feasible, but not reasonable, alternative [Exhibit "L" to Detailed Responses]; and (4) a February 12, 2010, report entitled "Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3" that concluded a cylindrical wedge-wire screen intake technology existed that could potentially reduce, but not minimize, entrainment by the facilities' CWISs and should be considered as BTA under 6 NYCRR § 704.5 [Exhibit "M" to Detailed Responses]. The Department understands that the Detailed Responses (including the two reports noted as Exhibits here) were submitted by Entergy to the NRC on February 12, 2010, but is not aware of whether Entergy has formally amended its pending nuclear license application with the NRC to include consideration of an alternative CWIS technology for Units 2 and 3 in order to reduce, but not minimize, the adverse environmental impact caused by their operations.

Based upon its review of these documents, the Department has concluded that Entergy has not demonstrated compliance with the BTA requirement of 6 NYCRR § 704.5 and CWA § 316(b) and, therefore, denial of the § 401 WQC is warranted. Below is a brief discussion of the Department's response to each of Entergy's points referenced above concerning Indian Point's proposed demonstration of compliance with 6 NYCRR § 704.5:

> (1) Compliance with 1987 SPDES permit. The Department previously indicated in its May 13, 2009 RFI, and its December 30, 2009, letter to Entergy that compliance with the 1987 SAPA-extended SPDES permit does not, and cannot, demonstrate compliance with the BTA requirement of 6 NYCRR § 704.5. That 5-year SPDES permit is now nearly 25 years old and, because of the provisions of the now-expired HRSA, does not mandate the installation of any technology to reduce the adverse impact of entrainment from the operation of the CWISs for Units 2 and 3. Thus, the provisions of, and continued operation under, the 1987 SPDES permit for Indian Point do not comply with existing legal requirements.

10 The Detailed Responses included, by reference, two other reports dated February 12, 2010, that were prepared for and submitted by Entergy in accordance with the August 13, 2008 *Interim Decision of the Assistant Commissioner* in the ongoing SPDES permit administrative proceeding entitled: (i) "Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration;" and (ii) "Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3." *See* Exhibits "L" and "M," respectively, attached to Entergy's Detailed Responses dated February 12, 2010.

In November 2003, the Department issued a draft SPDES permit for Units 2 and 3 that included conditions requiring Entergy to evaluate conversion of the existing once-through cooling system to a closed-cycle cooling system in order for the facilities to comply with the BTA requirement of 6 NYCRR § 704.5. Entergy undertook such an evaluation both in 2003 and, most recently, in 2010 in conjunction with the ongoing SPDES permit administrative proceeding for the 2003 draft permit. *See* report entitled "Economic and Environmental Impacts Associated with Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration" prepared for Entergy by ENERCON Services in June 2003; and report entitled "Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration" prepared for Entergy by ENERCON Services in February 2010 [Exhibit "L" to Detailed Responses].

More than 30 years ago, however, the NRC had already independently evaluated and selected a closed-cycle cooling system as the only appropriate technology for reducing the adverse environmental impact from Indian Point's CWISs. *See Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247* [AEC, Directorate of Licensing]; and *Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286* [NUREG-75/002]; *see also NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 2, Consolidated Edison Company of New York, Inc., August 1976 – Docket No. 50-247* [NUREG-0042]; *and NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 3, Consolidated Edison Company of New York, Inc., and Power Authority of the State of New York, December 1979 – Docket No. 50-286* [NUREG-0574].

Taken together, all of these reports and documents have concluded that conversion from a once-through cooling system to a closed-cycle cooling system, while expensive and involving a potentially lengthy construction process, is nevertheless the only available and technically feasible technology for Units 2 and 3 to completely satisfy the BTA requirement of 6 NYCRR § 704.5 and, therefore, comply with this State water quality standard.

The 2003 draft SPDES permit for Units 2 and 3 accurately reflects the Department's preliminary determination that closed-cycle cooling is the appropriate and available technology for the facilities to comply with 6 NYCRR § 704.5. The 2003 draft SPDES permit is currently the subject of an ongoing adjudicatory proceeding (that began in 2004). In its Detailed Responses, Entergy has proposed to abide by the outcome of the SPDES permit renewal process and any subsequent judicial appeals taken from the Department's final BTA determination in a renewed SPDES permit. Consequently, Entergy requests the Department to issue a qualified § 401 WQC to incorporate an as-yet-undetermined and not-yet-issued SPDES permit by reference.

The Department does not agree with Entergy's approach because the 1987 SPDES permit for Indian Point, now nearly 25 years old, does not contain any provisions

for the installation of a technology to minimize the mortality of aquatic organisms in the Hudson River from entrainment by the CWISs for Units 2 and 3. During that time period, Units 2 and 3 have continued to operate and the entrainment of aquatic organisms has continued at Indian Point virtually unabated. The CWA requires the Department to make an independent determination on whether Entergy's pending Joint Application complies with State water quality standards now, and the Department cannot defer making that decision until some future, as-yet-undecided event occurs in a separate and distinct proceeding. *See* CWA § 401(a)(1) [33 U.S.C. § 1341(a)(1)].

(2) Compliance with 1982 WQC. The 1982 WQC issued by the Department indicates that compliance with the joint SPDES permit issued contemporaneously for Units 2 and 3 at that time constituted compliance with the State's water quality standards. In its December 23, 2009 letter, Entergy suggests that the Department should adopt a similar approach now.

The Department reiterates its position on this issue that it raised in its December 30, 2009 letter to Entergy. First, the Department is not required to process Entergy's current § 401 WQC application as it did in 1982, particularly since the Department was required to issue a modified § 401 WQC to the facilities that incorporated by reference the 1982 SPDES permit, both issued in accordance with provisions of the HRSA. Thus, the 1982 § 401 WQC for Units 2 and 3 did not include an independent determination that the facilities complied with applicable State water quality standards at that time. Moreover, the 1982 § 401 WQC for Units 2 and 3 did not assess whether any technology for minimizing the adverse environmental impact (*i.e.*, entrainment) caused by the facilities' CWISs each year was needed and, as such, did not render the "best technology available" (BTA) determination required by 6 NYCRR § 704.5 and CWA § 316(b).

Second, as noted above, the Department cannot defer its determination on the facilities' present compliance with State water quality standards based upon a SPDES permit that was last issued in 1987, particularly since that permit does not conform with existing legal requirements pertaining to BTA. Lastly, the 1982 § 401 WQC does not reference several relevant and applicable State water quality standards to which the facilities are subject and for which the Department must make a determination as part of Entergy's current § 401 WQC application. In particular, compliance with the requirements of 6 NYCRR Parts 701 and 704 is not referenced in the 1982 § 401 WQC for Units 2 and 3. Consequently, Entergy may not rely upon the terms of the 1982 § 401 WQC in order to demonstrate its current compliance with State water quality standards.

(3) A closed-cycle cooling system is an "available" alternative. On February 12, 2010, Entergy submitted a report with its Detailed Responses entitled "Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration" that concluded conversion to a closed-cycle cooling system was a feasible, but not reasonable, alternative. *See* Exhibit "L" to Detailed Responses. This report indicated that conversion from a once-through cooling system to a closed-cycle cooling system, while expensive and involving a potentially lengthy construction process, is nevertheless an available and technically feasible technology for Units 2 and 3 to satisfy the BTA requirement of 6 NYCRR § 704.5 and, thereby, comply with this State water quality standard.

Moreover, as discussed previously, the NRC – the federal agency from whom Entergy is currently seeking a 20-year license extension – determined more than 30 years ago that a closed-cycle cooling system was an "available" and appropriate technology for reducing the adverse environmental impact from Indian Point's CWISs. *See Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247* [AEC, Directorate of Licensing]; and *Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286* [NUREG-75/002]; *see also NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 2, Consolidated Edison Company of New York, Inc., August 1976 – Docket No. 50-247* [NUREG-0042]; *and NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 3, Consolidated Edison Company of New York, Inc., and Power Authority of the State of New York, December 1979 – Docket No. 50-286* [NUREG-0574]. The NRC's determination was based upon detailed analyses and assessments of closed-cycle cooling systems conducted by the then-owners of the Indian Point facilities. *See Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Consolidated Edison Company of New York, Inc., December 1974 – Docket No. 50-247;* and *Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 3, Consolidated Edison Company of New York, Inc., January 1976 – Docket No. 50-286.*

Accordingly, based upon the reports and documents submitted by Entergy in conjunction with its § 401 WQC application, the Department has concluded that conversion from a once-through cooling system to a closed-cycle cooling system, while expensive and involving a potentially lengthy construction process, is nevertheless an available and technically feasible technology for Units 2 and 3 to meet the BTA requirement of 6 NYCRR § 704.5 and comply with this State water quality standard.

(4) Cylindrical wedge-wire screens are not a reasonable alternative intake technology. On February 12, 2010, Entergy submitted a report with its Detailed Responses entitled "Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3" that concluded a cylindrical wedge-wire screen intake technology existed that could potentially reduce, but not minimize, entrainment by the facilities' CWISs and should be considered as BTA under 6 NYCRR § 704.5. *See* Exhibit "M" to Detailed Responses (Alternative Technology Report).

The Alternative Technology Report, developed by Entergy for the ongoing SPDES permit proceeding, was intended to evaluate alternative cooling water intake technologies for the facilities that would result in reductions in impact to aquatic organisms, particularly by entrainment, that were commensurate with the reductions in mortality that could be achieved by the use of a closed-cycle cooling system. Consequently, the Alternative Technology Report discussed numerous intake technologies, including passive intake systems, various screening systems, and barrier technologies. The Alternative Technology Report ultimately concluded that the CWISs for Units 2 and 3 could be retrofitted with a system of cylindrical wedge-wire screens that

would reduce adverse environmental impacts, but not "minimize" them as a closed-cycle cooling system would.

The Department thoroughly reviewed the Alternative Technology Report and has determined that Entergy's proposal to use 2.0 mm cylindrical wedge-wire screens at Units 2 and 3 is not reasonable, primarily because it is still experimental in nature, is an unproven technology on the scale that would be required at Indian Point, is not based on scientifically supported facts, and would not result in entrainment reductions that are commensurate with those that could be obtained by a closed-cycle cooling system. To be sure, the NRC determined more than 30 years ago that closed-cycle cooling was an "available" and feasible technology for minimizing adverse environmental impact from the CWISs at Units 2 and 3. *See Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247* [AEC, Directorate of Licensing]; and *Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286* [NUREG-75/002]; *see also NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 2, Consolidated Edison Company of New York, Inc., August 1976 – Docket No. 50-247* [NUREG-0042]; *and NRC's Final Environmental Statement Related to Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit 3, Consolidated Edison Company of New York, Inc., and Power Authority of the State of New York, December 1979 – Docket No. 50-286* [NUREG-0574].

Accordingly, the proposal to use cylindrical wedge-wire (CWW) screens at Units 2 and 3, as set forth in the Alternative Technology Report, does not comply with the BTA requirement of 6 NYCRR § 704.5 because such proposal would only reduce, but not minimize, adverse environmental impact to aquatic organisms from operation of the facilities. Briefly below are the Department's reasons for not accepting the Alternative Technology Report's proposal as demonstrating compliance with the State water quality standard and BTA requirement of 6 NYCRR § 704.5 (and CWA § 316[b]):

> Adverse Environmental Impact:
>
> The Alternative Technology Report estimates that the use of 2.0 mm cylindrical wedge-wire screens on Units 2 and 3 will result in an 89.7% reduction in mortality of age-1 equivalent organisms. The Department defines adverse environmental impact under 6 NYCRR § 704.5 as the total numbers of aquatic organisms killed by a CWIS, not only age-1 equivalents. Based upon this, the estimated entrainment reductions included in the Alternative Technology Report (Table 10 of Attachment 6, page 32) concludes that the use of wedge-wire screens at Units 2 and 3 will only result in a 72.82 % to 73.5 % reduction in entrainment (2.0 mm – 9.0 mm slot width) from the calculation baseline based on total number of eggs and larvae. Therefore, the proposed wedge-wire technology does not provide commensurate minimization benefits as compared to those obtainable with a closed-cycle cooling system (*i.e.*, 90% or greater reductions), particularly when considering

reductions in mortality of individuals.[11]

Through-plant survival of fish larvae:

The Alternative Technology Report claims, and thereby presumes, a "significant" through-plant survival of fish larvae at Units 2 and 3. The Department requires Department-approved, contemporary site-specific studies to clearly demonstrate that through-plant survival actually occurs at a facility. The data used by Entergy to model the estimated through-plant survival in the Alternative Technology Report were taken from studies conducted by Consolidated Edison nearly 30 years ago. The Department did not recognize significant through-plant survival at Indian Point three decades ago, and Entergy has not submitted any new data to indicate that significant change has occurred regarding through-plant survival at Indian Point now. However, even if the Department concurred with the purported amount of through-plant survival, the entrainment reductions estimated by Entergy with the use of wedge-wire screens would still fall short of those that could be obtained by the use of a closed-cycle cooling system and would be needed to meet the BTA requirement of the State water quality standard in 6 NYCRR § 704.5. *See also* fn. 11.

Feasibility of wedge-wire screens at IPEC:

The Alternative Technology Report states that "[t]here are no applications of cylindrical wedge-wire [CWW] screens at nuclear power facilities." In fact, the Department is not aware of any steam electric generating facility similar to the size of Indian Point Units 2 and 3 that operates a once-through cooling water system with 2.0 mm slot width wedge-wire screens. The Department is also not aware of an existing electric generating facility that operates wedge-wire screens in conjunction with a once-though cooling water system where the wedge-wire screen technology has been determined to represent BTA for minimizing entrainment for purposes of complying with the State water quality standard in 6 NYCRR § 704.5 (and CWA§ 316[b]).

The Alternative Technology Report recognizes the experimental and unproven nature of using CWW screens at a facility having water withdrawal volumes such as Indian Point in a biologically diverse estuarine environment like the Hudson River. For instance, the Alternative Technology Report acknowledges that a "pilot" CWW screen project would be required in order to test, among other things, appropriate screen slot width sizes, different screen alloys, the number of screens to be used, potential screen

11 On March 10, 2010, the Department released for public comment a draft policy on BTA for CWISs. *See http://www.dec.ny.gov/animals/32847.html*. The policy establishes closed-cycle cooling or its equivalent as the BTA performance goal for facilities to minimize adverse environmental impact in accordance with 6 NYCRR § 704.5. Entergy's proposed cylindrical wedge-wire screen system would not meet the performance goals set forth in this draft BTA policy.

configurations, screen monitoring requirements, and screen maintenance functions. Given this, the Department does not concur that wedge-wire screens are a proven, "available" technology for Units 2 and 3 to meet the BTA requirement in 6 NYCRR § 704.5.

Effectiveness of wedge-wire screens in reducing entrainment:

The entrainment reductions estimated in the Alternative Technology Report are based upon the unproven assumption that hydrodynamics, coupled with active larval avoidance behavior, and not screen slot width, are responsible for the majority of the entrainment reduction observed with cylindrical wedge-wire (CWW) screens. Moreover, the wealth of available industry literature on this topic does not support this assumption. *See* Electric Power Research Institute (EPRI) reports of 1998, 2003, and 2005; Taft 2000; Heuer and Tomljanovich 1978; Uziel, *et al.* 1979; Weisberg, *et al.* 1987.

EPRI, an energy industry research organization, has conducted both laboratory and field studies of CWW screens and concluded that, for CWW technology to be effective in reducing entrainment, CWW must be designed with the following: (1) sufficiently small screen slot size to physically block passage of the smallest lifestage to be protected; (2) low through-slot velocity; and (3) relatively high velocity ambient current cross-flow to carry organisms and debris around and away from the screen. "Where all conditions are present, wedge-wire screens can reduce entrainment . . ." (EPRI 1998, Taft 2000).

Many laboratory and field studies have identified a positive correlation between screen slot width and the entrainment of fish eggs and larvae. Slot widths of 1.0 mm and less have been demonstrated to be the most effective at reducing entrainment of fish eggs and larvae less than 10.0 mm in length (with 0.5 mm slot widths being the most protective). Slot widths of 2.0 mm (the minimum slot width proposed in the Alternative Technology Report) have been shown to reduce, but not "minimize," the entrainment of fish larvae greater than 10 mm in length but are not that effective on smaller larvae and eggs. In fact, results from a 1985/1986 entrainment study of a 2.0 mm slot width CWW screen system employed at the Charles Point Resource Recovery Center (Charles Point) in Peekskill, New York, indicated that those screens did not have much of an effect with respect to reducing the entrainment of early life stages of important fish species. Larval striped bass, for example, were entrained by the CWW screen system at Charles Point at densities very nearly equal to those entrained by the Indian Point facilities (*see* EA 1986).

The Department is unaware of any laboratory studies conducted on wedge-wire screens with larger slot widths (greater than 3.0 mm) which would support the claim in the Alternative Technology Report that the larger slot size width wedge-wire screens (6.0 mm and 9.0 mm) would provide a

similar reduction in entrainment as the smaller slot width screens (1.0 mm to 3.0 mm). The only example of an alleged reduction in entrainment by larger slot width CWW of which the Department is aware is a recent field study at a steam electric facility in Eddystone, Pennsylvania. According to the Alternative Technology Report, the application of CWW with 6.35 mm slot width has resulted in an estimated reduction in entrainment of 60% from baseline at this facility. The Department notes that this claim runs counter to an EPRI report (1998) which found that the 6.4 mm slot width wedge-wire application at Eddystone resulted in no significant entrainment benefits.

Moreover, the application of CWW at the Eddystone facility was specifically chosen to reduce impingement of larger fish, not minimize entrainment. Even if the CWW was responsible for the recently alleged reduction in entrainment, this does not provide sufficient evidence that a similar CWW application at Indian Point Units 2 and 3 would have similar, or more protective, results. In addition, the Eddystone power plant is a fossil fuel facility designed to withdraw only 25% of the amount of cooling water withdrawn by Units 2 and 3. These differences significantly limit any use of the results from Eddystone as a measure for inferring whether or not CWW is an "available" technology at Indian Point or how effective CWW would be at "minimizing" entrainment by the facilities. Finally, even if the levels of entrainment reduction at Eddystone were achievable at Indian Point, those reductions are far short of those that could be achieved by a closed-cycle cooling system.

Relationship to Oak Creek:

The Alternative Technology Report also claims that CWW may be an "available" technology for satisfying 6 NYCRR § 704.5 at Indian Point based on the recent requirement for the Oak Creek Power Plant in Milwaukee, Wisconsin, to install and operate 9.5 mm CWW screens 7,000 ft offshore in the waters of Lake Michigan. The State of Wisconsin selected 9.5 mm CWW screens as BTA for impingement but made no similar claim for entrainment reductions. In fact, any entrainment reductions realized at the Oak Creek plant will be attributed to the location of the intake, not from the CWW technology. The successful operation of CWW screens on a large fossil fuel steam electric facility in a dynamic deepwater oligotrophic ecosystem like Lake Michigan is not analogous to the Indian Point setting an does not in any way demonstrate that this technology would be technically feasible at, or garner the same protective effects on, a nuclear facility of similar size in the Hudson River's highly turbid, estuarine ecosystem.

6 NYCRR § 608.9 – Water Quality Certifications

Pursuant to 6 NYCRR § 608.9, and consistent with the applicable language contained in the CWA, an "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." Section 608.9 provides that an applicant for a § 401 WQC must demonstrate compliance with many of the same statutes and regulations already cited above. In addition, 6 NYCRR § 608.9(a)(6) requires an applicant to demonstrate compliance with all "State statutes, regulations and criteria otherwise applicable to such activities."

ECL Article 11 – § 11-0535 – Endangered and threatened species, species of special concern

Pursuant to ECL Article 11, the "taking, importation, transportation, possession or sale of any endangered or threatened species of fish, shellfish, crustacea or wildlife, or hides or other parts thereof . . . is prohibited, except under license or permit from the department." *See* ECL § 11-0535(2). "Taking" and "take" are defined as "pursuing, shooting, hunting, killing, capturing, trapping, snaring and netting fish, wildlife, game, shellfish, crustacean and protected insects, and all lesser acts such as disturbing, harrying or worrying, or placing, setting, drawing or using any net or other device commonly used to take any such animal." *See* ECL § 11-0103 (13).

The shortnose sturgeon is listed as an endangered species in New York. *See* 6 NYCRR § 182.6(a). The shortnose sturgeon is present in the Hudson River and has been documented to inhabit the waters in the vicinity of Units 2 and 3. In addition, the Atlantic sturgeon, a Federal protected sturgeon species (and protected in New York under a multi-state agreement with the Atlantic States Marine Fisheries Commission), also occurs in the Hudson River by Indian Point and is currently a candidate for listing as threatened or endangered. *See NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 – Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3: Draft Report for Comment/Main Report, December 2008* [NUREG-1437, Vol. 1] at § 4.6 (Threatened or Endangered Species), pp. 4-49 to 4-53; *see also* Fed. Reg. Vol. 75, No. 3 at p. 838 (January 6, 2010) [*Endangered and Threatened Wildlife; Notice of 90-Day Finding on a Petition to List Atlantic Sturgeon as Threatened or Endangered under the Endangered Species Act*].

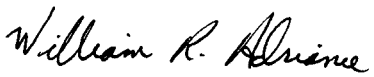
The historical biological data for the Indian Point facilities confirms that the operation of Units 2 and 3 harm ("take") both shortnose sturgeon and Atlantic sturgeon by impinging them on the CWISs screens or entraining them in the CWISs. Sampling at Indian Point has not occurred over the past 20 years and, therefore, no recent estimates for the impingement and entrainment of sturgeon are available. However, during limited sampling conducted at Indian Point from 1975 to 1990, numbers of both shortnose sturgeon and Atlantic sturgeon were impinged by Units 2 and 3. *See NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 – Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3: Draft Report for Comment/Main Report, December 2008* [NUREG-1437, Vol. 1] at § 4.6 (Threatened or Endangered Species), p. 4-51.

Given that Entergy is seeking an additional 20-year license to operate Units 2 and 3, and the previous history of unauthorized "take" of both shortnose sturgeon and Atlantic sturgeon, it is reasonable to conclude that the Indian Point facilities continue to cause mortality to the

sturgeon species in the Hudson River. *See Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation; June 25, 2003*. The taking of shortnose sturgeon by the operation of the Indian Point facilities is unlawful and also impairs the best usage of the waters of the Hudson River for propagation and survival of sturgeon. *See* 6 NYCRR § 701.11. Accordingly, the Department has determined that Units 2 and 3 are not in compliance with ECL Article 11 and, therefore, in accordance with 6 NYCRR § 608.9(a)(6), must deny the § 401 WQC application.

Uniform Procedures Regulations, 6 NYCRR § 621.10, provide that the applicant has a right to a public hearing on the denial of a permit, including a § 401 WQC. A request for hearing must be made in writing within 30 days of the date of this letter.

Sincerely,



William R. Adriance
Chief Permit Administrator

cc: via e-mail
E. Zoli, Esq. – Goodwin Procter
A. Stuyvenberg – NRC
J. Zappieri – DOS
P. Eddy – DPS
A. Peterson – NYSERDA
A. Ciesluk – R3
J. Parker – R3
C. Nieder – DFWMR
P. Kolakowski – DOW
T. Rice – DSHM
M. Sanza – OGC
B. Little – OGC
L. Wilkinson – OGC

COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos.
Entergy Nuclear Operations, Inc.	)	50-247-LR
(Indian Point Nuclear Generating	)	and 50-286-LR
Units 2 and 3)	)	

RIVERKEEPER ANSWER IN OPPOSITION

TO

"MOTION AND MEMORANDUM BY APPLICANT ENTERGY NUCLEAR OPERATIONS, INC. FOR DECLARATORY ORDER THAT IT HAS ALREADY OBTAINED THE REQUIRED NEW YORK STATE COASTAL MANAGEMENT PROGRAM CONSISTENCY REVIEW OF INDIAN POINT UNITS 2 AND 3 FOR RENEWAL OF THE OPERATING LICENSES"

April 5, 2013

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LIST OF ATTACHMENTS

Attachment	Description
1	NOAA Office of Ocean and Coastal Resource Management, *CZMA Federal Consistency Overview* (Feb. 20, 2009)
2	U.S. NRC, Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues. NRR Office Instruction No. LIC-203, Revision 2 (Feb. 2009)
3	Letter from S. Watson (General Counsel, NYSDOS) to E. Leeds (Director, Nuclear Reactor Regulation, NRC), Re: DOS File #: O-2009-0006, NRC Docket #: 50-247 & 50-286, Application to Renew Operating Licenses for Indian Point Nuclear Power Reactors Unit 2 and Unit 3, Hudson River, Village of Buchanan, Westchester County, General Correspondence – NL-12-107 (August 8, 2012)
4	NYSDOS, *In the Matter of the Petition of Entergy Nuclear Operations, Inc., Entergy Nuclear Indian Point 2, LLC, and Entergy Nuclear Indian Point 3, LLC, Petitioner, For a Declaratory Ruling*, Response to Request for Declaratory Ruling (Jan. 9, 2013)
5	Excerpt of NYSDEC, In the Matter of Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, and Entergy Nuclear Operations, Inc's Joint Application for a CWA § 401 Water Quality Certification, DEC App. Nos.: 3-5522-00011/00030 (IP2), 3-5522-00105/00031 (IP3), Combined Prefiled Rebuttal Testimony of Thomas C. Esselman, Ph.D., Matthew J. Barvenik, and F. Owen Hoffman, PhD, Radiological – Issue for Adjudication No. 3 (October 4, 2011)
6	Gordon R. Thompson, *Risk Related Impacts from Continued Operation of the Indian Point Nuclear Power Plants* (Nov. 28, 2007)
7	Pisces Conservation Ltd, *The Status of Fish Populations and the Ecology of the Hudson*, April 2008
8	NYSDEC, In the Matter of a Renewal and Modification of a SPDES Permit, DEC # 3-5522-00011/00004, SPDES # NY-0004472 and In the Matter of the Application by Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, for a Certificate Pursuant to §401 of the Federal Clean Water Act, DEC # 3-5522-00011/00030, 3-5522-00011/00031, Direct Testimony of Dr. Peter A. Henderson Regarding Entergy's Proposed Cylindrical Wedgwire [sic] Screens, on Behalf of Interveners, Riverkeeper Inc., Scenic Hudson, Inc. and Natural Resources Defense Council, Inc. (July 22, 2011)

9	NYSDEC, In the Matter of a Renewal and Modification of a SPDES Permit by Entergy, DEC # 3-5522-00011/00004, SPDES # NY-0004472, and In the Matter of the Application by Entergy 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)
10	Comments by Alliance for Nuclear Accountability, et al. on Scope of Waste Confidence Environmental Impact Statement (January 2, 2013)
11	Lynn R. Sykes et al., *Observations and Tectonic Setting of Historic and Instrumentally Located Earthquakes in the Greater New York City–Philadelphia Area*, Bulletin of the Seismological Society of America, Vol. 98, No. 4, pp. 1696–1719, August 2008
12	Bill Dedman, *What are the odds? US nuke plants ranked by quake risk* (March 17, 2011)
13	NYS Sea Level Rise Task Force Report (December 31, 2010)

In accordance with 10 C.F.R. § 2.323(c), the Atomic Safety and Licensing Board's ("ASLB") July 1, 2010 Scheduling Order,[1] and the ASLB's February 28, 2013 Order,[2] Riverkeeper, Inc. ("Riverkeeper"), hereby submits this answer in opposition to the "Motion and Memorandum by Applicant Entergy Nuclear Operations, Inc. ["Entergy"] for Declaratory Order that it has Already Obtained the Required New York State Coastal Management Program Consistency Review of Indian Point Units 2 and 3 for Renewal of the Operating Licenses," dated July 30, 2012 (hereinafter "Entergy's Motion for Declaratory Order"). For the reasons discussed below, the ASLB must decline to rule upon, and otherwise deny, Entergy's request for a declaratory order that coastal consistency certification review required under the Federal Coastal Zone Management Act ("CZMA") is "neither necessary nor appropriate" in relation to the proposed license renewal of Indian Point.

BACKGROUND

The Federal CZMA was enacted in 1972 to enable coastal states to establish programs for managing natural resources found in the coastal zone.[3] In order to ensure the protection of coastal resources, the CZMA encourages states with coastal zones to establish and implement their own Coastal Management Program ("CMP") pursuant to federal requirements.[4] State CMPs are comprehensive management plans that, *inter alia*, describe the uses subject to the management program and the authorities and enforceable policies of the program.[5]

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[1] In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), Docket Nos. 50-0247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, Scheduling Order (July 1, 2010), at ¶ G.
[2] In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), Docket Nos. 50-0247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, Order (Granting Parties Joint Motion for Alteration of Filing Schedule) (Feb. 28, 2013).
[3] Coastal Zone Management Act of 1972 ["CZMA"], 16 U.S.C. §1451 et seq.
[4] *Id.*
[5] *Id.* § 307, 16 U.S.C. 1456; NOAA Office of Ocean and Coastal Resource Management, *CZMA Federal Consistency Overview* (Feb. 20, 2009), at 3 (Attachment ("Att.") 1) (hereinafter "*CZMA Federal Consistency Overview* (Att. 1)").

The "cornerstone of the CZMA" is the federal consistency provision, which "provides states with an important tool to manage coastal uses and resources" within the state.[6] The CZMA requires that Federal agency actions resulting in effects on any land or water use or natural resource of the coastal zone *must* be consistent with the enforceable policies of a state's CMP.[7] Federal actions include Federal licensing activities, including certain Federal license renewal activities.[8] Guidance published by the National Oceanic and Atmospheric Administration ("NOAA") explains that there are

> four elements for determining that an authorization from a Federal agency is a "federal license or permit" subject to federal consistency review. First, federal law requires that an applicant obtain a federal authorization. Second, the purpose of the federal authorization is to allow a non-federal applicant to conduct a proposed activity. Third, the activity proposed has reasonably foreseeable effects on a state's coastal uses or resources, and fourth, the proposed activity was not previously reviewed for federal consistency ***by the state CMP agency*** (unless the authorization is a renewal . . . pursuant to §930.51(b) [which provides that certain license renewal activities that were previously reviewed are still subject to consistency review]).[9]

The "state CMP agency," i.e., the State agency responsible for conducting the Federal consistency review process, must make a determination about whether the proposed Federal licensing activity is consistent with State coastal policies; if the state finds that the activity is not consistent with the state CMP, i.e., by objecting to the Coastal Consistency Certification submitted by an applicant, the Federal agency involved cannot authorize the proposed licensing action.[10]

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[6] *CZMA Federal Consistency Overview*, *supra* Note 5 at 3.
[7] CZMA § 307, 16 U.S.C. §1456(c)(1)(A).
[8] 15 C.F.R. § 930.51.
[9] *CZMA Federal Consistency Overview*, *supra* Note 5 at 12 (emphasis added).
[10] *See* 15 C.F.R. Part 930, Subpart D; *CZMA Federal Consistency Overview*, *supra* Note 5 at 15 ("If state objects [to applicant's coastal consistency certification], Federal agency does not authorize the activity to commence. If a state issues a conditional concurrence and the applicant does not amend its federal application to include a state's conditions, a state's conditional concurrence automatically becomes an objection . . . Applicant may appeal a state's objection to the Secretary of Commerce within 30 days of the objection . . . . If the Secretary does not override a state's objection, the Federal agency does not authorize the project.").

States that develop management programs pursuant to the CZMA are required to generate a list of Federal agency activities that are expected to affect coastal use or resources "and which the State agency wishes to review for consistency with the management program.[11] NOAA guidance explains that "[a]ll federal license or permit activities occurring in the coastal zone are deemed to affect coastal uses or resources if the state CMP has *listed* the particular federal license, permit or authorization in its federally approved CMP."[12]

U.S. Nuclear Regulatory Commission ("NRC") guidance acknowledges and memorializes the clear regulatory scheme established under the CZMA and its implementing regulations.[13] NRC's guidance recognizes that "[a]ctivities of Federal agencies that are reasonably likely to affect coastal zones are required to be consistent with the approved CMP of the State or territory to the maximum extent practical."[14] NRC's guidance further recognizes that "[i]f a Federal agency receives an application for a permiting [sic]/licensing activity that has been pre-listed in a State's CMP, that agency has an obligation to withhold the permit/license approval until the State has concurred on the consistency determination."[15] NRC's guidance explains that nuclear power plant license renewals are "typically" "listed activities."[16] Furthermore, NRC's guidance acknowledges that NOAA "regulations specifically require Federal consistency certification for license renewal . . . that will affect any coastal use or resource" and explicitly states that nuclear power plant "license renewal applications" constitute

[11] 15 C.F.R. § 930.53; *CZMA Federal Consistency Overview* (Att. 1), *supra* Note 5 at 11.
[12] *CZMA Federal Consistency Overview* (Att. 1), *supra* Note 5 at 13 (emphasis in original).
[13] U.S. NRC, Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues. NRR Office Instruction No. LIC-203, Revision 2 (Feb. 2009) at 7-9 (Att. 2).
[14] *Id.* at 7.
[15] *Id.* at 8.
[16] *Id*. at 9; *see id.* ("*Upon receipt of an application for a listed activity (e.g. license renewal, [NRC Staff shall] ensure that the licensee has provided a Federal consistency certification.*") (emphasis in original).

"NRR [NRC Office of Nuclear Reactor Regulation] licensing actions requiring a Federal consistency certification."[17]

In New York, in recognition of the unique and critical nature of State coastal resources and various threats thereto, the New York State Department of State ("NYSDOS") prepared a CMP, originally approved by NOAA in 1982, which contains forty-four (44) coastal policies with which Federal agency actions must be consistent.[18] The NYS CMP explains the significance and importance of the Hudson River estuary, which is home to "an extraordinarily rich variety of fish species," "one of the major spawning grounds for several commercially significant Atlantic species," and "many important wildlife habitats."[19]

The NYS CMP designates the NYSDOS "as the State's agency responsible for reviewing federal activities as to their consistency with the CMP."[20] NYSDOS has clarified that in accordance with the CZMA, under the NYS CMP, "DOS has been designated as the ***sole*** state agency able to make federal consistency determinations pursuant to the CZMA and its regulations."[21] This is consistent with the mandate of the CZMA.[22] The NYS CMP explains how "[o]nly one State agency may be designated as the sole reviewer of Federal consistency

[17] *Id.* at 8.
[18] NOAA, Office of Coastal Zone Management, *New York State Coastal Management Program and Final Environmental Impact Statement* (Attachment 3 to Entergy's Motion for Declaratory Order) (hereinafter referred to as "NYS CMP").
[19] NYS CMP at § II-2, 6-7.
[20] *Id.* at § II-9, 8.
[21] Letter from S. Watson (General Counsel, NYSDOS) to E. Leeds (Director, Nuclear Reactor Regulation, NRC), Re: DOS File #: O-2009-0006, NRC Docket #: 50-247 & 50-286, Application to Renew Operating Licenses for Indian Point Nuclear Power Reactors Unit 2 and Unit 3, Hudson River, Village of Buchanan, Westchester County, General Correspondence – NL-12-107 (August 8, 2012) at 1 (Att. 3) (hereinafter "NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3)") (emphasis added); *see id.* ("No other New York state agency – neither the NYS Public Service Commission (PSC), nor the NYS Department of Environmental Conservation (DEC), nor the non-state agency Power Authority of the State of New York – is authorized to make or issue consistency determinations under the CZMA that are binding on federal agencies.").
[22] CZMA § 306(d)(6), 16 U.S.C. § 1455 (regarding designation of a "single State agency"); 15 C.F.R. § 930.11(o) (defining "State agency" for purposes of Federal coastal consistency determinations as "the agency of the State government designated pursuant to section 306(d)(6) of the Act").

determinations (15 CFR 9/30.18 [sic]). The Department of State's mandate makes it most suitable for the variety of policies in the Program."[23]

NYSDOS "must ensure" that federal activities, including activities requiring federal licenses, are consistent with the NYS CMP.[24] The NYS CMP explains that "[a]ctivities in or outside of New York's coastal zone, which require federal permits, licenses and other regulatory authorizations and affect land and water uses and natural resources in the coastal zone, are subject to review by DOS for their consistency with the State's CMP" and explicitly states that "[t]his requirement also ***applies to renewals . . . to such regulatory approvals***."[25] The NYS CMP indicates that the Federal agency may not issue a license "unless: (a) DOS concurs or concurs with conditions with the applicant's consistency certification; (b) DOS' concurrence is *conclusively* presumed; or (c) the U.S. Secretary of Commerce overrides DOS' objection to the applicant's consistency certification."[26]

Per Federal regulations, the NYS CMP includes a list of "[t]he specific federal regulatory activities subject to consistency review by DOS."[27] The list of Federal licensing activities that are unequivocally "subject to the consistency provisions of the Coastal Zone Management Act, its implementing regulations in 15 CFR Part 930, Subpart D, and the New York Coastal Management Program" includes the following actions undertaken by the NRC: "[*l*]*icensing* and certification of the siting, construction, and *operation* of nuclear power plants, pursuant to Atomic Energy Act of 1954, Title II of the Energy Reorganization Act of 1974 and the National Environmental Policy Act of 1969."[28] This specifically encompasses "renewals . . . to such

[23] NYS CMP at § IX, 20.
[24] *Id.*
[25] *Id.* at § II-9, 11 (emphasis added).
[26] *Id.* (emphasis added).
[27] *Id.* at § II-9, 12.
[28] *Id.* at § II-9, 18, 20 (emphasis added).

regulatory approvals."[29] NYS "DOS *will* review these activities for their consistency with New York's CMP."[30] NYSDOS recently explicitly confirmed that the licensing and operation of a nuclear plant "***is [a] listed*** federal activity in the CMP mandating a submission of a federal consistency certification to DOS."[31]

Ostensibly in light of the unambiguous Federal consistency certification scheme established under the CZMA, recognized by the NRC, and implemented in New York via the NYS CMP, and on or about April 23, 2007, Entergy filed a License Renewal Application ("LRA") with the NRC pertaining to the proposed relicensing of the Indian Point nuclear power plant that included a discussion of Entergy's intention to submit an application to the NYSDOS for a coastal consistency certification.[32] In the LRA, Entergy aptly recognized that the CZMA and implementing regulations undoubtedly require a Federal consistency determination that the license renewal of Indian Point "would be consistent with the state's federally approved coastal zone management program."[33] In accordance with NRC's guidance discussed above, NRC Staff has also appropriately recognized that, based on New York State's Federally approved coastal zone management program and the location of Indian Point within the state's coastal zone, the "license renewal of IP2 and IP3 ***will require*** a State coastal consistency certification."[34]

Over five years after acknowledging its clear obligation to file an application for and obtain a Federal coastal consistency determination from NYSDOS in connection with the proposed license renewal of Indian Point, and despite NRC Staff's confirmatory statements to

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[29] *Id.* at § II-9, 11.
[30] *Id.* at § II-9, 12 (emphasis added).
[31] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[32] *See* Indian Point Energy Center License Renewal Application, Appendix E, § 9.3, *available at,* http://www.nrc.gov/reactors/operating/licensing/renewal/applications/indian-point/2-ipec-lra-appendix-e_3-9.pdf
[33] *Id.*
[34] Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437, Supplement 38, Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3, *available at* http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement38/ (last visited April 2, 2013), at pp.2-141 to 2-142 (emphasis added).

this effect, on July 24, 2012, in a bizarre and unsubstantiated change in position, Entergy filed a supplement to its LRA in which Entergy now alleges that "IP2 and IP3 already have obtained the necessary consistency reviews from the State of New York and that . . . IP2 and IP3 require no further consistency review in connection with this proceeding."[35] The timing of this filing is questionable at best given that it was not based on *any* alleged changes in circumstances, but only on an apparent "reassessment" conducted by Entergy.[36]

Entergy's LRA supplement was followed shortly by Entergy's Motion for Declaratory Order (filed on July 30, 2012) which seeks an order from the ASLB that would echo the position Entergy takes in its July 24, 2012 LRA supplement, i.e., "that NRC may renew the IP2 and IP3 licenses without requiring a further consistency certification."[37] This position is based on spurious arguments that the proposed licensing activity has been "previously reviewed" and that the relicensing of Indian Point would not result in substantially different coastal effects.[38] As explained fully below, these arguments are unfounded and incorrect, since the proposed activity has not been reviewed already for the purposes of Federal coastal consistency certification by the CMP agency, i.e. the NYSDOS,[39] and since *numerous* substantially different coastal effects will occur as a result of any relicensing of Indian Point.[40] For these, and other reasons discussed below, Entergy's Motion for Declaratory Order must be rejected.

In addition, on December 17, 2012, Entergy in fact filed a coastal consistency certification with the NRC and NYSDOS alleging that the license renewal of Indian Point "is

[35] NL-12-107, Letter from F. Dacimo (Entergy) to U.S. NRC, Re: Supplement to License Renewal Application - Compliance with Coastal Zone Management Act, Indian Point Nuclear Generating Unit Nos. 2 & 3, Docket Nos. 50-247 and 50-286, License Nos. DPR-26 and DPR-64 (July 24, 2012) (Attachment 1 to Entergy's Motion for Declaratory Order) (hereinafter "Entergy Attachment 1, NL-12-107").
[36] Entergy Attachment 1, NL-12-107 at 1.
[37] Entergy's Motion for Declaratory Order at 25.
[38] *Id.*
[39] *See infra* pp. 10-15.
[40] *See infra* pp. 17-25.

consistent with the applicable and enforceable policies of the New York State Coastal Management Program."[41] This application is currently under review by the NYSDOS, and will ostensibly undergo a six-month review process upon a determination that Entergy's application is complete, in accordance with applicable regulations.[42] The filing of Entergy's application for coastal consistency certification renders Entergy's Motion for Declaratory Order effectively moot and unnecessary, since the coastal consistency review process that Entergy claims is not required is already underway and will result in the necessary determination by NYSDOS. Despite these circumstances, and without waiving any rights to assert mootness arguments, Riverkeeper responds to Entergy's Motion for Declaratory Order as follows.

ARGUMENT

I. THE ASLB IS NOT AN APPROPRIATE FORUM FOR ENTERGY'S MOTION FOR DECLARATORY ORDER

As an initial matter, Riverkeeper respectfully submits that the ASLB should decline to rule upon Entergy's Motion for Declaratory Order, since the ALSB does not appear to be a correct forum wherein the matters raised in the motion can be decided upon. Entergy states that "the NRC is vested with exclusive responsibility to decide whether the coastal zone effects from license renewal are substantially different than those previously reviewed by the State."[43] For the reasons explained fully below, because NYSDOS has never "previously reviewed" the coastal effects posed by the operation of Indian Point, a "determination of substantially different coastal effects . . . by the Federal agency" discussed in 15 C.F.R. § 930.51(e), is not necessary or

[41] Letter from K. Sutton (Entergy) to ASLB, re: Notification of Entergy's Consistency Certification Pursuant to the Coastal Zone Management Act (December 17, 2012); Letter from F. Dacimo (Entergy) to Secretary Cesar A. Perales (NYSDOS), Re: Consistency Certification for Entergy Nuclear Indian point 2 and Entergy Nuclear Indian Point 3 License Renewal Application (Dec. 17, 2012); Indian Point Unit 2 and Unit 3, Coastal Zone Management Act Consistency Certification in Support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licenses, Submitted by Entergy, Prepared by AKRF, Inc. and Entergy (December 2012).
[42] *See* 15 C.F.R. §§ 930.60, 930.61; *see generally* 15 C.F.R. Part 930, Subpart D
[43] Entergy's Motion for Declaratory Order at 4.

appropriate.[44] As a result, there is no reason for NRC to be called upon to make the determination Entergy now requests under 15 C.F.R. § 930.51(e).

However, even if input from NRC was necessary to make a "determination of substantially different coastal effects," which it is not,[45] Entergy has failed to justify how bringing the matter before the ASLB is appropriate. In particular, Atomic Safety and Licensing Board panels are adjudicatory bodies that "conduct [] public hearings concerning contested issues that arise in the course of licensing . . . proceedings" and which "afford the public . . . an opportunity to challenge proposed licensing activities."[46] As the parties in this proceeding are keenly aware, "the issues in contested NRC licensing adjudications fall into two generic categories: (1) safety/technical issues arising under the AEA; and (2) environmental issues arising under the National Environmental Policy Act (NEPA)."[47]

Indeed, the ASLB in the instant proceeding was convened in order to rule upon various petitions proffering contested issues, i.e., contentions, in relation to the proposed license renewal of Indian Point, and to conduct hearings on those issues that the ASLB determined met strict contention admissibility criteria.[48] In contrast, the ASLB was not convened for the purpose of ruling upon any issues that may arise in relation to ancillary Federal and State environmental processes. Notably, the ASLB has expressly denied to offer any opinions or guidance in relation to the impact of an ongoing State proceeding pending with the New York State Department of Environmental Conservation ("NYSDEC") relating to the license renewal of Indian Point, in

[44] *See* 15 C.F.R. § 930.51(b)(3), (e); *See infra* pp. 10-16.
[45] *See infra* p. 16.
[46] U.S. NRC, ASLBP Responsibilities, http://www.nrc.gov/about-nrc/regulatory/adjudicatory/aslbp-respons.html (last visited April 3, 2013).
[47] *Id.*
[48] *See* In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), Docket Nos. 50-247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, Memorandum and Order (Ruling on Petitions to Intervene and Requests for Hearing) (July 31, 2008), 68 N.R.C. 43, ADAMS Accession No. ML082130436.

apparent recognition of the adjudicatory, and not other, purposes for which the board was constituted.[49]

The matters raised in Entergy's Motion for Declaratory Order do not relate to and are not a part of any admitted or pending contention in the Indian Point license renewal proceeding, and will not and could not be subject to a hearing before the ASLB. As such, Riverkeeper respectfully submits that it is not within the purview of the ASLB's authority to make the determinations requested, and the ASLB should decline to rule upon Entergy's Motion for Declaratory Order. In the event that the ASLB does decide to rule upon the merits of Entergy's Motion for Declaratory Order, Riverkeeper offers the following responses to the substantive issues raised in the motion, without waiving any rights to assert the foregoing position.

II. NYSDOS HAS NEVER PREVIOUSLY CONDUCTED A FEDERAL CONSISTENCY REVIEW IN RELATION TO INDIAN POINT AND IS REQUIRED AND ENTITLED TO DO SO IN CONNECTION WITH THE PROPOSED LICENSE RENEWAL OF INDIAN POINT

Entergy alleges that Indian Point has been subject to reviews for consistency with the NYS CMP in the past, and that as a result, an alleged "further" review by NYSDOS is only necessary if the proposed relicensing of Indian Point will result in any coastal effects that are substantially different than those "previously reviewed."[50] However, Entergy's foundational premise for this assertion—that the licensing activity at issue has been "previously reviewed" for purposes of a Federal coastal consistency determination—is patently wrong and a clear attempt to subvert the purposes of the comprehensive coastal zone management program and Federal consistency review process established in New York State pursuant to the CZMA.

[49] *See* Official Transcript of Proceedings, Nuclear Regulatory Commission, Entergy Nuclear Operations Indian Point, Units 2 & 3 Pre-hearing Conference, Docket Number: 50-247-LR and 50-286-LR, ASLBP Number: 07-858-03-LR-BDO1 (April 19, 2010), Pages 795-900, ADAMS Accession No. ML101160416, at 899-900 (in response to inquiry about whether the Board "could speak to the impact of" the "decision by the New York State [Department] of Environmental Conservation to deny 401 water quality [cert]ification" to Indian Point, ASLB Chairman McDade indicating that "The answer is the Board *can't*." (emphasis added)).

[50] Entergy's Motion for Declaratory Order at 1, 14-21

Despite Entergy's unfounded assertions about prior consistency reviews, the fact of the matter is that the New York State agency *solely* charged with making coastal consistency determinations in relation to proposed Federal licensing activities, NYSDOS, has never made such a determination in relation to the operation of Indian Point. In fact, in response to the novel and unfounded assertions contained in Entergy's July 24, 2012 LRA supplement, NYSDOS explicitly explained that "DOS ***has never*** conducted a federal consistency review nor issued a determination for the licensing and operation of Indian Point Units 2 and 3."[51]

As NYSDOS has explained, the CZMA "does not provide for exceptions or exclusions from federal consistency review" but rather dictates that "[a]ll federal actions affecting land or water uses or natural resources of the coastal zone, including permit or licensing activities, are subject to federal consistency reviews."[52] In New York, the NYS CMP has explicitly listed Federal activities related to the licensing and operation of nuclear power plants, including license renewals, as subject to consistency review.[53] As the state agency vested with the *exclusive* authority to conduct a Federal consistency review,[54] and because no such review has occurred to date, NYSDOS has the obligation and right to make a consistency determination in relation to the proposed license renewal of Indian Point.

Yet, Entergy claims that a hodgepodge of alleged reviews conducted by other State and *non-State* entities is somehow sufficient to satisfy Entergy's obligation to obtain a coastal consistency certification in connection with Entergy's request to extend the operating life of

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[51] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[52] NYSDOS, *In the Matter of the Petition of Entergy Nuclear Operations, Inc., Entergy Nuclear Indian Point 2, LLC, and Entergy Nuclear Indian Point 3, LLC, Petitioner, For a Declaratory Ruling*, Response to Request for Declaratory Ruling (Jan. 9, 2013) (Att. 4) (citing CZMA, 16 U.S.C. § 1456) (hereinafter "NYSDOS Jan. 9, 2013 Response to Request for Declaratory Ruling (Att. 4)").
[53] NYS CMP at § II-9, 11-12, 18, 20; NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[54] NYS CMP at § II-9, 8, § IX, 20; NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.

Indian Point. Entergy argues that Federal regulations "recognize that NYSDOS may designate other state agencies to conduct consistency reviews in particular circumstances"[55] and apparently asserts that such "other" state agencies have been so designated in relation to certain previous activities involving the operation of Indian Point.[56]

However, this is clearly not the case. The fact that the NYS CMP mentions other entities and the obligation of such entities to ensure compliance with the NYS CMP in the context of state consistency determinations, does not equate to NYSDOS ceding authority to such entities and/or designating such entities for the purposes of a *Federal* coastal consistency review and determination. And in fact, in response to Entergy's confused and incorrect understanding of the Federal consistency certification requirements stemming from the NYS CMP, NYSDOS explicitly clarified that

> [n]o other New York state agency – neither the NYS Public Service Commission (PSC), nor the NYS Department of Environmental Conservation (DEC), nor the non-state agency Power Authority of the State of New York ["NYPA"] – is authorized to make or issue consistency determinations under the CZMA that are binding on federal agencies.[57]

In relation to Indian Point, NYSDOS has not designated any other entities to conduct a Federal consistency review, and remains the "sole" state agency with the authority to do so.[58]

An examination of the alleged prior reviews Entergy raises in its motion clearly reveals that there is no validity to Entergy's claims that the operation of Indian Point has been sufficiently reviewed for purposes of Federal coastal consistency requirements. First, Entergy points to "[t]he CMP itself," simply because it contains a statement that NYS has recognized "the national interest in energy facilities by the number and scope of facilities . . . already

[55] Entergy's Motion for Declaratory Order at 7.
[56] *Id.* at 9-11, 14-21.
[57] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[58] *Id.*; NYS CMP at § II-9, 8, § IX, 20; NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.

located in . . . New York's coastal area" including nuclear units.[59] This general statement clearly does not amount to determination that the operation of Indian Point is consistent with the coastal policies contained in the NYS CMP, and it is certainly not equivalent to an affirmative review of a Federal activity that is explicitly listed elsewhere in the NYS CMP as necessitating a review, i.e., the license renewal of a nuclear plant.[60] To allow such a statement to supplant Federal consistency reviews would completely undermine the entire Federal consistency scheme established in NYS pursuant to the CZMA.

Second, Entergy points to alleged consistency reviews that were conducted when the operating licenses of Indian Point Units 3 and 2 were transferred from NYPA in 2000 and Consolidated Edison in 2001 to Entergy, respectively.[61] In relation to the former transfer, Entergy points to an alleged review conducted by NYPA, a non-state agency for purposes of Federal consistency review (despite Entergy's representations otherwise), in which NYPA concluded that the license transfer of Indian Point Unit 3 to Entergy was consistent with the coastal policies of NYS.[62] As no Federal consistency review was conducted by the only actual state agency authorized to do so, i.e. NYSDOS, NYPA's "conclusion" does not constitute "a conclusive determination" of Federal consistency, or a prior Federal consistency decision.[63] Any conclusions drawn by NYPA in relation to a state consistency determination is simply not binding on NYSDOS.[64] In fact, Entergy concedes that there is *no* record that NYSDOS ever concurred with NYPA's conclusions.[65]

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[59] Entergy's Motion for Declaratory Order at 14-15 (citing NYS CMP at II-9, 3).
[60] NYS CMP at § II-9, 11-12, 18, 20; NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[61] Entergy's Motion for Declaratory Order at 15-19.
[62] *Id.* at 16-17.
[63] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1; NYS CMP at § II-9, 8, § IX, 20.
[64] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1.
[65] Entergy's Motion for Declaratory Order at 17.

Similarly, in relation to the latter transfer of the operating license of Indian Point Unit 2 to Entergy, once again, Entergy points to an alleged review that was not conducted by NYSDOS, but instead, by the NYS PSC.[66] Once again, the State agency with the power to conduct Federal consistency determinations was not involved in the process Entergy discusses.[67] Entergy explicitly acknowledges that there was no record of any application for federal consistency certification even submitted to NYSDOS in relation to the license transfer, let alone a Federal consistency concurrence by NYSDOS with regard to any such certification.[68] Any conclusions made by the NYS PSC relating to a state consistency determination were, thus, *not* "conclusive" or binding for purposes of Federal coastal consistency review.[69]

Third, and lastly, Entergy points to "repeated" determinations of coastal consistency in the context of "dozens of *state* permits" that have been issued to Indian Point since the aforementioned license transfers.[70] Entergy cites to statements made by the NYSDEC in a final environmental impact statement prepared in 2003 in connection with a State Pollutant Discharge Elimination System ("SPDES") permit renewal proceeding for Indian Point about coastal zone impacts.[71] Such statements related to state coastal consistency findings did not implicate a Federal consistency review process. Indeed, a SPDES permit renewal is a state permit process and not a Federal licensing activity that requires a Federal consistency determination. Entergy cannot rely upon findings made in the context of state coastal consistency assessments as a

[66] *Id.* at 17-18.
[67] *Id.*; NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1; NYS CMP at § II-9, 8, § IX, 20.
[68] Entergy's Motion for Declaratory Order at 18.
[69] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1; NYS CMP at § II-9, 8, § IX, 20.
[70] Entergy's Motion for Declaratory Order at 19-21 (emphasis added).
[71] *Id.* at 20.

substitute for a required Federal consistency determination that only NYSDOS can make, and which is unquestionably required in relation to the proposed license renewal of Indian Point.[72]

As stated best by the NYSDOS itself, "[c]obbling together disparate state agency reviews does not approximate the federal review required by the CZMA."[73] Entergy's twisted reading of applicable requirements would turn the regulatory scheme stemming from the CZMA and implemented in NYS through the NYS CMP on its head and improperly flout clear Federal requirements. NYSDOS has never performed a Federal consistency review in relation to Indian Point, and, pursuant to the CZMA, implementing regulations, and the NYS CMP, is required and entitled to conduct one now, in relation to the proposed license renewal of the plant.

III. THE PROPOSED LICENSE RENEWAL OF INDIAN POINT WILL RESULT IN SUBSTANTIALLY DIFFERENT EFFECTS ON COASTAL RESOURCES

Based on Entergy's invalid position that the operation of Indian Point has previously been subject to Federal consistency review, Entergy alleges that "further" review by NYSDOS is only necessary if the proposed relicensing of Indian Point will result in any coastal effects that are "substantially different" than those "previously reviewed."[74] As a result, Entergy's Motion for Declaratory Order attempts to portray Indian Point as an unchanging facility that does not have new, previously unanticipated effects on coastal resources in New York State, and which will not have new and varying and significant effects on coastal resources in the state should the plant continue operating an additional 20 years as Entergy has requested. This portrayal is a pure fiction that blatantly ignores *numerous* changed circumstances that have occurred in recent years and are continuing to occur at Indian Point that will indisputably result in new and varying coastal impacts that have not been subject to a Federal consistency determination by NYSDOS.

[72] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 1; NYS CMP at § II-9, 8, 11-12, 18, 20, § IX, 20.
[73] NYSDOS Letter in Response to Entergy Correspondence NL-12-107 (Att. 3), *supra* Note 21, at 2.
[74] Entergy's Motion for Declaratory Order at 1, 21-24.

A. A Determination of Substantially Different Coastal Effects Under 15 C.F.R. § 930.51(e) is Not Necessary Since NYSDOS Has Not Conducted Any Prior Federal Consistency Reviews of Indian Point

As an initial matter, the question of whether the license renewal of Indian Point will result in "substantially different" coastal impacts is only relevant if the Federal license renewal activity at issue was "previously reviewed by the State agency."[75] If a previous review of a Federal license renewal activity "by the State agency" has occurred, federal regulations explain that the renewal is still subject to Federal consistency requirements if it "will cause an effect on any coastal use or resource substantially different than those originally reviewed by the State agency."[76] Entergy's Motion for Declaratory Order expressly recognizes that a determination regarding whether there are "substantially different" coastal effects hinges upon the notion that the renewal has been "previously reviewed by the State agency" per 15 C.F.R. § 930.51(b)(3).[77]

However, as the discussion above plainly establishes, "the State agency" referenced in 15 C.F.R. § 930.51(b)(3), NYSDOS, has never "previously reviewed" the operation of Indian Point for the purposes of Federal coastal consistency.[78] Instead, the proposed license renewal of Indian Point is subject to Federal coastal consistency requirement because it falls squarely under 15 C.F.R. § 930.51(b)(1) as a "[r]enewal[] of [a] federal license . . . *not previously reviewed by the State agency.*"[79] As a result, there is absolutely no need for a determination by "the Federal agency" pursuant to 15 C.F.R. § 930.51(e) regarding "substantially different coastal effects."[80] Accordingly, the ASLB should dismiss Entergy's Motion for Declaratory Order since it requests a determination by the NRC that is not necessary or appropriate.

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[75] 15 C.F.R. § 930.51(b)(3).
[76] *Id.*
[77] *See* Entergy's Motion for Declaratory Order at 1, 4.
[78] *See supra* pp. 10-15.
[79] 15 C.F.R. § 930.51(b)(1) (emphasis added).
[80] *See* 15 C.F.R. § 930.51(b)(3), (e).

B. In Any Event, the Current Operation of Indian Point Causes, and the Proposed Future Operation of Indian Point Will Cause, Substantially Different Coastal Effects, for which a Federal Consistency Review and Determination is Unequivocally Required and Necessary

Without waiving any rights to assert the position that NRC is not required to make any determination in this matter, Riverkeeper submits that, in any event, the current operation of Indian Point causes, and the proposed future operation of Indian Point will undoubtedly cause substantially different coastal effects that necessitate a Federal consistency review. That is, even if a "determination of substantially different coastal effects" under 15 C.F.R. § 930.51(e) was needed, which it is not, Entergy's Motion for Declaratory Order still must be denied, since various new coastal effects are more than enough to warrant Federal consistency review.

To begin with, 15 C.F.R. § 930.51(e) states that "[t]he determination of substantially different coastal effects under paragraphs (b)(3), and (c) of this section is made on a case-by-case basis by the Federal agency *after* consulting with the State agency, and applicant."[81] This regulation clearly indicates that a Federal agency such as NRC cannot unilaterally make a finding regarding whether there are "substantially different coastal effects." In relation to Indian Point, there is no evidence that NRC has conducted this necessary consultation. Thus, it is clearly not possible for the ASLB to rule upon Entergy's request for an order declaring that the proposed license renewal of Indian Point "will not cause coastal effects that are 'substantially different'"[82] when there has been no indication that NRC has conferred at all with NYSDOS on the matter.

Notwithstanding NRC's failure to properly confer with NYSDOS, the language of 15 C.F.R. § 930.51(e), in conjunction with the position that has been expressed by NYSDOS in a separate forum, necessitate a finding that "substantially different coastal effects" exist which

[81] 15 C.F.R. § 930.51(e) (emphasis added).
[82] Entergy's Motion for Declaratory Order at 25.

require a Federal consistency review. In particular, 15 C.F.R. § 930.51(e) states that in making a determination regarding substantially different coastal effects, "[t]he Federal agency ***shall give considerable weight to the opinion of the State agency***" and that the term "substantially different" "shall be ***construed broadly*** to ensure that the State agency has the opportunity to review activities and coastal effects not previously reviewed.[83]

In response to a request for a declaratory ruling filed with NYSDOS by Entergy on or about November 5, 2012, NYSDOS stated its position that "the activities at IP2 and IP3 and the regulatory landscape have *substantially changed* since the original licenses were issued 40 years ago so that federal consistency is warranted and required."[84] In its response, NYSDOS explained this position at length and outlined the various substantial and material changes to the operation of Indian Point and/or regulatory changes that have occurred in recent years.[85] In the event a determination by NRC about "substantially different coastal effects" is necessary, which it is not, NRC must afford "considerable weight" to these opinions, and broadly construe the differences identified to ensure that NYSDOS has the opportunity to review the proposed activity.[86] Accordingly, it is clear that NRC would have to make a finding of "substantially different coastal effects" if any such determination was necessary.

Indeed, numerous changed circumstances and conditions at Indian Point have resulted and will continue to result in substantially different coastal effects that necessitate a Federal consistency review, and which would support a positive finding under 15 C.F.R. § 930.51(e) to the extent a determination pursuant to said regulation would ever be required. Entergy's representation that "[t]he plants' operations have not changed" and that Entergy's seeks to

[83] 15 C.F.R. § 930.51(e) (emphasis added).
[84] NYSDOS Jan. 9, 2013 Response to Request for Declaratory Ruling (Att. 4), *supra* Note 52 at 12 (emphasis added).
[85] *Id.* at 12-15.
[86] 15 C.F.R. § 930.51(e) (emphasis added).

continue operating Indian Point Units 2 and 3 "in the same manner as those units have operated for the last forty years"[87] is disingenuous at best. Such statements are belied by clear evidence to the contrary. Various changed circumstances and substantial differences relating to the current and/or future operation of Indian Point indisputably result in, or will result in, new and varying coastal impacts that have not been subject to a Federal consistency determination by NYSDOS. These substantial differences include the following:

1. Increased Power Output

Entergy's claim that plant operations at Indian Point have not changed over the last forty years is a patent misrepresentation. In point of fact, operating conditions at Indian Point Units 2 and 3 changed in 2004 and 2005 when Entergy implemented power increases of 3.26% and 4.85%, respectively.[88] Moreover, Entergy has touted that "power production since 2001, when Entergy completed acquisition of both units, has been higher each year than it ever had been previously."[89] Entergy's increased power output increases the likelihood of plant components succumbing to the effects of various aging mechanisms,[90] posing an increased risk of accidents

[87] Entergy's Motion for Declaratory Order at 22.
[88] *See* NRC Staff Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Units 2 and 3, Docket Nos. 50-247, 50-286, NUREG-1930, Volume 2, at pp. 3-25 to 3-29, ADAMS Accession No. ML093170671.
[89] NYSDEC, In the Matter of Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, and Entergy Nuclear Operations, Inc's Joint Application for a CWA § 401 Water Quality Certification, DEC App. Nos.: 3-5522-00011/00030 (IP2), 3-5522-00105/00031 (IP3), Combined Prefiled Rebuttal Testimony of Thomas C. Esselman, Ph.D., Matthew J. Barvenik, and F. Owen Hoffman, PhD, Radiological – Issue for Adjudication No. 3 (October 4, 2011), at 14 (Att. 5).
[90] *See, e.g.*, Riverkeeper, Inc.'s Request for Hearing and Petition to Intervene in the License Renewal Proceedings for the Indian Point Nuclear Power Plant (November 30, 2007), ADAMS Accession No. ML073410093, at 15-23 (discussing how the power increases that occurred in 2004 and 2005 at Indian Point "affect velocities, temperatures, coolant chemistry and steam moisture" and thereby affects Entergy's ability to adequately detect and manage the aging phenomenon of flow accelerated corrosion).

that could indisputably result in radiological releases and associated impacts to the Hudson River, i.e., the coastal resources of New York State.[91]

2. *Cylindrical Wedgewire Screens and/or Other Cooling Water Intake Structure Technology*

Entergy's statement that it seeks to operate Indian Point in the same manner as it currently operates the plant is a disingenuous, self-serving, gross misrepresentation. In reality, Indian Point currently operates pursuant to a 25-year old, outdated, administratively extended SPDES permit, which is currently the subject of renewal proceeding before the NYSDEC.[92] It is undisputed that this proceeding will result in the modification of Entergy's "current" permit to ensure Entergy implements the best technology available ("BTA") for minimizing the adverse environmental impacts caused by the operation of Indian Point's existing once-through cooling water intake structures.[93]

In particular, because the existing cooling water system is highly destructive and causes devastating and significant impacts to NYS coastal resources,[94] NYSDEC has issued a draft SPDES permit that requires the implementation of BTA, i.e., a closed-cycle cooling water intake structure to reduce current aquatic impacts; however Entergy proposes instead to operate with the installation of cylindrical wedgewire screens ("CWWS").[95] Moreover, NYSDEC properly

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[91] *See, e.g.*, Gordon R. Thompson, *Risk Related Impacts from Continued Operation of the Indian Point Nuclear Power Plants* (Nov. 28, 2007) (Att. 6) (discussing radiological harm from unplanned radiological releases to the environment as a result of accidents due to a variety of causes, including equipment failures).

[92] *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 5-7, 13-16 ("NYSDEC Notice of Denial").

[93] *See id.* (explaining how Entergy's "current" permit does not comply with existing BTA requirements).

[94] *Id.* at 8, 11 ("the withdrawal of approximately 2.5 billion gallons of Hudson River water per day" causes "the mortality of nearly one billion aquatic organisms per year from the operation of Units 2 and 3"); *see generally* Pisces Conservation Ltd, *The Status of Fish Populations and the Ecology of the Hudson*, April 2008 (Att. 7) (finding 10 of 13 "key" species of the Hudson River in decline) ("2008 Pisces Report (Att. 7)"); *see id* at 37-38 ("The impact of Indian Point is the largest of several impacts from once-through cooling on the Hudson.").

[95] *See* NYSDEC Notice of Denial, *supra* Note 92 at 15, 17-18.

denied Entergy's request for a necessary water quality certification ("WQC") pursuant to Clean Water Act ("CWA") § 401, based upon Indian Point's present and continuing violations of the New York water quality standards, including NYS's BTA requirement.[96]

It cannot be refuted that under any outcomes of the currently pending SPDES permit renewal proceeding, as well as an administrative appeal Entergy has initiated in relation to NYSDEC's denial of CWA § 401 WQC, it is likely that, if Entergy continues to operate Indian Point at all, the plant will be required to operate in a manner that differs considerably from its current operations.[97] This is foreseeable since, in order to keep operating, Entergy is unambiguously and unequivocally required to comply with the CWA and all State water quality standards and criteria, which it has yet to do. Any design and operational changes resulting from the outcome of ongoing NYSDEC proceedings will unquestionably result in substantial differences in the impact of Indian Point's operation on the Hudson River.

The construction and operation of Entergy's CWWS proposal would undoubtedly impact the physical, chemical, and biological parameters of water quality and impact and/or displace benthic fauna and habitat and otherwise directly and indirectly impact various critical fish species in the Hudson River. As proposed, these screens would require an enormous set of underwater structures—144 screens each of 72 inches in diameter, made of a metal alloy with toxicity implications—that would rest on the floor of the Hudson, where, aquatic organisms are present for foraging, migrating, and avoiding unsuitable thermal temperatures occurring at higher elevations due to thermal discharges from Indian Point.[98] Furthermore Entergy's CWWS

[96] *See generally* NYSDEC Notice of Denial, *supra* Note 92; Furthermore, Indian Point's current violation NYS's BTA requirement is established as a *matter of law*. *See In the Matter of Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC,* Interim Decision of the Assistant Commissioner, 2008 N.Y. ENV LEXIS 52, *34.

[97] *See* NYSDEC Notice of Denial, *supra* Note 92 at 5-7, 13-16.

[98] *See* Enercon Services, Inc., Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3 (February 12, 2010, at 56, *available at*, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/alttechrep.pdf; Enercon WWS

proposal would, at best, only marginally reduce the devastating entrainment impacts of Indian Point's current cooling water system, and will result in ongoing various cumulative environmental impacts on the aquatic ecology of the Hudson River.[99] Yet, Entergy has failed to reveal the implications of its CWWS proposal for the purposes of determining Federal coastal consistency,[100] despite Entergy's affirmative efforts to seek approval of the proposal from NYSDEC, and despite the fact that the proposal would result in significant environmental impacts to NYS coastal resources as well as exacerbate the existing circumstances facing such resources.[101]

The reality of the ongoing proceedings pending with the NYSDEC, no matter what the outcomes, represents circumstances that will result in substantially different coastal effects that are relevant to, and indeed necessarily require, a Federal consistency review.

3. Radiological Leaks and Groundwater Contamination

Accidental radiological water leaks have been a persistent problem at Indian Point.[102] These leaks have occurred from spent fuel pools ("SFPs") as well as a variety of other

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Power Point Presentation (Entergy Exhibit 15) at 1 (indicating Entergy's chosen CWWS specifications as follows: 144 72" diameter screens made of Z-alloy, with 2 mm screen slot velocity and 0.25 fps through-screen velocity).

[99] *See, e.g.*, NYSDEC, In the Matter of a Renewal and Modification of a SPDES Permit, DEC # 3-5522-00011/00004, SPDES # NY-0004472 and In the Matter of the Application by Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, for a Certificate Pursuant to §401 of the Federal Clean Water Act, DEC # 3-5522-00011/00030, 3-5522-00011/00031, Direct Testimony of Dr. Peter A. Henderson Regarding Entergy's Proposed Cylindrical Wedgwire [sic] Screens, on Behalf of Interveners, Riverkeeper Inc., Scenic Hudson, Inc. and Natural Resources Defense Council, Inc. (July 22, 2011) (Att. 8) (hereinafter "Henderson Testimony (Att. 8)").

[100] In the context of the ongoing SPDES permit renewal proceeding, Entergy very recently, on March 29, 2013, published an alleged "Certification of Consistency with New York's Coastal Policies in Connection with Installation and Operations of Cylindrical Wedgewire Screens." While Riverkeeper has yet to fully analyze the representations made in this document, based on reviews of Entergy's CWWS proposal conducted to date, it is apparent to Riverkeeper that Entergy's proposal would *not* necessarily be consistent with all relevant coastal policies contained in the NYS CMP. Riverkeeper maintains this position notwithstanding Entergy's most recent submission. Moreover, this document appears to constitute Entergy's tacit acknowledgement of the relevance of its CWWS proposal for purposes of Federal consistency review, and, in any event, does not alter the fact that the outcome of the current Indian Point SPDES permit renewal proceeding is squarely relevant to a Federal coastal consistency determination, and will result in substantially different coastal effects.

[101] *See, e.g.*, Henderson Testimony (Att. 8), *supra* Note 99; *see also* 2008 Pisces Report (Att. 7), *supra* Note 94.

[102] *See generally* NYSDEC, In the Matter of a Renewal and Modification of a SPDES Permit by Entergy, DEC # 3-5522-00011/00004, SPDES # NY-0004472, and In the Matter of the Application by Entergy for a Certificate

components.[103] Decades of inadvertent releases of radioactive water have resulted in at least two extensive groundwater plumes underlying the site, which indisputably leach through the bedrock and discharge into the Hudson River and thereby impact critical coastal resources of NYS.[104] Because of the aging and degraded condition of susceptible plant components, coupled with Entergy's failure to implement measures to anticipate and avert future accidental radiological leaks, it is highly foreseeable that the operation of Indian Point for a 20-year license renewal term will result in additional accidental releases of radioactive water.[105]

Accidental radiological releases at Indian Point implicate a variety of environmental impacts to waters of NYS[106] and are, thus, undeniably relevant to a Federal coastal consistency review and determination. Though radiological leaks and releases have occurred at Indian Point for decades, Entergy only "discovered" the groundwater plumes contaminating the Hudson River relatively recently in 2005[107] – i.e., *after* all of the alleged "prior" consistency reviews Entergy points to. The potential impacts of radiological leaks have clearly never been subject to a Federal coastal consistency by NYSDOS, and must be in light of the clear relevance of these substantially different circumstances at Indian Point.

4. Long-Term Onsite Nuclear Waste Storage

In June 2012, the U.S. Court of Appeals for the D.C. Circuit vacated the NRC's "Waste Confidence Decision," which proclaimed confidence in the Federal government's ability to come

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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) (Att. 9).

[103] *Id.* at 24-38.

[104] *Id.* at 2, 25, 31, 38-43, 56-60.

[105] *Id.* at 43-56.

[106] *Id.* at 60-65, 66-96 (explaining how radiological leaks from Indian Point may have already had, and may in the future cause, impacts to the aquatic ecology of the Hudson River, including, *inter alia*, bioaccumulation of toxic radionuclides in aquatic organisms, impacts to the use of the Hudson River as a drinking water source, impacts to the nearby state and Federally designated critical coastal habitat, impacts to recreational uses of the Hudson River, and violations of various State environmental standards).

[107] *See id.* at 25, 31 (explaining how an Entergy site hydrogeologic investigation initiated in 2005 in response to the discovery of SFP leaks at Indian Point uncovered the existence of large contamination plumes).

up with a permanent national nuclear waste disposal solution, and thereby exempted from environmental analysis any impacts stemming from "temporary" onsite nuclear waste storage while nuclear plants await such a permanent disposal solution.[108] This landmark court decision recognized that no long-term nuclear waste disposal solution may ever materialize, which would result in spent nuclear fuel being stored at nuclear plants "on a permanent basis," and ruled that the NRC must adequately account for and assess such an eventuality.[109]

Approximately 1,500 metric tons of high level nuclear waste is already stored onsite at Indian Point, and if the plant is relicensed and continues to operate for 20 years, Units 2 and 3 would produce approximately 1,000 additional tons of such waste. The long-term and/or permanent storage of thousands of tons of spent nuclear fuel at Indian Point is a previously unanticipated, i.e. substantially different, circumstance that will result in a variety of impacts that have never been assessed in the context of a Federal coastal consistency review. Given the fact that a CZMA consistency review of a license renewal activity requires consideration of whether the facility's *future* operation will be consistent with the state's coastal policies, the *previously unforeseen* and significant impacts posed by the long-term, perhaps permanent, storage of thousands of tons of nuclear waste on the banks of the Hudson are directly relevant.

For example, the prospect of permanent onsite nuclear waste storage at Indian Point poses numerous risks of SFP fires and radiological leaks, as well as risks to dry casks, which, at the plant, were licensed for the purpose of storing nuclear waste for just 20 years.[110] The permanent use of aging and already degraded nuclear waste storage structures at Indian Point is likely to result in environmental impacts, especially in light of increased risks of natural disasters

[108] *See New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012).
[109] *Id.* at 473, 478-79.
[110] *See generally* Comments by Alliance for Nuclear Accountability, et al. on Scope of Waste Confidence Environmental Impact Statement (January 2, 2013) (Att. 10).

(including risks posed by earthquakes, storm surges, hurricanes, sea level rise, etc), which could affect the structural integrity of such structures.[111] Such impacts may result in wide-ranging and serious coastal effects that are squarely relevant to a Federal consistency determination.

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Thus, the current and future operation of Indian Point clearly implicates various substantially different coastal effects for which a Federal coastal consistency determination is necessary and appropriate, and which would support a positive determination under 15 C.F.R. § 930.51(e), to the extent such a determination would ever be required.

CONCLUSION

Based on the foregoing, the ASLB should deny Entergy's Motion for Declaratory Order outright as not properly within the purview of the ASLB or NRC to decide upon, or otherwise deny the relief requested since NYSDOS has never reviewed the operation of Indian Point for Federal coastal consistency and since substantially different coastal effects posed by the ongoing and future operation of Indian Point unequivocally warrant a Federal consistency review.

Respectfully submitted,

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Dated: April 5, 2013

[111] *See* Lynn R. Sykes et al., *Observations and Tectonic Setting of Historic and Instrumentally Located Earthquakes in the Greater New York City–Philadelphia Area*, Bulletin of the Seismological Soc'y of Am., Vol. 98, No. 4, pp. 1696–1719, Aug. 2008 (Att. 11) (concluding that Indian Point is not in an area of low seismicity as was previously thought and that it is "quite possible" that the region surrounding the Indian Point plant could experience upwards of a 7.0 magnitude earthquake); Bill Dedman, *What are the odds? US nuke plants ranked by quake risk* (March 17, 2011 (Att. 12) (explaining NRC seismic hazard analysis finding that IP3 has the *highest* risk for core damage from an earthquake); NYS Sea Level Rise Task Force Report to the Legislature (Dec. 31, 2010) (Att. 13) (explaining drastic future sea level rise projections and associated increases in shoreline inundation, flooding, storm surges, and severe weather events.
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos.
	)	50-247-LR
Entergy Nuclear Operations, Inc.	)	and 50-286-LR
(Indian Point Nuclear Generating	)	
Units 2 and 3)	)	April 5, 2013

Certification Pursuant to 10 C.F.R. § 2.323(b)

In accordance with 10 C.F.R. § 2.323(b) and the ¶ G.7 of the ASLB's July 1, 2010 Scheduling Order in the above-reference proceeding, I certify that I have made a sincere effort to make myself available to listen and respond to the moving party, and to resolve the factual and legal issues raised in the motion, and that my efforts to resolve the issues have been unsuccessful.

Signed (electronically) by Deborah Brancato
Deborah Brancato, Esq.

COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 3

Entrainment, Impingement and Thermal Impacts at Indian Point Nuclear Power Station

Pisces Conservation Ltd, November 2007

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Pisces Conservation Ltd, November 2007

1. Summary

- The entrainment and impingement mortality of fish caused by the Indian Point power plant is reviewed and quantified.
- Entrainment and impingement mortality each year is in the order of billions and hundreds of thousands of fish respectively.
- The data used recently by Entergy to assess this impact are old, having been gathered between 1980 and 1990. Since then, the estuary has changed considerably, with several species declining in abundance, and some species, most notably striped bass, increasing. There have been large changes in the river environment and important biological invasions.
- For the 6 fish species for which data are available—American shad, bay anchovy, river herring (comprising 2 species alewife and blueback herring), striped bass, and white perch—the station entrain 1.2 billon eggs and larvae a year.
- Entrainment data for Atlantic tomcod are not available, but are likely to be significant, with an estimated conditional mortality rate (CMR) indicating that 12% of the tomcod population are being killed by Indian Point each year.
- Entrainment occurs from February to September, with peaks in March for tomcod, and June for the other species.
- Modern data suggest that striped bass entrainment is likely to have increased by over 750% from the level at the time when the data was gathered.
- The Indian Point stations impinge over 1 million fish a year, and kill between two and five hundred thousand, dependent upon the assumptions used in calculation. They kill individuals from several species that are in decline.
- Peak impingement occurs in over winter, in December and January, and in mid summer.
- The impingement of only eight species has been considered in detail: American shad, Atlantic tomcod, bay anchovy, alewife, blueback herring, spottail shiner, striped bass, and white perch.
- The temperature regime in the Indian Point cooling water discharge and the receiving waters of the Hudson River are reviewed.
- In recent years (2000 to 2007), the discharge temperature regularly exceeded 90°F, and in summer frequently exceeded 100°F. A temperature exceeding 100°F will produce lethal conditions for aquatic life of all kinds, including algae, crustaceans and fish.
- Fish can perceive small differences in temperature, and show behavioural avoidance of even mildly stressful temperatures.
- The spatial and vertical extent of the Indian Point plume is sufficient to raise concerns about the passage of fish and impacts on the benthic life of the river.
- The background temperature of the river is increasing, and this will result in increased harm from thermal pollution if present levels of heat discharge continue into the future.
- Absolute temperatures of riverine heated effluents of 26°C (78°F) or more are potentially lethal to rainbow smelt and Atlantic tomcod.
- There are no data on the movement or migration of fish in the vicinity of the Indian Point plume. It is therefore not possible to quantify the effect of this discharge on fish movement or passage.

- The impact of the mortalities caused by impingement and entrainment and thermal discharges on the fish populations of the Hudson is large.
- Entergy's assessment of entrainment and impingement and thermal discharge is inadequate.
- The impacts that Indian Point is having on the Hudson River fish species are not quantified fully.
- When considering all aspects of the impact of Indian Point on the aquatic ecology of the Hudson estuary, Entergy's reliance on old data results in an inadequate quantification of the impact that Indian Point currently has on the aquatic environment. Further, the use of such old analyses to project into the future would be a serious error.

2. Introduction

The use of direct cooling at power stations kills fish in several ways, most directly through impingement and entrainment. Water taken into the station for cooling is screened to remove large objects, including fish. Fish can sustain injury or death by entering intakes with the cooling water flow and then making physical contact with screens or filters; the death of fish in this way is termed impingement mortality. Water that passes through the screens, and then through the cooling system to be discharged back into the environment, holds small fish, fish eggs and larvae, and other microscopic organisms. These suffer injury or death through physical contact, rapid pressure or temperature change, and chemical poisoning from biocides and other chemicals introduced into the water. The death caused by passage through a power station is termed entrainment mortality.

A heated discharge released to surface waters also has damaging effects. Animals in the receiving water can be suddenly exposed to hot water and biocides in the mixing zone, resulting in death or injury. In addition, the heating of the local environment can influence the distribution and movement of fish and other organisms. Finally, there is the risk that the temperature of the receiving water is raised to a level that excludes some fish and other organisms from living in the area. This is becoming more likely as average summer water temperatures increase.

This document examines the estimates of the numbers of fish impinged and entrained at Indian Point power plant, on the Hudson River. A previous report, *The status of fish populations and the ecology of the Hudson* (Pisces Conservation 2007) gives supporting information.

Indian Point 2 has six two-speed circulating water pumps, designed to pump 140,000 gpm (US gallons per minute) at full speed and 84,000 gpm at reduced speed. Indian Point 3 has six variable-speed circulating water pumps, designed to pump between 64,000 and 140,000 gpm.

This gives the station the ability to intake 2.4 billion gallons of cooling water per day. This is the largest intake on the Hudson estuary and produces the largest plume of heated effluent.

3. Entrainment

Very large numbers of fish are entrained at Indian Point; calculations for five fish species estimate over 1 billion individuals of those species alone to be entrained each year (Table 1). The figures given in Table 1 are the total numbers of entrainable life stages, including eggs, yolk-sac larvae, post-yolk-sac larvae (PYSL), and some juveniles, for the species studied. These data come from utility-sponsored studies on entrainment. (DEIS Appendix VI-1-D-2). Data were collected from 1972 to 1987, with the exception of 1982. The data used in the Draft Environmental Impact Statement (DEIS), prepared by the prior owners of Indian Point, were collected from 1981-1987. The calculations in Table 1 are the average number of fish entrained per year from 1981-87. The original data are in DEIS appendix VI-1-D-2. The Draft Environmental Impact Statement (FEIS), prepared by the prepared by the New York State Department of Environmental Conservation (NYSDEC) included this calculation of annual number of fish entrained at Indian Point to assess the magnitude of the impact (FEIS, Table 1, page 2)

Number of Fish entrained	
American shad	13,380,000
Bay anchovy	326,666,667
River herring	466,666,667
Striped bass	158,000,000
White perch	243,333,333
Total of 5 species	**1,208,046,667**

Table 1: The annual number of fish entrained at Indian Point - based on in-plant sampling 1981-1987; no Atlantic tomcod were sampled, as sampling started too late for young Atlantic tomcod to be caught (From FEIS page 2).

The species for which entrainment mortality has been quantified form only a very small proportion of the total species present in the estuary. As was noted in the FEIS (page 53):

> *Finally, although impingement and entrainment mortality is measured, it is typically measured only for several of the 140 species of fishes found in the Hudson. Information about the impact on the full suite of aquatic organisms is limited.*

The impact on other species is un-quantified and may be significant.

3.1. Numbers of fish entrained

Considerable ecological changes have taken place over the last 20 years, so that entrainment numbers derived from the DEIS can no longer give a reliable guide to present entrainment. In this section, we attempt to estimate recent numbers entrained. Table 2 gives the total entrainment estimates given in the DEIS (DEIS Appendix VI-1-D-2, Table 2).

Species	Eggs	Yolk-sac	PYSL	Juveniles	Total	Years	Average
River herring	1,955,720	935,220,000	1,865,420,000	2,083,000	2,804,678,720	6	467,446,453
Bay anchovy	309,750,000	160,080,000	1,482,500,000	5,799,200	1,958,129,200	6	326,354,867
White perch	8,235,740	46,979,000	1,398,400,000	9,284,500	1,462,899,240	6	243,816,540
Striped bass	1,518,500	89,866,000	850,000,000	6,229,000	947,613,500	6	157,935,583
American shad	119,400	7,290,000	59,000,000	465,190	66,874,590	5	13,374,918
					Total		1,208,928,361

Table 2: The number and stage of some of the main species entrained at Indian Point between 1981 and 1987.

The numbers in Table 1 are slightly different from those in Table 2, since the data in the earlier table have been rounded to three significant figures during the calculation of the averages. For example, for striped bass the total would be 948,000,000 / 6 giving 158,000,000 rather than 947,613,500 / 6 which gives 157,935,583).

The data available do not include Atlantic tomcod, which breeds earlier in the year than the other species. The estimated Conditional Mortality Rate (CMR)[1] for this species is high, at over 12% (Indian Point Energy Center Applicant's Environmental Report Operating License Renewal Stage). This species is already in decline in the estuary (Pisces 2007).

3.2. Annual pattern of entrainment and the conditional mortality rate

There are two main periods of fish entrainment, spring/summer when most species breed and have larvae in the water, and February/March when the tomcod breed (Figure 1). When assessing the impact of any pumping regime on entrainment reduction, it is important to consider the annual pattern of entrainment. Conditional mortality rates (CMR) measure the proportion of the available population living in the Hudson Estuary that is killed by entrainment or impingement (Table 3). In the DEIS, CMR were used instead of simple estimates of the number of animals killed, because they allow insight into the level of impact on the population.

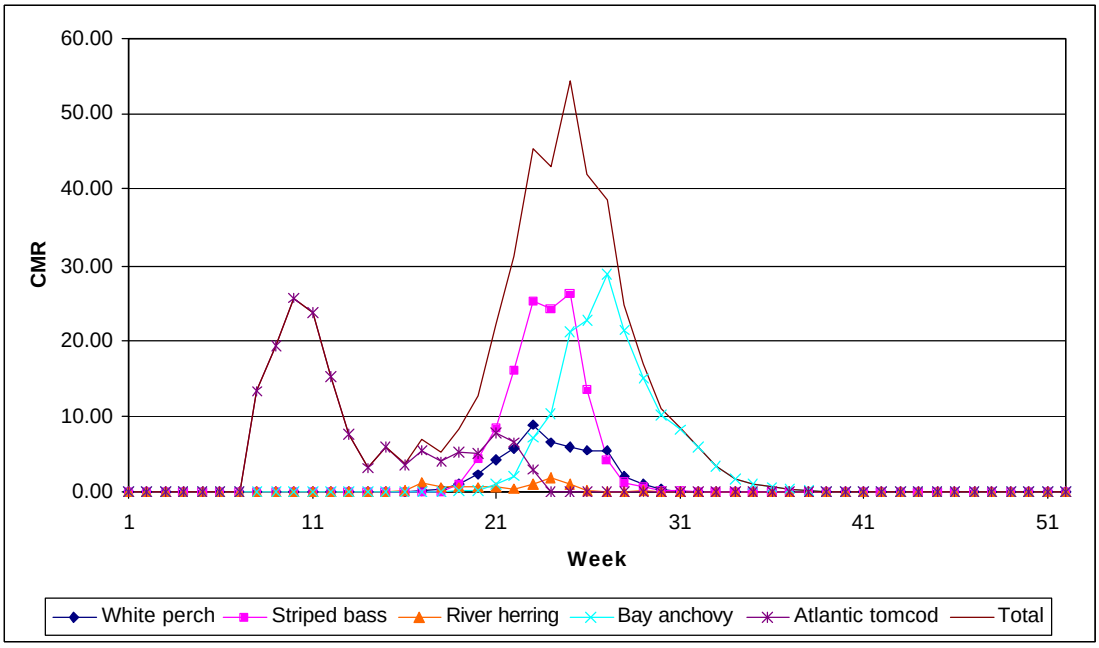

Figure 1: Plot showing the seasonal pattern in entrainment. From Table 3.

[1] CMR - is the probability of a fish dying due to the power plant. It is expressed as a percentage and measures how many fewer Hudson River fish exist at the end of their first year of life (actually at September 1) than would exist if not for the loss to entrainment.

			Entrainment CMR x 1000					
Starting date of week	**Week No.**	**SPDES Permit Flow (gpm)**	**White perch**	**Striped bass**	**River herring**	**Bay anchovy**	**Atlantic tomcod**	**Total**
5-Jan	1	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
12-Jan	2	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
19-Jan	3	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
26-Jan	4	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
2~Feb	5	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
9-Feb	6	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
16-Feb	7	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
23-Feb	8	1008	0.00	0.00	0.00	0.00	13.33	**13.33**
1-Mar	9	1008	0.00	0.00	0.00	0.00	19.22	**19.22**
8-Mar	10	1008	0.00	0.00	0.00	0.00	25.75	**25.75**
15-Mar	11	1008	0.00	0.00	0.00	0.00	23.80	**23.80**
22-Mar	12	1008	0.00	0.00	0.00	0.00	15.21	**15.21**
29-Mar	13	1008	0.00	0.00	0.00	0.00	7.65	**7.65**
5-Apr	14	1008	0.00	0.00	0.00	0.00	3.18	**3.18**
12-Apr	15	1008	0.00	0.00	0.00	0.00	5.91	**5.91**
19-Apr	16	1008	0.08	0.00	0.15	0.00	3.67	**3.90**
26-Apr	17	1008	0.22	0.00	1.19	0.00	5.56	**6.97**
3-May	18	1008	0.53	0.07	0.73	0.00	4.01	**5.34**
10-May	19	1024	0.96	1.09	0.64	0.26	5.39	**8.34**
17-May	20	1152	2.34	4.53	0.71	0.14	5.03	**12.75**
24-May	21	1344	4.21	8.50	0.58	1.07	7.84	**22.21**
31-May	22	1440	5.83	16.16	0.44	2.03	6.62	**31.08**
07-Jun	23	1616	8.90	25.32	0.99	7.22	2.97	**45.39**
14-Jun	24	1680	6.67	24.13	1.85	10.47	0.00	**43.13**
21-Jun	25	1680	5.85	26.26	1.03	21.13	0.00	**54.26**
28-Jun	26	1680	5.43	13.62	0.31	22.63	0.00	**41.97**
5-Jul	27	1680	5.42	4.30	0.10	28.75	0.00	**38.57**
12-Jul	28	1680	2.15	1.23	0.10	21.36	0.00	**24.83**
19-Jul	29	1680	1.12	0.61	0.20	15.00	0.00	**16.94**
26-Jul	30	1680	0.41	0.31	0.10	10.20	0.00	**11.02**
2-Aug	31	1680	0.10	0.20	0.00	8.26	0.00	**8.56**
9-Aug	32	1680	0.00	0.00	0.00	6.01	0.00	**6.01**
16-Aug	33	1680	0.00	0.00	0.00	3.36	0.00	**3.36**
23-Aug	34	1680	0.00	0.00	0.00	1.63	0.00	**1.63**
30-Aug	35	1680	0.00	0.00	0.00	1.02	0.00	**1.02**
6-Sep	36	1680	0.00	0.00	0.00	0.71	0.00	**0.71**
13-Sep	37	1680	0.00	0.00	0.00	0.51	0.00	**0.51**
20-Sep	38	1680	0.00	0.00	0.00	0.20	0.00	**0.20**
27-Sep	39	1584	0.00	0.00	0.00	0.10	0.00	**0.10**
4-Oct	40	1456	0.00	0.00	0.00	0.00	0.00	**0.00**
11 -Oct	41	1456	0.00	0.00	0.00	0.00	0.00	**0.00**
18-Oct	42	1456	0.00	0.00	0.00	0.00	0.00	**0.00**
25-Oct	43	1456	0.00	0.00	0.00	0.00	0.00	**0.00**
I-Nov	44	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
8-Nov	45	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
15-Nov	46	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
22-Nov	47	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
29-Nov	48	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
6-Dec	49	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
13-Dec	50	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
20-Dec	51	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
27-Dec	52	1008	0.00	0.00	0.00	0.00	0.00	**0.00**
Total			**50.22**	**126.32**	**9.12**	**162.08**	**155.15**	**502.89**

Table 3: Conditional mortality rates (CMR) of fish entrained at Indian Point, from DEIS

In the Indian Point Energy Center Applicant's Environmental Report Operating License Renewal Stage (page 4 - 12) it is noted that entrainment impacts are large:

> *The estimated average annual CMR due to entrainment for American shad is 0.64%, for Atlantic tomcod is 12.04%, for bay anchovy is 10.38%, for river herring is 1.20%, for striped bass is 7.82%, and for white perch is 4.94%.*

First it should be noted that in the FEIS (Fish populations 3 - page 62) the CMR figure for white perch is stated as 21%. In general, these numbers are notably high, especially when it is remembered that several of the species under consideration are showing long-term declines in abundance in the Hudson. The CMR numbers indicate that Indian Point is killing an appreciable proportion of the Atlantic tomcod, white perch and bay anchovy populations in the estuary. These deaths will be contributing to the decline of these species.

In the DEIS, it was argued that even mortality rates of this magnitude were unlikely to have any impact on the adult population. In an unpublished report by Barnthouse *et al* (2002), it is stated:

> *As long as key populations are relatively stable, the mix of species present remains relatively constant, and important functional relationships continue, the river can be said to be healthy and can continue to persist in spite of the deaths of individuals*

In this statement, the key populations are presumably common species, and as shown in Pisces (2007), many of these species are showing long term trends. With many species in decline, it is unclear how the observation of a general trend is to be shown to be unrelated to the power plants, if there are direct observational data demonstrating that the power plants are killing the species. For example, it is clear that tomcod are killed by cooling water systems. The Atlantic tomcod population is in decline. It would be almost certain that if these individuals were not killed, the population would be larger.

What is clear, from these data and analyses presented in the DEIS, is that entrainment and impingement, primarily the former, are eliminating a significant portion of the most abundant species in their egg and larval stages. It is probable that similar levels of impact will be felt by the many rarer species that spawn or spend part of their life stages in the lower Hudson River. (see FEIS p. 59).

3.3. Adjusting entrainment estimates with new data

A number of approaches were taken to estimate current entrainment at Indian Point. The 2005 Year Class Report for the Hudson River Estuary Monitoring Program (ASA 2007) estimates the abundance of various species in the Hudson for each year, from the mid 1970s until 2005. To examine the changes in entrainment that must have occurred since 1987, these data were used in conjunction with the estimates of entrainment from 1981-7 (DEIS Appendix VI-1-D-2, Table 2). No more recent entrainment data were available.

The 2005 Year Class Report calculates an index for each of the entrainable stages (egg, larvae, post yolk sac larvae and juvenile fish) for each year. This is an index calculated for the whole Hudson estuary. As the number of fish entrained at Indian Point must be related to the number of fish in the estuary, it is possible to make an estimate of how the number of selected entrained species has changed over time. Details of some of the trends are given in the Pisces Conservation report *The status of fish populations and the ecology of the Hudson* (Pisces 2007).

Of the 5 taxa of fish whose entrainment data are presented in the DEIS, only three could be analysed. River herring is a combination of two fish species, blueback herring and alewife, precluding calculation without further information. Bay anchovy are only recorded as juveniles in the river survey. Since most of the animals

entrained at Indian Point are eggs or larvae, this index was unsuitable to estimate entrainment.

The three species for which estimates could be made were American shad, striped bass and white perch. To make the estimate of entrainment in each year, the average number of fish entrained for each life stage for 1981-87 (only including sampled years) was calculated. The average index for each life stage, for the appropriate years, was then calculated. The average number entrained, divided by the average index, gives the number of fish entrained per index unit.

The indices for each life stage and year were multiplied by this factor to estimate the entrainment. The results are given in Figure 2 and Figure 3.

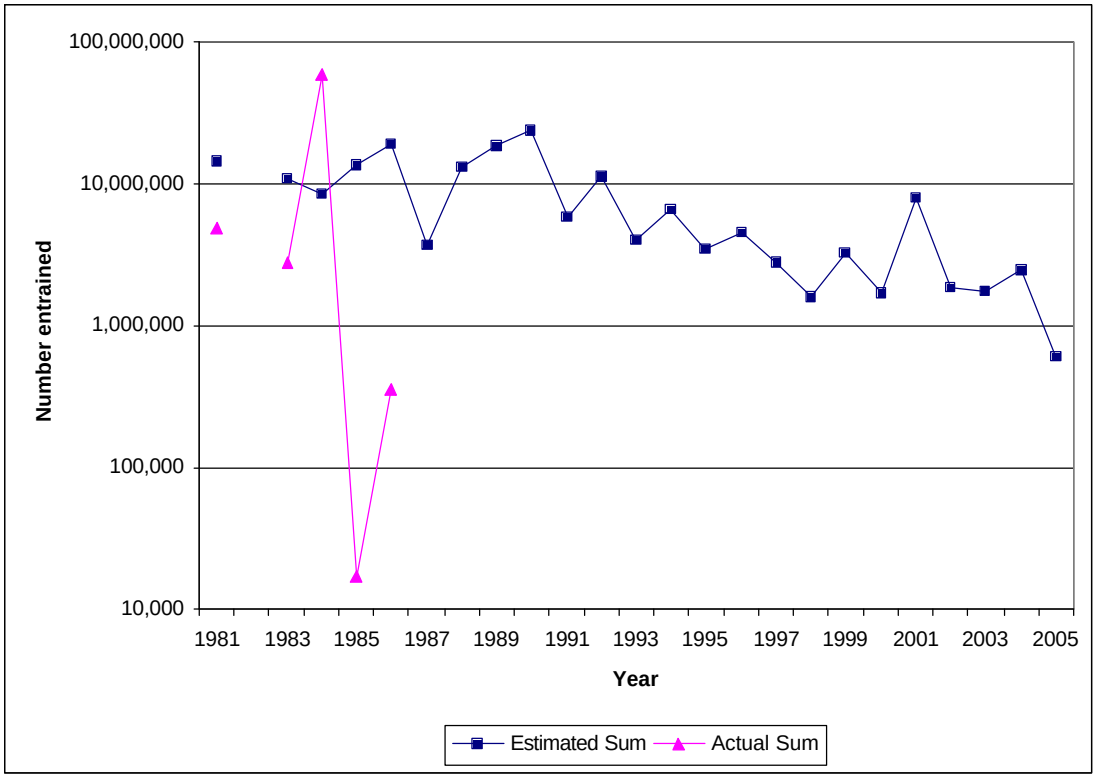

Figure 2: The actual and estimated number of all life stages for American shad at Indian Point. Log scale.

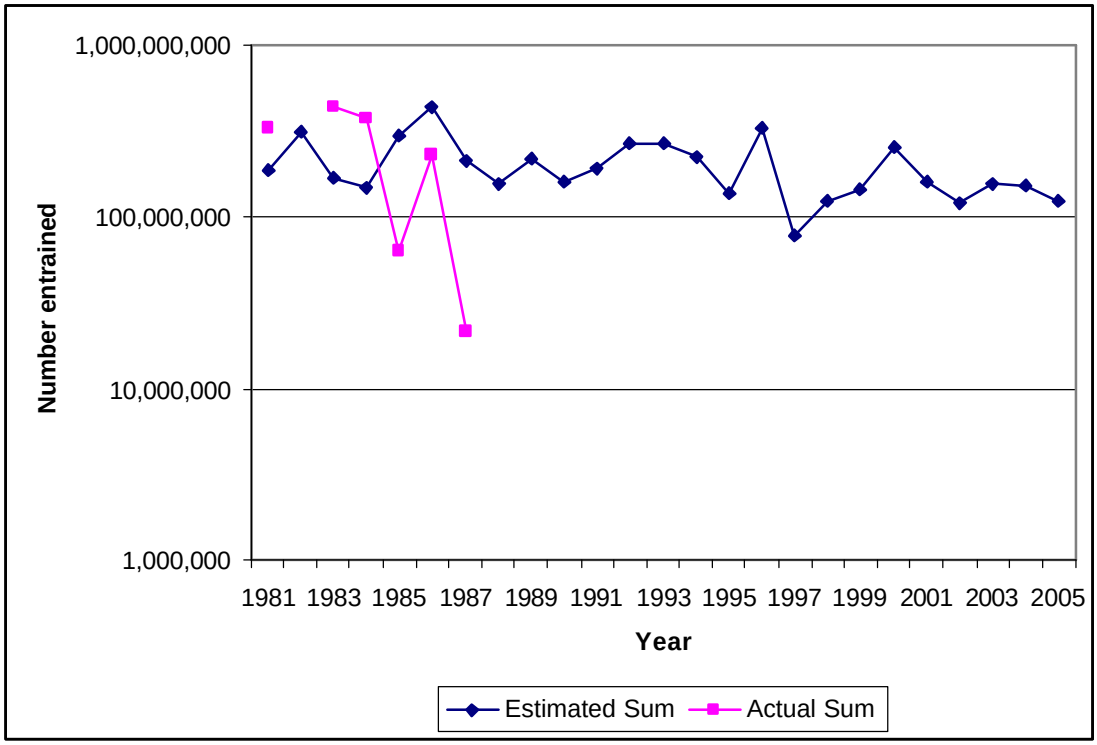

Figure 3: The actual and estimated number of all life stages for white perch at Indian Point. Log scale.

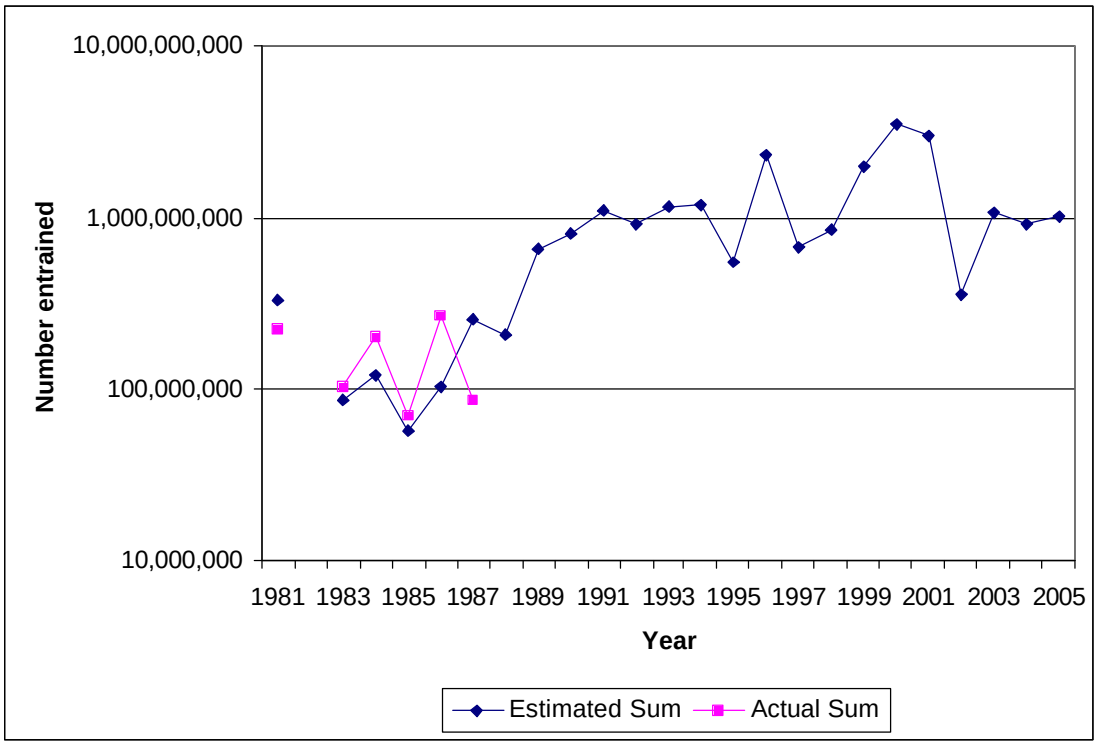

Figure 4: The actual and estimated number of all life stages for striped bass at Indian Point. Log scale.

The fit of the American shad (Figure 2) relationship is poor. American shad breed in the upper regions of the estuary and the numbers found at Indian Point may be related to river flows and vary greatly between years. White perch (Figure 3) also

release eggs in the upper estuary, but spread steadily throughout the estuary as they grow. The relationship is better than that for American shad, but is still poor. The relationship for striped bass (Figure 4) is good, as the bass breed close to Indian Point. This is demonstrated in Figure 5, which shows the river regions where various striped bass life stages are found in the estuary.

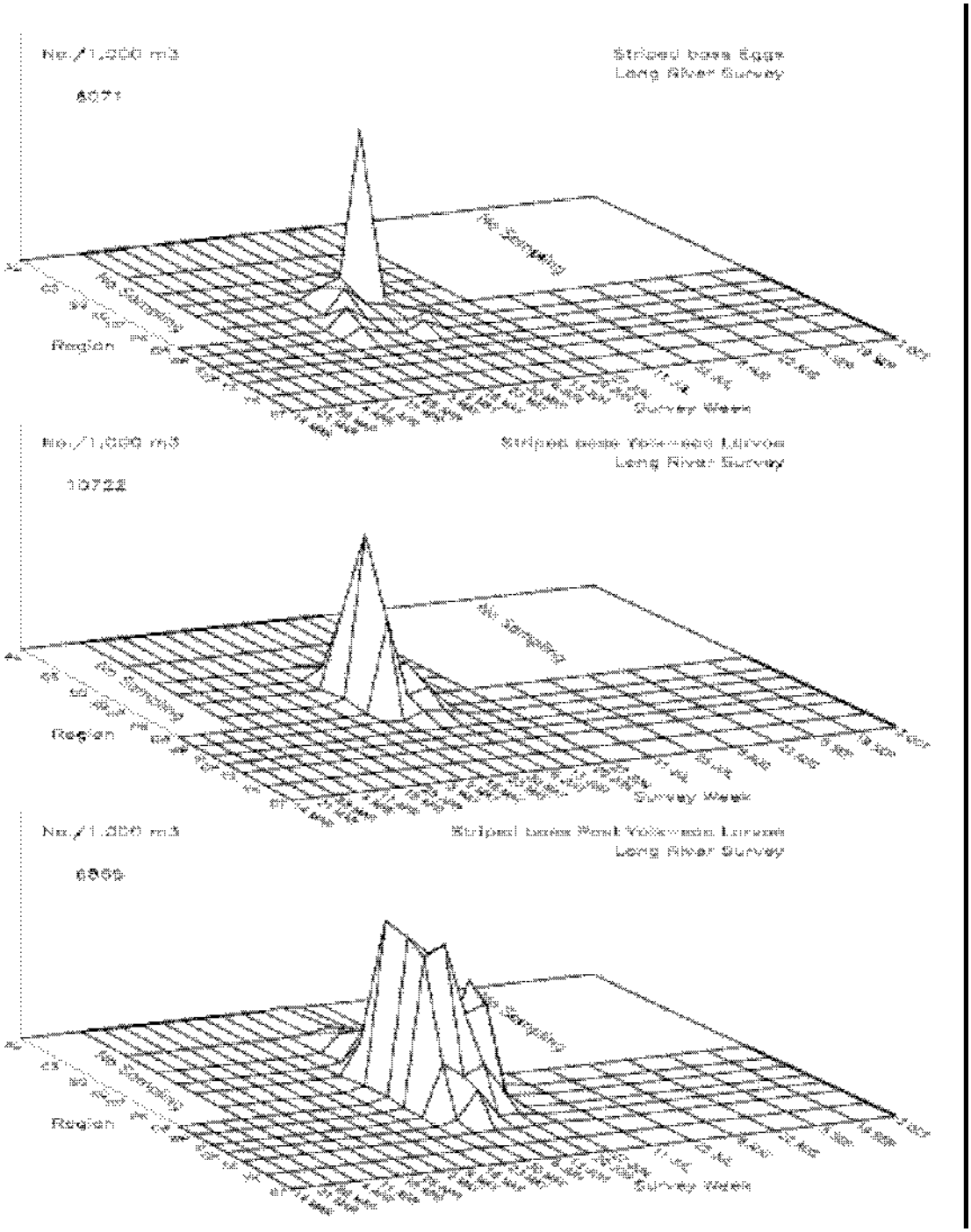

Figure 5: Spatio-temporal distribution of egg, yolk-sac and post yolk-sac larval striped bass in the Hudson River, based on the 2005 Long River Survey. From 2005 year class report figure 4-1.

The striped bass calculations demonstrate that present entrainment estimates based on the old estimates in the DEIS would be underestimated. The average number of striped bass entrained in 1981-7 was 46 million. Using the estimates presented in Figure 4, the average number entrained between 1987 and 2005 was 366 million, an increase of over 750%.

To analyse the relationships fully, data are needed on the density of the fish in the vicinity of the power plant. The year class reports do give the densities of each life stage in each part of the estuary for each week. We believe that these data are gathered for the year class reports; if so, a much more detailed and accurate calculation could be made of the number of fish entrained. We conclude that the entrainment impact has not been quantified to the best extent possible.

3.4. Entrainment - Conclusions

The data used recently by Entergy to assess this impact are old, having been gathered between 1980 and 1990. Since then, the ecology of the estuary has changed considerably, with several species declining in abundance, and some species, most notably striped bass, increasing. There have been large changes in the river environment, and important biological invasions.

For the five fish species for which data are available, the Indian Point stations entrain over 1.2 billon eggs and larvae a year. Entrainment data for Atlantic tomcod are not available, but are likely to be significant, with an estimated conditional mortality rate (CMR) indicating that 12% of the Atlantic tomcod population are being killed by Indian Point each year.

Efforts have not been made to assess current entrainment levels, using the year class reports and existing entrainment data. A rough approximation of the number of striped bass entrained indicates that the number may have increased by 750% over old estimates. Reliance on 20-year old data, in an estuary that has undergone many significant environmental and ecological changes, makes any prediction of the impact highly imprecise. The data were collected before many significant recent ecological changes in the Hudson had occurred, including the arrival of zebra mussels, the closure of several fisheries and the recovery in striped bass numbers.

In a system that is under stress from many sources, the entrainment of 1.2 billion fish attributable to Indian Point is significant. With CMR for Indian Point as high as 12% for Atlantic tomcod, 10% for bay anchovy, 1% for river herring, 8% striped bass and 5% for white perch, the mortalities caused by Indian Point are large.

Closed-cycle cooling, required under the draft SPDES permit for Indian Point, represents about a 95% reduction in water use relative to the existing once-through system. This alone would also reduce entrainment mortality by 95% and could, if needed, allow other entrainment reducing technologies to be used. We know of no alternative technology(s) that will result in equivalent protection for aquatic resources to the level which can be achieved by closed cycle cooling.

4. Impingement

4.1. Numbers impinged at Indian Point power station

Before 1990, fish impinged on the cooling water filter screens would invariably have been killed. The installation of Ristroph screens and fish return systems at Indian Point between 1990 and 1991 reduced this mortality for some species.

Surveys of the impingement at Indian Point were undertaken from 1981 to 1990, and the number of fish impinged was known with good accuracy for this period. Only data for the top 8 species were presented in the DEIS in detail. Because the sampling was undertaken regularly throughout the year, estimates of the total annual catch for the common species were made (Table 4).

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
American shad	94,529	1,131	8,670	782	2,630	7,746	3,186	479	9,755	32	12,894
Alewife	26,656	1,565	7,715	8,427	5,741	3,170	3,488	1,652	1,633	2,415	6,246
Tomcod	377,320	84,314	142,717	139,136	84,581	65,841	1,356,287	18,046	14,525	111,647	239,441
Bay anchovy	605,163	111,301	193,056	107,527	19,711	59,187	28,065	29,299	10,408	-	116,372
Spottail shiner	2,267	1,032	1,237	2,604	2,148	1,588	3,310	1,793	7,906	-	2,389
White perch	1,315,592	1,113,621	362,652	614,593	780,545	756,219	647,111	747,660	759,042	505,537	760,257
Blueback herring	248,616	1,091	83,450	15,872	28,050	19,146	77,992	26,141	59,477	21,248	58,108
Striped bass	47,719	20,841	28,011	13,838	77,953	8,833	31,302	234,229	326	-	46,305
Totals	**2,717,862**	**1,334,896**	**827,508**	**902,779**	**1,001,359**	**921,730**	**2,150,741**	**1,059,299**	**863,072**	**640,879**	**1,242,013**

Table 4: The number of fish impinged annually at Indian Point from 1981 to 1990 for 8 species. Data from DEIS V1-2-D.

Impingement numbers can still be calculated after the installation of fish return systems, by intercepting the impinged fish before they are returned to the estuary.

4.2. Estimates of the number killed by impingement

4.2.1. Survival rates – Indian Point estimates

Once Ristroph screens and a fish return system were added to the station in 1990-1, some of the impinged fish survived. A key aspect to consider when analysing fish survival data from Ristroph screens is the time after impingement and handling when survival was measured (see section 4.2.2). Some early studies quoted high survival after 10 to 15 minutes in a holding tank. This is clearly of little interest, as most injured fish will take considerably longer to die.

The minimum time at which survival rates are likely to give a fair indication of the eventual survival of the impinged fish will be after 8 hours; Fletcher (1990) gives estimates for the survival of common species at Indian Point in the Hudson Estuary after this time period (Table 5).

Fish species	Survival %
Bay anchovy	77
American shad	65
Blueback herring	74
Striped bass	91
White perch	86
Atlantic tomcod	83
Alewife	38

Table 5: Eight-hour survival rates for Indian Point (Fletcher, 1990).

4.2.2. Survival rates – effects of timing of measurement

The survivals presented in Table 5, and similar results, have been highly influential in guiding the EPA to the conclusion that Ristroph screens could achieve reductions in

mortality of at least 70 to 80%. However, there are a number of factors that will likely reduce eventual survival below that observed after 8 hours. It has been found that stressed and damaged fish can take a number of days to die. Experiences in angling and fish farming demonstrate that quite minor damage may lead to bacterial and fungal infections, resulting in eventual death. For example, in an experiment where fish were simply caught from a tank using different types of netting, and returned to a lake, Barthel *et al* (2003) found that the fish often took 2 or 3 days to die.

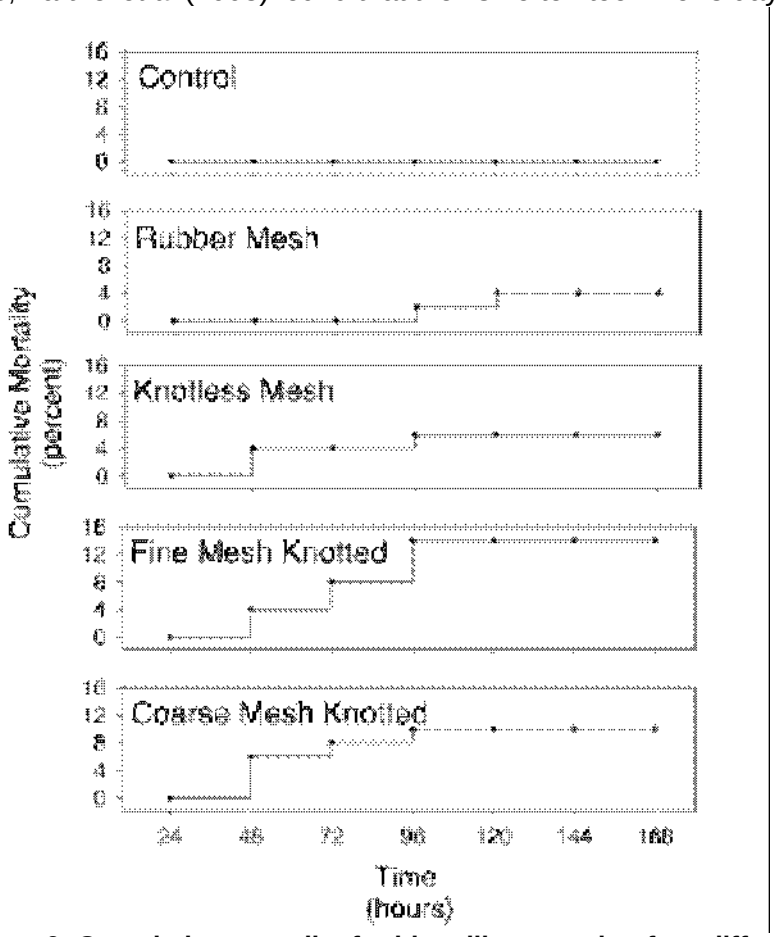

Figure 6: Cumulative mortality for bluegill exposed to four different netting treatments. (Barthel *et al,* 2003)

There is also the problem with all fish return systems that exhausted, disorientated and damaged individuals can be picked off by predators on their return to the main water body. It is normal to observe large predatory fish and piscivorous birds patrolling and feeding at water discharges.

The progressive decline in survival with time following impingement is demonstrated in data collected at Roseton Generating Station in the Hudson estuary (Table 6). Apart from spottail shiner, all other species showed a marked decline in the rate of survival between 2.5 and 96 hours after impingement. This clearly indicates the need to use survival estimates over periods of at least 96 hrs if the post-impingement survival is to be correctly estimated.

Species	Number	Survival Rate through time					
		0 hr	2.5 hr	8 hr	24 hr	48 hr	96 hr
American shad	575	0.689	0.252	0.123	0.080	0.071	0.068
Alewife	1839	0.662	0.229	0.151	0.096	0.073	0.060
Bay anchovy	1093	0.282	0.169	0.110	0.032	0.014	0.004
Blueback herring	8973	0.753	0.335	0.204	0.110	0.090	0.071
Striped bass	899	0.889	0.740	0.578	0.494	0.405	0.345
Spottail shiner	331	0.958	0.931	0.915	0.897	0.873	0.831
White perch	899	0.950	0.909	0.828	0.727	0.648	0.583

Table 6: Data from 1994 impingement mortality studies at Roseton (dualflow screens) (NAI 1995).

When the Roseton survival rates are plotted against time, it can be seen how many individuals are likely to die after 8 hours of survival (Figure 7). A dotted red line has been added to the graph to show the time at which the survival of impinged fish at Indian Point is used in the DEIS. (Note, these are not the survival figures used for Indian Point in the DEIS – but are presented to show the effect of the passage of time on the survival rate).

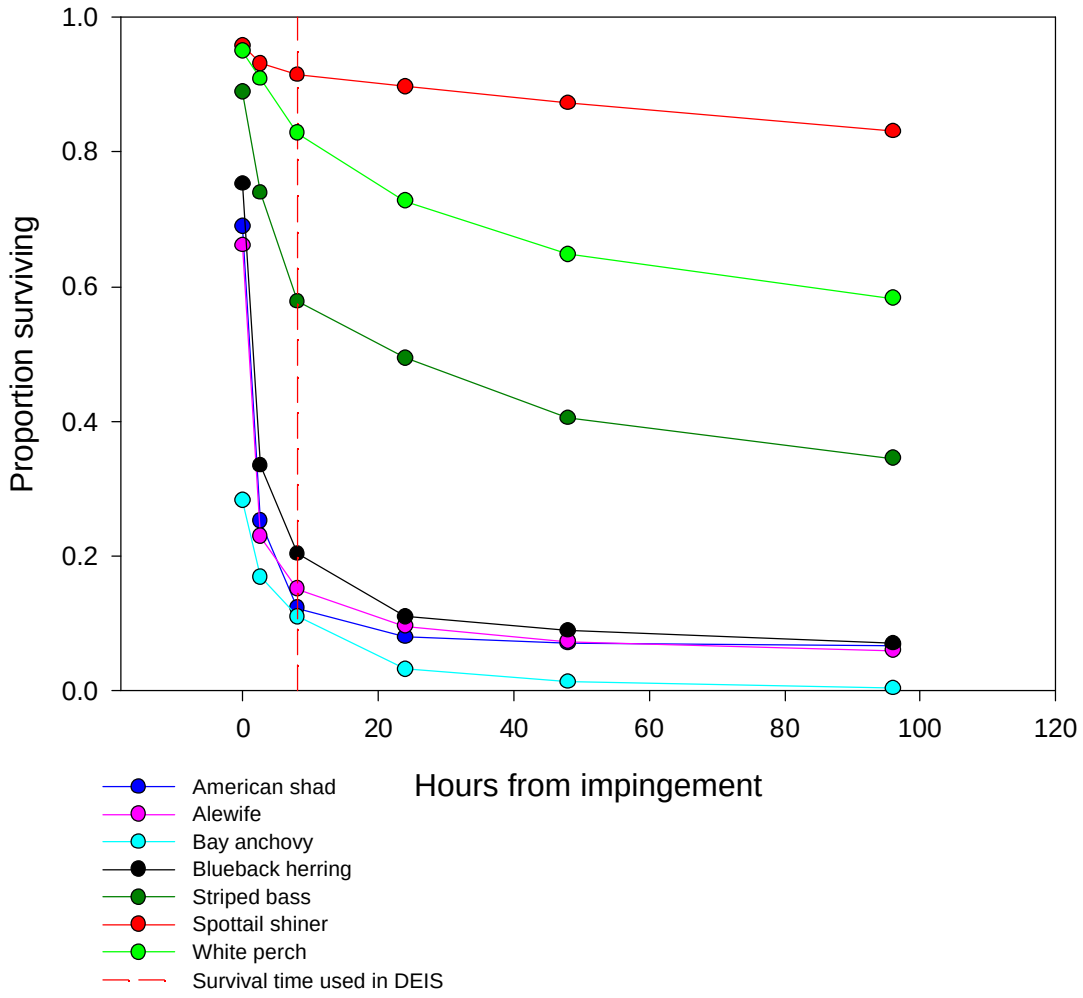

Figure 7: The proportion of fish surviving after 0, 2.5, 8, 24, 48 and 92 hours after impingement at Roseton. (NAI 1995)

4.2.3. Environmental factors affecting survival rates

Temperature and salinity can also change survival rates after impingement. Injured fish are more likely to die at low temperatures and salinities (Muessig *et al.* 1988; Figure 8). Salinity is probably important because damage to the skin results in a loss of osmotic control. While these studies were carried out on conventional, rather than Ristroph, screens, this will not detract from the insight gained into the effects of salinity and temperature upon injured individuals.

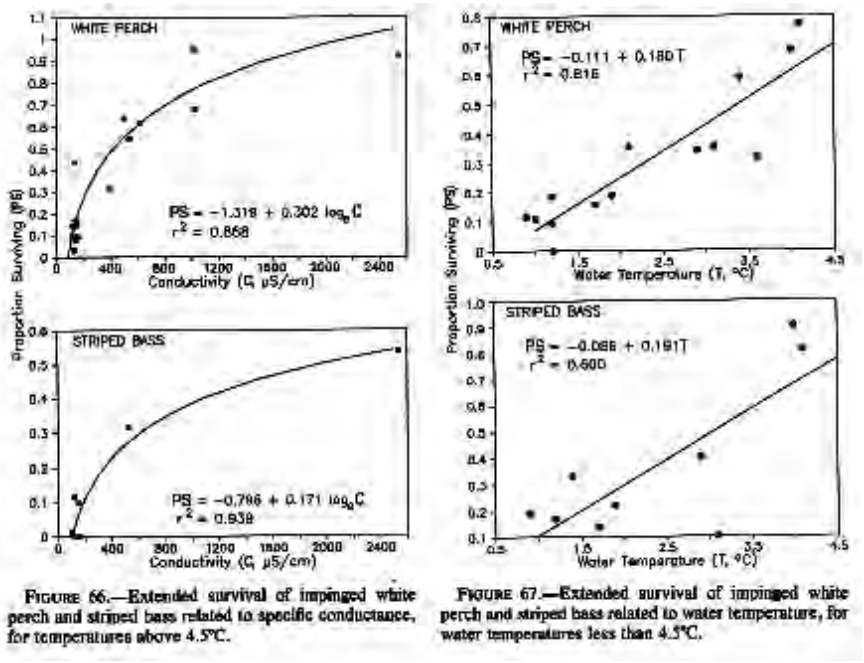

FIGURE 66.—Extended survival of impinged white perch and striped bass related to specific conductance, for temperatures above 4.5°C.

FIGURE 67.—Extended survival of impinged white perch and striped bass related to water temperature, for water temperatures less than 4.5°C.

Figure 8: The survival of white perch in relation to water temperature and salinity following impingement. Reproduced from Muessig et al. (1988)

The results of Muessig *et al*'s studies in Figure 8 above indicate that short-term survival rates at intermediate water temperatures and salinities are unlikely to fully reflect the eventual mortality rate for species that are easily injured. For example, for both striped bass and white perch, the survival is much lower at low water temperatures than at high

4.2.4. Survival rates – the PSEG estimates

As only 8-hour survival figures for the Ristroph screens are given in the DEIS, data from other sources were examined. The most recent review of likely survival rates appeared in PSEG Power New York Inc's *Bethlehem Energy Center SPDES Modification, Alternative Cooling Systems Study for Ristroph screens,* (PSEG (from LMS 1998a)); the post-impingement survival rates presented there are given in Table 7 below. This gives the best available survival estimates for American east coast estuarine and marine fish.

Family	Species	Percent Survival	
		Conventional	Ristroph type
Acipenseridae	Atlantic sturgeon	60	80
	Shortnose sturgeon	60	80
Anguillidae	American eel	70	95
Bothidae	Summer flounder	70	95
Catostomidae	White sucker	50	70
Centrarchidae	Black crappie	30	40
	Bluegill	80	80
	Largemouth bass	75	90
	Longear sunfish	70	80
	Pumpkinseed	75	80
	Redbreast sunfish	70	80
	Rock bass	70	80
	Smallmouth bass	75	90
	White crappie	30	40
Clupeidae	Alewife	0	10
	American shad	0	10
	Blueback herring	0	10
	Gizzard shad	5	10
	AW/BBH	0	10
Cyprinidae	Bluntnose minnow	50	90
	Carp	50	80
	Common shiner	50	90
	Creek chub	50	90
	Emerald shiner	50	90
	Fallfish	50	90
	Golden shiner	45	90
	Goldfish	50	80
	Rosyface shiner	50	90
	Silvery minnow	50	90
	Spotfin shiner	50	90
	Spottail shiner	50	90
	Unidentified shiner	50	90
Cyprinodontidae	Banded killifish	85	90
	Mummichog	85	90
Engraulidae	Bay anchovy	0	80
Esocidae	Chain pickerel	70	90
	Northern pike	70	90
	Redfin pickerel	70	90
Gadidae	Atlantic tomcod	10	70
Gasterosteidae	Fourspine stickleback	70	90
	Threespine stickleback	70	90
Ictaluridae	Brown bullhead	65	90
	Channel catfish	70	90
	Tadpole madtom	70	90
	White catfish	75	90
	Yellow bullhead	70	90
Osmeridae	Rainbow smelt	0	85
Percichthyidae	Striped bass	25	70
	White bass	25	70
	White perch	25	70
Percicidae	Logperch	65	80
	Tessellated darter	90	100
	Walleye	65	80
	Yellow perch	65	80
Percopsidae	Trout-perch	15	20
Petromyzontidae	Lamprey spp.	70	95
Salmonidae	Brown trout	60	80
Sciaenidae	Freshwater drum	20	25
Soleidae	Hogchoker	90	95
Umbridae	Central mudminnow	60	80

Table 7: The post-impingement survival of fish on conventional and Ristroph screens Used at Bethlehem Energy Centre (BEC). From PSEG.

4.2.5. Using survival rates to estimate Indian Point impingement mortality

To quantify the impact of impingement at Indian Point, the estimates for impingement in the 1980s were used. By applying mortality rates (1-survival) for each species, the number of individuals of the common fish species killed were computed (see Table 8). Both the mortality rates used in the DEIS and those used in the PSEG Bethlehem power plant were used for the calculations.

		DEIS Mortality Rates		PSEG Mortality Rates	
	Impinged	**Mortality Rate**	**Killed**	**Mortality Rate**	**Killed**
American shad	12,894	0.35	4,513	0.90	11,605
Alewife	6,246	0.62	3,873	0.90	5,622
Tomcod	239,441	0.17	40,705	0.30	71,832
Bay anchovy	116,372	0.23	26,765	0.90	104,735
Spottail shiner	2,389	0.16	370	0.10	239
White perch	760,257	0.14	106,436	0.30	228,077
Blueback herring	58,108	0.26	15,108	0.90	52,297
Striped bass	46,305	0.09	4,167	0.30	13,892
Total	**1,242,013**		**201,938**		**488,298**

Table 8: The mean number impinged and killed using the estimates of mortality of Ristroph screen for Indian Point. Mortality rates from Fletcher (1990) (see Table 5) and PSEC (LMS) (see Table 7). Impingement data from DEIS V1-2-D and VI-2-B.

While the number of fish impinged and killed is large, irrespective of the survival rate applied, the estimate using 8 hr survival rates is less than half that using the rates from the PSEG report. The biggest difference in mortality rates is for the bay anchovy, which is estimated at only 23% in the DEIS and 90% in the PSEG report.

4.3. Seasonality

The impingement of fish at Indian Point is seasonal, with two peaks per year, one in winter (December and January) and second in summer (June and July). This is true for both the total number impinged and for the estimate of the number killed when survival is taken into account (Figure 9 and Figure 10).

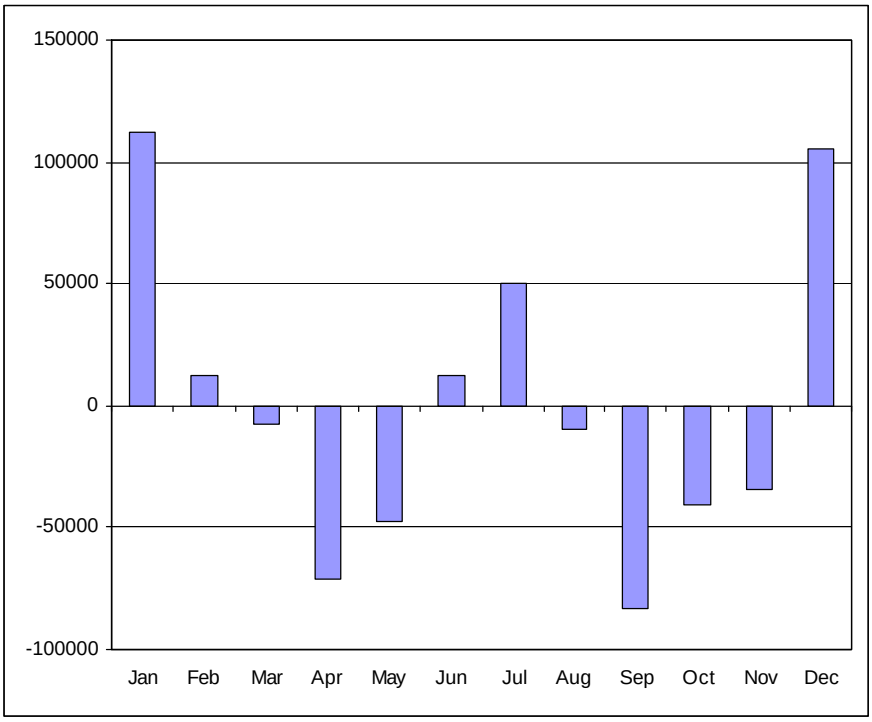

Figure 9: The difference from mean number of fish killed by impingement each month at Indian Point. Data for 8 species (see text) - 8 hr survival DEIS VI-2-D and VI-2-B.

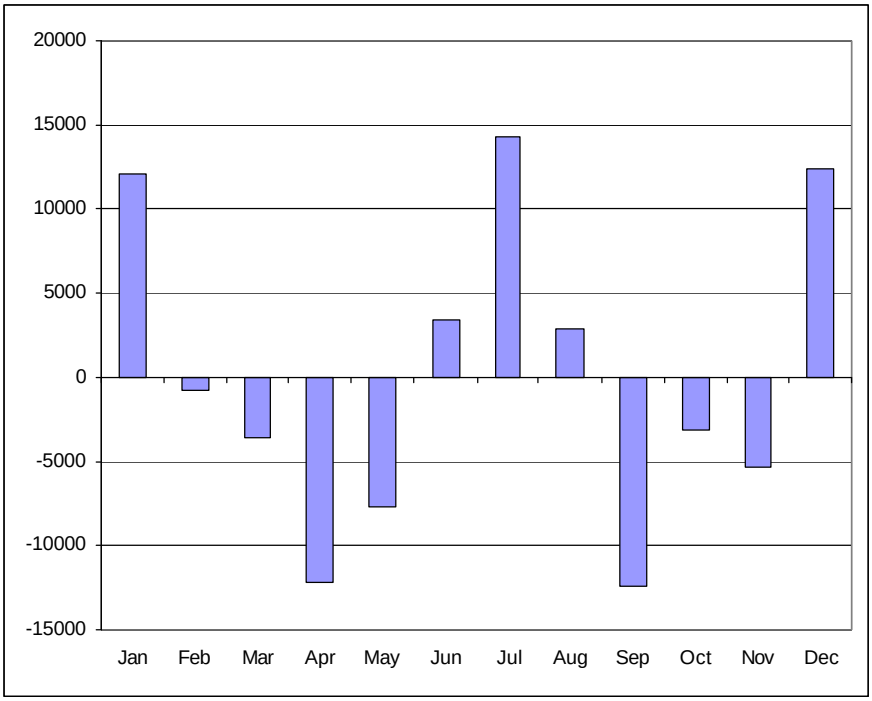

Figure 10: The difference from mean number of fish killed by impingement each month at Indian Point. Data for 8 species (see text) – DEIS VI-2-D and BEC (PSEG) hr survival (Table 7)

4.4. Impingement - Conclusions

The number of fish impinged at Indian Point, as estimated in the DEIS, is large, at over 1.2 million fish. Not all these fish die, but even so, the average number that do die exceeds 200,000, using the most optimistic survival figures, and 400,000 using

more conservative survival values. The DEIS' impingement mortality estimate is unlikely to be a reliable estimate of current or future impingement, as it is based on the number of fish being impinged between 1981 and 1990. It is over 17 years since any impingement monitoring data have been published, and the fish community of the Hudson has greatly changed over this time. For further information see *The status of fish populations and the ecology of the Hudson* (Pisces 2007). The data presented by the power plant concentrate on a few abundant species. The impact of impingement on less abundant species is unknown. There is therefore a need to obtain new estimates of the number of fish impinged, and their survival rates.

Closed-cycle cooling, required under the draft SPDES permit for Indian Point, represents about a 95% reduction in water use relative to the existing once-through system. With closed-cycle cooling, the smaller volumes of water pumped and the much lower velocities involved would almost eliminate impingement on the station cooling water intake screens. We know of no alternative technology(s) that will result in equivalent protection for aquatic resources to the level which can be achieved by closed cycle cooling.

5. Thermal Issues

5.1. Introduction

This section describes the thermal impact of the Indian Point generating station cooling water discharge, and briefly reviews the impact of heated water on aquatic life. The impact of a thermal discharge is related to the background temperature of the water body, and the potential effects of thermal pollution become more serious as the background temperature increases. We therefore also briefly review the background temperature of the Hudson River and the recent increase in water temperatures.

The principal reason for establishing and enforcing thermal water quality criteria is to limit the impact of water temperature on aquatic organisms. The limits on surface width and cross-sectional area in which elevated water temperatures are permissible are designed to ensure zones of passage and regions of habitability for aquatic organisms using the estuary. Similarly, the establishment of the 90°F maximum surface water temperature is in recognition of the thermal tolerance limits of various resident and migratory species.

The relevant criteria governing thermal discharges are summarised below:

704.1 Water quality standards for thermal discharges.

(a) All thermal discharges to the waters of the State shall assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water.

704.2 Criteria governing thermal discharges.

(a) *General criteria*. The following criteria shall apply to all waters of the State receiving thermal discharges, except as provided in section 704.6 of this Part:

(1) The natural seasonal cycle shall be retained.

(2) Annual spring and fall temperature changes shall be gradual.

(3) Large day-to-day temperature fluctuations due to heat of artificial origin shall be avoided.

(4) Development or growth of nuisance organisms shall not occur in contravention of water quality standards.

(6) For the protection of the aquatic biota from severe temperature changes, routine shut down of an entire thermal discharge at any site shall not be scheduled during the period from December through March.

(b) There are also criteria for specific water bodies:

(5) Estuaries or portions of estuaries.

(i) The water temperature at the surface of an estuary shall not be raised to more than 90 degrees Fahrenheit at any point.

(ii) At least 50 percent of the cross sectional area and/or volume of the flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge at any stage of tide, shall not be raised to more than four Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin or a maximum of 83 degrees Fahrenheit whichever is less.

(iii) From July through September, if the water temperature at the surface of an estuary before the addition of heat of artificial origin is more than 83 degrees Fahrenheit an increase in temperature not to exceed 1.5 Fahrenheit degrees at any point of the estuarine passageway as delineated above, may be permitted.

(iv) At least 50 percent of the cross sectional area and/or volume of the flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge at any stage of tide, shall not be lowered more than four Fahrenheit degrees from the temperature that existed immediately prior to such lowering.

704.3 Mixing zone criteria.

The following criteria shall apply to all waters of the State receiving thermal discharges, except as provided in section 704.6 of this Part.

(a) The department shall specify definable, numerical limits for all mixing zones (*e.g.*, linear distances from the point of discharge, surface area involvement, or volume of receiving water entrained in the thermal plume).

(b) Conditions in the mixing zone shall not be lethal in contravention of water quality standards to aquatic biota which may enter the zone.

> (c) The location of mixing zones for thermal discharges shall not interfere with spawning areas, nursery areas and fish migration routes.

Under Section 316(a) of the Clean Water Act, and Part 704 of the NYSDEC water quality regulations, regulators are permitted to allow thermal discharges in excess of the established criteria if it can be demonstrated that such a discharge will assure "*the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water receiving the thermal discharge.*"

As noted in the FEIS, it seems clear that Indian Point's thermal discharge does not meet applicable thermal criteria. Furthermore, as the FEIS points out from the DEIS there is no mixing zone definition for Indian Point generating station discharges.

> *Indian Point:* As of the 1987 - 1992 SPDES permit term, thermal discharges from Indian Point did not meet applicable thermal criteria. … These provisions alone [in the SPDES permit based on the Hudson River Settlement Agreement and Consent Orders], however, are not sufficient for Indian Point to meet thermal criteria. Thermal modelling indicates that the thermal discharge from Indian Point causes water temperatures to rise more than allowed, which is four degrees (F.) over the temperature that existed before the addition of heat, or a maximum of 83°F, whichever is less, in the estuary cross sections specified in 6 NYCRR §704.2(b)(5).2 A mixing zone was not specified in the previous SPDES permit for the Indian Point facility.

(FEIS page 19).

5.2. The thermal footprint of Indian Point

5.2.1. The near field

The term "Near field" is used here to describe the area in the vicinity of the outfall where there is a discrete thermal plume.

Infrared images highlight the surface extent of the thermal plume released from Indian Point (Figure 11). The image below, taken from the FEIS, shows the high proportion of the width of the river that is impacted by the Unit 3 discharge of Indian Point. The following quotation describes the concern:

> "*The surface extent of thermal discharges from the HRSA plants is also a concern. Figure 8 is an aerial thermal image of the plume from Indian Point, Unit 3 only, on the east side of the Hudson plus the smaller plume from Lovett on the west bank. In this image, the two plumes came very close to meeting on the surface, even with Indian Point running at less than its full capacity.*"

(FEIS, Chapter 5 p 71)

In summary, the surface extent of the thermal plume produced by Indian Point covers a high proportion of the width of the river.

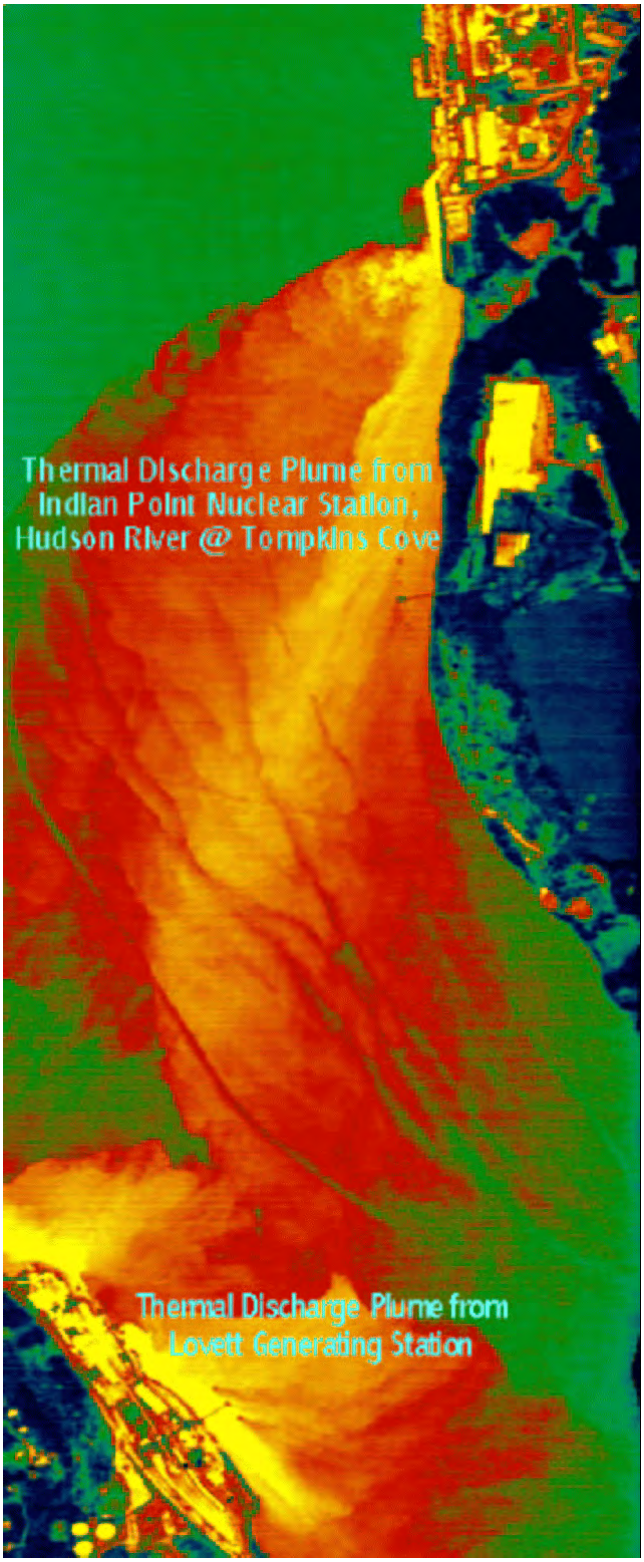

Figure 11: The extent of the thermal plume from the cooling water discharge of Indian Point Unit 3, and the Lovett generating station.

The FEIS also expresses concern about the vertical distribution of the thermal plume. In general, heated effluents are buoyant, and thus the impacts are mostly restricted to the surface waters and any area of bank which the plume contacts. However, if the plume is sufficiently large then heated water will penetrate to the bed of the river and

impact bottom-living and deep-water species. Such deeper water penetration of the thermal plume is always a matter for concern, as it may lead to damage to the benthic food chain and also not allow migrating fish to pass under the heated water plume. It is clear that almost the entire vertical water column in the vicinity of Indian Point holds water heated above background temperatures (Figure 12). The FEIS states:

> "*A study by HydroQual, Inc., examined passive particle movement and also investigated thermal and salinity profiles in several river reaches, including the portion of the Hudson River where the HRSA plants are located. Figures 6 and 7 of this FEIS (following pages), excerpted from that study, show two vertical temperature profiles of the Hudson River from NYC to just above the northernmost of the HRSA plants, one during a spring and the other during a neap tide. Based on these representations, it appears that there may be times and conditions where effluent-warmed waters occupy nearly the entire vertical water column.*"

(FEIS, Chapter 5 p 71)

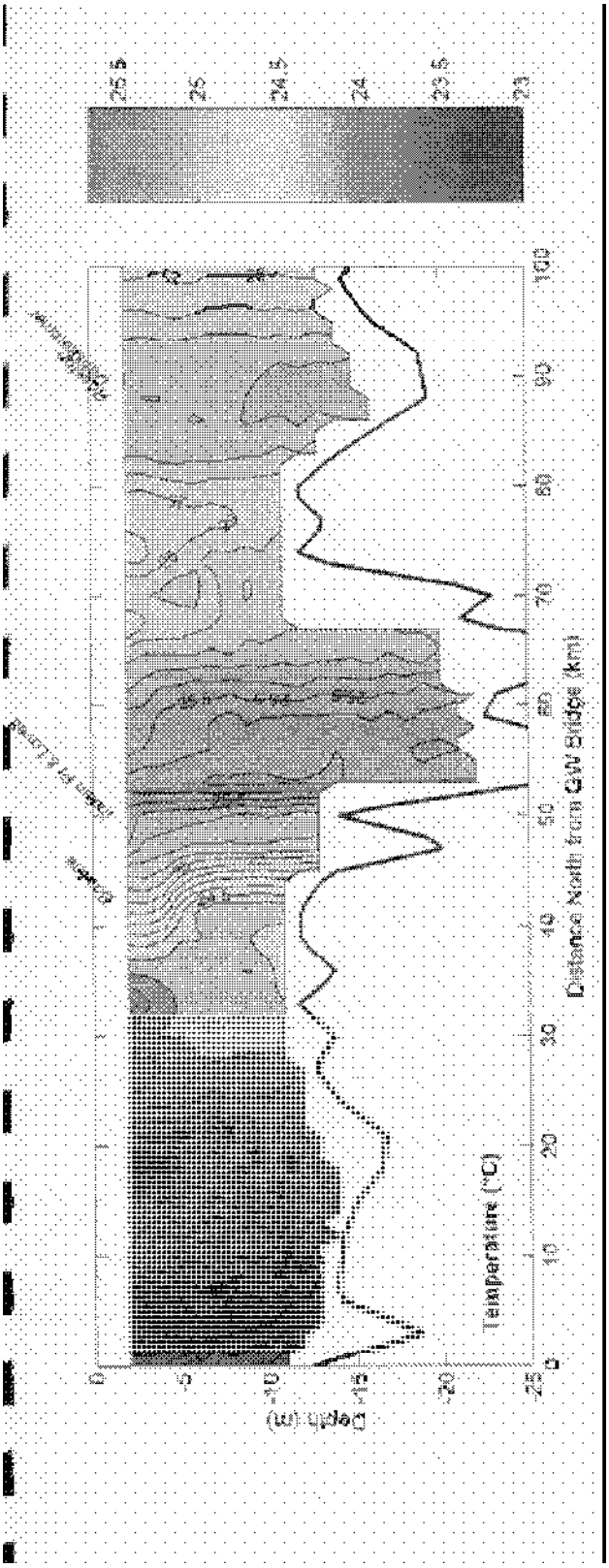

Figure 12: Temperature profile of the Hudson River, NYC to Newburgh, during a neap tide. From the FEIS and originally HydroQual, 1999.

In any event, the FEIS states on page 71:

> *Thermal discharges were inadequately addressed in the DEIS. The DEIS asserts, with no supporting evidence, that "... [t]he surface water orientation of the plume allows a zone of passage in the lower portions of the water column, the preferred habitat of the indigenous species." Other data and analyses cast doubt on this assertion.*

The FEIS goes on to say, on page 72:

> *Given the extent of warming shown in the HydroQual graphs, combined with the recent dramatic declines in tomcod and rainbow smelt as discussed previously, the Department believes it prudent to seek additional thermal discharge data for each facility, including a mixing zone analysis, and anticipates requiring triaxial thermal studies as conditions to each of the SPDES renewals. Depending on the results of those analyses, additional controls may be required to minimize thermal discharges.*

Having briefly introduced evidence on the spatial extent of the thermal plume, we now move on to consider the temperature of the discharge. The average maximum temperatures for each calendar month for the years 2000 to 2007 are given in Table 9. Note that for the summer months the maximum is regularly in excess of 90 degrees Fahrenheit, while the regulations clearly state "*The water temperature at the surface of an estuary shall not be raised to more than 90 degrees Fahrenheit at any point*". Further, there are occasions when the temperature exceeds 100°F; this is a temperature at which many aquatic organisms living in the estuary will suffer acute harm or death.

Figure 13 shows a plot of the maximum daily discharge temperatures at Indian Point, with the 90° and 100°F reference temperatures shown in red. Note that 90°F has been exceeded for extended periods every summer since 2001. Furthermore, 100°F has been exceed in 3 of the 7 summers for which data are plotted.

Month	2000	2001	2002	2003	2004	2005	2006	2007
1	66.38	57.35	70.53	68.45	70.78	70.74	74.78	70.25
2	63.63	67.61	69.76	65.41	69.57	71.88	71.39	67.76
3	64.08	70.57	69.91	65.20	70.46	69.17	69.59	63.29
4	70.05	71.52	74.75	66.00	71.89	72.86	75.54	69.90
5	77.01	78.07	79.85	79.20	82.64	81.92	79.82	83.80
6	79.40	88.82	86.41	84.40	91.81	92.08	89.17	93.30
7	88.66	97.27	98.29	96.68	97.21	87.89	96.95	
8	89.19	100.01	101.29	96.45	97.21	103.58	101.20	
9	86.83	96.11	94.91	94.38	90.27	99.66	94.24	
10	80.62	83.70	85.24	82.56	81.88	83.89	85.34	
11	75.87	77.70	68.06	78.00	76.52	77.68	81.20	
12	64.05	76.80	73.23	74.30	73.95	75.50	77.25	

Table 9: The average maximum discharge temperature (°F) of the Indian Point cooling water discharges for the years 2000 to 2007. Missing numbers are months for which no data are available. (Indian Point Daily Temperature Reports 2000-07)

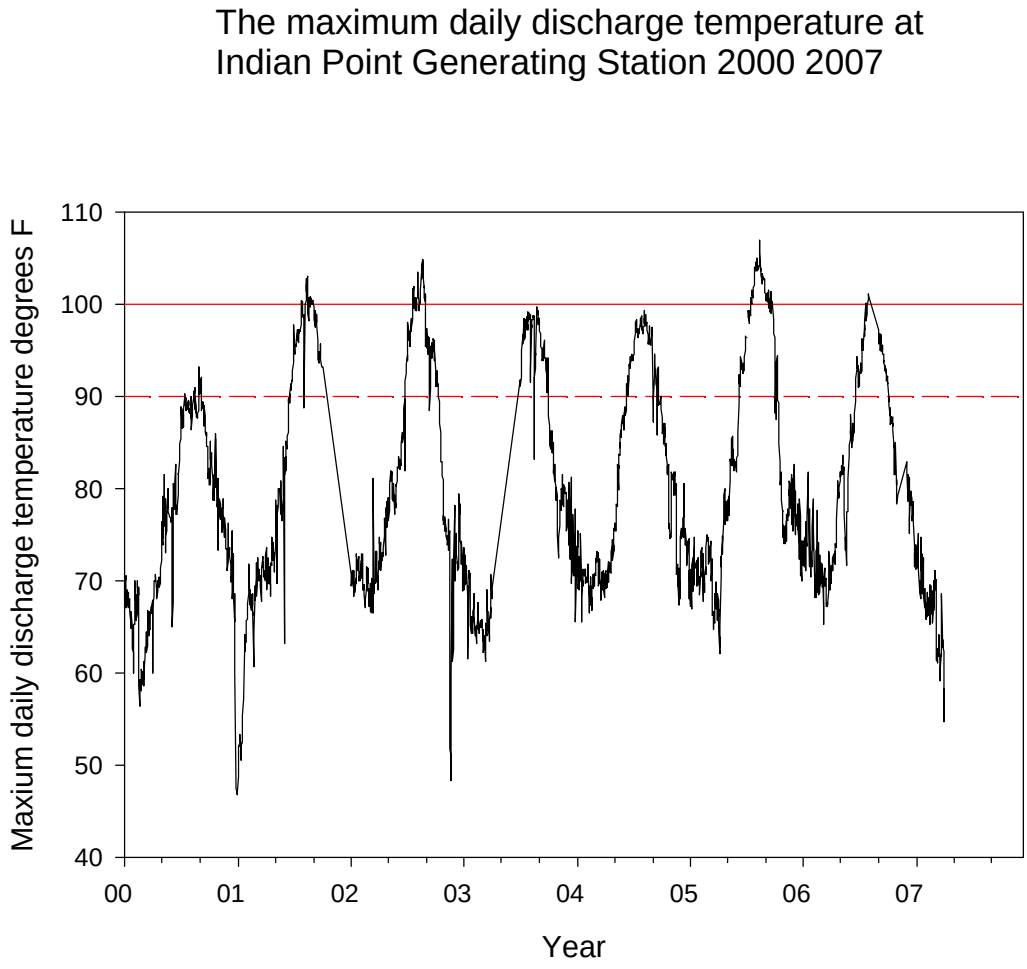

Figure 13: Plot of the maximum daily discharge temperatures at Indian Point 2000-2007. The 90° and 100°F reference levels are shown in red.

5.2.2. The far field

Far field predictions can be made using existing temperature measurements or modelling methods. The Massachusetts Institute of Technology dynamic network model was used in the DEIS for Indian Point, Bowline and Roseton generating stations. In the DEIS this far field model is referred to as the FFTM (Far Field Thermal Model).

There are a variety of natural and anthropogenic heat inputs into the Hudson Estuary, and to assess the far field impact of Indian Point we need to be able to distinguish the impact of Indian Point from these other sources. Fortunately, this is possible and we can give a reasonable estimate of the increase in the far field temperature caused by the Indian Point discharge. The table below is copied from the DEIS, and gives the heat loads from the principal anthropogenic sources. Note that Indian Point at this time injected considerably more heat into the system than the other sources considered at this time.

FACILITY	CAPACITY HEAT LOAD (BBTU/day)
Albany Steam Station	67.7
Danskammer Point	34.3
Roseton	136.0
Peekskill WHR	11.5
Indian Point	328.0
Lovett	71.0
Bowline Point	120.0
World Trade Center	19.9

Table 10: Capacity Heat Loads (Table 23 from DEIS appendix VI-3-A).

The Massachusetts Institute of Technology dynamic network model was reported in the DEIS for a range of power plant discharge scenarios. A typical output is presented in Figure 14. A comparison of lines 3 and 5 show the appreciable effect of Indian Point generating station, which was predicted to increase river temperature by > 1°F for more than 10 miles of estuary.

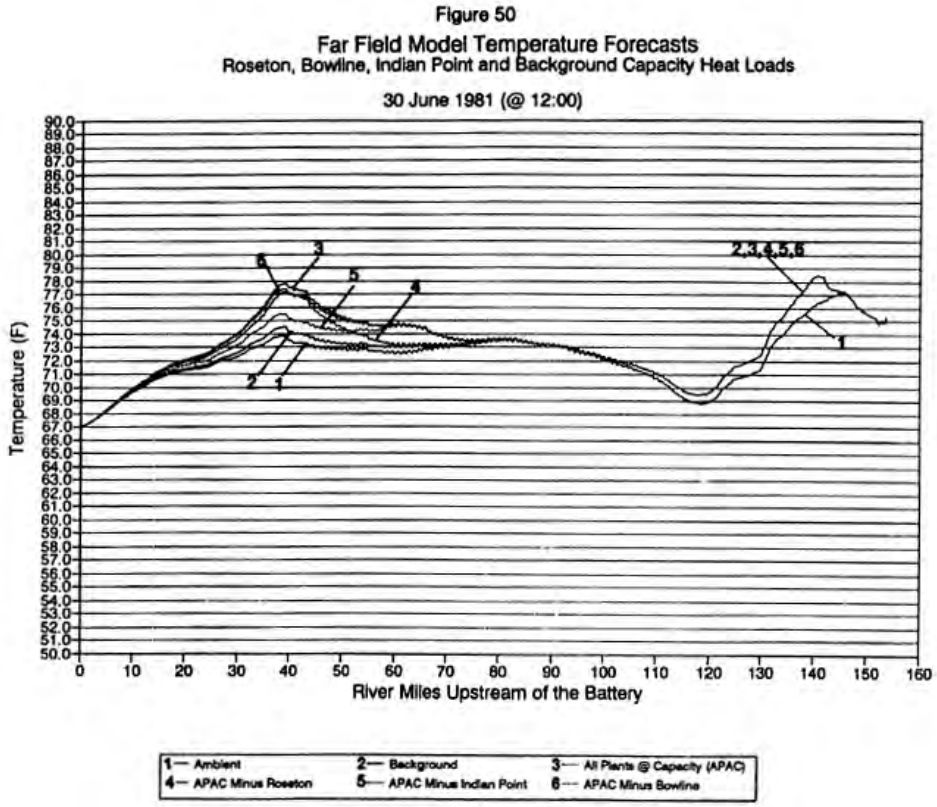

Figure 14: A sample of the results presented for the far field temperature effects of the Hudson Estuary power plants. From the DEIS for Roseton, Bowline and Indian Point generating stations.

5.3. The change in the background temperature of the Hudson River

Water temperatures in the Hudson are increasing. This is clearly demonstrated by the statistically significant increase in mean average annual water temperature

measured at Poughkeepsie Water Treatment Facility (Figure 15). The mean annual temperature in recent years is about 2°C (3.6°F) above that recorded in the 1960s.

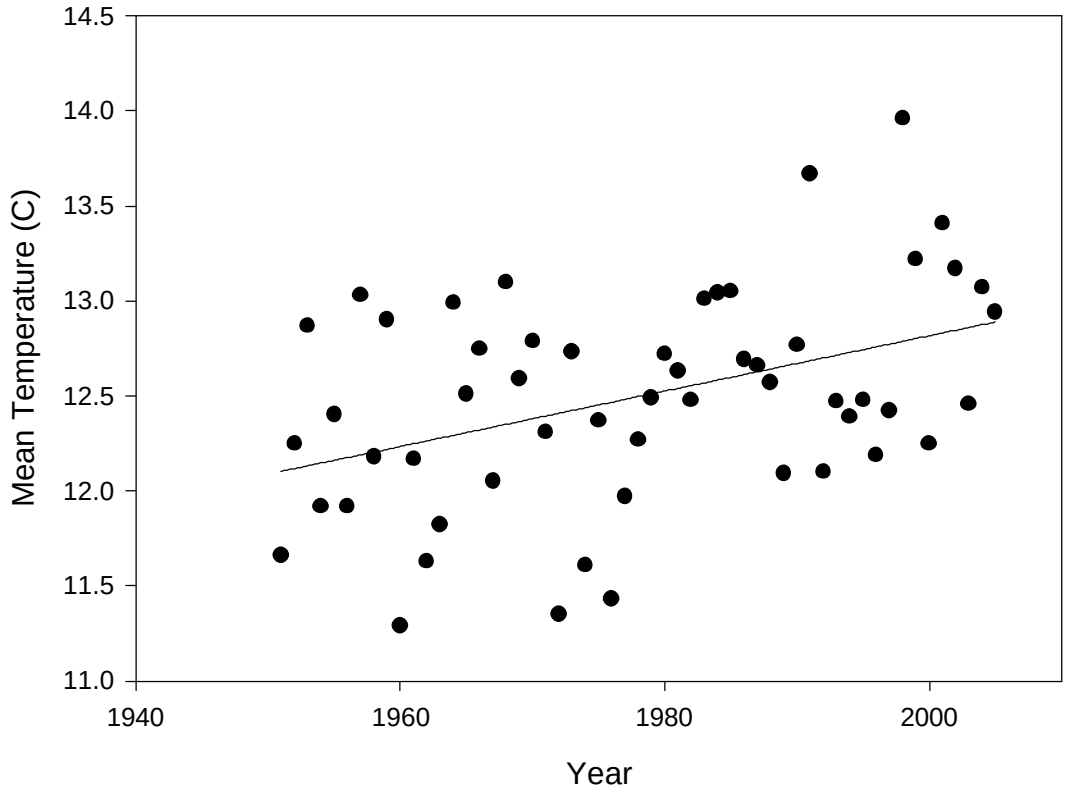

Figure 15: Average annual water temperature (°C) as measured at Poughkeepsie's Water Treatment Facility, 1951 to 2005. (a = 0.0146, b = -16.32, F = 11.1157, p = 0.0016) – Data from 2005 Year Class Report – Appendix B Table B - 6.

Examination of the daily temperatures for 2005 plotted against the mean, minimum and maximum temperatures from 1951 to 2004, show that the temperature for several summer months in 2005 was close to the maximum ever recorded. However, in the winter, it also reached some of the lowest temperatures recorded over a 53 year period. In summary, the temperature regime is becoming more extreme.

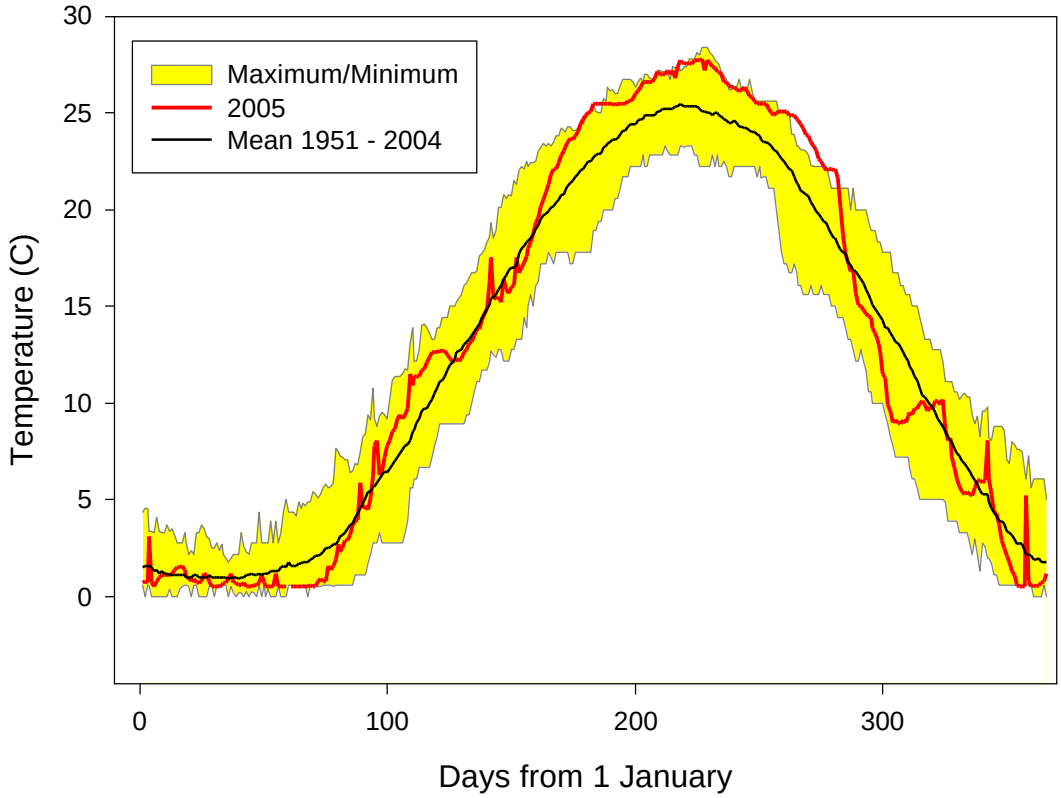

Figure 16: Poughkeepsie Water Treatment Facility data; mean, minimum, and maximum temperature (°C) for each day of the year, 1951 to 2004, with 2005 data plotted in red. – Data from 2005 Year Class Report – Appendix B Table B - 5.

5.4. The effects of heated water on river life

While the term entrainment is commonly used to describe the process in which planktonic animals are drawn into and pass through the condenser circuits of power plants, the term can also be used to describe the capture of organisms in an effluent discharge. When Indian Point discharges warm water into the river, it mixes with the receiving waters. Any small organisms in the receiving water with which it mixes will also be subjected to sudden changes in temperature that are potentially harmful. The importance of these impacts will be in part determined by both the temperature and volume of the discharge. Other factors may also become important. For example, in a tidal body of water, some organisms or populations may be repeatedly exposed to the discharge as the water body in which they live oscillates with the tide past the discharge point.

5.4.1. The temperature sensitivity of aquatic life

Almost all aquatic life is affected by thermal discharges. Below is presented a summary of the impacts on aquatic life in general, and rather more detailed data on thermal tolerance of fish.

5.4.1.1. Thermal impacts on plants

Several studies have shown that species diversity of phytoplankton decreases in areas consistently heated to over 30°C (mid 80s F). The available data indicate that phytoplankton productivity, as measured by carbon assimilation rates, declines with increasing temperatures above about 30°C. Figure 17 from Langford (1990) shows

the rapid decline for phytoplankton in lakes. It is likely that a similar response would occur with Hudson River phytoplankton.

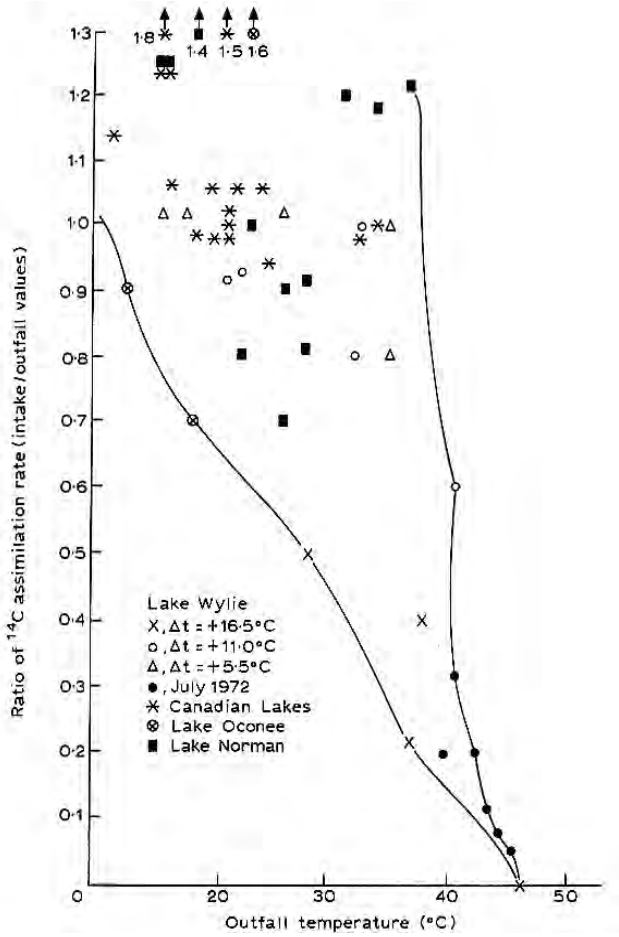

Figure 17: The effect of discharge temperature on the photosynthetic activity of phytoplankton. From Langford (1990).

5.4.1.2. Thermal effects on small crustaceans - zooplankton

When water temperatures reach 35 – 38°C (95 - 100°F) zooplankton abundance declines and mortalities occur (Langford, 1990). Effects on benthic invertebrate life have also been noted, but at Indian Point, the main effect of the discharge will be on planktonic life, because of the depth of the water, since the buoyant plume of heated water remains towards the surface.

5.4.1.3. The thermal tolerance of Hudson fish species

The effects of temperature on the biology and ecological requirements of fish have been extensively studied and reviewed. Temperature can affect survival, growth and metabolism, activity, swimming performance and behaviour, reproductive timing and rates of gonad development, egg development, hatching success, and morphology. Temperature also influences the survival of fishes stressed by other factors such as toxins, disease, or parasites. Many of these effects will occur well below the upper lethal temperature which is given below.

The published information on the temperature requirements of freshwater fishes is found in thousands of documents. It is convenient that several authors have condensed this information into reviews of the literature. The general reviews of

fisheries biology by Carlander (1969, 1977) and Scott and Crossman (1973) include some temperature data. Several reviewers have focused on thermobiology, specifically, lethal and/or preference temperatures (Coutant 1977a; Cherry *et al* 1977; Kowalski *et al* 1978; Houston 1982). Others have widened their reviews to include data on growth, preference and lethal temperatures (Leidy and Jenkins 1977; McCauley and Casselman 1980; Jobling 1981). Comprehensive reviews on the whole range of temperature requirements for fishes (i.e., lethal, preference, growth, reproductive) were given by EPA (1974) and Brown (1974).

A summary of thermal effects literature is published each year for aquatic organisms in the June issue of the Journal of the Water Pollution Control Federation (Talmage and Coutant 1978, 1979, 1980; Cravens 1981, 1982; Cravens *et al* 1983; Harrelson *et al* 1984). The temperature requirements of Great Lakes fishes have been reviewed by a number of authors. Firstly, Reutter and Herdendorf (1976) presented lethal and preference temperatures for 46 species of Lake Erie fishes. Secondly, Spotila *et al* (1979) reviewed 80 species covering: thermal requirements for survival, temperature preference, growth, reproduction and early development. Finally, Wismer & Cristie (1988) made a general compilation of the available data.

Below, the upper temperature that a range of Hudson River fish can tolerate is tabulated. When no size is given, the values are for adults. Generally, young and small fish are more vulnerable to elevated water temperatures than adults. A temperature of 81°F (27.2°C) is the highest that most fish can withstand, indicating that they can just tolerate the maximum summer temperature. However, for some fish, such as the tomcod, it is too hot, and they must seek cooler waters (for example, head towards the ocean). The maximum temperature for the outfall can be 100°F, which is 37.8°C. As can be seen from the table below, this is well above the upper temperature that almost all species can tolerate.

Species	**Latin Name**	**Acclimatization temperature °C**	**Upper tolerance limit °C**
Carp	Cyprinus carpio	20	31-34
Large mouth bass	*Micropterus salmoides*	20	32.5
		30	36.4
Blue gill	*Lepomis macrochirus*	15	30.7
3 spined stickleback	*Gasterosteus aculeatus*	25-26	30.6
Yellow perch	*Perca flavescens*	15	27.7
Alewife	*Alosa pseudoharengus*	15	23
Rainbow smelt	*Osmerus mordax*		21
Sea lamprey	*Petromyzon marinus*		34
Tomcod	*Microgadus tomcod* (2 cm)		19-20.9
	(14-15 cm)		23.5-26.1
	(22-29 cm)		25.8-26.1
Common shiner	*Notropis cornutus*	15	30.3
Brown bullhead	*Ictalurus nebulosus*	15	31.8
Striped bass	*Morone saxatilis* - yolk sac		Mortalities start at 26
	- Post yolk sac		Mortalities start at 30
	- Early juveniles		Mortalities start at 34
American shad	*Alosa sapidissima*		28
White perch	*Morone americana*		32-34

Table 11: The upper temperature that a range of Hudson River fish can tolerate – for sources, see text.

When considering the effect of a heated outfall, we must take into account both the temperature and the exposure time. It is quite likely that larger fish will simply avoid entering the warm water plume, and thus will not suffer direct harm. However, these

animals will be denied access to warmed areas. The thermal impacts will likely be felt most severely by the eggs and weakly swimming early life stages. Maximum temperatures in the discharge may exceed 35°C. It therefore seems inevitable that the heated discharge will result in the death of, or harm to, any American shad, Atlantic tomcod and river herring early life stages in the region of the discharge.

5.4.2. The influence of the discharge on fish migration.

One of the reasons for the limitation on the cross sectional area and surface width that can be thermally polluted is because of long-held concerns that thermal pollution can interfere with fish migration.

5.4.2.1. The response of fish to temperature

Water has a relatively high thermal capacity, and a fish will gain (or lose) heat quite rapidly by conduction across its entire body surface. Moreover, it must pass this fluid over its gills, in considerable volumes, since the concentration of oxygen in water is comparatively low. Gills are richly supplied with blood and have a substantial surface area to optimize gas exchange. These features also make for efficient heat exchange, and the blood rapidly distributes heat throughout the body (Crawshaw, 1979).

Most organisms can acclimate (i.e. metabolically adjust) to temperatures above or below those to which they are normally subjected. Baldwin and Hochachka (1970) correlated thermal acclimation and the switch to alternative metabolic pathways with changes in the proportions of iso-enzymes. However, as the temperature of the fish rises, coordination in the central nervous system can break down, which eventually manifests itself as "distress" symptoms; ultimately "heat death" will ensue. It was recognised many years ago that various reflexes disappear in a consistent sequence (e.g. Fisher, 1958).

As early as the 1930s, Bull (1936) demonstrated, from a range of marine species covering a number of taxa (not salmonids) and ecotypes, that fish could detect and respond to a temperature front of 0.03 to 0.07°C. Fish will therefore attempt to avoid stressful temperatures by actively seeking water at the preferred temperature, but this becomes increasingly a matter of chance once coordination begins to break down. If an uncoordinated fish is moved to cooler water it may recover, but the chances of recovery decrease with duration of exposure.

At less than stressful levels, increasing temperatures allow increased rates of metabolism, and (notably with regard to migratory activity) increased swimming speeds, but decreased endurance (Turnpenny & Bamber, 1983; Beach, 1984). The temperature at which locomotory activity becomes disorganized, and thus the fish loses its ability to escape from adverse conditions, has been termed the Critical Thermal Maximum (CTM).

Once temperatures exceed 40°C (104°F), heat death ensues: enzymes are inactivated, proteins denature or coagulate and fats melt. The last comprehensive review of this subject, from the molecular to whole organism level, was that of Rose (1967).

The response of fish to temperature is complex. Fish have natural thermal niches (preferenda) and in the temperate zone, freshwater species are either:

cold water species, such as salmon, trout, tomcod & smelt;
cool water species;
warm water species, such as carp;

This categorization tends to fall along taxonomic lines, in that related species and genera have similar thermal niches (Hokanson, 1977).

Superimposed upon this thermal selectivity are temporal variations in preferenda that can be correlated with the age or developmental stage of the fish, its physiological condition, or with various environmental variables. Young fish generally have higher thermal preferences and greater tolerances than do older fish. Feeding activity, reproductive or migratory behaviour and stress (anoxia, turbidity, salinity changes and chemical pollutants) might substantially alter normal thermal responses.

Some species are better than others at adapting their physiology or behaviour: in general, estuarine species are fairly resilient, since they are subject to regular environmental fluctuation.

For any fish there are temperatures that it prefers, temperatures to which it can acclimate, temperatures that it would seek to avoid but at which it can survive for various periods of time, and temperatures that are lethal. Moreover the ability of individuals to survive is not the same as the ability of the species to continue; increased temperatures may advance or delay breeding seasons, encourage breeding in the wrong place, or inhibit fish migration.

5.4.2.2. Temperature and dissolved gases

Indirect effects of temperature on fish include reduced solubility of gases, particularly of oxygen, an effect which can be exacerbated by the elevated temperature simultaneously increasing the rate of oxygen removal by pollutants such as sewage. The sort of temperature elevations that are encountered outside the immediate vicinity of a power station discharge are of between 1° and 3°C, which would decrease the solubility of oxygen by only about 0.5 ppm. Were the water to be 100% saturated with oxygen then this reduction in solubility would lead to outgassing. However most rivers are by no means fully saturated and so this slight decrease in solubility has no effect. On the other hand, the rate at which flowing water absorbs oxygen increases with temperature (Truesdale and Vandyke, 1958) whilst the rate of outgassing is sufficiently slow that any slight supersaturation is redissolved as the temperature decreases through mixing.

As would be predicted, the significant upward trend in temperature of the Hudson River has resulted in a statistically significant downward trend in Dissolved Oxygen (DO) (Figure 18 and Figure 19). The sharp decline in DO in 2004 and 2005 is particularly notable.

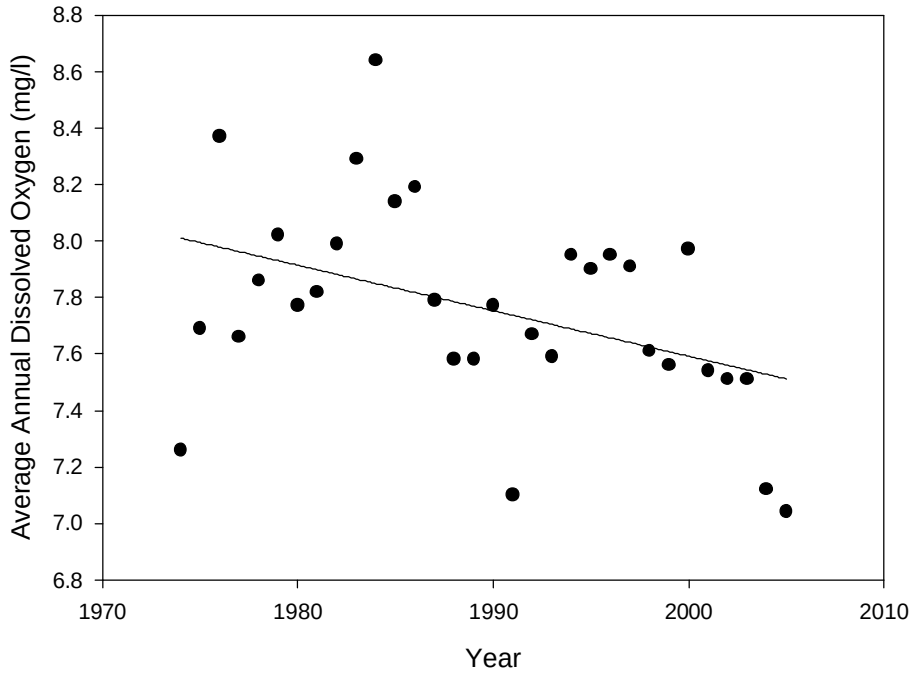

Figure 18: Average annual dissolved oxygen (mg/l) from Long River/Fall Juvenile Surveys, 1974 to 2005 - (a =-0.0161, b = 39.7804, F = 6.4047, p = 0.0169) – Data from 2005 Year Class Report – Appendix B Table B - 14.

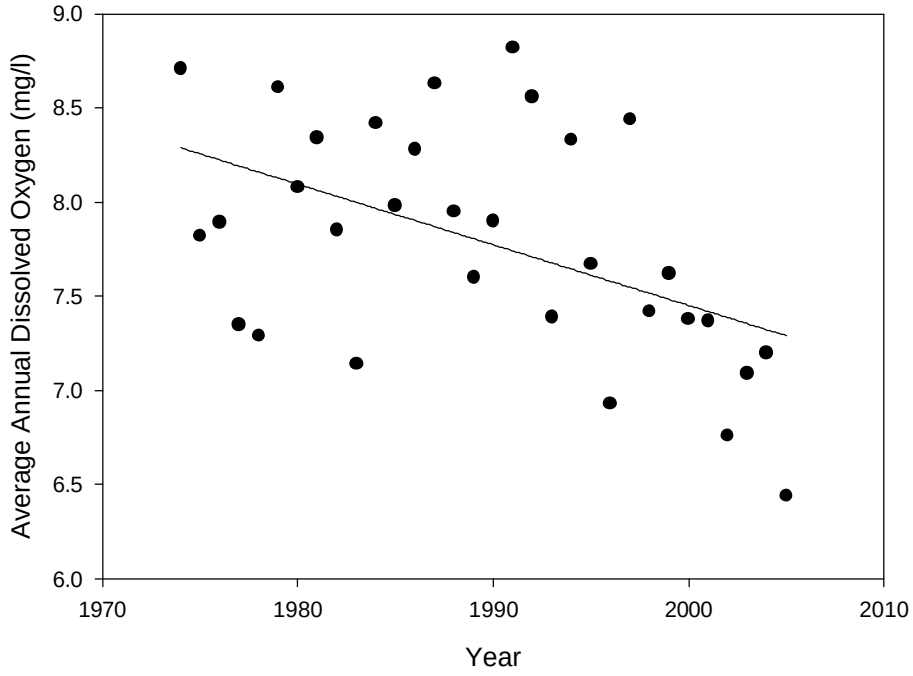

Figure 19: Average annual dissolved oxygen (mg/l) from beach seine surveys, 1974 to 2005 -(a =-0.0322, b = 71., F =9.5142, p = 0.0044) – Data from 2005 Year Class Report – Appendix B Table B - 16.

Given the considerable efforts that have been taken to reduce organic pollution, and the great improvement in water quality in the vicinity of New York City, these declines

in DO are disappointing, and potentially important indicators of a decline in water quality for fish.

The distribution of DO within the water column is complex. It can be affected by many factors including tidal flow, riverine metabolism, stratification and atmospheric diffusion. A typical profile of DO versus depth is shown in Figure 20.

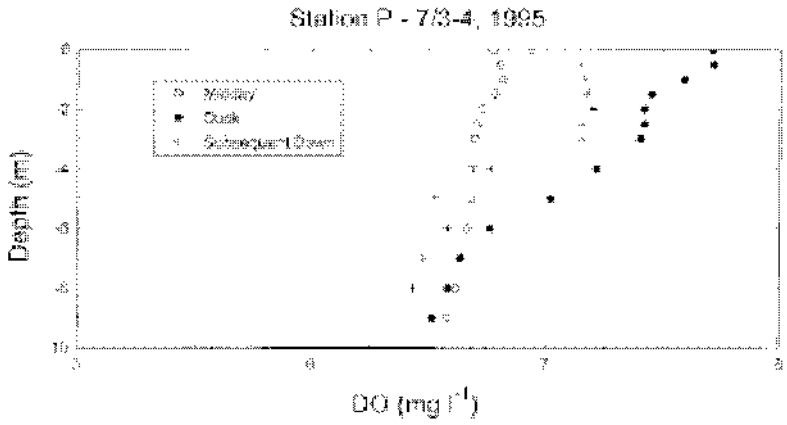

Figure 20: Typical depth profiles of DO measured on 3–4 July 1995 at Haverstraw Bay. Profiles for three sample times are shown for each station. (Swaney *et al* 1999)

This figure shows that the amount of oxygen in the water is often higher at the surface, and is increased during daylight hours as result of oxygen released by photosynthesis. The levels of DO are often reduced overnight as oxygen is metabolised by the organisms in the river.

5.4.2.3. Temperature and migration

Many of the studies of the effects of temperature on migration have been on salmonids, and as such are not relevant to the Hudson. However, shad species which do migrate though the Hudson show similar temperature responses to salmonids. For example the temperature preferences of American shad in Canada are characterised as follows:

> *"The American shad lives for several years at sea before returning to spawn in the stream or river where it hatched. Shad avoid cold temperatures, preferring to stay in water that is 8°C or warmer. Much of their migration and behaviour is determined by water temperature and currents. Each spring, schools of shad, using their sense of smell, begin to migrate up coastal rivers and tributaries when water temperatures reach 12°C. Spawning in the Maritimes occurs during June and July in water temperatures of 13-20°C. Migration stops in temperatures over 20°C."*
>
> Source http://www.gov.ns.ca/fish/sportfishing/species/shad.shtml

Almost all migratory fish are suspected of using temperature as a trigger to initiate migration. Once migrating, the degree to which they are responsive to temperatures they experience en route is more difficult to determine. However, it is clear that fish such as striped bass are sensitive to water temperature at almost all stages in their life-cycle, including both up-stream and down-stream migrants.

5.5. Heat Shock

Thermal issues are likely to become ever more important over the coming years as we are clearly following a warming trend in river temperature (see Figure 15). It is therefore complacent of Entergy to state on p 4-24:

> "*Entergy concludes that continued operation in the manner required by the current SPDES permit and the associated agreement to continue implementation of the fourth Consent Decree ensures that thermal impacts will satisfy the requirements of CWA 316(a) and will thus remain SMALL during the license renewal term.*"

It is appropriate for Entergy, when considering the future, to model scenarios with higher river temperatures than those observed in the recent past or even the present. We have not been presented with an analysis sufficient to prove that future thermal impacts will be small.

5.6. Thermal issues - Conclusions

The cooling water discharge is large and affects the receiving waters of the Hudson River. In recent years (2000 to 2007), the discharge temperature regularly exceeded 90°F and in summer frequently exceeded 100°F. A temperature exceeding 100°F will produce lethal conditions for aquatic life of all kinds, including algae, crustaceans and fish.

Indian Point's thermal discharge does not meet applicable thermal criteria. Furthermore, there is no mixing zone definition for Indian Point generating station discharges. The plume can spreads over a large proportion of the river.

There is an upward trend in the background temperature of the river, and a corresponding trend down in dissolved oxygen. This will result in increased harm from thermal pollution, if present levels of heat discharge continue into the future. Absolute temperatures of riverine heated effluents of 26°C (78°F) or more are potentially lethal to smelt and tomcod. The spatial and vertical extent of the Indian Point plume is sufficient to raise concerns about the passage of fish and impacts on the benthic life of the river.

Fish can perceive small differences in temperature, and show behavioural avoidance of even mildly stressful temperatures. However there are no data on the movement or migration of fish in the vicinity of the Indian Point plume. It is therefore not possible to quantify the effect of this discharge on fish movement or passage.

The changes in the flora and fauna of the Estuary indicate that it would be unwise to allow the statutory temperature limits to be exceeded.

Closed-cycle cooling, required under the draft SPDES permit for Indian Point. Under the closed-cycle cooling alternative, the amount of heat injected into the river would be greatly reduced, and thermal impacts would be confined to the discharge canal. Thus, closed-cycle cooling would likely eliminate thermal pollution concerns at Indian Point. We know of no alternative technology(s) that will result in equivalent protection for aquatic resources to the level which can be achieved by closed cycle cooling.

6. Critique of Entergy analysis given in Indian Point Energy Center Applicant's Environmental Report Operating License Renewal Stage

We discuss below the sections of the Environmental Report relevant to aquatic ecology.

6.1. Section 2.2 - Aquatic and Riparian Communities

This section starts with a standard description of the general physical environment. There can be no doubt that temperature issues (page 2-6) are becoming more important because of climate change. It was therefore notable that the report quotes average water temperatures between 1951 and 1997. This part of the report is therefore 10 years out of date. Further, there is no consideration at all of temperature trends over the last 50 years. Trends become important when considering the future impacts of the thermal plume. It is legitimate to ask how much higher the background temperature of the river is likely to get over the next 10 to 15 years and what effect this could have on the temperature of the plume.

In the section 2.2.2 - Plankton Communities, it is again apparent how out of date this document is. In the final paragraph of page 2-10 Entergy quote work on the phytoplanktonic species present in 1972. Given the large-scale changes in water quality since this time, such data cannot be considered reliable. As a general point, this document both relies on old data and notes the considerable changes that have occurred. The switch from using old data to stating that the system is under rapid change is not justified in the text. The viewpoint is picked for convenience to support their argument.

In the paragraph which follows, at the top of page 2-11, a reference is made to the 1972 FES. What is so striking is the complete lack of reference to the far more recent FEIS.

6.2. Section 2.2.3 - Macroinvertebrate Communities

Page 2-12 states:

> "*Recent studies have shown that the zebra mussel invasion is associated with a decline in open-water shad and herring (pelagic particle feeders), while the littoral fish such as sunfish (benthic feeders) have prospered [IES].*"

This type of statement is a standard way of asserting that declines in species are due to agents other than the power plants. It is an assertion without any underlying empirical or theoretical support.

There is another point of importance here. The zebra mussel is a filter feeder and is well know to radically change the ecosystems it invades. One of the first impacts is on the phytoplankton (which it consumes) and the zooplankton, which it affects by competing for their food. We therefore find here one of the classic inconsistencies that runs through this document, in that it quotes and uses data on the phytoplankton from the 1970s but notes that there have been major changes in the macro-invertebrates which feed on these phytoplankton. It is self-evident that if the zebra mussel has become abundant, then the phyto- and zooplankton must have changed. There are in fact studies which state exactly this. Below is an account of the recent

changes linked to zebra mussel. The important point to note is that zebra mussels have changed the system, and data pre-1992 are now of historical interest only.

6.2.1. The arrival of the Zebra mussel

Prior to 1992, the nutrient-rich Hudson River estuary supported abundant phytoplankton populations that constituted a ready food supply for large populations of freshwater zooplankton, including rotifers, cladocerans, and copepods, on a seasonal basis. The introduction and population explosion of zebra mussel (*Dreissena polymorpha*) has depleted the standing stock of phytoplankton and has impacted other components of the food chain. Benthic invertebrates are relatively abundant but the species diversity is low, primarily oligochaetes and chironomids.

In 1986, the Zebra mussel, an inhabitant of fresh and brackish Eurasian waters, arrived via the Great Lakes in the ballast water of ships. First seen in the Hudson at Catskill in May 1991, Zebra mussels now inhabit the Mohawk River and the Hudson River from Albany to Haverstraw Bay. Within little more than a year of their arrival the biomass of the mussels was greater than that of all other heterotrophic animals in the Hudson, and reached an estimated 550 billion individuals, at an average density of 4,000 / m^2 over the freshwater tidal river. A secondary estimate was that, as filter feeders, the mussel population could filter the entire volume of the freshwater Hudson in 1 to 3 days. Their presence poses a number of very considerable threats to the ecosystem of the Hudson:

- Zebra mussels tend to colonize on rocky substrates in shoal areas, replacing or smothering any existing community that is in these habitats. Taxa of particular concern include Unionid and Sphaeriid clams. They also out-compete native mussel species for food and space, leading to a decline in native mussel populations.
- Phytoplankton and detritus are major food sources for lake and river food webs. Excessive removal of the phytoplankton by zebra mussels reduces the zooplankton species that feed upon them and can result in fisheries-related impacts.
- Mussels can filter large amounts of water and reduce the available food in the water column. Their filtering activity increases water clarity and hence light penetration. This, too, can dramatically change the benthic community structure.
- Zebra mussels cause significant biofouling in water intakes. This requires higher levels of biocide to combat the problem and this could lead to secondary effects in relation to the biocide chemical being released in to the environment.

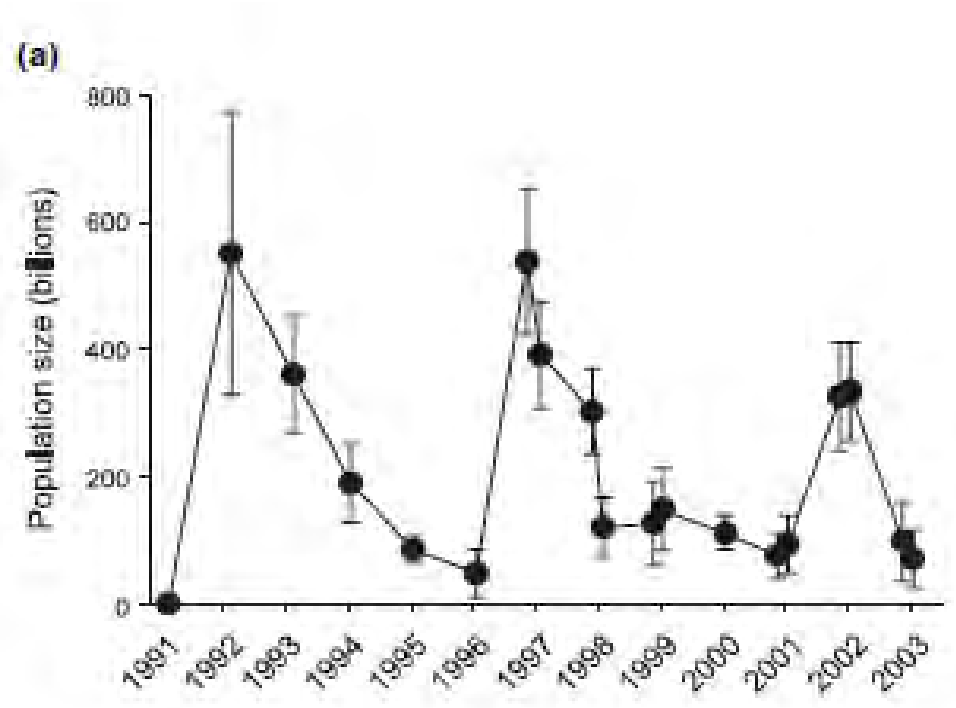

Figure 21: The estimated population of Zebra mussels in the Hudson (from Strayer and Malcom 2006).

Given their considerable numbers and their ecological effects, (lakes and rivers colonized by the mussels often see 50-75% declines in phytoplankton and small zooplankton biomass, rise in water clarity of 50-100%, drop of more than 50% in filter-feeding zooplankton and native bivalves, and increase in macrophyte beds and animals associated with mussels), it is inevitable that their presence will have a profound effect on the food web of the Hudson. This is illustrated in Figures 21a and 21b below (from Pisces Conservation, 2003), which represent a very simplified Hudson river food web, before and after the introduction of Zebra mussels. In Figure 21b, elements of the food web increased by the changes are shown in shades of magenta; and elements suffering a decrease in abundance or strength by shades of light blue.

Long-term reduction of zebra mussels by natural predators has yet to be demonstrated, but at least 17 species of North American fish have been documented to consume attached zebra mussels and quagga mussels (*Dreissena bugenis*). Additional species are likely to consume zebra mussels (particularly fish in the sturgeon, sucker, and catfish families), but cases remain undocumented. Although numerous and widespread, the efficacy of molluscivorous fish as a control mechanism for zebra mussels is unclear. However, zebra mussels are more susceptible to fish predation than native unionids or *Corbicula* spp. because *Dreissena* shells are weaker, adults are smaller in size, and most individuals are exposed to predators. (Kirk, *et al*, 2001).

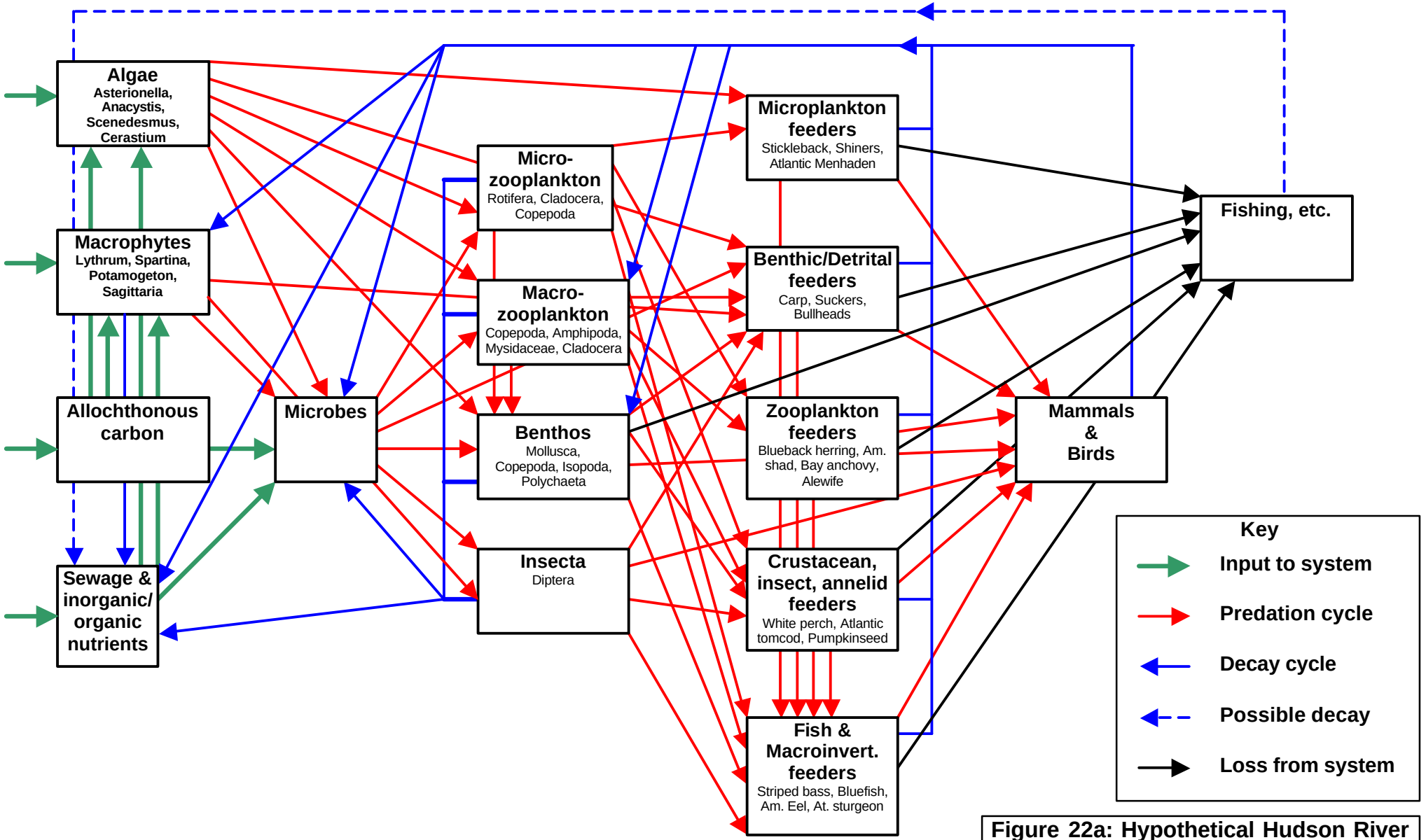

Figure 22a: Hypothetical Hudson River food chain, prior to invasion by Zebra mussel

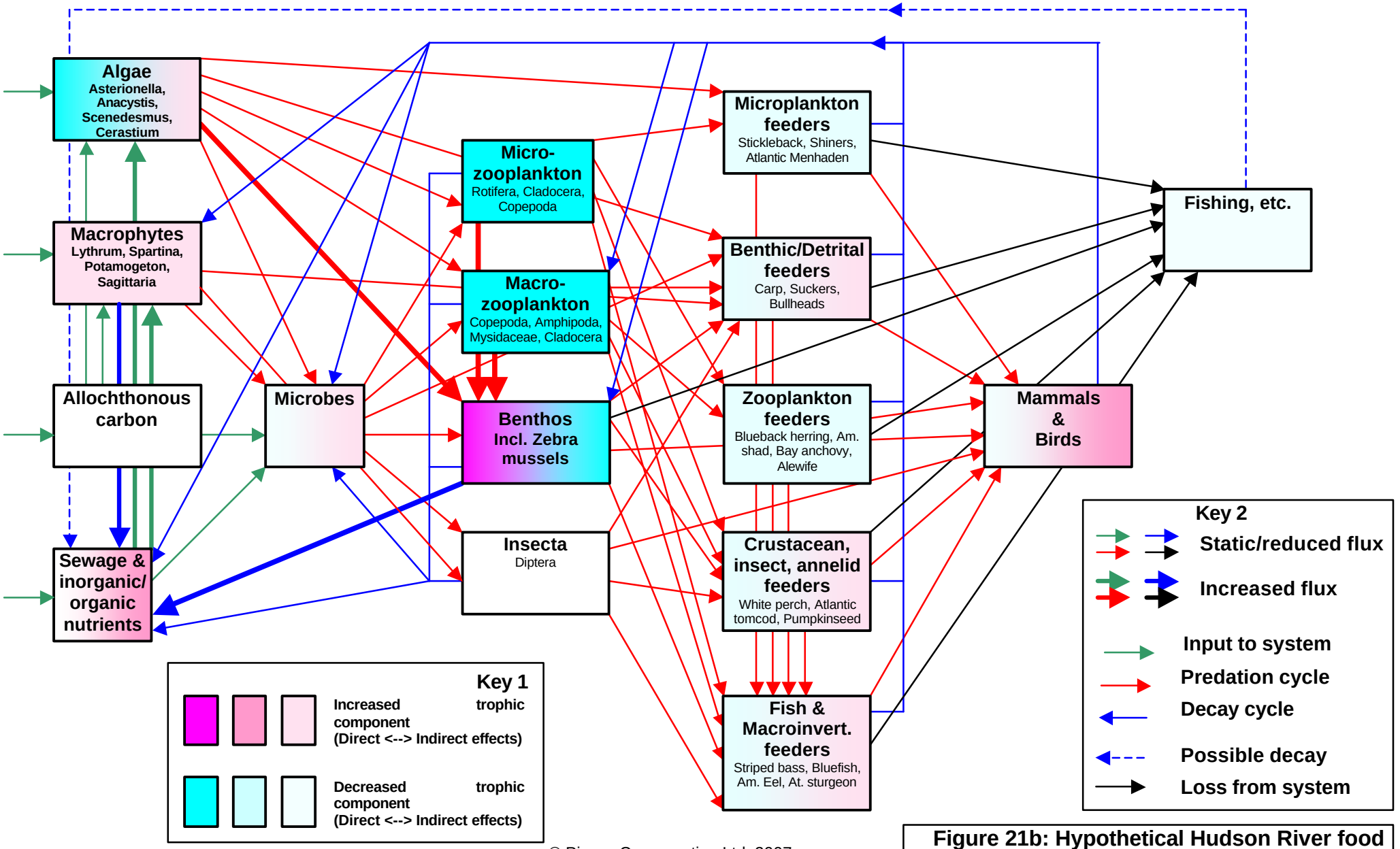

Figure 21b: Hypothetical Hudson River food chain, after invasion by Zebra mussel

6.3. Section 2.2.5 Fish Communities

This section is misleading. There is continued reference to the DEIS, and not the FEIS, and furthermore, there is almost no reference to data collected after 1997. This use of data more than 10 years old is unacceptable when more recent data have been collected and circulated.

For example, p 2-15 states: "*The DEIS emphasized an examination of long-term trends (1974-1997) primarily for the following two life stages of fish representative of impingement (YOY) and entrainment (PYSL).*"

There is an attempt to mislead on the health of fish populations. Yet again this is based on old data and carefully crafted statements. In fact, many species have been in decline. An example of a serious decline is Atlantic tomcod – there are many other species that have also declined. Below is a graph for tomcod abundance.

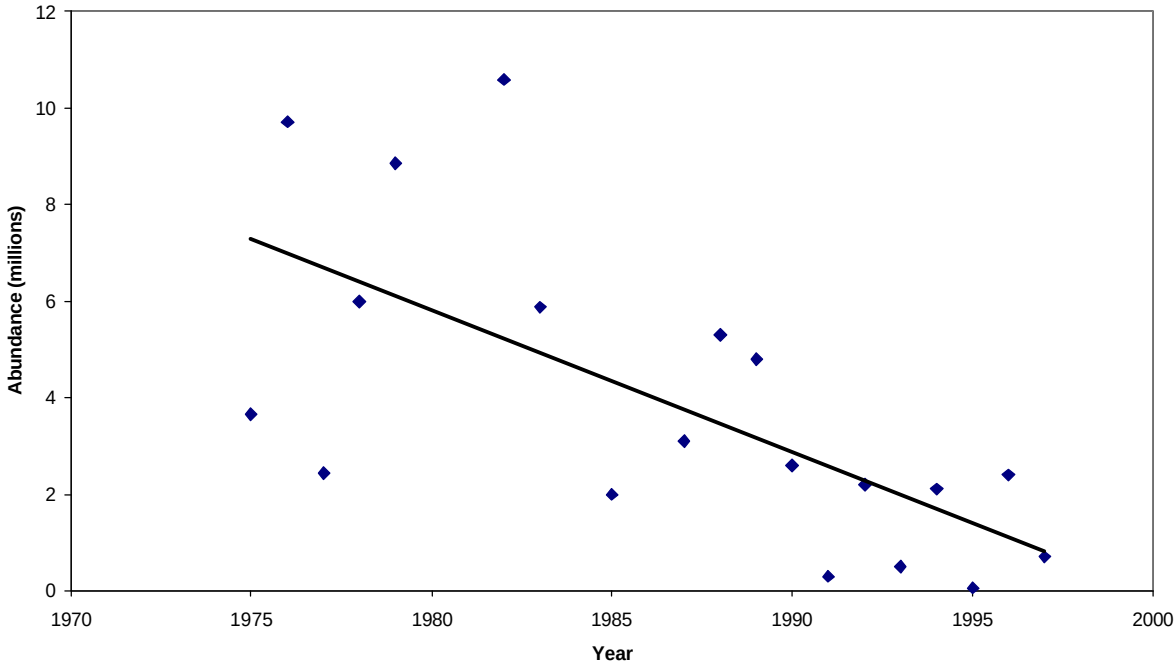

Figure 23: The change in estimated abundance of Atlantic tomcod at age 1. A linear regression has been fitted to the data to show the trend of declining number.

An example of a misleading statement of this type is on p 2-16:

> "*During the 24-year monitoring period from 1974 to 1997, species richness and overall abundance of PYSL increased in most areas of the estuary. Analysis of the long-term trends in the larval fish community in both the marine brackish regions and the freshwater zone revealed an overall increase in the total number of taxa collected. Increases in overall abundance were due to increases in the abundance of larval striped bass in all areas of the estuary and increases in the abundance of larval bay anchovy in brackish areas. [CHGEC, Section V.D.3.i]*"

When more recent work is quoted, no specifics are given, but rather general, misleading and inaccurate statements are made. For example at the bottom of 2-16:

> "*The recent 2004 annual year class report continues to confirm that the conclusions developed in the DEIS are still relevant and supported [ASA].*"

This statement is gives the reader the impression that the DEIS assertion that populations are healthy and flourishing is supported by recent studies. The opposite is in fact the case.

The fish community of the Hudson Estuary has been continuously changing since systematic recording began in the 1980s. There are clear indications both at the community and individual population level that the populations of fish in the estuary are becoming less stable and showing greater year to year variation in abundance. In the report on the status of fish population in the Hudson (Pisces Conservation 2007), of the 13 key species subject to intensive study, three species, striped bass, blue fish and spottail shiner have shown a trend of increasing abundance since the 1980s. The other 10 species have declined in abundance, some greatly. Apart from the species that have been intensively studied in the estuary many other important species of fish are also showing long-term declines in abundance. For example, the American eel has greatly declined.

There has been a recent increase in average water temperature and a decrease in dissolved oxygen levels. This may be influencing some of the changes observed, and will increase the impact of thermal discharges. All the evidence points to the Hudson ecosystem presently being in a state of change, with declining stability. Neither the ecosystem as a whole, nor many of the individual species populations, are in a healthy state.

6.4. Section 4.1 - Water Use Conflicts

When considering entrainment there is clearly an attempt to justify once through cooling. On p 4-13 appears a typical statement:

> "*The results of the studies performed from 1974 to 1997, the period of time covered in the DEIS, are referenced and summarized in the DEIS, and have not shown any negative trend in overall aquatic river species populations attributable to plant operations.*"

The important point to note is the phrase "*attributable to plant operations*". There have been many negative trends in aquatic life, but rather than address these issues, they avoid them by simply claiming they are not attributable to the plant. It is clear that species losses are multi-factorial. If more are killed than are produced, then the population of an animal will decline. When this happens, every unnatural activity that is contributing to the mortality must take on some of the responsibility. Further, those that kill the most must take on more of the responsibility. Indian Point kills members of the species that are in decline so it must bear some guilt; since it kills more than most other agents, it must bear a high proportion of the guilt and the responsibility for remedial action.

Exactly the same approach is taken with respect to impingement. On p 4-19 it is stated:

"*Therefore, withdrawal of water from the Hudson River for the purposes of once-through cooling at the site does not have any demonstrable negative effect on representative Hudson River fish populations, nor does it warrant further mitigation measures.*"

This is an extraordinary statement, and contradicts the conclusions of the FEIS that the system and many of its fish are in serious trouble. Species such as the American shad are demonstrably in decline. These declines are clearly because the fish have been unable to produce sufficient young to replace the dying adults. It is known that fish are killed by Indian Point, yet the declines are held to be nothing to do with the station.

7. Discussion

Indian Point has the largest water intakes and discharges on the Hudson. It is known that it killed billions of fish by entrainment and hundreds of thousands by impingement when these were last measured in the 1980s. Since then the ecology of the Estuary has altered, with many species showing large changes in abundance.

Quantifying the impact of entrainment and impingement at Indian Point by simply looking at the numbers of fish killed is not fully quantifying the effect. NYSDEC's position in the FEIS is that the fish kills at a power plant cannot be compared to selective cropping (i.e. removal by fishing or hunting). Instead of one or two species being affected, the entire community is impacted. Indeed, even the thermal impact can be considered in this way. NYSDEC state:

> *These "once-through cooling" power plants do not selectively harvest individual species. Rather, impingement and entrainment and warming of the water impact the entire community of organisms that inhabit the water column.*
>
> *For example, these impacts diminish a portion of the forage base for each species that consumes plankton (drifting organisms in the water column) or nekton (mobile organisms swimming through the water column) so there is less food available for the survivors. In an intact ecosystem, these organisms serve as compact packets of nutrients and energy, with each trophic (food chain) level serving to capture a diffuse resource and make it more concentrated. Ichthyoplankton (fish eggs, larvae and very small fish which drift in the water column) and small fish feed on a base of zooplankton (drifting animal life) and phytoplankton (drifting plant life). The loss of these small organisms in the natural community may be a factor that leads to harmful algal blooms. The small fish themselves serve as forage for the young of larger species, which serve as forage for larger individuals, and so on up the food chain, more correctly understood as a "trophic pyramid".*
>
> *Once-through cooling mortality "short-circuits" the trophic pyramid and compromises the health of the natural community. For example, while an individual bay anchovy might ordinarily serve as food for a juvenile striped bass or even for a common tern, entrainment and passage through a power plant's cooling system would render it useful only as food to lower trophic level organisms. It could no longer provide its other ecosystem functions of consuming phytoplankton, digesting and concentrating it into its tissues, and ranging over a wide area,*

> *distributing other nutrients as manure. This is just a single example from a very complex natural system, where the same basic impact is multiplied millions of times over more than one hundred fish species.* (FEIS page 53-54.)

When considering all aspects of the impact of Indian Point on the aquatic ecology of the Hudson estuary, the reliance by Entergy on old data in their recent reports results in an inadequate quantification of the impact that Indian Point currently has on the aquatic environment. Further, the use of such old analyses to project into the future would be a serious error.

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COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 4

FINAL ENVIRONMENTAL IMPACT STATEMENT

By the

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

As Lead Agency

Concerning the
Applications to Renew

NEW YORK
STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM
(SPDES) PERMITS

For the

ROSETON 1 & 2, BOWLINE 1 & 2
AND INDIAN POINT 2 & 3
STEAM ELECTRIC GENERATING STATIONS,
ORANGE, ROCKLAND AND WESTCHESTER COUNTIES

HUDSON RIVER POWER PLANTS FEIS

Accepted:
June 25, 2003

Prepared by NYS Department of Environmental Conservation

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Final Environmental Impact Statement
for SPDES Permit Renewals at
Roseton 1 & 2, Bowline 1 & 2
And Indian Point 2 & 3
Steam Electric Generating Stations

This Final Environmental Impact Statement (FEIS) consists of multiple sections:

- The fundamental underlying data and studies are contained in the 1999 DEIS, which is incorporated as part of this FEIS. The 1999 DEIS contains an extended description of the environmental setting, which is not duplicated in this FEIS.
- An Executive Summary immediately follows the Table of Contents.
- The first section following the Executive Summary of this FEIS is a discussion of the regulatory setting for and history of the proposed action which updates and augments the materials in the DEIS.
- The next section of this FEIS is a table in which all public comments received by the Department on the DEIS are excerpted and summarized. A list of all commentors is provided at the end of the table. The full texts of all comments received by the Department are included in Appendix F-I.
- The Department's responses to public comments complete the FEIS. In the interest of responding most effectively to the submitted comments, Department staff grouped the comments under related themes and responded to each theme.
- In addition to the public comments, other appendices provide background reports and reference materials that may not be readily available to readers.

FINAL ENVIRONMENTAL IMPACT STATEMENT

NEW YORK
STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

For the ROSETON 1 & 2, BOWLINE 1 & 2, and INDIAN POINT 2 & 3
STEAM ELECTRIC GENERATING STATIONS

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Please note that appendices are not available on the website. However, you may request one or more of the appendices by contacting Betty Ann Hughes at bahughes@gw.dec.state.ny.us.

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EXECUTIVE SUMMARY

The action before the New York State Department of Environmental Conservation (Department) is the decision whether to renew State Pollutant Discharge Elimination System (SPDES) permits which would allow three steam electric generating stations to discharge waste heat, a pollutant, to the waters of the Hudson River; the permits would also allow the facilities to continue to withdraw water from the Hudson River for use as cooling water. The three facilities are:

- Bowline Point (Units 1 and 2), West Haverstraw, Rockland County;
- Indian Point (Units 2 and 3), Buchanan, Westchester County; and
- Roseton (Units 1 and 2), Newburgh, Orange County

(*See* Figure 1 in main text for general locations of all 3 facilities).

In December 1999, the owners and operators of the three facilities submitted a Draft Environmental Impact Statement (DEIS) to the Department which assessed the resources likely to be impacted by the facilities; evaluated alternative technologies and management strategies to mitigate impacts from each facility's operations; and proposed a preferred action intended to reduce the respective impacts. In March 2000, the Department accepted the DEIS for purposes of review and subsequently issued a Notice of Complete Application in the Environmental Notice Bulletin and in newspapers in the vicinity of each facility.

Department staff have further reviewed the DEIS and conclude that, while it was acceptable as an initial evaluation and assessment, it is not sufficient to stand as the final document, and additional information as to alternatives and evaluation of impacts must be considered. These considerations have been undertaken by Department staff to develop a final environmental impact assessment. This Final Environmental Impact Statement (FEIS) consists of the original DEIS submitted by the facilities' operators; comments received on the DEIS; the Department's responses to those comments, with similar comments grouped for response purposes; plus expanded discussions of the regulatory setting and alternatives for mitigation of impacts from the operation of the HRSA plants.

The Hudson River is rich with aquatic life, providing habitat for the early, sub-adult, and adult life stages of many aquatic species, including a number of game, commercial, and forage fish species. The Department's regulatory role includes limiting thermal discharges from each facility to ensure the survival of aquatic resources and also preventing aquatic organism mortality

resulting from impingement and entrainment at each facility's cooling water intake structure (CWIS).[1]

To illustrate the magnitude of impacts of entrainment, Table 1 (below) uses data from the DEIS to calculate the average annual number of organisms of six of the fish species entrained by the three facilities.[2] If one assumes that all entrained fish die, as does the United States Environmental Protection Agency (USEPA) in its proposed rulemaking for cooling water intakes, then the total number of fish entrained is equal to total mortality from entrainment.[3]

Table 1. Estimated Average Numbers of Selected Fish Species Entrained Annually at Roseton, Indian Point, and Bowline Stations, Based on In-plant Abundance Sampling, 1981-1987.[4]

Plant / Species	Roseton	Indian Point	Bowline	Total
American Shad	3,128,571	13,380,000	346,667	16,855,238
Bay Anchovy	1,892,500	326,666,667	81,000,000	409,559,167
River Herring[5]	345,714,286	466,666,667	13,814,286	826,195,238

[1] Entrainment occurs when small aquatic life forms are carried into and through the cooling system as water is withdrawn for use in a plant's cooling system; impingement occurs when larger aquatic life forms are caught against racks or screens at the intakes, where they may be trapped by the force of the water, suffocate or be otherwise injured.

[2] DEIS Appendix VI-1-D-2, "Estimated Total Number of Fish Entrained", and DEIS Appendix VI-1-D-1, "Estimated Number of Fish Killed Due to Entrainment", (both utilizing generator estimates of through-plant survival), and calculating the mean mortality over the years presented for each species at each facility.

[3] National Pollutant Discharge Elimination System - Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities. USEPA Docket No. OW-2002-0049; *see* 67 FR 17122.

[4] Figures are absolute numbers of entrainable life stages, including eggs, yolk-sac larvae, post-yolk-sac larvae, and some juveniles, of the species studied.

[5] "River Herring" includes both Blueback Herring and Alewife, which are difficult to differentiate in their early life stages. It does not include other herring species like shad.

Striped Bass	129,857,143	158,000,000	15,571,429	303,428,571
White Perch	211,428,571	243,333,333	13,257,143	468,019,048
Atlantic Tomcod[6]	No Data This Study	No Data This Study	No Data This Study	No Data This Study
Total	692,021,071	1,208,046,667	123,989,524	2,024,057,262

The generators attempted to estimate through-plant survival, and using those adjustments, the calculations result in a slightly lower number of fish killed by entrainment mortality, as shown in Table 2 (below).

Table 2. Estimated Annual Entrainment Mortality of Six Fish Species at Roseton, Indian Point, and Bowline Stations, Using Generator Estimates of Through-plant Survival.

Plant / Species	Roseton	Indian Point	Bowline	Total
American Shad	2,500,000	10,640,000	281,667	13,421,667
Bay Anchovy	1,892,500	326,666,667	78,285,714	406,844,881
River Herring	277,142,857	371,666,667	11,085,714	659,895,238
Striped Bass	40,428,571	46,500,000	4,671,429	91,600,000
White Perch	130,000,000	138,666,667	8,071,429	276,738,095
Atlantic Tomcod	No Data This Study	No Data This Study	No Data This Study	No Data This Study
Total	451,963,929	894,140,000	102,395,952	1,448,499,881

[6] No numbers are available for Atlantic tomcod because, for the source study, no collections were made during the early part of the season when Atlantic tomcod entrainment and mortality would be a serious issue.

Based on data presented in the DEIS and analyses in that and in this FEIS, Department staff conclude that the generators' estimates represent the lower boundary of the actual mortality range, that is, the actual mortality lies somewhere between the generators' number (low end) and 100% (upper end, all entrained organisms die). Later sections of this FEIS discuss the significance of entrainment mortality; other impacts of continued operation of the HRSA generating stations, including thermal impacts; and potential control or mitigation measures.

As a result of the Department's further review of the DEIS plus the additional information and analysis provided by staff, a draft permit can be developed for each facility. Each draft permit will be based on this FEIS together with a detailed, site-specific application for that station and will contain a decision on the "best technology available" (BTA) to minimize entrainment and impingement mortality at that station. These BTA decisions are required by §316(b) of the federal Clean Water Act.[7] Supplemental application materials relating to existing facilities and system designs are still necessary for each site. An individual draft permit will be issued for each site, but in general terms, each permit will require the covered facility to meet BTA by designating, as SPDES permit conditions, a compliance schedule to implement one or more of the technologies now available to substantially reduce entrainment and impingement mortalities from the cooling water intake at that station.

[7] 33 U.S.C. §§ 1251 - 1376

PROPOSED ACTION

The action before the New York State (NYS) Department of Environmental Conservation (Department) is the decision whether to renew State Pollutant Discharge Elimination System (SPDES) permits which would allow three steam electric generating stations to discharge pollutants, including waste heat, to the waters of the Hudson River. The permits, if renewed, would also allow the continued withdrawal of water from the Hudson River to be used as cooling water. The three facilities are:

- Bowline Point (Units 1 and 2), West Haverstraw, Rockland County;
- Indian Point (Units 2 and 3), Buchanan, Westchester County; and
- Roseton (Units 1 and 2), Newburgh, Orange County.

Figure 1, on the following page, shows the location of the three generating stations

PUBLIC COMMENT SUMMARY

Table 3 (following pages) presents a summary of comments received on the 1999 DEIS, both in writing and orally, at the June 8, 2000, legislative hearing. Comments addressing similar themes are grouped together. The final page of this summary contains a list of all commentors with a key to name abbreviations. Full texts of all written comments plus the hearing transcripts are attached in Appendix F-I.

Table 3. Summary of Public Comments Received on DEIS[111]

TOPIC ⇓	PUBLIC COMMENTS
FISH POPULATIONS	
1. "Cropping" (that, is, consumption of some portion of one or more populations) by power plants is not a legitimate use of NYS's fisheries and other aquatic resources.	EA: continued operation of plants at current levels of entrainment and impingement are inconsistent with prior NYS statements that power plants should not "crop" fish stocks NMFS: alternatives discussion weakened by presumption that "cropping" aquatic resources by power plants is acceptable Riverkeeper: DEIS provides no basis for concluding that mitigation measures should be accepted instead of closed-cycle cooling - technology and policy have advanced to point where [continued] fish mortality at power plants is an unnecessary anachronism
2. Many species in the Hudson River system are actually declining. While the striped bass (SB) population is up, that increase may be the result of other management decisions and activities. Historic baseline or trend data not substantially discussed.	EA: some fish stocks actually showing declines - utilities' own data shows substantially reduced year classes and abundance for several species PISCES: DEIS seriously underestimates potential impacts on bay anchovy, especially early in season Riverkeeper: DEIS assessment of health of populations and estuary "overly sanguine" - system actually far from equilibrium with several species in decline; shad and tomcod deserve "more sober assessment" of current low levels Scenic: plants have killed billions of fish over last 20 years; evidence of long-term declines

[111] A list of all commentors and abbreviations is included at the end of this table.

TOPIC ⇓	PUBLIC COMMENTS
3. Several commentors question one or more of the assumptions used in one or more of the population models; in particular, density-dependence is unproven.	DEC (@ hearing): accepting DEIS for comment doesn't mean agency agrees with it EA: concur with Riverkeeper's conclusion that assumptions for models are flawed so underestimate impacts of plants on Hudson River fish; because analyses do not include pre-power plant conditions, no basis for saying plants have not changed conditions PISCES: large changes in fish species abundance over time plus small decrease in total species richness/diversity suggest that Hudson estuary far from equilibrium; density-dependence unproven, and in SB probably causes serious understatement of importance of numbers of fish killed; by assuming density-dependence and not considering other factors, models ignore disproportionate impacts of reductions in strong year classes Riverkeeper: model does not accurately represent impacts of entrainment so should not be basis for decisions; does not account for year-to-year variability in year class strength; models force-fit some data, with biased or unsupportable conclusions
4. Climate, disease, and the changing ecology of the Hudson River system are not considered in the population models	ASA: 20+ years of studies and data are represented in the DEIS DEC (@ hearing): accepting DEIS for comment doesn't mean agency agrees with it Jacobs - M: cites Croton Landfill cleanup NMFS: SB analyses neglect other factors in assessing current abundance - need to take a wider view Riverkeeper: their experts conclude that the DEIS 'contains a naive ecological analysis which completely ignores the role of climate and disease in determining population'
5. Thermal analyses need to be updated to reflect recent, more extreme conditions	PISCES: use of 1981 thermal data for far-field model may seriously underestimate thermal impacts Riverkeeper: thermal model based on older data so don't reflect extreme summer conditions of later years; DEIS does not address general warming in Hudson estuary

TOPIC ⇓	PUBLIC COMMENTS
FISH PROTECTION POINTS	
6. Fish protection points (FPP) would provide operational flexibility but even less protection than conditions in the Hudson River Settlement Agreement (HRSA)	ASA: existing technologies at all 3 plants plus proposed operating schemes would achieve future fish protection levels similar to those required in last 20 years DEC (@ hearing): accepting DEIS for comment doesn't mean agency agrees with it EA: HRSA levels not sufficient level of protection; FPP likely to lead to larger fish kills so is not sound approach NMFS: FPP are comparable to HRSA standards, but those standards were only intended to be interim and should not now be considered as meeting objectives of the Clean Water Act (CWA); should be looking to "... build[s] on the prior successes rather than simply taking advantage of them" NRDC: DEIS scheme would weaken fish protection in Hudson PISCES: FPP appear designed more to benefit power plants than fish and may result in increased entrainment and impingement mortality; "banking" between years could lead to excessive population impact if critical year classes hit by disproportionate entrainment Riverkeeper: their experts conclude that FPP system is really just a way to trade credits and has "serious weakness and seems designed to aid power plant profitability rather than to protect fish"; could actually result in greater harm being inflicted on fish populations, for example, trading credits among years could lead to devastating impacts on strong year classes; represents an extreme initial negotiating position Scenic: concur with NRDC & Riverkeeper; continuation of Settlement Agreement conditions not acceptable objective; DEIS scheme would weaken fish protection in Hudson

TOPIC ⇓	PUBLIC COMMENTS
MITIGATION	
7. DEIS includes little information on acoustic deterrence and barrier systems.	PISCES: insufficient information on acoustic deterrents
8. DEIS significantly overstates costs and energy impacts of closed cycle cooling	NRDC: have changed opposition to cooling towers with changes in technology since the 1970's NYRU: cooling tower analyses should include more analysis of their potential environmental impacts Riverkeeper: cooling technology changes have eliminated prior objections to towers

TOPIC ⇓	PUBLIC COMMENTS
9. DEIS alternatives and proposed action do not present a fair picture of available alternatives	ASA: once-through with protection measures best balance of all interests CHV: tragedy to allow continued killing of billions of fish by antiquated cooling technologies; require plants to be brought up to modern standards COE: look at boom in Tompkins Cove DEC (@ hearing): accepting DEIS for comment doesn't mean agency agrees with it; draft permits and supporting documents will consider multiple alternative technologies Downs: plants should get on schedule to either convert to dry cooling or close NMFS: alternatives discussion weakened by presumption that "cropping" aquatic resources by power plants is acceptable; accepting these proposals would not meet CWA obligation to protect public trust resources NYRU: Gunderboom ® should be included in DEIS; incorporate results of river flow pattern research into mitigation alternatives; restoration projects must be regional in scope and on same scale as impact PISCES: insufficient treatment of barriers Riverkeeper: their experts conclude that the DEIS "constructs an argument in favor of the lack of impact ..."; DEIS provides no basis for concluding that mitigation measures should be accepted instead of closed-cycle cooling - technology and policy have advanced to point where [continued] fish mortality at power plants is an unnecessary anachronism Scenic: DEIS does not consider pre-plant conditions; permits should require closed-cycle or 32-week outages

TOPIC ⇓	PUBLIC COMMENTS
OTHER TOPICS	
10. The DEIS needs to consider effects of New York's recent conversion to a competitive energy market, take the State Energy Plan into account, or impose parity among facilities.	Downs: if permits create easier standards for older plants, competitive market will not shift generation to newer, less-impacting plants EA: conversion to market system means there will be pressures to run as much as possible so imperative that renewal permits include conditions "highly protective of Hudson River fish ..."; in deregulated market, there would be increased incentive for these plants to run in preference to newer, more protective units unless these plants are compelled to retrofit to closed-cycle or shut down Gordon/Kennedy/Lee: competitive market increases urgency to impose environmental controls on older facilities NRDC: should be parity of permit conditions between these "old" and newer plants on Hudson; look to Athens decision for model; need to now move rapidly to final decision NYRU: outages or reduced operations can be "alternatives to reduce cooling water use", but deregulated market may make harder to control or achieve so should factor that uncertainty into permit terms or conditions Riverkeeper: need to follow Athens decision model and truly minimize impacts

TOPIC ⇓	PUBLIC COMMENTS
11. Radiation discharges are not discussed in the DEIS, but should be.	Baiman: history of radiation discharges causes multiple concerns (cites NYS Health Department reports); should shut down all the nuclear plants EA: submitted NYS Health Department radiation survey numbers Elie: [DEIS] should consider radiation Gabrielle: wants more information on radiation impacts especially on reservoirs; do not renew Indian Point permits Jacobs - B: monitoring of leak from Indian Point 1 should be included in this permit Jacobs-M: EIS needs to consider radioactive discharges, including results of monitoring reports from NYS Department of Health which show increased levels in summer; renewals should prohibit all pollutant discharges Likes: concerned that any radioactive release is permissible; prefer that plants be closed; actual discharge should be monitored for radioactivity Schepart: should consider reports by NYS DOH on radiation levels in Hudson - records show radiation discharges in excess of health limits; should include radiological limits in new permits Weinstein: look at radioactive discharges and chemicals used in piping system

TOPIC ⇓	PUBLIC COMMENTS
12. Several commentors expressed generalized opposition to renewal for one or more facilities	Carlin: downwind - close Indian Point Downs: ironic to be looking at continuation of these withdrawals in face of Athens decision Goodman: do not permit Indian Point Jacobs - S: evacuation plans appear inadequate; laws should be fully enforced Jordan: don't renew Indian Point - poorly maintained facilities should be shut down Mirabito: do not issue permits Moon: concerns with Indian Point plant safety (radiation leaks, old equipment); shut the plant down Nelson-Epstein: close Indian Point Riverkeeper: 10-year SPDES permit term as proposed in DEIS would be illegal; thermal discharges, at least at Indian Point, do not meet water quality standards so should not renew permit(s) Scenic: power plant entrainment & impingement not a valid use of resources; 10-year permit would be illegal Smallev: move from unconscionably hazardous energy sources; shut plants down Wren: oppose nuclear power so don't renew Indian Point permit

List of Commentors

Oral Comments

Benas, Richard (DEC) for NYS Department of Environmental Conservation
Clempner, Jean
Downs, Roger with Susquehanna shad restoration project
Elie, Marilyn of Westchester Citizens Awareness Network
Gabrielle, Susan
Hudson Riverkeeper (Riverkeeper) by David Gordon, Esq.
Jacobs, Barbara
Jacobs, Mark of Westchester Greens and of WESTPAC (Westchester People's Action Coalition)
Jacobs, Stanley
Kennedy, Katherine for Natural Resources Defense Council (NRDC)
Lee, Cara for Scenic Hudson (Scenic)
Likes, Philip
Moon, Dan
Schepart, Margo of Westchester Citizens Awareness Network
Smallev, Jillian [phonetic sp, from transcript]
Weinstein, Lucille
Young, John (ASA) for generators/utilities

Written Comments

Baiman, Sydney
Carlin, Lynne
Citizens for the Hudson Valley (CHV) by Dimitri Sevastopoulo
Environmental Advocates (EA) by Kyle Rabin
Gabrielle, Susan
Goodman, Sidney J.
Hudson Riverkeeper (Riverkeeper) by David Gordon, Esq.
Jacobs, Mark of Westchester Greens and of WESTPAC (Westchester People's Action Coalition)
Jordan, John of Catskill Alliance for Peace
Likes, Philip
Mirabito, Stephen
National Marine Fisheries Service (NMFS), by Michael Ludwig
Natural Resources Defense Council (NRDC) by Katherine Kennedy
Nelson-Epstein, David
New York Rivers United (NYRU) by Ivan Vamos
PISCES Conservation Ltd (PISCES) by Peter Henderson, Ph.D., for Riverkeeper, Scenic Hudson, and Natural Resources Defense Council
Scenic Hudson (Scenic) by Cara Lee
Schepart, Margo
U. S. Army Corps of Engineers (COE), by Richard L. Turner
Wyler, Megan

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RESPONSES TO COMMENTS

Consolidated responses follow to each of the comment themes identified in Table 3 (preceding). Each topical response is considered to reply to all of the comments identified within that theme group.

Fish Populations - 1. "Cropping" (that, is, consumption of some portion of one or more populations) by power plants is not a legitimate use of NYS's fisheries and other aquatic resources.

Some commentors have suggested that fish populations should not be "cropped" by power plants. In other words, they object to any argument that electric generating facilities be permitted to cause injury or death to any life stages of fish and other aquatic organisms, provided only that specified populations of adult fish of selected species be maintained.

The Department agrees that fish should not be "cropped" by power plants. Instead, the Department asserts, and is supported through statute, regulation, policy and practice, that it is in the public interest to minimize the loss of fish and other aquatic resources at electricity generation facilities. The Department further asserts that significant impacts to aquatic resources are not an inevitable result of electric power generation.

The mission of the Department is to provide for the best uses of the State's waters and of its fish and wildlife resources. These resources belong to the people of the State and are held in trust for the use and enjoyment of current and future generations of New Yorkers. The Department's obligations regarding fish and wildlife are described in ECL Articles 11 and 13; its obligations regarding the waters of the State are described in ECL Articles 15 and 17. (*See also* FEIS Regulatory Setting - Legislative Findings and Commissioner's Powers.)

The State's fish and wildlife

Fish and wildlife are the property of the State but numerous uses of fish and wildlife which result in their deaths are permitted. Recreational and commercial fishing, hunting, trapping, scientific collection, and relief from nuisance or damage are examples. In each instance, the permissible methods of take are defined explicitly in statute or regulation.

Fishing, hunting, trapping and scientific collection are highly regulated. The species, age (or its surrogate, size) and sometimes even the sex of the animal to be taken are specified. The time of year is also determined for most species of game, through "open seasons." Generally, breeding seasons are avoided and the "crop" of fish or wildlife is made available to its human consumers when populations are highest or the values in flesh or fur are at their peaks. In order to ensure that populations are

not over-exploited, populations are monitored, either directly or indirectly. At a minimum, the goal of management for such harvested species is to ensure sustainable populations.

Similar considerations apply when permitting the destruction of wildlife which pose a threat to human safety or property. Generally, the taking of such wildlife is permitted either as a last resort or where the magnitude of the take is believed to be insignificant to the species' population or its ecological function.

That fish should not be wasted as a part of energy production was made clear by former Commissioner Jorling, in 1991 letters to the generators, in which he stated:

> "The inadvertent mortality of fish by utilities is not a legitimate use of fishery resources. Therefore, the Department will not allocate a portion of fishing mortality to utilities and will seek elimination if possible, and otherwise minimization, of mortality caused by utilities...".[112]

The State's waters

The waters of New York, too, are the property of the State. Numerous uses are recognized and permitted. New York's waters are used for human consumption, recreation, agriculture, industry, commerce, navigation, and as habitat for fish and wildlife. New York State laws and regulations recognize these uses and provide a regulatory framework which ensures that water quality is maintained at levels which can support particular uses. Generally, the "cleaner" waters are classified for those activities which require the highest water quality, such as for drinking. The goal of the regulatory program is to maintain or improve water quality to enable the designated "best usage."[113]

The waters near the Hudson River plants have been classified as either Class A, B, C, SB, or SC. Each of these classifications has "fishing" as at least one of the designated best use(s). Each also includes the condition that, "... These waters shall be suitable for fish propagation and survival ...".

Historically, the water classification system recognized industrial cooling and process water as "best usages" for Class D water supplies. The listing of these activities as "best usages" was removed by amendments to the regulations prior to 1972. Currently, the least protective designation in NYS is Class D. In fresh surface waters, the best usage of even Class D waters is fishing and the waters must be "... suitable for fish survival ...". [114]

If a water cannot achieve the usages for which it has been designated, it is deemed to be impacted. Pursuant to § 305(b) of the CWA, the Department biennially publishes a report on the State's water quality which, among other things, describes

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[112] Copies of letters in Appendix F-V.

[113] 6 NYCRR Parts 800 - 941.

[114] *See* 6 NYCRR § 701.9

such impairments.[115] The NYS Water Quality Report for 2002 lists the Hudson River downstream from the federal dam at Troy as being impacted by cooling water use by power plants. As discussed more thoroughly below and in several other responses, the effects of the use of Hudson River water for generating plant cooling include the loss each year of a substantial percentage of annual fish propagation. Under alternative density-dependent hypotheses, maximum sustainable yield of shad could double if entrainment mortality at all generation facilities was eliminated.[116] Thus, current levels of impingement and entrainment impair and may preclude the best usage components of propagation and survival. The thermal effects of power plants on Atlantic tomcod and rainbow smelt also appear to preclude or impair fish survival.[117]

Ecosystem values

Numerous public agencies have formally recognized the especially significant values of the Hudson's fisheries. For example, the NMFS has designated the Hudson an Essential Fish Habitat, in recognition of the role it plays in maintaining 34 commercially important fish species. The National Oceanic and Atmospheric Administration has designated four sections, Piermont Marsh, Iona Island, Tivoli Bays and Stockport Flats, as a National Estuarine Research Reserve. NYS Department of State has designated 41 sections of the Hudson as significant tidal habitat, and the USFWS has recognized a number of regionally significant habitats along the River, including Papscanee Marsh, Vosburg Swamp and the Esopus Estuary.

Impacts on the aquatic community

Hudson River fish populations have been studied both intensively and extensively. Survival and mortality investigations have been conducted over long periods of time to measure the impacts, primarily mechanical and thermal, of the power plants on particular fish populations. Although the DEIS asserts that the generating facilities have caused no harm to the aquatic community, numerous findings suggest otherwise. Henderson and Seaby (2000) summarize the differing views:

> "The DEIS concludes that there is no evidence of community change that can be attributed to the power stations. 'While changes in the composition and abundance of this fish community have been observed,

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[115] CWA § 305(b); 33 U.S.C. § 1315.

[116] Deriso, R., K. Hattala & A. Kahnle, 2000. Hudson River Shad Assessment and Equilibrium Calculations: Revision of the 1995 Report to include data through 1997. *In*: ESSA Technologies, Ltd. 2000. Review of the Draft Environmental Impact Statement for SPDES Permits for the Bowline Point 1 & 2, Indian Point 2 & 3, and Roseton 1 & 2 Steam Electric Generating Stations. Report to the Parties to the Application. Prepared by ESSA Technologies, Ltd., Richmond Hill, ON, for NYSDEC, Albany, N.Y. 31 pp. plus appendices.

[117] *See* Atlantic Tomcod and Rainbow Smelt discussions under response 4 in this section of the FEIS.

all appear attributable to factors other than power plant operations.' (VI-36) Second, a key conclusion in the DEIS is that the Hudson ecosystem is healthy. For example, the DEIS states: 'The relatively large number of taxonomic groups collected in these surveys as post yolk-sac larvae demonstrates that the Estuary is a species rich environment and is consistent with the Hudson being [a] healthy ecosystem.' (V-159). The conclusion relies on no particular measure of ecological quality and probably represents a simplistic assumption that because there are many fish present it must still be in good health. This observation would be more convincing if it considered how many species would be expected in the estuary in a completely natural state.

...

"From these observations it is concluded that: 'the fish community in the system remains healthy and robust' ([1999 DEIS] Section VI page 36). All the observed changes are attributable to causes other than those linked to the operation of power plant[s] including, water chestnut growth, zebra mussel invasion, changes in commercial fishing, increases in salinity and improved water quality in New York harbour.

"The available facts can be interpreted differently. The following account better reflects the available data.

"Large temporal changes in fish species abundance together with a small decrease in total species richness and diversity suggest that the Hudson estuary ecosystem is far from equilibrium. There is a small long-term decline in both species richness and diversity within the fish community. These losses are not confined to rare or infrequent visitors. A number of common or once abundant fish have long-term trends of declining abundance including tomcod, Atlantic sturgeon, bluefish, weakfish, rainbow smelt, white perch and white catfish. The rate of decrease in abundance of a number of these species is in their [sic] range of 5-8% per annum. If these trends were to continue, they will quickly result in profound changes in the fish community.

"Since the improvement in water quality in New York harbour [from sewage treatment plant completion], blue crab, Atlantic silversides and striped bass have increased in abundance. In the case of striped bass this is probably related to a decrease in fishing pressure as well as increased habitat for juveniles at the mouth of the estuary. The power stations can affect the fish populations by increasing mortality, principally via entrainment, so that the populations are no longer able to fully replace themselves. For the species which breed in the Hudson estuary and have young stages vulnerable to entrainment, the estimated power station mortality rate is sufficiently high to cause a significant reduction in adult numbers.

"Because the tomcod is a short-lived fish which stays for its entire life within the Hudson estuary, is not commercially fished and suffers the highest level of entrainment mortality of any fish in the estuary, it is a key species to study for the detection of power station effects. The

> population of this fish is in long-term decline and entrainment losses must be considered a probable contributory cause. This would not be the case if strong density-dependence were operating after the early juvenile stages. However, there is no compelling evidence in favor of density-dependence and good reasons to believe it is not operating. Not least of which is the rapid decline in abundance.
>
> ...
>
> "In conclusion, it is not possible to dismiss the influence of the power plants on the fish community, particularly when it is proposed to further increase fish mortality rates. The present community is far from equilibrium and undergoing considerable change. The DEIS's simple declaration [of] it as 'healthy' is a complacent over-generalization." [118]

The aquatic resource mortality from power plants is not comparable to the "selective cropping" that occurs in a regulated fishing or hunting season. Under such regulation, only selected species are harvested, and the forage base remains intact or is improved because fewer individuals higher on the food chain are available to consume lower food chain organisms. Furthermore, fishing and hunting seasons are generally established during that part of the annual cycle which provides both maximum benefit to the users and ensures the sustainability of the population. Mortality at these Hudson River power plants is not limited to a specific, benign season; it occurs throughout the annual cycle, whenever the plants operate their "once-through" pumps. Finally, although impingement and entrainment mortality is measured, it is typically measured only for several of the 140 species of fishes found in the Hudson. Information about the impact on the full suite of aquatic organisms is limited.

Rather than "selective cropping", the impacts associated with power plants are more comparable to habitat degradation; the entire natural community is impacted. These "once-through cooling" power plants do not selectively harvest individual species. Rather, impingement and entrainment and warming of the water impact the entire community of organisms that inhabit the water column.

For example, these impacts diminish a portion of the forage base for each species that consumes plankton (drifting organisms in the water column) or nekton (mobile organisms swimming through the water column) so there is less food available for the survivors. In an intact ecosystem, these organisms serve as compact packets of nutrients and energy, with each trophic (food chain) level serving to capture a diffuse resource and make it more concentrated. Ichthyoplankton (fish eggs, larvae and very small fish which drift in the water column) and small fish feed on a base of zooplankton (drifting animal life) and phytoplankton (drifting plant life). The loss of these small organisms in the natural community may be a factor that leads to

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[118] Henderson, P. A. and R. M. Seaby , 2000. Technical Comments on the Draft Environmental Impact Statement for the State Pollutant Discharge Elimination System Permit Renewal for Bowline Point 1 & 2, Indian Point 2 & 3, and Roseton 1 & 2 Steam Generating Stations. June 2000, Pisces Conservation Ltd. (PISCES report; included in App. F-I.)

harmful algal blooms.[119] The small fish themselves serve as forage for the young of larger species, which serve as forage for larger individuals, and so on up the food chain, more correctly understood as a "trophic pyramid".

Once-through cooling mortality "short-circuits" the trophic pyramid and compromises the health of the natural community. For example, while an individual bay anchovy might ordinarily serve as food for a juvenile striped bass or even for a common tern, entrainment and passage through a power plant's cooling system would render it useful only as food to lower trophic level organisms. It could no longer provide its other ecosystem functions of consuming phytoplankton, digesting and concentrating it into its tissues, and ranging over a wide area, distributing other nutrients as manure. This is just a single example from a very complex natural system, where the same basic impact is multiplied millions of times over more than one hundred fish species.

The direct reduction of the quantity of organisms within the water column by water intakes is known as draw-down. The draw-down of organisms can be understood from the work which HydroQual performed for one of the generators to quantify probabilities of entrainment or re-entrainment for passive particles such as plankton.[120] This study produced multiple profiles of the velocities at various depths across multiple sections of the Hudson in the vicinity of the HRSA generating stations. The measurements were done continuously through time and gave an hourly, three-dimensional profile of water particle travel through time and space in the Hudson; both high flow and low flow conditions were considered. Figures 4 and 5 demonstrate the probability of any single egg or larva or other plankton organism being entrained within seven days of momentarily occupying a single location.[121]

The actual draw-down is likely even greater because the three HRSA generating plants (combined with other facilities in the same river reaches) act cumulatively on the entire aquatic community; many organisms live in this reach of the River for more than seven days; and any organisms coming from upstream, such as tomcod, would also be subject to the draw-down from the Danskammer and Lovett Stations (located in the same river reach but not part of the HRSA nor the subject of this FEIS; *see* Fig. 2 at end of Regulatory Setting). The most important effect of drawdown is that it dramatically reduces food availability within the ecosystem and, thus, survivability of multiple species over significant stretches of the Hudson River.

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[119] Capriulo, G. M., G. Smith, R. Troy, G. H. Wikfors, J. Pellet, and C. Yarish. 2002. The planktonic food web structure of a temperate zone estuary, and its alteration due to eutrophication. Hydrobiologia 475/476: 263-333.

[120] HydroQual, Inc. 1999. Modeling the Entrainment of Passive Particles Into Hudson River Power Plants. *For* Orange and Rockland Utilities, February 1999, by HydroQual, Inc., Mahwah, NJ.

[121] *From* HydroQual, 1999.

[122] HydroQual, 1999.

Fig. 4. Entrainment Probability at Low Flow[122]

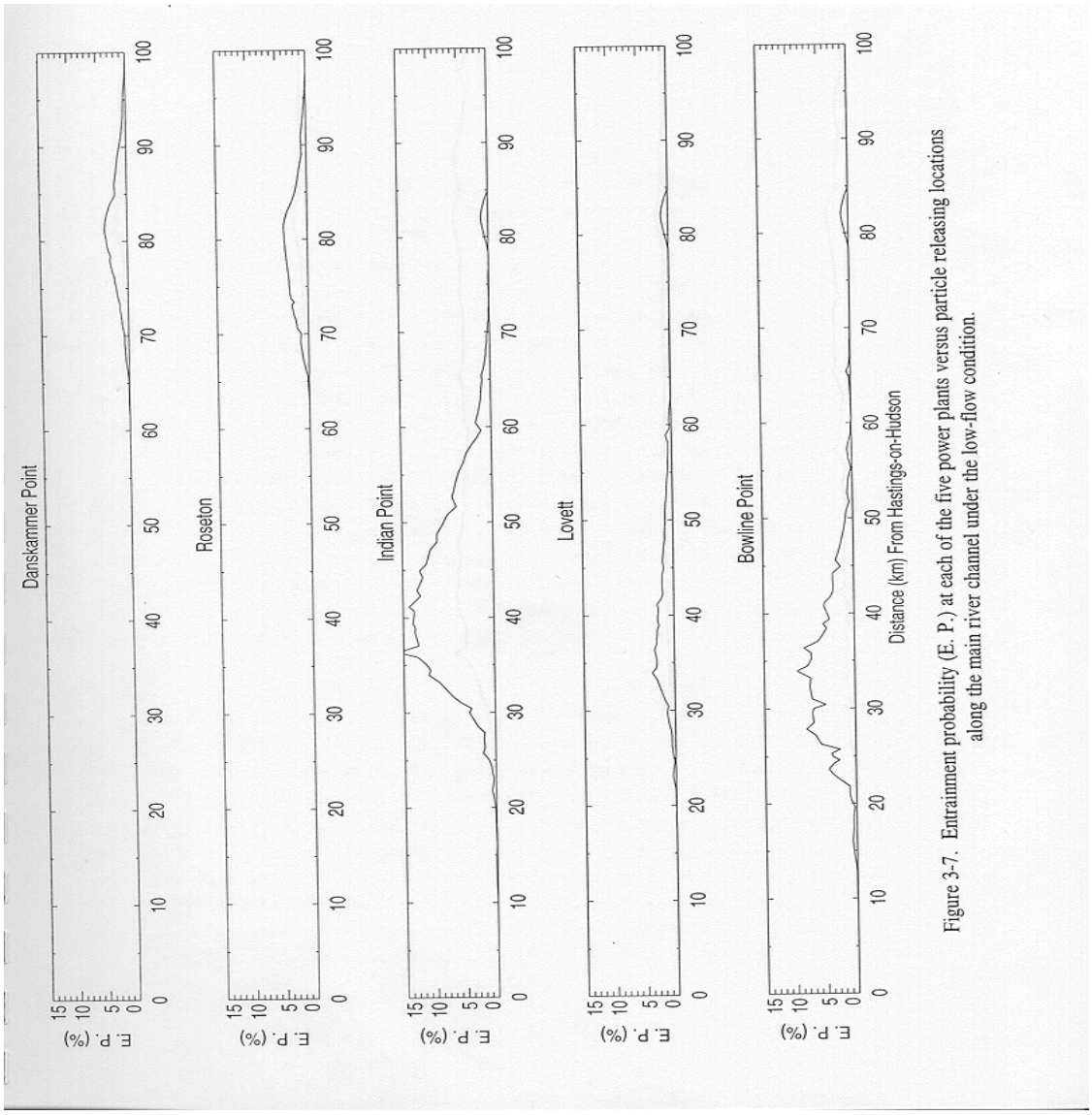

Figure 3-7. Entrainment probability (E. P.) at each of the five power plants versus particle releasing locations along the main river channel under the low-flow condition.

Fig. 5. Entrainment Probability at High Flow[123]

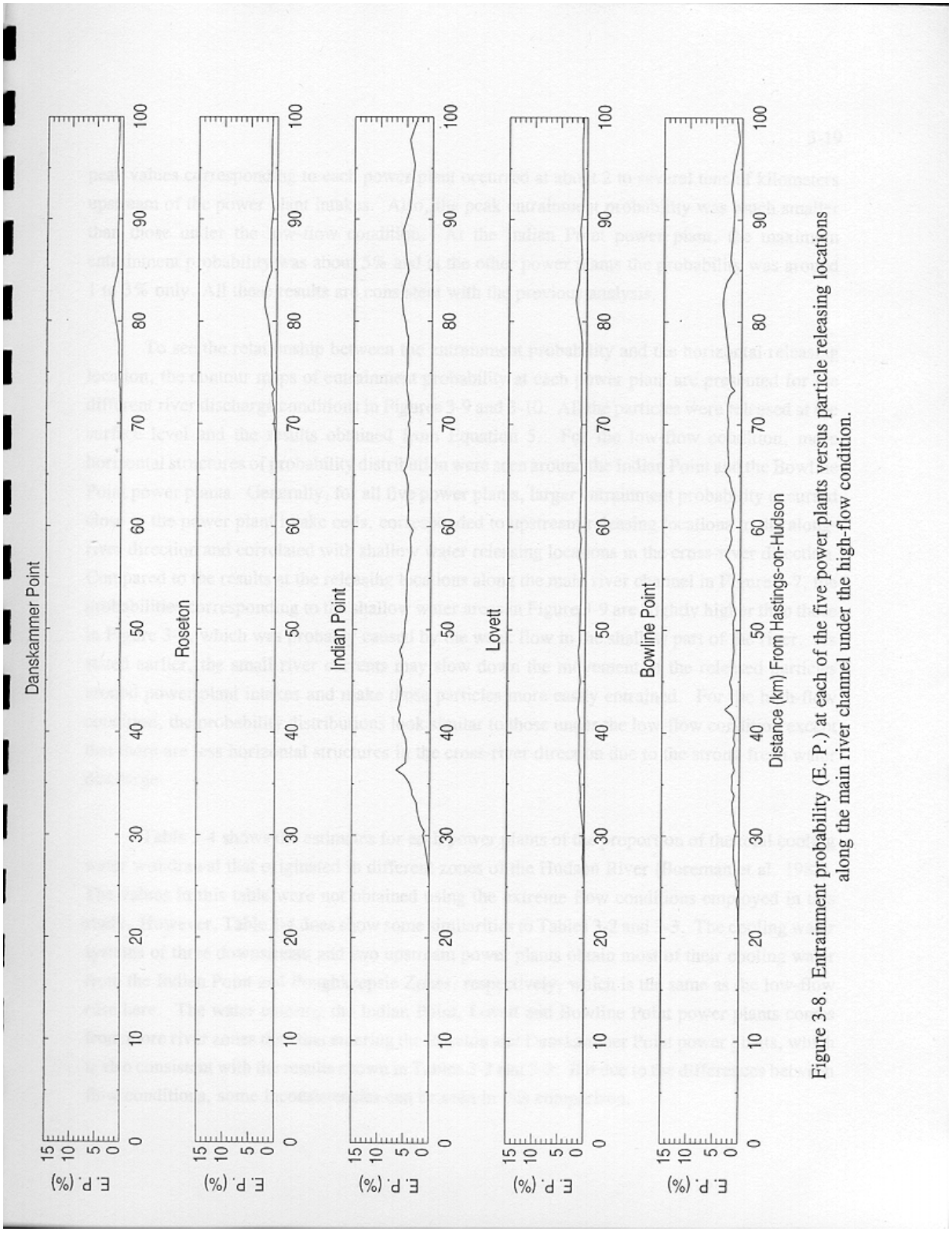

Figure 3-8. Entrainment probability (E. P.) at each of the five power plants versus particle releasing locations along the main river channel under the high-flow condition.

[123] HydroQual, 1999.

Fish Populations - 2. Many species in the Hudson River system are actually declining. While the striped bass (SB) population is up, that increase may be the result of other management decisions and activities. Historic baseline or trend data is not substantially discussed.

In Section VI (p. 36), the DEIS concludes that "...the fish community in this system remains healthy and robust, and consistent with that expected in a large temperate estuary like the Hudson." It further states that "While changes in the composition and abundance of this fish community have been observed, all appear attributable to factors other than power plant operation."

The Hudson River has been the subject of more than 25 years of fisheries investigations, and, as such, is one of the most intensively studied rivers in the world. These studies have revealed that, although overall species richness (the total number of species) is high, with more than 200 species recorded, diversity (which incorporates consideration of abundance and distribution amongst the species) is relatively low; most of the River's fish production is concentrated among a few of these species. Overall species richness and overall abundance of fish larvae in the river have increased since 1974. However, increases in species richness are mainly due to an increase in use of the River by marine species, and increases in abundance can be attributed to increases in but two species, striped bass and Atlantic silversides. Species richness and abundance in both young-of-year and older fish have decreased over this same period, especially among freshwater species, as described below.[124]

Several species of fish in the Hudson River estuary, such as American shad, white perch, Atlantic tomcod and rainbow smelt, have shown trends of declining abundance.[125] The American shad stock in the Hudson river has been in decline since the early 1990's. White perch eggs, yolk-sac and post yolk-sac larvae abundance has remained stable since the mid 1980's; however, indices of young-of-year and older fish have shown declines since the late 1970's.[126] Atlantic tomcod juvenile abundance has shown no trend, but adult abundance over the last 10 years has been lower than in previous years and continues to show high interannual

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[124] Dey, W., S. Jinks and N. Decker, 2003. Changes in the Fish Community Throughout the Hudson River Estuary. *At* Hudson River Environmental Society Presents: Hudson River Fishes & Their Environment. March 20-21, 2003, Marist College, Poughkeepsie, NY. No published proceedings.

[125] ASA Analysis and Communications. 2002. 1999 Year Class Report for the Hudson River Estuary Monitoring program. August 2002.

[126] Wells, A. W. 2003. Status of White Perch in the Hudson River. *At* Hudson River Environmental Society Presents: Hudson River Fishes & Their Environment. March 20-21, 2003, Marist College, Poughkeepsie, NY. No published proceedings.

variability.[127] Rainbow smelt have been virtually absent from the collections from the long river and fall shoals surveys since 1995.[128]

Declines in the abundances of several species and changes in species composition raises concerns and questions regarding the health of the River's fish community. The Hudson River environment has undergone a number of significant changes in recent decades. In addition to changes directly attributable to power plants, these changes include: water quality, especially as a result of major improvements in sewage treatment; invasions by exotic species such as water chestnut and zebra mussels; hazardous substances contamination, especially PCBs, organochlorine pesticides and heavy metals; global climate change, which includes both increasing annual mean temperatures and higher frequencies of extreme weather events; and the management of individual species, such as striped bass, which have undergone strict regulation for both the recreational and commercial fisheries. Each is a stressor, to a greater or lesser extent, on the River's biota. For example, the zebra mussel invasion, which began in 1991, is thought to have caused very large reductions in the biomass of plankton and non-zebra mussel macroinvertebrates. Overall, it is estimated that the biomass of these forage invertebrates has dropped by approximately 50 percent, leading to large changes in the fish community.[129]

The impingement, entrainment and thermal impacts caused by the HRSA facilities are well-documented elsewhere in this FEIS and in other portions of the HRSA proceedings. The millions of fish that are killed by power plants each year represent a significant mortality and are yet another stress on the River's fish community. Although the primary cause of these population changes cannot conclusively be attributed entirely to the operation of these three steam electric generating stations, the mortality that they cause must be taken into account when assessing these population declines.

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[127] Young, J., M. T. Mattson , Q. E. Ross and D. J. Dunning. 2003. Population Fluctuation of Atlantic Tomcod in the Hudson River Estuary. *At* Hudson River Environmental Society Presents: Hudson River Fishes & Their Environment. March 20-21, 2003, Marist College, Poughkeepsie, NY. No published proceedings.

[128] The "long river", or Longitudinal River Ichthyoplankton Survey (LRS) encompasses the entire length of the Hudson River Estuary, from the Battery (River Mile, RM, 1) to the Federal Dam in Troy (RM 152). The LRS yields ichthyoplankton data to support calculations of standing crop, temporal and geographical indices, and growth rates for selected Hudson River species (Atlantic tomcod, American shad, striped bass, white perch and bay anchovy). LRS sampling is concentrated during the spring, summer and early fall when eggs and larvae of the selected species have been historically abundant.
Fall Shoals Survey (FSS) samples are collected every other week from the Battery to the Federal Dam in Troy from mid-summer through the fall. The FSS objective is to provide data on young-of-year (YOY) fish to support calculation of standing crop and temporal and geographical indices of for selected Hudson river species (Atlantic tomcod, American shad, striped bass and white perch). *From* ASA 2002.

[129] Strayer, D. L., N. F. Caraco, J. J. Cole, M. L. Pace, S. Finlay, K. A. Hattala, and A. W. Kahnle. 2003. Ecological Changes From Two Recent Species Invasions in the Freshwater Tidal Hudson River. *At* Hudson River Environmental Society Presents: Hudson River Fishes & Their Environment. March 20-21, 2003, Marist College, Poughkeepsie, NY. No published proceedings.

Fish Populations - 3. Several commentors questioned one or more of the assumptions used in one or more of the population models; in particular, density-dependence is unproven.

The DEIS relies on fish population modeling to support the generators' conclusion that entrainment mortality is not significant for two species, tomcod and striped bass, based upon compensatory density dependence.[130] Bay anchovy do not have a population model presented in the DEIS. However, a Production Foregone model that is based upon data from the Chesapeake Bay predicts that bay anchovy populations in the Hudson River could remain stable if there were an annual influx of migrants from a general east coast population. A population dynamics model is not presented for white perch in the DEIS. Thus, estimated impacts of entrainment and impingement for this species are highly speculative. The American shad population model in the DEIS shows significant variation in abundance between 1990 and 1997; the stock apparently has not recovered from low numbers in recent years and may be over-exploited unless high density-dependence is assumed. Models were not prepared for other species.

The Department concludes that the models and analyses presented in the DEIS are somewhat useful, but that there are significant questions and concerns regarding the inputs and assumptions for each species analysis which may result in very different conclusions than those presented in the DEIS. It is noteworthy that the analyses and conclusions performed by three different sets of professional fisheries population modelers, in three different countries and with different backgrounds, all point out significant concerns within each model and that alternative results could easily be presented. These modelers represent the generators, the Department and ESSA Technologies, Ltd., and environmental organizations; this is a diverse group that is not predisposed toward a common outcome. What is clear from the data and analyses presented in the DEIS is that entrainment and impingement, primarily the former, are eliminating a significant portion of the above-listed species in their egg and larval forms, as well as many more species which spawn or spend part of their life stages in the lower Hudson River. While it is reasonable to conclude that some of these losses may be compensated for by increased survival of organisms not killed, it is not possible to determine the impact of these losses on adult populations with much confidence.

Fisheries scientists are keenly aware of dramatic natural changes in fish populations, both on an annual basis and long term. There are a great many natural reasons for these changes. The Hudson River is a dynamic system with many environmental

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[130] The *Dictionary of Ichthyology*, Brian W. Coad and Don E. McAllister, Revised: 13 May 2003, provides the following definitions:
Density dependence = the dependence of a factor influencing population dynamics (such as survival rate or reproductive success) on population density. The effect is usually in the direction that contributes to the regulative capacity of a stock.
Compensatory survival = a decrease in the rate of natural mortality that some fish show when their populations fall below a certain level. This may be caused by less competition for food and living space.

For a general discussion of the concepts, *see* Boreman, John. 2001. Surplus Production is a Myth. 10 pp. Included in Appendix F-V.

parameters differing from apparently natural causes each year. Flow, temperature, salinity, dissolved oxygen, nutrients and others fluctuate markedly. Many of these same parameters are influenced by human activities, too. Addition or deletion of pollutants, invasion by exotic species of plants and animals, habitat management, and fishing pressure and regulations all combine with the withdrawal of billions of gallons of water each day, for cooling purposes at steam electric stations as well as for other industrial or public water supply uses, and with very large amounts of thermal inputs, to contribute to changes in the River. Attempts to identify, measure and understand specific impacts are complicated by the array of interacting and potentially confounding variables. The inherent uncertainties of data management and especially population models cast further doubt on available information and analyses.

Data in the 1999 DEIS and comments on the topic of population dynamics and modeling identify entrainment rates for fish eggs and larvae as significant impacts. They also indicate that neither the terms of the HRSA and subsequent Consent Orders nor the applicants' proposed actions would reduce this impact to levels consistent with BTA requirements. The body of analyses in the fish population models presented in the DEIS indicates that the models overestimate the role of density dependence and thereby underestimate impacts associated with entrainment and impingement. This leads the Department to conclude that this modeling effort alone will not conclusively show whether or not fish populations are significantly affected by entrainment and impingement. Therefore, the Department has determined to not rely on these models to make conclusions for this FEIS or for the SPDES permits to be issued for each of the three HRSA power plants.

Detailed reviews of population dynamics models are presented in the ESSA Technologies, Ltd. report *Review of the Draft Environmental Impact Statement*, dated October 20, 2000, and the reviews of the Atlantic Tomcod, Bay Anchovy, Striped Bass, and American Shad models appended to it.[131] Additional comment on the models, as well as other topics, was provided by Dr. Peter Henderson of Pisces Conservation, Ltd. representing the Riverkeeper, Scenic Hudson and NRDC.[132]

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[131] ESSA Technologies, Ltd. 2000. Review of the Draft Environmental Impact Statement for SPDES Permits for the Bowline Point 1 & 2, Indian Point 2 & 3, and Roseton 1 & 2 Steam Electric Generating Stations. Report to the Parties to the Application. Prepared by ESSA Technologies, Ltd., Richmond Hill, ON, for NYS DEC, Albany, NY. 31 pp plus Appendices; the full set of ESSA reports is included as Appendix F-V to this FEIS.

[132] PISCES, 2000.

Atlantic Tomcod

The Atlantic Tomcod population in the Hudson River appears to be declining rapidly. This conclusion is supported in the DEIS by 1989-97 early life-stage data.[133] The DEIS further asserts that, "... Adult abundance in recent years is distinctly lower than it was in the 1970s ...".[134] Because this species is at the southern edge of its geographic range, observed declines could be the result of increasing river temperatures, whether from thermal discharges, global climate change, or other unidentified factors. Nevertheless, the population stability predicted by the population model in the DEIS is predicated upon a conclusion that significant density-dependent mortality occurs for this species at the life stage *after* most entrainment mortality has occurred. If the conclusion proves to be based upon limited data or errors in analysis (as suggested by ESSA Technologies, Ltd. in their initial DEIS review),[135] then the Hudson River tomcod population is *not* determined by this density-dependent mortality and the generators proposed actions could instead increase the conditional entrainment mortality rate (CEMR) of this species.[136]

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[133] 1999 DEIS, p. V-43, Figure V-65

[134] 1999 DEIS, p. VI-11

[135] Parnell, I., D. Marmorek, and R. Deriso. 2000. Review of the Assessment of Atlantic Tomcod. Companion Report to Chapter 3 *in* ESSA, 2000.

[136] Conditional Entrainment Mortality Rate (CEMR) is the probability of a fish dying from passage through the cooling water system of a power plant. It is expressed as a percentage and measures how many fewer Hudson River fish exist at the end of their first year of life (actually at September 1) than would exist if not for the loss to entrainment. The actual computations are based on measurements of mortality rates of all life stages of fish. These stages include eggs, larvae, juveniles and even some small adults; larger fish usually do not become entrained because they can swim well enough to escape from the intake current or are protected by mechanical devices such as racks or screens installed expressly to prevent entrainment. Because much of the raw data involves early life stages, the mortality rates of eggs and larvae are "normalized" to a rate expected of young-of-the-year fishes on September 1. This statistical process is based on existing information about expected mortality (or its inverse, survival) of each life stage from natural causes, such as predation.
This survival information varies among species. For most species, natural mortality of early life stages is very high. For example, for striped bass, about 75 percent of eggs die before they hatch to become yolk sac larvae. Similarly, mortality can be as high as 89 percent as the yolk sac larvae mature to become post-yolk sac larvae. This natural attrition continues throughout the life cycle. Typically, only two-hundredths of one percent of striped bass eggs would survive to become juveniles on September 1; this is a survival rate of .0002. The CEMR, then, accounts for such natural mortality rates when it is used to calculate mortality attributable to entrainment at power plants.
See Public Service Electric and Gas Company (PSE&G). 1999. 316(b) Demonstration for the Salem Nuclear Generating Station. Appendix L in Application for Certification of a Major Electric Generating Facility Under Article X of the New York State Public Service Law, Appendix 8b. 2000. TRC Environmental for KeySpan Energy.

Population declines could continue and ultimately result in the elimination of this species in the lower River.[137]

Striped Bass

The DEIS presents arguments in support of the generators' proposed action, and the resulting mortality of this species due to entrainment and impingement, that are based upon the assumption of strong density dependence within the striped bass population in the Hudson River. ESSA Technologies, Ltd. has noted that this conclusion is based upon data and model assumptions that, if not faulty, may not be the only data and assumptions that could be employed in the model.[138] For example, fishing mortality estimates presented in the model are inconsistent with recent tagging analyses and stock assessments developed for Atlantic coast stocks.[139] An alternative analysis could be presented that indicates much lower density-dependence; such an indication would lead to a prediction of a much greater impact from entrainment and impingement.

White Perch

A population dynamics model was not prepared for this species because the Technical Workshops concluded that the data do not support development of a defensible model. However, juvenile and age-1 abundance indices suggest that white perch numbers in the Hudson River are declining.[140] This contrasts with the DEIS conclusion that the population appears resilient enough to sustain its population in the future under similar levels of power plant mortality. These conditional mortality rates (CMR) are stated to be approximately 21 percent over the period of analysis presented. As with other species, use and interpretation of other available information can easily result in very different conclusions regarding impacts

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[137] *See also* Everly, A. W. and J. Boreman. 1999. Habitat use and requirements of important fish species inhabiting the Hudson River Estuary: Availability of Information. NOAA Tech. Memorandum NMFS-NE-121. US Dept. of Commerce, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA.
http://www.nefsc.noaa.gov/nefsc/publications/tm/tm121/tm121.pdf
Of the 140 species that occur in the Hudson River Estuary, Everly and Boreman also chose Atlantic Tomcod as one of their 11 representative species for their study. Tomcod were chosen as important and representative of the fish community of the Hudson River as euryhaline nonmigratory species. The life history synopsis on p.14 illustrates the exposure of this species to entrainment, impingement, and thermal pollution impacts from once-through cooling, by virtue of its life cycle in the Hudson River.

[138] Deriso, R., D. Marmorek, and I. Parnell. 2000. Review of the Assessment of Striped Bass. Companion Report to Chapter 5, *in* ESSA, 2000.

[139] Deriso et al, 2000.

[140] Parnell, I. and D. Marmorek. 2000. Review of the Assessment of White Perch. Companion Report to Chapter 6, *in* ESSA, 2000.

of entrainment and impingement. In their earlier reviews, the HRSA technical workshops and the review by ESSA Technologies, Ltd. recommended that topics and issues stemming from data limitations be considered in the DEIS analysis. This was not done.

American Shad

American shad population impact analysis in the DEIS is based upon Hudson River Shad Assessment and Equilibrium Calculations: Revision of the 1995 Report to Include Data Through 1997, by Dr. Richard Deriso, Kathryn Hattala, and Andrew Kahnle.[141] Ms. Hattala and Mr. Kahnle are Department staff and Dr. Deriso is a consultant to ESSA Technologies, Ltd., the Department contractor that assists in review of population dynamics modeling, among other topics. This analysis was the only model which employed more than one level of density dependence to determine abundance. The DEIS concludes that the American shad population appears healthy and able to sustain itself within the constrains of the proposed action. This is the least conservative conclusion that can be drawn from the data presented. More likely is the conclusion that the stock has not shown any recent recovery from very low levels ("At the present time, shad stocks in the Hudson River are at an all-time low" [142]), and both entrainment and fishing mortality rates need to be minimized.

Bay Anchovy

Bay anchovy population modeling presented in the DEIS was developed to analyze this species in the Chesapeake Bay and used data from that water body, not from the Hudson River. The model's author, Dr. Kenneth Rose, presented many analytical caveats that should be used in the application of the model; the model is very sensitive to different assumptions. The discussion of the model results presented in the DEIS, however, does not acknowledge these limitations. This model estimates production foregone, in contrast to other population dynamics models. The analysis overestimates the predatory demand of striped bass and bluefish because their populations have increased so markedly and suggests that anchovy spawner immigration serves to avoid population extinction caused by entrainment and impingement in the Hudson; this immigration would come from the Atlantic coast stock. This assumption appears to ignore entrainment and impingement impacts from the many other coastal power plants which affect the coastal anchovy population. Therefore, the conclusions concerning bay anchovy presented in the DEIS are not sufficiently supported by the model.

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[141] Appended to ESSA, 2000.

[142] DEIS, p. V-101

Fish Populations - 4. Climate, disease, and the changing ecology of the Hudson River system are not considered in the population models.

Any measurement of ecological impacts attributable to power generating stations is confounded by the changing ecosystem itself. As will be discussed here and in following sections, the Hudson River ecosystem has undergone numerous profound changes in the last few decades, many of which are continuing. The population models presented in the DEIS do not account for such fundamental and dynamic ecosystem influences as climate, disease, water quality, flow and invasive species. For example, n the years since the 1999 DEIS was published, Atlantic tomcod have continued to decline, contrary to the predictions of the model presented in the DEIS.[143] Rainbow smelt numbers, too, have declined significantly during this period.

In addition, many assumptions in the model and the selective use of datasets for the various models cast doubt on the validity of many of the conclusions presented in the DEIS.[144] For example, different years of data are used throughout the DEIS in order to demonstrate a lack of correlation between post-yolk sac (PYS) and juvenile fish of a selected species. Although the DEIS asserts that this relationship between PYS and juveniles demonstrates density-dependent compensation, other, more plausible explanations are available.

If one is to entertain the concept of density-dependent compensation as a mechanism by which fish populations respond to changing stressors within their environment, it must be evaluated against the many changes which can impact the population, not only the indiscriminate cropping imposed by cooling water intakes. Even if density dependent compensation exists, it cannot be presumed that the ability to make up for natural and anthropogenic induced mortality is infinite. The factors above, which are only recent examples of changes affecting fish in the Hudson, illustrate how many factors can consume portions of any compensation ability fish populations may have.

Climate Change

Over the past decade a large body of data has been collected in a variety of scientific disciplines which indicates that climatic changes are occurring on a global scale.[145] Growing evidence suggests that temperature has increased over the past century at an accelerated rate. One indicator of this change has been increased ocean temperatures. Of the marine waters of the world, coastal areas and estuaries are most susceptible to climatic changes due to their relatively shallow depth and proximity to land. These coastal areas are also the most biologically productive as

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[143] ASA, 2002.

[144] PISCES, 2000.

[145] Kennedy, V., et al. 2002. Coastal and Marine Ecosystems and Global Change. Prepared for the Pew Center on Global Climate Change, Arlington, VA.

the majority of marine fishes spawn, and many mature in near shore or inshore areas. Though estuaries only represent approximately 0.5 percent of the world's marine environment, they support about 5 percent of global fish production.[146]

Many scientists believe that the accelerated increase in global temperatures is due primarily to anthropogenic impacts. Chief among these is the emission of "greenhouse gases" produced by burning fossil fuels. The accumulation of these emissions in the atmosphere causes air temperatures to increase; this indirectly increases temperatures of oceans, estuaries and other surface waters. Because of their proximity to land, estuaries and coastal waters are also directly influenced by other human activities which may increase temperature, such as by storm water runoff from impervious surfaces, wastewater effluent and cooling water discharges. A review of data collected over a 51-year period indicates increases in water temperature of the Hudson River Estuary in the last half of the twentieth century.[147]

Very small changes in water temperature have been shown to affect many species of fish, particularly during early life stages.[148] Temperature changes may influence spawning success, early life stage development, and survival of ichthyoplankton and adults.[149] Most vulnerable would be cold water species, and impacts upon these species would be an early indicator of changes which could eventually affect any and all species inhabiting a water body.

Rainbow Smelt

Rainbow smelt may be disappearing from some reaches of the Hudson because of thermal discharges from electric generating stations. The rainbow smelt *(Osmerus mordax*) is a small soft-bodied species which inhabits coastal areas of North America from Labrador to as far south as Virginia. Smelt also occur naturally as landlocked populations in some lakes in New England and eastern Canada. In 1912, smelt were introduced into Crystal Lake in Michigan. From there they spread throughout the Great Lakes where they are now found in abundance.[150] Coastal populations support

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[146] Kennedy, 2002.

[147] Ruggiero, R. Hudson River Temperature Data Collected at the City of Poughkeepsie Water Treatment Facility. Unpublished; submitted to Department March 6, 2003. Copy in Appendix F-V.

[148] Kennedy, 2002.

[149] USEPA - New England, 2002. CWA NPDES Permit Determinations for Thermal Discharge and Cooling Water Intake from Brayton Point Station in Somerset, MA. July 22, 2002.

[150] Buckley, J. L. 1989. Species Profiles: Life Histories and Environmetnal Requirements of Coastal Fishes and Invertebrates (North American) Rainbow Smelt. USFWS Biological Report 82(11.106) TR EL-82-4.

recreational fisheries and modest commercial fisheries in New England .[151] Ecologically, smelt serve as forage for species such as striped bass and bluefish.[152]

Research conducted by the Massachusetts Division of Marine Resources has documented relatively stable populations of smelt in several rivers located in Massachusetts through 2000.[153] Studies conducted by Dominion Nuclear Connecticut, Inc. as a requirement of the operation of the Millstone Power Station also demonstrate a stable population of smelt in the Niantic River and adjacent areas of Long Island Sound through 2000.[154] In contrast, data collected by the Hudson River Estuary Monitoring Program, contained in the 1999 Year Class Report, document the apparent local disappearance of rainbow smelt.[155]

Because the Hudson River is located in the southern portion of the rainbow smelt's east coast range, one might reasonably conclude that observed increases in ocean and coastal water temperatures, as from global climate change, have caused a range shift northward, with the smelt abandoning its southernmost range. However, smelt populations at nearly the same latitudes as the Hudson River Estuary remain stable. This fact may indicate that localized influences have caused the apparent local disappearance of this species in the Hudson River. Thermal discharges, as from power plants, may be a principal factor in the disappearance of this species from the Hudson estuary. Such a trend, if continued, could impact other species. This circumstance warrants review of thermal contributions to the Hudson River Estuary.

Atlantic Tomcod

Atlantic tomcod declines, too, may be attributable to the effects of cooling water intakes at electric generating stations in the Hudson River. Like smelt, the Atlantic tomcod (*Microgadus tomcod*) is a cold water species that has declined dramatically since 1995.[156] Tomcod populations in the Hudson River have been monitored since 1974 with a mark-recapture program using box traps. In 1982, trawling, primarily south of the George Washington Bridge, was added as a means of collecting fish. The population of tomcod fluctuated but remained abundant through 1995, after

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[151] Chase, B. and C. Childs, 2001. Rainbow Smelt (*Osmerus mordax*) Spawning Habitat in the Weymouthfore River. Massachusetts Division of Marine Fisheries Technical Report TR-5.

[152] Buckley, 1989.

[153] Chase & Childs, 2001.

[154] Keser, M. 2001. Monitoring the Marine Environment of Long Island Sound at Millstone Power Station, 2000 Annual Report. Environmental Laboratory, Millstone Power Station, Dominion Nuclear, Waterford, CT.

[155] ASA, 2002.

[156] ASA, 2002, and prior (1996-99) Hudson River Year Class Reports. Normandeau Associates, Inc. (NAI). Letter reports and field data from M. Ricci to J. Kelly on the Striped bass and Atlantic tomcod Mark Recapture Program; April 26, 2002, and April 22, 2003.

which a steady decline has occurred. During the 2001-2002 and 2002-2003 sampling seasons, tomcod have become virtually absent.[157]

The tomcod has a much shorter life span in the Hudson River than in more northern systems, living only about 2 years. Three-year and older fish represent a tiny fraction of the population (0.6 percent in 1995-96 season) and the majority of the spawning stocks are 1-year-old fish.[158] In contrast, stocks in other areas in New England and Canada are much longer-lived and spawning stocks are dominated by 2-year-and-older fish.

Numerous studies have been conducted investigating anthropogenic impacts upon tomcod inhabiting the Hudson River Estuary and have revealed a very high incidence of liver cancer.[159] Recent research indicates a synergistic effect from elevated levels of polycyclic aromatic hydrocarbons (PAHs), which appear to damage hepatic DNA, leaving the fish more susceptible to PCB-induced early life-stage toxicities.[160]

In addition to chemical contaminants, other impacts upon the Atlantic tomcod population which have been investigated include: reductions in food sources; predation; and mortality due to cooling water intakes estimated at approximately 22 percent of each year class (1974-1997). The Hudson River is the southern extreme of the range for tomcod. While stocks in Massachusetts waters appear to be stable, preliminary observations suggest that the abundance of tomcod in Connecticut has declined.[161] As discussed above, these declines in populations at the southernmost portion of the species range could indicate temperature-induced impacts from climatic changes acting to shrink the species range. In the Hudson River this effect could be exacerbated by the addition of thermal discharges from power plants.

Atlantic tomcod spawning begins in mid-February and extends into mid-March in the Hudson River. The area of peak spawning is in the Highlands section of the river

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[157] NAI, 2002-03.

[158] Lawler, Matusky and Skelly Engineers (LMS),1999. Abundance and Stock Characteristics of Atlantic Tomcod Spawning Population in the Hudson River, Winter 1995-1996. Prepared for NYPA, White Plains, NY.

[159] Schreibman, M. and J. Young. 2002. Physiology Investigations of the Atlantic Tomcod. Aquatic Research and Environmental Assessment Center *and* ASA Analysis & Communications, Inc.

[160] Wirgin, I. 2003. Contaminants: Use of Atlantic Tomcod as a Model to Evaluate the Possible Toxic Effects of Pollutants on Hudson River Populations. *At* Hudson River Environmental Society Presents: Hudson River Fishes & Their Environment. March 20-21, 2003, Marist College, Poughkeepsie, NY. No published proceedings.

[161] Simpson, D. 2003. Personal communication from Connecticut Department of Environmental Protection to this Department regarding Connecticut information on Atlantic tomcod abundance in tributaries to Long Island Sound. Included in Appendix F- V.

near Con Hook approximately 5 river miles upriver from Indian Point.[162] When eggs and yolk sac larvae drift down river, in addition to being exposed to entrainment, they are also exposed to a thermal plume from Indian Point Units 2 and 3 which extends the entire width of the river on flood tide and across more than two thirds of the width on ebb.[163] In years of high freshwater floods, larvae are transported down river by current into the Haverstraw region or the Tappan Zee region while maturing. Post yolk sack tomcod then concentrate near the leading edge of the salt front (approximately 1 ppt salinity) and move with the tidal flow.[164] In dry years with low freshwater input, this front can be located in the Indian Point region. This results in tomcod larvae congregating in the leading edge of the salt front, being repeatedly moved past the Indian Point station discharge and intakes, potentially increasing the thermal and entrainment effects of the plant on this species.[165] Less than average rainfall from 1995 into 2002 reduced the freshwater flow in the Hudson River. This period corresponds to the period of rapid decline in numbers of Atlantic tomcod in the Hudson River.

Many factors are impacting tomcod populations: climatic trends leading to increased water temperatures; decreases in available food resources caused by improvements in waste water treatment and the invasion of zebra mussels; increased predation from increased striped bass populations; and the physiological effects of chemical pollutants.[166] These multiple stressors can exacerbate the effects of heat discharged from generating stations, particularly during low freshwater flow periods. Not only could increases in river temperatures decrease the survival of larval tomcod, but higher temperatures could also depress the growth rate of this species. Since the fecundity of females is proportional to size, higher water temperatures could result in fewer young produced. Should these factors, in combination with the mortality induced by entrainment, significantly depress tomcod populations in the Hudson River, further ecological repercussions could be expected to follow on populations including striped bass, for which tomcod are a significant food source.[167] Neither the tomcod nor the striped bass population model proposed in the DEIS, however, has any means to integrate these variables.

Comb Jellies

Members of the phylum Ctenophora are commonly known as comb jellies and are found in the Hudson River. In most years they become abundant in the lower reaches of the River and New York Harbor from June to September when increases

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[162] Dew, B. C. 1991 Early Life History and Population Dynamics of Atlantic Tomcod (*Microgadus tomcod*) in the Hudson River Estuary, New York. Doctoral thesis submitted to the City University of New York, NYC, NY.

[163] DEIS, Appendix VI

[164] Dew, 1991.

[165] Dew, 1991.

[166] Wirgin, 2003.

[167] Dew, 1991.

in salinity and temperature typically occur. Comb jellies are a voracious predator feeding on invertebrates and larval fishes. In areas of high comb jelly density, ichthyoplankton samples collected contain few larval fish.

An analysis of data collected to assess the impacts of the Brayton Point station located on Mount Hope Bay in Massachusetts determined that water temperature increases resulted in an increase in the population of comb jellies, as well as the extent of their range and the length of time they were present. The warming was directly attributable to the cooling water discharge of the plant.[168]

Observations of the comb jelly population in the Hudson River over the past 10 years indicate that a similar trend is occurring. While the warming climate may be influencing the abundance and distribution of comb jellies, thermal discharges, particularly in spawning and nursery areas of the Hudson River, should not be discounted.

Zebra Mussels

Zebra mussels (*Dreissena polymorpha*), an invasive species of bivalve first observed in the Hudson River in 1992, appear to have caused very significant reductions in primary production (plant life, including phytoplankton) in the freshwater portion upriver of River Mile 63. Between 1987 and 1991, before the invasion of zebra mussels, summertime concentrations of chlorophyll averaged 30 mg/m^3. During 1993 and 1994, concentrations dropped to 5 mg/m^3.[169] This ecological change is not presented in the DEIS or reflected in the models offered in the DEIS.

Densities of both phytoplankton and small zooplankton (rotifers, tintinnids, and copepods) dropped to 10 to 20 percent of their previous levels after zebra mussels invaded the Hudson.[170] This reduction directly affects planktivorous fishes and early-life-stages of fishes which feed upon small zooplankton. The copepod population did not change with the arrival of zebra mussels, however, *Bosmina* (a genus of water flea) declined by 50 percent.[171] The continued presence of copepods, a preferred prey of young fish, may have insulated higher trophic levels in the Hudson from the negative effects of the zebra mussel population.[172] However, in contrast to Dr. Strayer's assumption, the 1999 Hudson River Year Class Report provides clear evidence of several anadromous and resident species of fish in decline during the

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[168] USEPA, 2002.

[169] Caraco, N. F., et al. 1997. Zebra Mussel Invasion in a Large, Turbid River: Phytoplankton Response to Increase Grazing. Ecology 78(2), 1997, pp. 588-602. Ecological Society of America.

[170] Caraco et al., 1997.

[171] Strayer, D. L., et al. 1999. Transformation of Freshwater Ecosystems by Bivalves, A Case Study of Zebra Mussels in the Hudson River. BioScience, volume 49(1), pp. 19 - 27.

[172] Strayer et. al., 1999.

post-zebra mussel invasion period.[173] One group of organisms which has increased significantly since the appearance of zebra mussels is bacteria, but no information on any pathogenic effects upon fishes in the Hudson has been found.[174]

[173] ASA, 2002.

[174] Strayer et. al., 1999.

COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 5

RIVERKEEPER®

July 15, 2011

VIA U.S. MAIL
AND E-MAIL to depprmt@gw.dec.state.ny.us
Christopher M. Hogan
NYSDEC Headquarters
625 Broadway
Albany, NY 12233
depprmt@gw.dec.state.ny.us

Re: *Entergy Nuclear Indian Point 2, LLC & Entergy Nuclear Indian Point 3, LLC Proposed Modification of Special Condition 7.b of SPDES Permit, DEC No.* 3-5522-00011/00004, SPDES No. NY-000472

Dear Mr. Hogan:

Riverkeeper, Inc., the Natural Resources Defense Council (NRDC) and Scenic Hudson Inc., (collectively hereinafter "Riverkeeper") hereby respectfully submit the following legal comments and accompanying technical comments of even date, along with Riverkeeper's October 2007 technical comments entitled "Comments on Entrainment, Impingement and Thermal Impacts at Indian Point Nuclear Power Station" (October 2007) (both sets of technical comments being collectively hereinafter "Riverkeeper's technical comments") on the above-referenced Application of Entergy Nuclear Operations, Inc. ("Entergy") under ECL Article 17, Titles 7 & 8 in connection with the tentative determination of the New York State Department of Environmental Conservation (NYSDEC) to modify[1] Special Condition 7.b of the above-referenced 2004 draft SPDES permit to allow for a 75-acre thermal mixing zone (hereinafter the "Thermal Modification"), as noticed in NYSDEC's Environmental Notice Bulletin ("ENB") issued on June 15, 2011.

Entergy seeks a SPDES permit to withdraw 2.5 billion gallons of cooling water per day from the Hudson River and discharge a nearly-equal amount of unabated heated effluent to the Hudson River while operating the Indian Point Nuclear Electric Generating Facility (the Facility) in

[1] Although the June 15, 2011 notice styles the NYSDEC action as a tentative determination to "modify" the existing draft 2004 SPDES permit, Riverkeeper notes that a "modification" under 6 NYCRR § 621.2(t) is defined as modification as "any change or amendment whatsoever to a permit that is currently in force, including permit transfer." Since the proposed Thermal Modification is actually a revised draft permit term, the limitations of 6 NYCRR § 750-1.18(d) are not applicable to these comments.

once-though cooling mode, as the Facility has operated for roughly the last thirty five (35) years. But the Clean Water Act's antidegradation policy and requirements for the application of the stricter of technology or water quality based effluent limitations mandate otherwise. Moreover, the Thermal Modification's proposed mixing zone is similarly inconsistent with the Clean Water Act and state law. Since the proposed mixing zone is illegal, the discharge will continue to violate thermal (and other) water quality standards and impair the designated uses of the receiving water. Since the discharge violates effluent limitations and water quality standards, Entergy would need to seek a variance under Section 316(a) of the Clean Water Act and 6 NYCRR § 704.4. Additionally, since the thermal discharge does not comply with effluent limitations or water quality standards and impairs designated and existing uses, a compliance schedule including interim measures to minimize pollution is required pursuant to 6 NYCRR § 750-1.14(a).

NYSDEC has recognized the inseparable connection between the Facility's cooling water intake and thermal discharge and has required closed-cycle cooling based on adverse environmental impacts associated with the Facility's cooling water intake. Accordingly, Riverkeeper's Petition for Party Status dated July 10, 2010 and NYSDEC's April 2, 2010 Denial of Entergy's Request for a CWA § 401 Water Quality Certification are hereby incorporated by reference and Riverkeeper requests that the legal and technical points raised by these comments be considered in the light of the cumulative and synergistic effects of the Facility's cooling water intake impacts. That being said, Riverkeeper respectfully submits that the Facility's thermal discharge also independently requires the imposition of closed cycle cooling by NYSDEC as a SPDES condition.

Accordingly, Riverkeeper respectfully requests that NYSDEC hold an adjudicatory hearing in connection with the proposed Thermal Modification, since Riverkeeper's comments herein raise substantive and significant issues relating to Entergy's application.[2] The resolution of the issues raised herein may result in denial of the Thermal Modification, or the imposition of significant conditions thereon.[3]

I. The Commenter's Respective Interests

a) Riverkeeper's Interest

Riverkeeper is a not-for-profit organization dedicated to protecting the ecological integrity of the Hudson River.[4] Since its inception in 1966, Riverkeeper has used litigation, science, advocacy, and public education to raise and address concerns relating to the operation of the Indian Point nuclear power plant. For decades, Riverkeeper has fought tirelessly against Entergy's continued use of an environmentally destructive once-through cooling water system at Indian Point. In more recent years, Riverkeeper has been actively involved in addressing newly discovered

[2] 6 NYCRR § 621.8(b).

[3] 6 NYCRR § 621.8(b).

[4] *See* Riverkeeper.org, Our Story, http://www.riverkeeper.org/ourstory_index.php (last visited July 15, 2011).

accidental leaks of radioactive water to the environment from degraded plant components. As parties in both the license renewal proceeding currently pending before the U.S. Nuclear Regulatory Commission, and in the ongoing Indian Point State Pollutant Discharge Elimination System ("SPDES") permit renewal proceeding and appeal of NYSDEC's denial of Entergy's request for a Clean Water Act § 401 Certification, Riverkeeper continues to play an integral role in addressing such issues.

b) NRDC's Environmental Interest

As a national not-for-profit environmental advocacy organization organized under the laws of New York State and headquartered in New York City, NRDC includes among its principal purpose safeguarding the earth's people, its plants and animals, and the natural systems on which all life depends. The protection of the environment, including the land, air, energy, and water, as well as advocacy to protect aquatic life from adverse impacts from power plants such as harm from cooling water intake structures, remain core functions of its organizational mission. Founded in 1970, NRDC is composed of approximately 1.3 million members, tens of thousands of which live in New York State. NRDC strives to protect nature in ways that advance the long-term welfare of present and future generations by working to foster the fundamental right of all people to have a voice in decisions that affect their environment. Many of NRDC's members engage in fishing, swimming, boating, and other recreational, conservation, education, and aesthetic activities in the Hudson River and the New York Harbor, into which the Hudson River flows.

c) Scenic Hudson's Environmental Interest

Scenic Hudson is a not-for-profit environmental organization and separately incorporated land trust dedicated to protecting and enhancing the scenic, natural, historic, agricultural, and recreational treasures of the Hudson River and its valley. Scenic Hudson was originally founded to oppose the proposed Storm King Mountain pumped storage electrical generation facility. Since its incorporation, Scenic Hudson has been an active participant in efforts to promote environmentally sound development and protection of the Hudson River Valley. Scenic Hudson is dedicated to protecting and restoring the Hudson River, its riverfront and the majestic vistas and working landscapes beyond as an irreplaceable national treasure for America and a vital resource for residents and visitors. Scenic Hudson has approximately 20,000 members from New York State and the nation, a majority who reside in the counties along the Hudson River. Its supporters are regular users of the Hudson River for fishing, boating, swimming, and other activities. Scenic Hudson's interests include protecting and improving the River's water quality and aquatic life.

II. Riverkeeper's Legal Issues

Issue No. 1: *The Thermal Modification Was Issued Without a Fact Sheet*

The Thermal Modification does not include a Fact Sheet (and the 2003 SPDES Fact Sheet has not been amended) and this may limit Riverkeeper's ability to provide sufficiently detailed

comments on the modified SPDES permit[5] since the Fact Sheet would set forth, *inter alia*, "the principal facts and the significant factual, legal, methodological and policy questions considered in preparing the draft permit."[6] A Fact Sheet would also include "a brief summary of the basis for the draft permit conditions including references to applicable statutory or regulatory provisions."[7] Riverkeeper accordingly submits these comments without prejudice to its right to supplement or amend these comments if and when NYSDEC issues a Fact Sheet for the proposed Thermal Modification.

Issue No. 2: *The Draft SPDES Permit with the Thermal Modification Violates the Clean Water Act and other Applicable Law Because it Lacks Technology-Based Effluent Limitations for the Facility's Thermal Discharge*

It is the 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. . ."[8] SPDES permits must ensure, *inter alia* that discharges will conform to and meet the requirements of the Clean Water Act (CWA) and all "rules, regulations, guidelines, criteria, standards and limitations adopted pursuant thereto relating to effluent limitations [and] water quality related effluent limitations. . ."[9] Accordingly, SPDES permits must contain applicable effluent limitations as required by the CWA and as may be required by NYSDEC regulations.[10]

The principal purpose of the CWA is "to *restore* and *maintain* the chemical, physical and biological integrity of the Nation's waters."[11] This purpose "is to be achieved by compliance with the Act, including compliance with the permit requirements."[12] Technology-based effluent limitations ("TBELs") provide the minimum required controls for NPDES permits. TBELs are promulgated by EPA as technology-based effluent limitation guidelines (ELGs) which restrict the quantities, rates, and concentrations of certain point-source pollutants.[13] EPA's NPDES regulations provide that "[t]echnology-based treatment requirements under section 301(b) of the

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[5] 40 C.F.R. § 124.8; 6 NYCRR § 750-1.9.

[6] 40 C.F.R. § 124.8(a).

[7] 40 C.F.R. § 124.8(b)(4).

[8] ECL § 17-0101.

[9] ECL § 17-0801.

[10] ECL § 17-0809(1); ECL § 17-0811(1).

[11] CWA § 101(a), 33 USC § 1251(a) (emphasis supplied).

[12] *Weinberger v. Romero-Barcelo,* 456 U.S. 305, 313 (1982).

[13] CWA § 301, 33 USC § 1311.

Act *represent the minimum level of control that must be imposed*" in a permit issued under section 402 of the CWA.[14] Where no applicable national ELGs have been set by EPA, a delegated permitting authority sets TBELs using its best professional judgment (BPJ).[15]
CWA § 301(b)(2) requires industrial dischargers to meet "Best Available Technology" (BAT) limits based for non-conventional pollutants (such as rejected heat from the Facility).[16] BAT requires, at a minimum, that technologically available and economically achievable limits be applied to eliminate discharges, or at least provide reasonable further progress towards such elimination.[17] NYSDEC's SPDES regulations similarly require that the provisions of SPDES permits for thermal discharges ensure compliance with BAT.[18] Although the 2003 Fact Sheet which accompanied the 2004 draft SPDES Permit recognized closed-cycle cooling as an "available technology which can substantially reduce the amount of heat discharged" by the Facility,[19] the proposed modified SPDES permit lacks any provision requiring a TBEL for the Facility's thermal discharge.

Issue No. 3: *The Draft SPDES Permit with the Thermal Modification Violates the Clean Water Act and other Applicable Laws because it Lacks Water Quality-Based Effluent Limitations for the Facility's Thermal Discharge*

Water quality-based effluent limitations ("WQBELs") apply over and above TBELs as needed to protect or restore water quality.[20] Thus, where a point source discharges pollutants with even a "reasonable potential" to cause or contribute to violations of state water quality standards (including narrative standards), NPDES permits must include WQBELs.[21] New York law similarly prohibits discharges which cause or contribute to a condition in contravention of the water quality standards[22] and requires WQBELs.[23]

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[14] 40 CFR § 125.3(a) (emphasis supplied).

[15] *Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York*, 451 F.3d 77, 85 (2d Cir. 2006). CWA § 402(a)(1), 33 U.S.C. § 1342(a)(1); 40 C.F.R. § 125.3(c)(2). Since EPA has not issued ELG's for thermal discharges from facilities in the steam electric power generating point source category, NYSDEC must, as threshold matter, utilize BPJ to determine the appropriate technology-based effluent limitations for the Facility's thermal discharge. *See also* 6 NYCRR §§ 750-1.2(a)(14) and 750-1.11(a)(7).

[16] CWA § 301(b), 33 U.S.C. §1311(b); 40 C.F.R. 125.3(a). *See also In re: Dominion Energy Brayton Point, L.L.C. (Formerly USGen New England, Inc.) Brayton Point Station*, 12 EAD 490(NPDES 03-12), *Remand Order*, (Feb. 1, 2006) 2006 EPA App. LEXIS 9, 25-26; 6 NYCRR 750-1.2(a)(10).

[17] CWA § 301(b)(2), 33 U.S.C. § 1311(b)(2).

[18] 6 NYCRR § 750-1.11(a)(3).

[19] November 2003 SPDES Fact Sheet at 4.

[20] CWA § 301(b)(1)(A) and (B), 33 USC § 1311(b)(1)(A) and (B).

[21] 40 CFR § 122.44(d), CWA § 301(b)(1)(C), 33 USC § 1311(b)(1)(C); 6 NYCRR § 750-1.11(a)(5)(i)

[22] ECL § 17-0501.

[23] ECL § 17-0811(5).

As the United States Supreme Court has observed, even a discharger who meets the CWA's minimum technology-based effluent limitations can be "further regulated" via a WQBEL "to prevent water quality from falling below acceptable levels."[24] Thus, any SPDES permit issued by NYSDEC must require "any requirements in addition to or more stringent than" promulgated effluent limitations guidelines or standards which are necessary to achieve water quality standards—that is, WQBELs.[25] Notably, WQBELs are cost-blind, as EPA's Environmental Appeals Board has explained:

> Water quality-based effluent limitations ("WQBELs"), on the other hand, are designed to ensure that state water quality standards are met regardless of the decisions made with respect to technology and economics in establishing technology-based limits.[26]

As is set forth more fully herein and in Riverkeeper's accompanying technical comments, the Facility's thermal discharge causes and/or has the potential to cause and/or contributes to violations of New York's water quality standards.

NYSDEC has not imposed a WQBEL and has not undertaken the requisite analysis in the context of the proposed modification to determine if the Facility's thermal discharge causes, has the reasonable potential to cause, or contributes to a violation of water quality standards. Yet both the owners of the Facility and NYSDEC have previously indicated that the Facility's unabated thermal discharge *does* cause violations of water quality standards.[27] As NYSDEC's counsel noted in a related NRC proceeding:

> the generators' own statements in the 1999 DEIS pointed out that IP2 and IP3 did not meet the State's §704.2 water quality criteria as to all requirements. The DEIS states that lateral (across the River) and cross-sectional (top-to-bottom of the water column) thermal criteria would be exceeded in the vicinity of Indian Point during some months and during full load operating conditions. The effect is that aquatic species could be blocked from migrating through this part of the Hudson River during certain time periods or seasons. Despite the conclusions of the generators' DEIS, the Department does not consider thermal discharge impacts from Indian Point to be negligible. As reflected in the Declaration of

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[24] *Arkansas v. Oklahoma*, 503 U.S. 91, 101(1992) (internal quotation omitted).

[25] 40 CFR § 122.44(a)(1) and (d)(1).

[26] *In re: Scituate Wastewater Treatment Plant*, (NPDES Appeal No. 04-17) 2006 EPA App. LEXIS 22, 10 (April 19, 2006).

[27] *See In re License Renewal Application Submitted by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, & Entergy Nuclear Operations, Inc.*, New York State Notice of Intention to Participate and Petition to Intervene, 2007 NRC LEXIS 167, 599-627 (NRC 2007)

> David Dilks, on the basis of the DEIS, the Department understands that thermal discharges from Indian Point already violate water quality criteria. This is reflected in the Department's draft SPDES permit conditions that require Entergy to conduct a "triaxial survey", a water temperature study, to support the Department's understanding of the contemporary condition of the Hudson River as effected by thermal discharges from IP2 and IP3.[28]

NYSDEC's technical consultant similarly opined that as of November 28, 2007, all technical analyses conducted related to the thermal discharges from the Facility "clearly indicate[d] that the discharges [did] not meet New York State water quality criteria."[29] Riverkeeper's accompanying technical comments illustrate Riverkeeper's scientific disagreement with Entergy over whether Entergy's tri-axial thermal study demonstrates that the Facility's thermal discharge does not *cause* a violation of water quality standards. But the Clean Water Act requires NYSDEC to find that the Facility does not cause, have a reasonable potential to cause, or contribute to a violation of water quality standards.[30]

As recently as 2007, NYSDEC's consultant opined that the Facility, *operating alone*, violated the thermal criteria for estuaries found in 6 NYCRR § 704.2(b)(5)(ii): "Where the criteria require that a minimum of one-third of the surface shall not be raised more than four Fahrenheit degrees, model results indicate that 100% of the surface width will be raised by more than four degrees (i.e., 0% of the surface width will not be raised) during certain tidal conditions."[31] When he considered the Facility's discharge in conjunction with other thermal discharges, NYSDEC's consultant opined that "the extent of criteria violation increases substantially."[32]

The 2003 SPDES Fact Sheet similarly recognized that the Facility's thermal discharge violates water quality standards[33] and indicated that the draft SPDES permit would require a tri-axial thermal study.[34] Nothing further in the record, aside from the letter submitted on behalf of NYSDEC staff dated May 16, 2011, is provided in terms of NYSDEC's conclusions as to whether the discharge causes, has the reasonable potential to cause, or contributes to a violation

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[28] *Id.* at *720, Declaration of William Little, Esq., ¶ 37.

[29] *Id.* at *601, Declaration of David W. Dilks, ¶3.

[30] 40 C.F.R. § 122.44(d)(1)(i).

[31] *In re License Renewal Application Submitted by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, & Entergy Nuclear Operations, Inc.*, New York State Notice of Intention to Participate and Petition to Intervene, 2007 NRC LEXIS 167, 610 (NRC 2007), Declaration of David W. Dilks, ¶19.

[32] *Id.* at ¶ 20.

[33] November 2003 SPDES Fact Sheet at 8.

[34] *Id.* at 7.

of water quality standards. NYSDEC simply appears to adopt the conclusions of Entergy's tri-axial study without any independent analysis.[35]

But there are a number of problems with Entergy's tri-axial thermal study, as is set forth more fully in Riverkeeper's accompanying technical comments. The tri-axial thermal study is based on a number of faulty assumptions, including, without limitation, a failure to sufficiently consider the Facility's discharge in conjunction with other thermal discharges. Entergy's tri-axial thermal study declined to consider the full thermal loading conditions of "all plants at capacity" as NYSDEC had requested.[36] But NYSDEC's regulations require consideration of a particular discharge in the context of all other thermal discharges by requiring reference to "the temperature that existed before the addition of heat of artificial origin. . ."[37] Heat of artificial origin, in turn, is defined as "*all heat from other than natural sources, including but not limited to cumulative effects of multiple and proximate thermal discharges.*"[38] The regulations clearly require the consideration of *all heat* (not just power plants running at below capacity) from other than natural sources. Riverkeeper's accompanying technical comments illustrate this and other deficiencies in Entergry's tri-axial thermal study.

Moreover, even if NYSDEC could somehow delegate its obligation to analyze the discharge's compliance with New York and federal law to Entergy (which it clearly cannot), Entergy's tri-axial thermal study neither includes nor is based upon an analysis of whether the thermal discharge has the reasonable potential to cause or contribute to a violation of water quality standards when considered in conjunction with "all heat from other than natural sources," including, without limitation, the effects of other thermal discharges and the heated, uncontrolled stormwater discharges which run off from the Facility's acres of impervious surfaces[39] (as well as other sources of stormwater).

In order to determine whether the discharge has the reasonable potential to cause an excursion above a water quality standard, NYSDEC must use all relevant and available data (including facility-specific effluent monitoring data) and employ procedures which account for existing controls on *point and non-point sources* of pollution and the variability of the pollutant or

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[35] Indeed, Entergy declined to even conduct the analysis under the worst-case scenarios requested by NYSDEC staff, i.e., "under MA7CD10 (7 day, 10 year low flow) and the lowest flow for the available record period, background temperature in the river of 90 degrees Fahrenheit (at "slack ebb begin" and "slack flood begin" tide conditions), and during thermal stratification periods. . .and at [a]ll predictions are to be performed at All Plants at Capacity (APAC) conditions." NYSDEC April 2, 2010 401 Denial of Water Quality Certification at 12.

[36] March 29, 2011 ASA Part 1 Response to NYSDEC Staff review of 2010 Thermal Field Program and Modeling Analysis at 8-9.

[37] 6 NYCRR § 704.2(b)(5)(ii).

[38] 6 NYCRR § 700.1(a)(25) (emphasis supplied).

[39] Since the stormwater associated with the industrial activities at the Facility is subject to separate NPDES permitting requirements, *see* 40 C.F.R. § 122.26, those (apparently uncontrolled) thermal discharges, as well as other sources of heat of artificial origin, need to be considered in conjunction with the Facility's rejected heat effluent.

pollutant parameter in the effluent *in addition to* the dilution of the discharge in the receiving water.[40] Section 6.3.2 of the EPA NPDES Permit Writer's Manual illustrates the type of mass balance water quality equation that should be conducted for a steady-state direct discharge such as the one from the Facility for which monitoring data is available. The record in this case contains no such reasonable potential analysis and Entergy's tri-axial thermal study certainly cannot constitute such an analysis.

The Facility's thermal discharge violates a wide array of water quality standards above and beyond the numeric temperature criteria, and causes, has the potential to cause, or contributes to the following violations of water quality standards, as is explained further herein and as supported by Riverkeeper's accompanying technical comments:

- ► Heated effluent (which is a discharge of industrial waste)[41] impairs the best usages of the receiving water.[42]

- ► The protection and propagation of a balanced, indigenous population of fish, shellfish and wildlife in and on the receiving water is not assured.[43]

- ► Large day-to-day fluctuations in temperature occur in the receiving water.[44]

- ► The water temperature at the surface of the receiving water is raised to more than 90 degrees Fahrenheit.[45]

- ► The temperature of more than 50% of the cross-sectional area and volume and/or flow of the estuary is raised more than four degrees Fahrenheit and/or over 83 degrees Fahrenheit over the temperature that existed before the addition heat of artificial origin.[46]

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[40] *American Iron & Steel Inst. v. EPA*, 115 F.3d 979, 999 (D.C. Cir. 1997), quoting 40 C.F.R. § 122.44(d)(1)(ii).

[41] ECL § 17-0105(5); 6 NYCRR § 700.1(a)(26), 6 NYCRR § 701. 1, 6 NYCRR § 701.11 and6 NYCRR § 864.6 In the alternative and at a minimum, heated effluent could be defined as an "other waste" within the meaning of 6 NYCRR § 701.1.

[42] 6 NYCRR § 701.1.

[43] 6 NYCRR § 704.1(a).

[44] 6 NYCRR § 704.2(a)(3).

[45] 6 NYCRR § 704.2(b)(5)(i). *See, .e.g.,* Entergy's May 3, 2011 Alternative Mixing Zone Explanation, Figure 1; Entergy's March 29, 2011 Response to NYSDEC Staff Review 11.

[46] 6 NYCRR § 704.2(b)(5)(ii). As is set forth more fully in Riverkeeper's accompanying technical comments, Entergy's tri-axial thermal study does not properly consider the effect of heat of artificial origin as that term is defined by 6 NYCRR § 701.1(a)(25): "Following the procedure described in the earlier modeling report (Swanson et al., 2010b), i.e., running the model *without any thermal discharges*, the results showed that the surface ambient temperature during this period was always under 83°F, which is the ambient threshold at which the allowable plume temperature rise is limited to 1.5°F versus 4°F." *Indian Point Final Report 2010 Field Program & Modeling Analysis of the Cooling Water Discharge* at ii. Moreover, the flawed conclusions of Entergy's tri-axial thermal study pertain to causation of water quality violations (that is, whether the discharge, standing alone, complies with

► From July through September, when water temperature at the surface of the estuary before the addition of heat of artificial origin is more than 83 degrees Fahrenheit, the temperature of the estuarine passageway as delineated above is raised more than 1.5 Fahrenheit degrees.[47]

► Existing instream water uses and the level of water quality necessary to protect the existing uses are neither maintained nor protected.[48]

Whether considered in the context of causation of, reasonable potential for causation of, or contribution to violations of water quality standards, the operation of the Facility in once-through cooling mode subverts the command of the Clean Water Act that discharges be controlled beyond the minimum requirements of TBELs. Accordingly, NYSDEC should require a WQBEL in the form of closed cycle cooling for the Facility's thermal discharge.

Issue No. 4: *The SPDES Permit as Modified Violates the Clean Water Act's Antidegradation Policy*

The proposed Thermal Modification would violate the fundamental protections provided and required by the CWA's antidegradation policy. At a minimum, EPA notes, a state must apply antidegradation requirements to activities which result in significant degradation of water quality, are regulated under state or federal law and require a permit.[49] EPA's CWA implementing regulations require that water quality standards include an antidegradation policy.[50] Antidegradation requires that "existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected."[51]

As is set forth more fully in Riverkeeper's accompanying technical comments, the Facility's thermal discharge clearly damages and impairs the existing fishery and aquatic habitat uses of

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water quality standards) and do not consider reasonable potential for or contribution to water quality violations, rather, the tri-axial thermal study simply determined that "IPEC was in compliance with NYSDEC Thermal WQS."*Id.* at 119.

[47] 6 NYCRR § 704.2(b)(5)(iii). *See supra* note 36.

[48] Existing uses are those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards. 40 C.F.R. § 131.2(e). The Clean Water Act's antidegradation policy requires that existing uses be maintained and protected. *See* Riverkeeper Issue No. 4, *infra, see also PUD No. 1 v. Wash. Dep't of Ecology,* 511 U.S. 700, 705 (1994), quoting 40 C.F.R. § 131.12

[49] *Ohio Valley Environmental Coalition v. Horinko*, 279 F.Supp.2d 732, 769 (S.D.W.Va. 2003), citing 63 Fed. Reg. 36742, 36783 (July 7, 1998).

[50] 40 C.F.R. § 131.6(d).

[51] *PUD No. 1 v. Wash. Dep't of Ecology,* 511 U.S. 700, 705 (1994), quoting 40 C.F.R. § 131.12

the Hudson River estuary. Moreover, since the Facility does not meet a number of applicable water quality criteria the uses of the Hudson River are not being protected.[52]

As is set forth more fully in Riverkeeper's accompanying technical comments, NYSDEC has recognized the historical impacts of the Facility's thermal discharge on the overall fishery and habitat which existed in the Hudson River.[53] Species such as tomcod and rainbow smelt have been impacted by the Facility's thermal discharge and their populations have declined dramatically since November 28, 1975.[54] The 2003 FEIS notes that previously-abundant tomcod populations in the Hudson River have been monitored since 1974 and are now virtually absent from the River.[55] As the FEIS explains:

> Atlantic tomcod spawning begins in mid-February and extends into mid-March in the Hudson River. The area of peak spawning is in the Highlands section of the river near Con Hook approximately 5 river miles upriver from Indian Point. When eggs and yolk sac larvae drift down river, in addition to being exposed to entrainment, they are also exposed to a thermal plume from Indian Point Units 2 and 3 which extends the entire width of the river on flood tide and across more than two thirds of the width on ebb. In years of high freshwater floods, larvae are transported down river by current into the Haverstraw region or the Tappan Zee region while maturing. Post yolk sack tomcod then concentrate near the leading edge of the salt front (approximately 1 ppt salinity) and move with the tidal flow. In dry years with low freshwater input, this front can be located in the Indian Point region. This results in tomcod larvae congregating in the leading edge of the salt front, being repeatedly moved past the Indian Point station discharge and intakes, potentially increasing the thermal and entrainment effects of the plant on this species. Less than average rainfall from 1995 into 2002 reduced the freshwater flow in the Hudson River. This

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[52] When water quality criteria are met, water quality will *generally* protect the designated use. *See* 40 C.F.R. § 131.3(b). Designated uses must be at least as protective of water quality as existing uses. 40 C.F.R. § 130.10. Since the Facility's thermal discharge violates applicable criteria and impairs designated uses, existing uses are not being protected with once-through cooling and any SPDES permit that allows for once-through cooling would violate antidegradation.

[53] *See* Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation on June 25, 2003 (hereinafter "2003 FEIS"); see also Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247 [AEC, Directorate of Licensing]; and Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286 [NUREG-75/002].

[54] This is the operative date for establishing existing uses as per 40 C.F.R. § 131.2(e).

[55] *See* 2003 FEIS at 66-67.

> period corresponds to the period of rapid decline in numbers of Atlantic tomcod in the Hudson River.[56]

The Thermal Modification proposes to allow the Facility to maintain these indisputably detrimental thermal discharges to the Hudson River. But no activity that would "'partially or completely eliminate any existing use" can be permitted, "even if it would leave the majority of a given body of water undisturbed." [57] Rainbow smelt populations have been similarly impacted:

> Because the Hudson River is located in the southern portion of the rainbow smelt's east coast range, one might reasonably conclude that observed increases in ocean and coastal water temperatures, as from global climate change, have caused a range shift northward, with the smelt abandoning its southernmost range. However, smelt populations at nearly the same latitudes as the Hudson River Estuary remain stable. This fact may indicate that localized influences have caused the apparent local disappearance of this species in the Hudson River. Thermal discharges, as from power plants, may be a principal factor in the disappearance of this species from the Hudson estuary.[58]

Riverkeeper's accompanying technical comments further illustrate the impact of the Facility's thermal discharge on the once-abundant and existing fisheries of the Hudson River.

Even if the Facility's thermal discharge were not impairing existing uses in contravention of the most fundamental protections of antidegradation (which it clearly is doing), NYSDEC has failed to conduct a legally sufficient antidegradation analysis for the proposed Thermal Modification. EPA's antidegradation regulation further provides (again, at a minimum) that

> Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and

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[56] 2003 FEIS at 67-68 (internal footnotes omitted).

[57] *Islander E. Pipeline Co., LLC v. McCarthy*, 525 F.3d 141, 144 (2d Cir. 2008), quoting *PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. at 718-19 (quoting EPA, Questions and Answers on Antidegradation at 3 (Aug. 1985).

[58] 2003 FEIS at 65.

> existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.[59]

The proposed Thermal Modification is not supported by the requisite socio-economic justification required by 40 C.F.R. § 131.12(a)(2). As previously noted, the proposed Thermal Modification does not assure adequate water quality to fully protect existing uses. The proposed Thermal Modification does not mandate the "highest statutory and regulatory requirements" for existing point source discharges, particularly the thermal discharge at issue (for which NYSDEC has required neither a TBEL nor a WQBEL).

Nor does the proposed Thermal Modification assure that all cost-effective and reasonable best management practices (BMPs) are required for nonpoint source control. To the contrary, cumulative effects of all sources of "heat of artificial origin,"[60] including the heated stormwater runoff from the Facility, were not considered and do not appear to be regulated in any fashion. It is in fact undisputed that "the discharge of radiological substances (including, but not limited to, radioactive liquids, radioactive solids, radioactive gases, and stormwater)"[61] has occurred and continues to occur at the Facility from a variety of diffuse sources. Although the draft SPDES permit includes BMPs for toxic or hazardous pollutants,[62] it does not appear to require BMPs to address stormwater or the thermal and radiological components contained in such stormwater.[63]

EPA's antidegradation regulation further requires the state to implement antidegradation in a manner that is at least as protective as Section 316 of the CWA:

> In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act.[64]

Section 316 of the CWA, in turn, requires the imposition of the best technology available to minimize adverse environmental impacts from cooling water intakes, and also requires that thermal discharges assure the protection and propagation of a balanced, indigenous population (BIP) of shellfish, fish and wildlife in the receiving waters. While the proposed Thermal

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[59] 40 C.F.R. § 131.12(a)(2).

[60] 6 NYCRR § 700.1(a)(25).

[61] NYSDEC April 2, 2010 Denial of Water Quality Certification at 11.

[62] 2004 Draft SPDES permit at 20-24.

[63] Riverkeeper recognizes that the discharge of radiological substances cannot be authorized by a SPDES permit and is unlawful *per se*. ECL § 17-0807(1). Accordingly, Entergy cannot show, and NYSDEC cannot find, that cost effective and reasonable BMPs are required for radiological discharges in any event and thus the SPDES permit cannot satisfy antidegradation as a result.

[64] 40 C.F.R. § 131.12(a)(4).

Modification recites similar language from NYSDEC's thermal criteria regulations,[65] nothing in the proposed permit term provides any restrictions to require that the criteria are met, or indicates how NYSDEC will determine compliance.

The permit term reduces itself to a mere tautology by reciting the thermal criteria standards while providing nothing in the way of restrictions on the discharge, measures for enforcement purposes, or indeed any showing as to what the BIP is and how its protection and propagation shall be assured.

Issue No. 5: *The Draft SPDES Permit with the Thermal Modification Violates the Clean Water Act and other Applicable Law Because it is Unsupported by a BIP Demonstration*

Since New York's water quality standards require that all thermal discharges shall assure the protection and propagation of the BIP,[66] any applicant for a SPDES permit for a thermal discharge must demonstrate compliance with that standard. As noted, the NYSDEC thermal criteria make reference to the requirement for the protection and propagation of the BIP, but those regulations do not define the term BIP. Since the state standards must be at least meet the federal minimums of the Clean Water Act,[67] reference to EPA's definition of the term BIP is appropriate. EPA defines a BIP as follows:

> The term balanced, indigenous community is synonymous with the term balanced, indigenous population in the Act and means a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species and by a lack of domination by pollution tolerant species. Such a community may include historically non-native species introduced in connection with a program of wildlife management and species whose presence or abundance results from substantial, irreversible environmental modifications. Normally, however, such a community will not include species whose presence or abundance is attributable to the introduction of pollutants that will be eliminated by compliance by all sources with section 301(b)(2) of the Act; and may not include species whose presence or abundance is attributable to alternative effluent limitations imposed pursuant to section 316(a).[68]

The discharger bears a stringent burden of proof to demonstrate that its discharge will ensure

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[65] 6 NYCRR § 704.1(a) provides: "All thermal discharges to the waters of the State shall assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water."

[66] 6 NYCRR § 704.1(a).

[67] CWA § 510, 33 U.S.C. § 1370; 40 C.F.R. § 131.4(a).

[68] 40 C.F.R. § 125.71(c).

protection and propagation of the BIP.[69] In order to meet the standard of demonstrating that the proposed discharge will assure the protection and propagation of the BIP an existing discharger may: (1) employ a retrospective demonstration showing that no prior appreciable harm has resulted from the discharge, or (2) employ a prospective demonstration showing that, despite such previous harm, the discharge will nevertheless ensure the protection and propagation of the BIP.[70] In determining whether or not prior appreciable harm has occurred, the permitting authority must consider "the length of time in which the applicant has been discharging and the nature of the discharge."[71]

To Riverkeeper's knowledge, Entergy has provided NYSDEC with neither an analysis of what constitutes the BIP for the receiving water nor a demonstration that the protection and propagation of the BIP will be assured. Accordingly, there is no basis for NYSDEC to determine either what the BIP is or if the protection and propagation of the BIP will be assured.

To the contrary, the existing and well-documented SPDES record establishes that the Facility's thermal discharges have caused long-standing adverse environmental impacts to aquatic organisms and fish such as stress, injury, shock and mortality.[72] Although the burden is squarely placed and will squarely remain on Entergy to show that the Facility meets the requirements of the Clean Water Act and the ECL,[73] the record of this proceeding thoroughly demonstrates that the Facility has caused prior appreciable harm to the BIP in the light of the nature and long-standing duration of the thermal discharge.[74] Moreover, as previously noted, NYSDEC has recognized the inextricable link between the thermal discharge and the impacts of the Facility's cooling water intake. A determination that the protection and propagation of the BIP will be

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[69] *In re: Dominion Energy Brayton Point, L.L.C. (Formerly USGen New England, Inc.) Brayton Point Station*, 12 EAD 490(NPDES 03-12), *Remand Order*, (Feb. 1, 2006) 2006 EPA App. LEXIS 9, 163-164 (expressly rejecting the discharger's arguments apparent arguments that the burden was on EPA to show that the thermal discharge at issue would not ensure the protection and propagation of the BIP).

[70] *Id.*, quoting 40 C.F.R. § 125.73.

[71] *Id.*, quoting 40 C.F.R. § 125.73(c)(2).

[72] *See* Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Accepted by the New York Department of Environmental Conservation on June 25, 2003; see also Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Consolidated Edison Company of New York, Inc., September 1972 – Docket No. 50-247 [AEC, Directorate of Licensing]; and Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Consolidated Edison Company of New York, Inc., February 1975 – Docket No. 50-286 [NUREG-75/002].

[73] CWA § 316(a), 33 U.S.C. § 1326(a); 6 NYCRR § 624.9(b)(1).

[74] 40 C.F.R. § 125.73(c)(2); *see also* August 13, 2008 Interim Decision of the Assistant Commissioner, *Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC*, DEC No. 3-5522-00011/0004, SPDES No. NY-0004472 at 15 (finding that the requisite adverse environmental impact specified in 6 NYCRR § 704.5 has been thoroughly demonstrated in the record of this proceeding and that therefore no reason exsited to adjudicate that issue).

assured requires a consideration of the cumulative impact of the thermal discharge together with all other significant impacts.[75]

While Riverkeeper disputes that NYSDEC can issue a SPDES permit for the discharge at issue without granting a variance,[76] the standard for *all* thermal discharges in New York requires an assurance of the protection and propagation of the BIP. Section 316(a) of the Clean Water Act and its implementing regulations at 40 C.F.R. Part 125 clearly delineate what is required to make a showing that the protection and propagation of the BIP shall be assured. While there is a difference between the respective agency actions (i.e., granting a variance or establishing a mixing zone), the regulatory requirement and ecological analysis (that is, the assurance of the protection and propagation of the BIP) remain the same. That analysis is lacking with respect to the proposed Thermal Modification.

Issue No. 6: *The Proposed Mixing Zone Is Illegal*

i) The Mixing Zone Violates the Clean Water Act

Permissible mixing zone characteristics should be established to ensure that

(1) mixing zones do not impair the integrity of the water body as a whole;
(2) there is no lethality to organisms passing through the mixing zone; and
(3) there are no significant health risks, considering likely pathways of exposure.[77]

While the decision as to whether to create mixing zones is a matter of state discretion, any decision to allow mixing zones must be consistent with the CWA's antidegradation policy.[78] Mixing zones are permissible so long as a number of fundamental protections, such as the absence of lethal conditions to aquatic life, are maintained.[79] By definition, a mixing zone is a defined area.[80] "The size and configuration of the mixing zone is a crucial variable in

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[75] 40 C.F.R. § 125.73(a).

[76] *See* Riverkeeper's Issue No. 8, *infra.*

[77] *American Wildlands v. Browner,* 94 F. Supp. 2d 1150, 1162 (D. Colo. 2000), citing EPA WATER QUALITY STANDARDS HANDBOOK . SPDES permits must ensure that discharges will conform to and meet the requirements of the Clean Water Act (CWA) and as well as all rules, regulations and guidelines adopted pursuant thereto. ECL § 17-0801.

[78] *Id.* at 1162, citing 33 U.S.C. § 1313(d)(4)(B).

[79] *Am. Wildlands v. Browner,* 260 F.3d 1192, 1195 (10th Cir. 2001), quoting EPA WATER QUALITY STANDARDS HANDBOOK § 5.1.1, at 5-5 (2d ed.1994).

[80] *Puerto Rico Sun Oil Co. v. United States EPA,* 8 F.3d 73, 75 (1st Cir. 1993).

determining whether or not a given effluent can be discharged."[81] But the Thermal Modification permits a 75-acre undefined mixing zone[82] which includes temperatures which are lethal to aquatic biota and in violation of the antidegradation policy. Accordingly, the proposed Thermal Modification violates the Clean Water Act.

ii) The Mixing Zone Violates New York's Water Quality Standards for Mixing Zones

The proposed Thermal Modification fails to specify definable, numerical limits for the thermal discharge's mixing zone.[83] The Thermal Modification simply permits a blanket mixing zone of seventy five (75) acres (roughly three million square feet), without any reference to linear distances from the point of discharge or the location of the discharge—which will of course change directions several times a day as the tide changes in this estuarine receiving water. Moreover, as is explained in Riverkeeper's accompanying technical comments, the actual area impacted by the thermal plume is greater than 75 acres. In any event, the Hudson River is only .7 nautical miles across at Indian Point, so a 75-acre mixing zone could completely block the Hudson River.[84] Since the area of the thermal plume is in fact larger than the allocated 75-acre mixing zone, the mixing zone's surface area involvement has been understated and the thermal plume's ability to cover the entire receiving water from shore to shore has not been considered.

Moreover, NYSDEC's mixing zone regulations prohibit the location of mixing zones for thermal discharges where the mixing zone will simply "interfere" with (rather than block) spawning areas, nursery areas and fish migration routes.[85] The Hudson River estuary in the vicinity of Indian Point serves all such purposes. Conditions in the mixing zone cannot be lethal in contravention of water quality standards to aquatic biota which may enter the zone.[86] As is set forth more fully in Riverkeeper's accompanying technical comments, Entergy's tri-axial thermal study shows that surface water temperatures in excess of 90 degrees Fahrenheit or greater (lethal temperature for many aquatic organisms) covering up to fourteen (14) acres within the "inferred mixing zone." Thus, the mixing zone creates massive areas where conditions are lethal to aquatic biota, many of which drift with the current and cannot avoid the thermal plume. As is also set forth in Riverkeeper's accompanying technical comments, inferred mixing zone interferes with spawning and nursery areas in the littoral zone.

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[81] *Marathon Oil Co. v. EPA,* 830 F.2d 1346, 1349 (5th Cir. 1987).

[82] As is set forth more fully in Riverkeeper's accompanying technical comments, the area of the thermal plume which exceeds thermal numeric water quality standards is actually greater than 75 acres.

[83] 6 NYCRR § 704.3(a).

[84] Riverkeeper's accompanying technical comments provide additional in-depth discussion of these issues.

[85] 6 NYCRR § 704.3(c).

[86] 6 NYCRR § 704.3(b).

iii) The Mixing Zone is Inconsistent With EPA Guidance

EPA has provided very specific guidance with regards to mixing zones, which NYSDEC has failed to abide by in granting Entergy the Thermal Modification:

> EPA recommends that mixing zone characteristics be defined on a case-by-case basis after it has been determined that the assimilative capacity of the receiving system can safely accommodate the discharge. This assessment should take into consideration the physical, chemical, and biological characteristics of the discharge and the receiving system; the life history and behavior of organisms in the receiving system; and the desired uses of the waters. Mixing zones should not be permitted where they may endanger critical areas (e.g., drinking water supplies, recreational areas, breeding grounds, areas with sensitive biota)"[87]

As noted above, the Thermal Modification did not include a WQBEL analysis or a demonstration of what constitutes the BIP or what will assure the protection and propagation thereof. As Riverkeeper's accompanying technical comments illustrate, Entgery has not demonstrated that the receiving water can safely accommodate the Facility's thermal discharge. Thus, NYSDEC did not consider the physical, chemical and biological characteristics of the receiving water or the life history and behavior of the organisms in the receiving waters when it issued the proposed thermal modification. Nor did NYSDEC consider the critical area into which the unabated thermal discharge would be allowed, that is, a critical estuarine breeding habitat with sensitive biota, including endangered short nosed sturgeon.

As EPA's Water Quality Handbook explains, a disproportionately large mixing zone (like the one at issue) "could potentially adversely impact the productivity of the water body and have unanticipated ecological consequences" and thus mixing zones "should be carefully evaluated and appropriately limited in size."[88] Here, NYSDEC did not carefully evaluate or appropriately limit the size of the mixing zone.

The size of the mixing zone at issue implicates the zone of passage for aquatic biota. Zones of passage are defined by EPA as "continuous water routes of such volume, area, and quality as to allow passage of free-swimming and drifting organisms so that no significant effects are produced on their populations." [89] As EPA further explains:

> Transport of a variety of organisms in river water and by tidal movements in estuaries is biologically important for a number of reasons:

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[87] EPA, WATER QUALITY HANDBOOK 5.1, *available at* http://water.epa.gov/scitech/swguidance/standards/handbook/chapter05.cfm. (last visited July 12, 2011).

[88] *Id.* at 5.1.1.

[89] *Id.* at 5.1.1.

- food is carried to the sessile filter feeders and other nonmotile organisms;
- spatial distribution of organisms and reinforcement of weakened populations are enhanced; and
- embryos and larvae of some fish species develop while drifting.[90]

The objective of carefully evaluating the sensitivity of the receiving water and appropriately sizing the mixing zone "is to provide time-exposure histories that produce negligible or no measurable effects on populations of critical species in the receiving system."[91] Here, Entergy's own data shows that maximum temperatures in the proposed zone would be allowed to exceed lethal thresholds with observed temperatures of 95 degrees Fahrenheit[92] or higher.[93]

iv) The Methodology Attempting to Support and Indicate the Mixing Zone is Insufficient.

The flaws in the methodology include,[94] but are not limited to the following: (as noted *supra* and *infra)*:

- Failure to properly consider heat of artificial origin: As is set forth more fully in Riverkeeper's accompanying technical comments, Entergy's tri-axial thermal study does not properly consider the effect of heat of artificial origin as that term is defined by 6 NYCRR § 701.1(a)(25): "Following the procedure described in the earlier modeling report (Swanson et al., 2010b), i.e., running the model *without any thermal discharges*, the results showed that the surface ambient temperature during this period was always under 83°F, which is the ambient threshold at which the allowable plume temperature rise is limited to 1.5°F versus 4°F." *Indian Point Final Report 2010 Field Program & Modeling Analysis of the Cooling Water Discharge at ii.* Moreover, the flawed conclusions of Entergy's tri-axial thermal study pertain to causation of water quality violations (that is, whether the discharge, standing alone, complies with water quality standards) and do not consider reasonable potential for or contribution to water quality violations, rather, the tri-axial thermal study simply determined that determine that "IPEC was in compliance with NYSDEC Thermal WQS."*Id.* at 119.

- Failure to properly evaluate MA7CD10 and APAC: Entergy declined to even conduct the analysis under the worst-case scenarios requested by NYSDEC staff, i.e., "under

[90] *Id.* at 5.1.1.

[91] *Id.* at 5.1.2.

[92] March 29, 2011 ASA Part 1 Response to NYSDEC Staff review of 2010 Thermal Field Program and Modeling Analysis at 11.

[93] *See* Riverkeeper's accompanying technical comments.

[94] We note that Riverkeeper has not had discovery with respect to Entergy's thermal submissions in the SPDES and CWA Section 401 proceedings and thus respectfully reserves the right to comment further at a later date.

MA7CD10 (7 day, 10 year low flow) and the lowest flow for the available record period, background temperature in the river of 90 degrees Fahrenheit (at "slack ebb begin" and "slack flood begin" tide conditions), and during thermal stratification periods. . .and at [a]ll predictions are to be performed at All Plants at Capacity (APAC) conditions." NYSDEC April 2, 2010 401 Denial at 12.

- Inaccurate assumptions as to the ambient temperature: See Riverkeeper Technical Comments at 16 – 17.

- Projected Climate Change is not considered: See Riverkeeper Technical Comments at 15; also, please see *infra*, Issue #11.

Issue No. 7: *Since the Mixing Zone is Illegal, the Thermal Discharge Will Continue to Violate New York's Thermal Criteria*

As noted in Riverkeeper's Issue No. 5, there has not been any demonstration that the discharge will "assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water," and such a showing is required in order to show compliance with New York's thermal discharge criteria.[95] Further, as is set forth in the attached technical comments, the discharge will cause large day-today temperature fluctuations due to heat of artificial origin.[96]

Moreover, the thermal discharge violates specific numerical water quality criteria applicable to estuaries.[97] As is set forth more fully in Riverkeeper's accompanying technical comments, the thermal discharge raises the surface water temperature of the estuary over ninety degrees across large sections of the Hudson River,[98] and raises the temperature of more than fifty percent (50%) of the cross sectional area and/or volume of the flow of the Hudson River (including more than one-third of the surface as measured from water edge to water edge at any stage of the tide) more than four degrees Fahrenheit over the temperature that existed before the addition of heat of artificial origin and to a maximum of 83 degrees Fahrenheit,[99] all in violation of New York's estuarine thermal criteria. As NYSDEC's consultant opined in a related NRC proceeding:

> Specifically, operation of the Indian Point facilities alone is predicted to violate 6 N.Y.C.R.R. section 704.2(5)(ii). Where the criteria require that a minimum of one-third of the surface shall not be raised more than four Fahrenheit degrees, model results indicate that 100% of the surface width will be raised by more than four

[95] 6 NYCRR § 704.1(a).

[96] 6 NYCRR § 704.2(a)(3).

[97] 6 NYCRR § 704.2(b)(5).

[98] 6 NYCRR § 704.2(b)(5)(i).

[99] 6 NYCRR § 704.2(b)(5)(ii).

> degrees (i.e., 0% of the surface width will not be raised) during certain tidal conditions.[100]

NYSDEC has recognized that the Facility's thermal discharges (alone and when considered along with all thermal discharges in the region) violate New York's thermal water quality standards.[101]

Since the unabated thermal discharge is emitted at lethal temperatures and in vast quantities into a sensitive estuarine system and otherwise fails to satisfy numerous state and federal requirements for mixing zones, the discharge cannot be allowed via a mixing zone and thus violates water quality standards.

> **Issue No. 8:** *Since the Thermal Discharge Will Continue to Violate Water Quality Standards, if Closed-Cycle Cooling is Not Required, Entergy Must Seek a Variance Under Section 316(a) of the Clean Water Act and 6 NYCRR § 704.4.*

The proposed Thermal Modification has been issued in violation of Sections 301 and 303 of the Clean Water Act, including, without limitation, effluent limitation requirements, antidegradation requirements and New York's water quality standards relating to thermal criteria and mixing zones. Accordingly, there are several reasons which require NYSDEC to mandate the installation of closed-cycle cooling for the Facility's thermal discharge as it has done for the Facility's cooling water intake. The Facility stands apart from other steam electric generating plants as uniquely injurious to the aquatic environment. As NYSDEC's consultant has put it:

> IP2 and IP3 draw enormous amounts of water -- 2.5 billion gallons each day. Nearly all of this water is eventually discharged into the Hudson River, but at a much higher temperature because it has been used to cool the plants' operations. Collectively, the maximum permitted thermal discharge for IP2 and IP3 is for trillions of BTUs of total heat per year. Based on my review of the EPA Permit Compliance System, *these BTU limits are hundreds of times larger than most power facilities.*[102]

As with the entrainment impacts associated with the Facility's cooling water intake (over a billion aquatic organism per year), the numbers associated with this particular facility are simply so staggering (roughly 2.5 billion gallons of water per day discharged as waste heat totaling

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[100] *In re License Renewal Application Submitted by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, & Entergy Nuclear Operations, Inc.*, New York State Notice of Intention to Participate and Peitition to Intervene, 2007 NRC LEXIS 167, 599-627 (NRC 2007), Declaration of David W. Dilks, ¶19.

[101] *Id.* at ¶ 18.

[102] *Id.* at ¶ 7.

trillions of BTUs per year) that the Facility stands apart. The Facility is the largest user of water in the state[103] and it discharges heated effluent in amounts nearly equal to its intake.

Accordingly, even if NYSDEC declines to require closed-cycle cooling as a TBEL or WQBEL for the thermal discharge, the discharge is not an appropriate candidate for a mixing zone approach to compliance. Even if NYSDEC were to ignore the mandates of Sections 301 and 303 of the Clean Water Act, NYSDEC could not allow Entergy to circumvent the requirements of Section 316(a) of the Act by exceeding thermal criteria and operating in circumvention of effluent limitations without seeking a variance.[104] Notably, both federal and state law require the opportunity for a public hearing on a variance.[105]

Issue No. 9: *The Draft SPDES Permit with the Thermal Modification Allows for the Impairment of Best Usages*

New York regulations require that discharges "shall not cause impairment of the best usages of the receiving water as specified by the water classifications at the location of discharge and at other locations that may be affected by such discharge."[106] New York designated the Hudson River in the vicinity of the Facility as a Class SB saline surface water,[107] and thus its best uses are "primary and secondary contact recreation and fishing"[108] and the waters must be "be suitable for fish, shellfish, and wildlife propagation and survival."[109] As previously noted, the Thermal Modification was issued without consideration of TBELs, WQBELs, antidegradation or an analysis and presentation of the composition of the BIP and consideration of whether the protection and propagation of the BIP will be assured. Moreover, the use a 75-acre mixing zone (which is actually smaller than the thermal plume) with lethal temperatures is in direct contravention of thermal water quality criteria, mixing zone requirements and the requirements to protect and support existing and designated uses.

Entergy's tri-axial thermal study addresses the Facility's compliance with numerical thermal criteria but lacks any predictive assessment of biological effects on designated uses. Riverkeeper disputes Entergy's conclusions with respect to numerical thermal criteria as set forth herein and in Riverkeeper's accompanying technical comments. But it is well-settled that compliance with water quality standards involves more than meeting numeric criteria. As previously noted herein, the record is devoid of any antidegradation analysis with respect to

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[103] 2003 NYSDEC FEIS at 71, n. 175.

[104] CWA § 316(a), 33 U.S.C. § 1326(a), 6 NYCRR § 704.4.

[105] CWA § 316(a), CWA § 1326(a), 6 NYCRR § 704.4(e).

[106] 6 N.Y.C.R.R. § 701.1.

[107] 6 N.Y.C.R.R. § 868.6.

[108] 6 N.Y.C.R.R. § 701.11.

[109] 6 N.Y.C.R.R. § 701.11.

existing uses. "Under the literal terms of [the CWA], a project that does not comply with a designated use of the water does not comply with the applicable water quality standards."[110] Use designations "must be translated into specific limitations for individual projects."[111] Entergy's tri-axial thermal study focuses on numeric criteria rather than the effect of the discharge on designated and existing uses. Entergy's failure to separately address compliance with designated uses and existing uses (and the absence of any independent analysis of those questions by NYSDEC) is compounded by the record of this proceeding which thoroughly demonstrates the impact of the Facility's long-standing and uncontrolled thermal discharge.[112]

The thermal discharge of Indian Point also impairs the best usage of the waters of the Hudson River for propagation and survival of endangered and threatened species.[113] In particular, it is undisputed that endangered shortnose sturgeon and threatened Candidate Species Atlantic sturgeon reside in the Hudson River in the vicinity of Indian Point, and that these species are impacted by the thermal effluent emanating from the plant.[114]

Issue No. 10: *NYSDEC Must Impose a Schedule of Compliance as an Interim Measure With Respect to the Facility's Thermal Discharge*

Since the discharge is not in compliance with applicable effluent limitations, water quality standards or the requirements of antidegradation, NYSDEC must "establish specific steps in a compliance schedule designed to attain compliance within the shortest reasonable time" consistent with the Clean Water Act and Article 17 of the ECL.[115] The schedule of compliance must comply with time requirements for interim actions[116] and the substantive requirements of 6

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[110] *PUD No. 1 v. Wash. Dep't of Ecology,* 511 U.S. 700, 705 (1994), quoting 40 C.F.R. § 131.12.

[111] *Islander E. Pipeline Co., LLC v. McCarthy,* 525 F.3d 141, 165 (2d Cir. 2008).

[112] 40 C.F.R. § 125.73(c)(2); *see also* August 13, 2008 Interim Decision of the Assistant Commissioner, *Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC*, DEC No. 3-5522-00011/0004, SPDES No. NY-0004472 at 15 (finding that the requisite adverse environmental impact specified in 6 NYCRR § 704.5 has been thoroughly demonstrated in the record of this proceeding and that therefore no reason exsited to adjudicate that issue).

[113] *See* 6 N.Y.C.R.R. § 701.11.

[114] *See* Letter from Mary A. Colligan (Assistant Regional Administrator for Protected Resources, National Marine Fisheries Service (NFMS)) to James A. Thomas (Enercon Services, Inc.), January 23, 2007 ("A population of federally endangered shortnose sturgeon (*Acipenser brevirostrum*) occurs in the Hudson River. Shortnose sturgeon have been documented to occur in the Hudson River from the northern end of Staten Island in New York Harbor (RM -3) to the Troy Dam (RM 151). . . . [A]dult shortnose sturgeon concentrate . . . near Haverstraw Bay (RM 33-40). . . . most juveniles occupy the broad region of Haverstraw Bay (RM 33-40) by late fall and early winter. . . . Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are also present in the Hudson River. . . . Sturgeon yolk sac larvae (YSL) and post yolk sac larvae (PYSL) have been documented in the vicinity of Indian Point. . . . NMFS has several concerns regarding the potential for the authorized withdrawals and discharges to affect sturgeon. . . . Both shortnose and Atlantic sturgeon may also be affected by the discharge of heated effluent, chlorine, and other pollutants or antifouling agents.").

[115] 6 NYCRR § 750-1.14(a); ECL § 17-0813.

[116] 6 NYCRR § 750-1.14(b).

NYCRR § 750.1-14 including, without limitation, a pollutant minimization program for the thermal discharges which are impairing or precluding the best usages of the receiving water.[117]

The draft SPDES permit includes a schedule of compliance to reduce entrainment via scheduled outages of no fewer than 42 unit-days between February 23 and August 23 of each calendar year.[118] This provision should be revised to require additional scheduled outages which must occur during the warmest months of the year (July and August) in order to abate the Facility's thermal discharge.

Issue No. 11: *The Thermal Modification Fails to Take Climate Change into Account*

NYSDEC policy requires that all Departmental activities, including permitting, are to integrate climate change considerations.[119] It is also Federal policy to assess and account for climate change in developing permit limits and standards for protecting waterways.[120] All NYSDEC Divisions, Offices and Regions are required to integrate the climate change policy into their programs as follows:[121]

> Department staff are directed to integrate climate change considerations as may be relevant, along with other environmental issues and State priorities, into the full range of their Departmental activities, including but not limited to all decision-making, planning, permitting, remediation, rulemaking, grant administration, natural resource management, enforcement, land stewardship, facilities management, internal operations, contracting, procurement, and public outreach and education.[122]

The policy goes on further to require that analyses and decision-making processes use the best available scientific information of environmental conditions resulting from the impacts of climate change such as increased air and water temperatures and incorporate measures "that

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[117] 6 NYCRR § 750-1.14(f).

[118] 2004 Draft NPDES permit at 16.

[119] NYSDEC Policy CP-49 dated October 22, 2010 at 2.

[120] *See* Chesapeake Bay Protections and Restoration Executive Order §§ 202, 601 (May 12, 2009) at 6 (requiring federal agencies to "assess the impacts of a changing climate on the Chesapeake Bay and develop a strategy for adapting natural resource programs and public infrastructure to the impacts of a changing climate on water quality and living resources of the Chesapeake Bay watershed" and to include the assessment of temperature and effects on fish habitat). EPA accordingly accounted for climate change in its issuance of the Nutrient TMDL for the Chesapeake Bay. Final Chesapeake Bay TMDL (December 29, 2010). 76 Fed. Reg. 54901 (Jan. 5, 2011). The Chesapeake Bay TMDL can be found at http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html (last visited July 14, 2011).

[121] NYSDEC Policy CP-49 at 6.

[122] NYSDEC Policy CP-49 at 2.

enhance the capacity of ecosystems and communities to absorb and/or accommodate the impacts of climate change."[123] Such objectives are particularly relevant to NYSDEC's decision regarding the Facility's proposed mixing zone.

III: Conclusion

Based on the foregoing as supported by and in addition to Riverkeeper's accompanying technical comments, Riverkeeper respectfully requests that NYSDEC reconsider its issuance of the proposed Thermal Modification, impose the stricter of technology-or-water quality based effluent limitations following a determination of what constitutes the BIP and the performance of legally and technically supportable analyses of the impact of the discharge on the BIP and the receiving water.

Such analyses must include an evaluation of the impacts of the discharge in conjunction with all other sources of heat of artificial origin, and address the Facility's reasonable potential to cause a violation of water quality standards as well as whether the Facility contributes to such a violation. Such analyses must address the protection of existing uses afforded by the antidegradation policy, a socio-economic justification for lowering water quality, and assure that the highest statutory and regulatory requirements for the existing discharge is required, along with cost-effective and reasonable best management practices for nonpoint source controls.

Riverkeeper further submits that when NYSDEC conducts such analyses, NYSDEC will inevitably conclude that a water quality based effluent limitation is required for the Facility's thermal discharge (without regard to questions of cost or technological feasibility) and that a schedule of compliance must be imposed in the interim while Entergy retrofits the Facility to accommodate closed-cycle cooling. If a mixing zone is still required for the Facility after the fundamental dictates of the Clean Water Act have been satisfied, the mixing zone must comply with both state and federal law.

Riverkeeper appreciates NYSDEC's consideration of the above comments. Should you require any clarification, or additional information, please do not hesitate to contact the undersigned at (914) 478-4501.

Very truly yours,

Mark L. Lucas
Hudson River Program Staff Attorney

[123] *Id.* at 3.

Appendix 1

To: Riverkeeper Inc.

From: Richard Seaby and Peter Henderson

CC:

Date: 7/15/2011

Re: Thermal issues at Indian Point

Comments on the proposed Indian Point thermal mixing zone

These comments are made in reference to the report entrainment, impingement and thermal impacts at Indian Point Nuclear power station, Pisces Conservation ltd, 2007 are incorporated here by reference.

1 The Hudson River resource at issue and its vulnerability

The Hudson River estuary is one of the major estuarine systems on the east coast of the USA. It acts as both an important nursery and breeding ground for marine animals and fish in particular. Key commercial and recreational species like striped bass, bluefish, and blue crab depend upon the estuary for nursery habitat. It supports huge populations of small forage fish such as bay anchovy which are prey for the larger predatory species. Further, it is the migratory route by which anadromous[1] and catadromous[2] fish move between their spawning and feeding grounds. Haverstraw Bay, immediately to the south of Indian Point, is known as an important feeding habitat for both the Atlantic and shortnose sturgeon.The Hudson River, up to the federal dam in Troy, has been designated as Essential Fish Habitat. See National Estuarine Inventory: Data Analysis - Vol. 1: Physical and Hydrological Characteristics, Strategic Assessment Branch, Office of Oceanography and Marine Assessment, NMFS.

The Hudson River estuary is one of the most species-rich temperate estuaries in the world; about 140 fish species have been recorded from the Hudson estuary. This probably relates to its unique geographical position, which enables it to support cold water species such as the Atlantic tomcod during the winter, and many warm water species during the summer. The estuary's productivity is ecologically and economically valuable to the fisheries and aquatic ecosystem to a wide expanse of the Atlantic coast of the USA.

[1] Anadromous fish live in the sea and migrate to fresh water to breed. An example is the American shad.
[2] Catadromous fish spend most of their lives in fresh water, then migrate to the sea to breed. The most well-known example is the American eel.

The Hudson River estuary holds extensive areas of significant fish habitat. Just to the north of Indian Point, Hudson River mile 44-56 is designated by Department of State as a Significant Coastal Fish and Wildlife Habitat and offers significant spawning habitat for striped bass and white perch.

It is now proposed to designate the region between river miles 40 and 60 as Significant Coastal Fish and Wildlife Habitat. This region encompasses the Hudson Estuary where Indian Point extracts and discharges large volumes of cooling water (about 2.5 billion per day). It also offers nursery habitat for species that spawn elsewhere, including sturgeon.

The proposed regulations state

Any activities that would degrade water quality, increase turbidity, increase sedimentation, or alter flows, temperature, or water depths in the Hudson River Miles 40-60 would result in significant impairment of the habitat. Of primary concern in this deep estuarine area would be diversion of freshwater flows out of the Hudson, contamination by toxic chemicals, major structural alterations to the underwater habitat (e.g., dredging, filling, or construction of jetties), and thermal discharges. (http://www.nyswaterfronts.com/downloads/pdfs/sig_hab/HudsonRiverJune/Hudson%20River%20Mile%2040-60.pdf)

Three miles to the south of Indian Point lies Haverstraw Bay which is also a significant coastal fish and wildlife habitat. Haverstraw Bay possesses a combination of physical and biological characteristics that make it one of the most important fish and wildlife habitats in the Hudson River estuary. The Coastal Fish and Wildlife Habitat Rating Form states;

"Haverstraw Bay is also a major nursery and feeding area for certain marine species, most notably bay anchovy, Atlantic menhaden, and blue claw crab. Depending on location of the salt front, a majority of the spawning and wintering populations of Atlantic sturgeon in the Hudson may reside in Haverstraw Bay. Shortnose sturgeon (E) usually winter in this area as well. Significant numbers of waterfowl may occur in Haverstraw Bay during spring (March-April) and fall (September-November) migrations, but the extent of this use is not well documented.

Haverstraw Bay is a critical habitat for most estuarine-dependent fisheries originating from the Hudson River. This area contributes directly to the production of in-river and ocean populations of food, game, and forage fish species. Consequently, commercial and recreational fisheries throughout the North Atlantic depend on, or benefit from, these biological inputs from the Hudson River estuary".

The Hudson River is highly important to the region. Perhaps the best example is the spawning of striped bass which is centred on River Miles 44-56, just north of Indian Point. As noted in the Coastal Fish and Wildlife Habitat Rating Form for this region

"Striped bass stock discrimination studies conducted in coastal New York and southern New England indicate that approximately 50 percent of striped bass harvested in these fisheries were of Hudson River origin, the remainder primarily originating from the Chesapeake Bay system. With the documented poor Chesapeake production from 1983-1985, it is anticipated that the relative contribution of the Hudson stock to the coastal migratory striped bass population will continue to rise above 50 percent."

For striped bass, the area close to Indian Point is now the most important spawning ground along the entire Atlantic east coast of the USA.

Daniels 2005 showed species such as rainbow smelt and tomcod are in decline over the whole river[3]. The Pisces (2008) report The Status of Fish Populations and Ecology of the Hudson supports the view that many species are in decline. It concludes that

"the fish community has been changing rapidly since 1985 and is now showing clear signs of increased instability with greater year-to-year variation in abundance. ….The population abundance and dynamics of 13 key species subject to intensive study. Three species, striped bass, bluefish and spottail shiner, show a trend of increasing abundance since the 1980s. The other 10 species, including shad, tomcod and white perch, have declined in abundance, some greatly. … Many other important species of fish not included within the key 13 species are also showing long-term declines in abundance. An important example of a once abundant fish now in decline is the American eel. All the evidence points to the Hudson estuary ecosystem presently being in a state of change, with declining stability. Neither the ecosystem as a whole, nor many of the individual constituent species' populations, is in a healthy state."

The Department's regulatory role includes limiting thermal discharges from each facility to ensure the survival of aquatic resources (NYSDEC 2003 FEIS). It was noted in the FEIS that Indian Point did not meet its water quality criteria.

This plant has been operating since the 1970, and producing a large thermal discharge into the valuable habitats of the Hudson. The situation with regards to thermal plume has not changed.

2 The adverse impacts from thermal discharges and specifically that of Indian Point

The discharge of heated water from cooling systems has been shown to harm fish and wildlife and has long been recognized to have effects upon the structure and function of ecosystems (EPA Environmental and Economic Benefits Analysis for Proposed Section

[3] Daniels, R.A., K. E. Limburg, R. E. Schmidt, D. L. Strayer And R. C. Chambers (2005) Changes in Fish Assemblages in the Tidal Hudson River, New York. American Fisheries Society Symposium 45:471–50

316(b) Existing Facilities Rule EPA 821-R-11-002 March 28, 2011). Features they list that have been shown to be affected by thermal pollution include;

- photosynthetic,
- metabolic rates
- growth rates
- reduce levels of dissolved oxygen
- alter the location and timing of fish behavior including spawning, aggregation, and migration
- thermal shock-induced mortality for some species

The operational differences between once-through cooling systems and closed-cycle cooling systems will significantly reduce the thermal load of the discharge to surface water. Unlike once-through cooling systems, where the entire thermal load is delivered to the surface water body, in a closed-cycle cooling system, most of the heat is transferred to the air. Thus, irrespective of how the flows are configured, there will be a substantial reduction in the thermal load of the effluent from a closed-cycle system compared to a once through system. The use of cylindrical wedgewire screen will not affect the thermal plume.

2.1 The Plume

The heat in the discharged cooling water is initially dispersed by mixing with the receiving water. As it mixes and usually rises to the surface it spreads out over the surface forming a detectable plume which spreads in the direction of the prevailing current. The initial drop in water temperature is almost entirely due to mixing with the receiving water. Some heat will be lost from the surface of the plume to the air, but close to the discharge the surface area from which the heat can be dispersed to air is small so the majority of the heat is dispersed by mixing.

The direction of dispersal and ultimate shape of a discharge plume is determined by the ambient current. Water movement in the vicinity of Indian Point is dominated by tidal forces as reported in *Analysis of Near-Bottom Flow in the Hudson River at Indian Point Energy Center from Data Collected by Acoustic Doppler Current Profilers 4 March through 2 November 2010* prepared by Normandeau Associates, Inc. Both the direction and speed of the current varies tidally and seasonally. On the flood tide the current direction is predominately north easterly and on the ebb tide south westerly. On p 6 it states "*Current speeds at all four fixed ADCP Stations exceeded 0.25 fps at least 80% of the time, 0.50 fps at least 63% of the time, 0.75 fps at least 49% of the time, 1.00 fps at least 35% of the time, and 2.00 fps at least 7% of the time for the entire monitoring period from 4 March through 2 November 2010 (Table 7).*" The result of these variations is that the plume swings with the tide and the shape changes over the tidal cycle. Further, there will also be spring-neap and seasonal changes in currents which will affect the shape of the plume.

The depth of the plume will also change over time depending on several factors such as the current passing the outfall and the salinity and temperature profile of the river. The FEIS (2003) data from HydroQual, 1999 shows that there may be times and conditions when the effluent-warmed waters occupy nearly the entire vertical water column. For

example at every slack tide (which occurs about 4 times per day) the warm water will pool and would be much deeper.

Because the plume changes in direction and shape the location of the mixing zone and the region with elevated temperatures changes constantly. The effect is that a larger area of river is regularly within the mixing zone and subject to thermal impacts, than would be the case with a discharge on a river with a constant directional flow.

Entrainment of plankton in thermal discharge plumes is a normal and unavoidable occurrence. As the jet of heated cooling water is released from the plant it entrains the receiving water into the jet and mixes. This mixing of the heated water discharged from the power plant and receiving water creates a larger more diffuse area of warmed water. Organisms, including fish eggs and larvae, are entrained in this flow of warm water and become impacted by the sudden rise in temperature.

2.2 The discharge temperatures

The average maximum temperatures of the discharge for each calendar month for the years 2000 to 2007 are tabulated below. Note that for the summer months the maximum is regularly in excess of 90 *degrees* Fahrenheit, further, there are occasions when the temperature exceeds 100°F; this is a temperature at which many aquatic organisms living in the estuary will suffer acute harm or death (see Effects of temperature on the organisms in the Hudson, below).

Figure 1 shows a plot of the maximum daily discharge temperatures at Indian Point with the 90° and 100°F reference temperatures shown in red. Note that 90°F, a temperature that is known to be lethal to some aquatic organisms, has been exceeded for extended periods every summer since 2001. Furthermore, 100°F has been exceed in 3 of the 7 summers for which data are plotted.

Table 1: The average maximum discharge temperature (°F) of the Indian Point cooling water discharges for the years 2000 to 2007. Missing numbers are months for which no data are available. (Indian Point Daily Temperature Reports 2000-07)

Month	2000	2001	2002	2003	2004	2005	2006	2007
1	66.38	57.35	70.53	68.45	70.78	70.74	74.78	70.25
2	63.63	67.61	69.76	65.41	69.57	71.88	71.39	67.76
3	64.08	70.57	69.91	65.20	70.46	69.17	69.59	63.29
4	70.05	71.52	74.75		71.89	72.86	75.54	
5	77.01	78.07	79.85		82.64	81.92	79.82	
6	79.40	88.82	86.41		**91.81**	**92.08**	89.17	
7	88.66	**97.27**	**98.29**	**96.68**	**97.21**	87.89	**96.95**	
8	89.19	***100.01***	***101.29***	**96.45**	**97.21**	***103.58***		
9	86.83	**96.11**	**94.91**	**94.38**	**90.27**	**99.66**	**94.24**	
10	80.62		85.24	82.56	81.88	83.89	85.34	
11	75.87		68.06	78.00	76.52	77.68		
12	64.05		73.23	74.30	73.95	75.50	77.25	

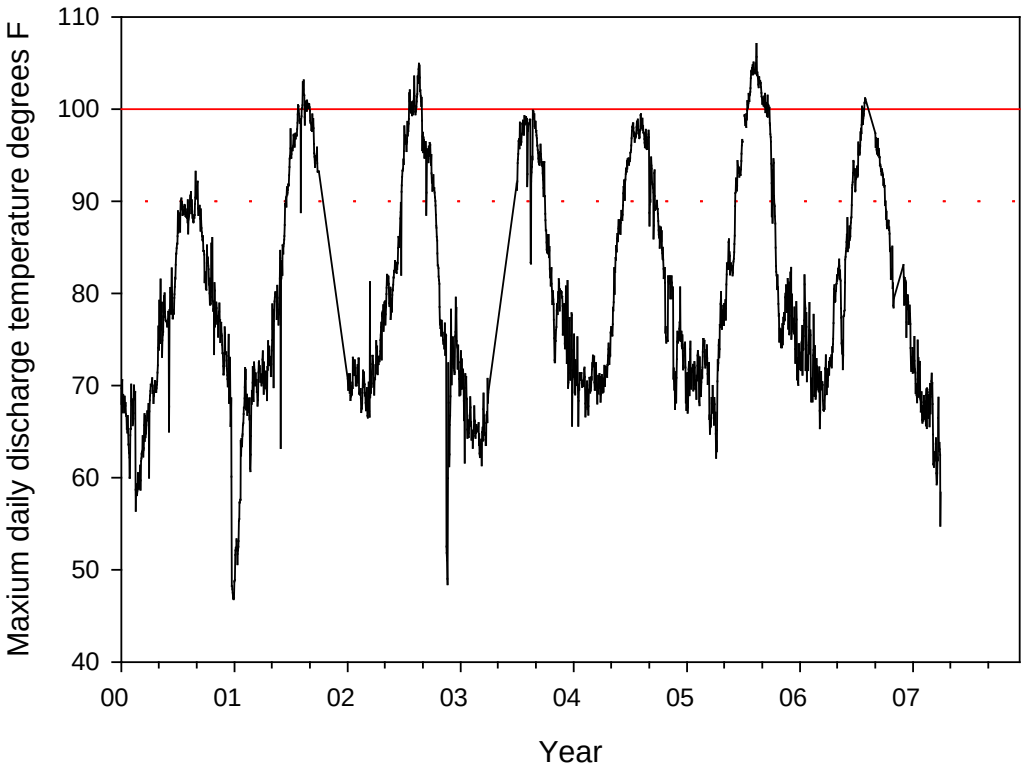

Figure 1: Plot of the maximum daily discharge temperatures at Indian Point 2000-2007. The 90° and 100°F reference levels are shown in red.

2.3 The size of the plume

There is no discrete boundary around a thermal plume. The plume loses temperature as it mixes with the ambient waters and releases heat to the atmosphere. Temperature constraints are set at defined isotherms. Water quality standards have two different limits (1.5°F or 4°F) for the delta F (temperature rise) above ambient. This plume (either the one defined by 1.5°F or 4°F) is then accessed as to whether it spreads across to much of the waterbody. The two different temperature definitions area based on the ambient temperature of the river. If during July, August and September the ambient temperature is over 83°F then the allowable plume increment is 1.5°F, while if the ambient temperatures are below 83°F then the allowable plume increment is 4°F.

In the ASA (2010) study the maximum defined ambient temperature was below 83°F (ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge page ii) (for example on the 10th July it was between 80 and 81 °F – figure 5-5). So the delta 4 °F rule (as less than 83 °F Background) was modelled. In Figure 3A (Figure 7-1 and 7-2 from ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge) the modelled 4 °F isotherm plume is shown at maximum extent to reach approximately 2.2 miles downriver into Haverstraw Bay. This plume spreads about 0.2 miles across the river – this gives a very approximate area of 1536 acres. If the 1.5 °F rule was in place the plume would need to be diluted

approximately 2.6 times more, which would require a much larger area. The size of the plume can be

In addition to the effect of the Indian Point discharge in isolation, its impact in combination with that of other thermal inputs needs to be considered. The Massachusetts Institute of Technology dynamic network model was reported in the DEIS for a range of power plant discharge scenarios. A typical output is presented in Figure 2. In this graph the lower line (line 1) represents the ambient temperature of the estuary. The top line (line 5) represents the effect of all the thermal discharges in combination. The line labelled 3 is the temperature rise in the estuary excluding the thermal discharge from Indian Point. A comparison of lines 3 and 5 show the appreciable effect of Indian Point generating station, which was predicted to increase river temperature by > 1°F for more than 10 miles of estuary. Note that the plume of Indian Point also combined with the thermal pollution from other sources.

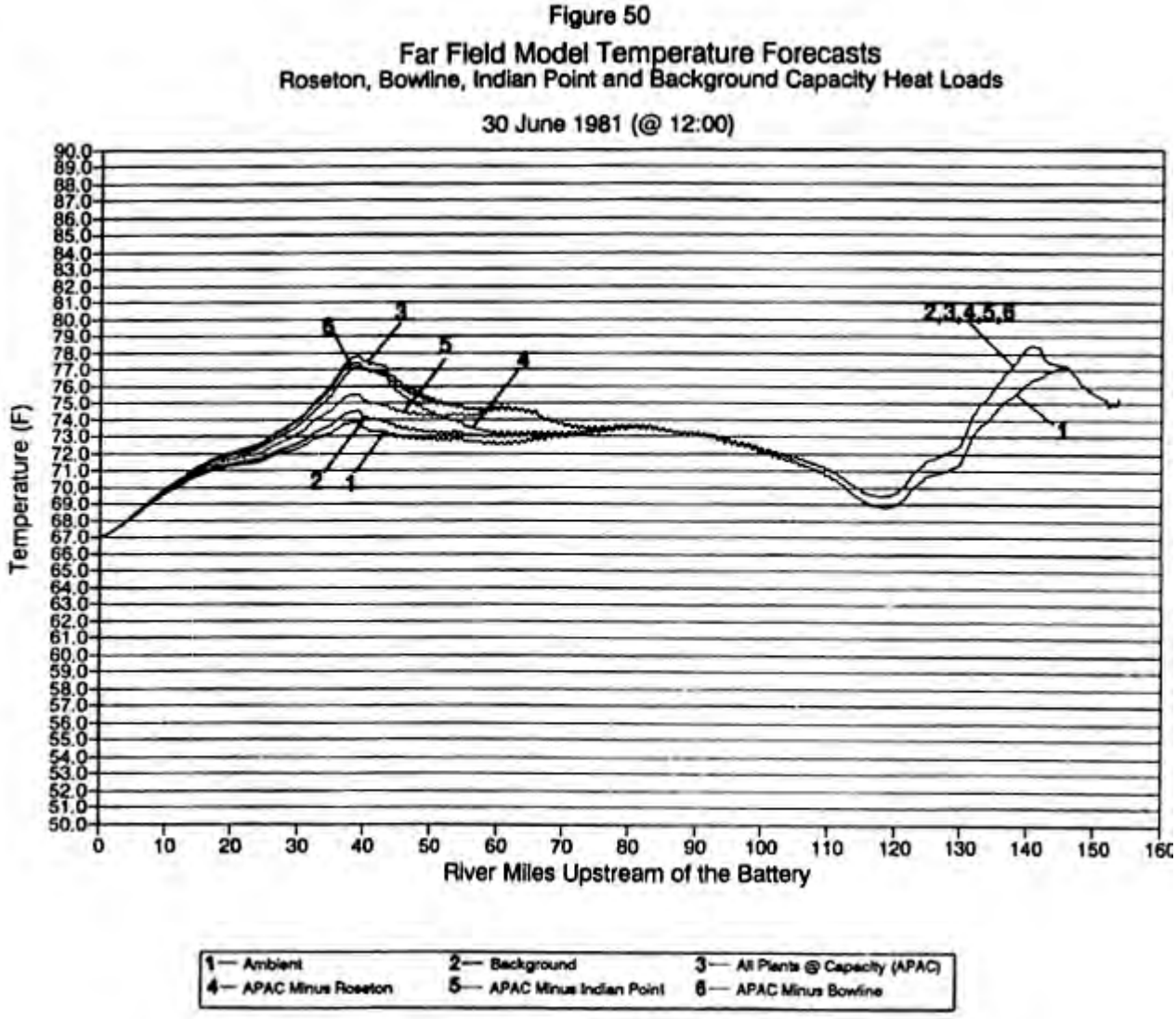

Figure 2: A sample of the results presented for the far field temperature effects of the Hudson Estuary power plants. From the DEIS for Roseton, Bowline and Indian Point generating stations.

In Figure 3B the observed plume (bounded by a 4°F isotherm) is summarised; the plume here is about 1mile long and about 0.2 miles wide.

A B

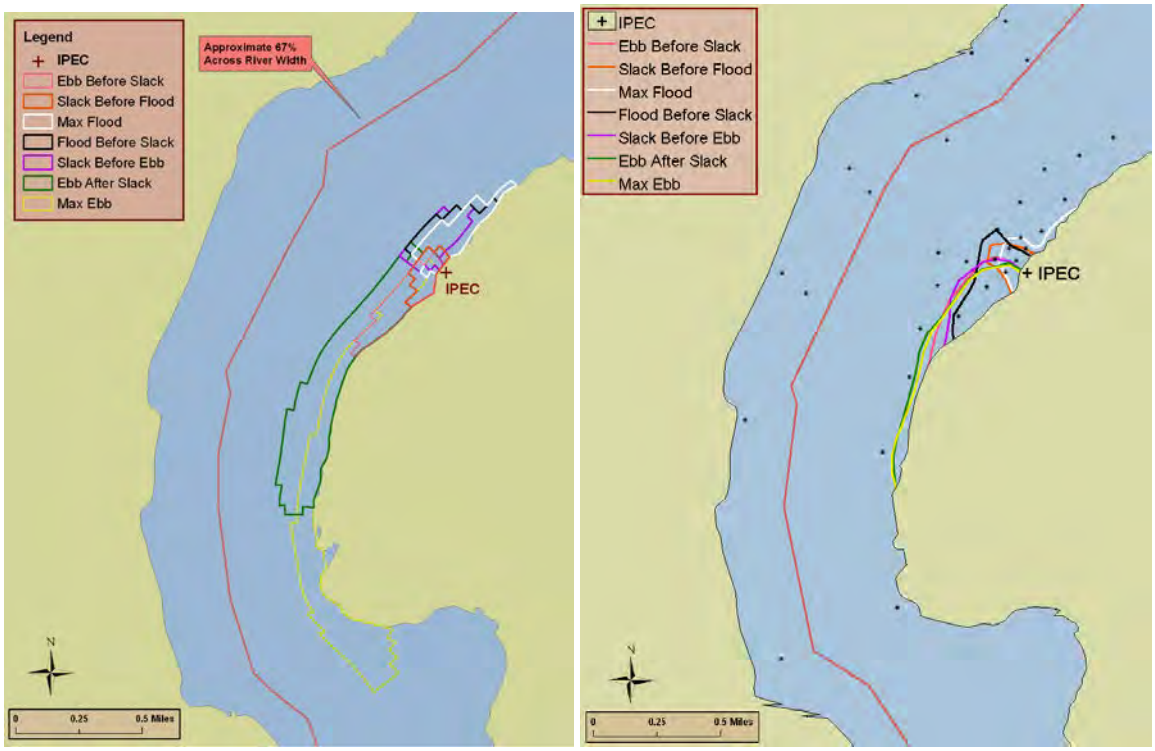

Figure 3: A Figure 7-1 Extent of the 4°F plume over a tidal cycle using model predictions. B Figure 7-2 Extent of the 4°F plume over a tidal cycle using contoured observed temperatures with modeled ambient subtracted

During the ASA 2010 study, the area within the 90°F isotherm, an area where lethal conditions exist for aquatic life, was found to be about 14 acres during the ebb and about 4 acres during the flood tide (ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge page 106 Figure 5.2), this area will kill fish and other organisms that are entrained into it. This is about 9 °F above ambient. This is obviously much smaller than the actual size of the plume as shown in Figure 4.

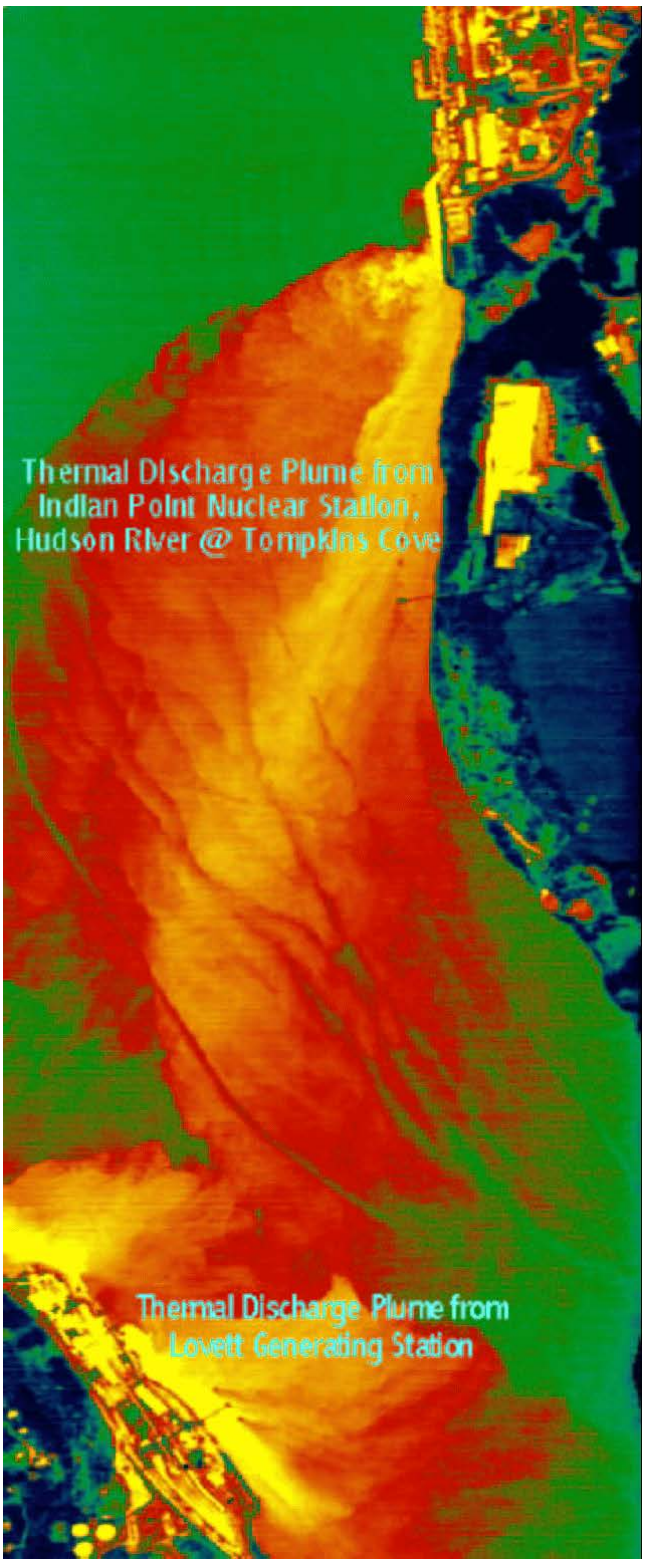

Figure 4: The extent of the thermal plume from the cooling water discharge of Indian Point Unit 3, and the Lovett generating station.

Infrared images highlight the surface extent of the thermal plume released from Indian Point (Figure 4). The image below, taken from the FEIS, shows the high proportion of the width of the river that is impacted by the Unit 3 discharge of Indian Point. The following quotation describes the concern:

"The surface extent of thermal discharges from the HRSA plants is also a concern. Figure 8 is an aerial thermal image of the plume from Indian Point, Unit 3 only, on the east side of the Hudson plus the smaller plume from Lovett on the west bank. In this image, the two plumes came very close to meeting on the surface, even with Indian Point running at less than its full capacity." (FEIS, Chapter 5 p 71)

In summary, the surface extent of the thermal plume produced by Indian Point covers a high proportion of the width of the river.

2.4 Effects of temperature on the organisms in the Hudson

Almost all aquatic life is affected by thermal discharges. The effects of temperature on the biology and ecological requirements of fish have been extensively studied and reviewed. Temperature can affect survival, growth and metabolism, activity, swimming performance and behaviour, reproductive timing and rates of gonad development, egg development, hatching success, and morphology. Temperature also influences the survival of fishes stressed by other factors such as toxins, disease, or parasites. Many of these effects will occur well below the upper lethal temperatures which are given below. It can be seen from this table that many species will die in waters over 90°F.

Table 4: Upper tolerance temperatures for some species of Hudson fish. (Acclimatization is the temperature the fish is used to before being exposed to hot water). (Multiple sources: particularly Langford (1990)).

Species	Latin Name	Acclimatization temperature		Upper tolerance limit	
		ºC	°F	ºC	°F
Carp	*Cyprinus carpio*	20	68	31-34	87.8-93.2
Large mouth bass	*Micropterus salmoides*	20	68	32.5	90.5
		30	86	36.4	97.52
Blue gill	*Lepomis macrochirus*	15	59	30.7	87.26
3 spined stickleback	*Gasterosteus aculeatus*	25-26	77 – 78.8	30.6	87.08
Yellow perch	*Perca flavescens*	15	59	27.7	81.86
Alewife	*Alosa pseudoharengus*	15	59	23	73.4
Rainbow smelt	*Osmerus mordax*			21	69.8
Sea lamprey	*Petromyzon marinus*			34	93.2
Tomcod	*Microgadus tomcod* 2 cm			19-20.9	66.2-69.62
	14-15 cm			23.5-26.1	74.3-78.98
	22-29 cm			25.8-26.1	78.44-78.98
Common shiner	*Notropis cornutus*	15	59	30.3	86.54
Brown bullhead	*Ictalurus nebulosus*	15	59	31.8	89.24
Striped bass (temperature when mortalities start)	*Morone saxatilis* yolk sac			26	78.8
	Post yolk sac			30	86
	Early juveniles			34	93.2
American shad	*Alosa sapidissima*			28	82.4
White perch	*Morone americana*			32-34	89.6-93.2

Generally young and small fish are more vulnerable to elevated water temperatures than adults. Maximum summer temperature of the Hudson River in the vicinity of Indian Point is over 81 °F

(27.2 °C). Most of the fish in the Hudson can just tolerate the maximum summer temperature although for some such as the tomcod it is too hot and they must seek cooler waters (for example head towards the ocean).

Several studies have shown that species diversity of phytoplankton decreases in areas consistently heated to over 30 °C (mid 80s °F). When water temperatures reach 35 – 38 °C (95-100 °F) zooplankton abundance declines and mortalities occur. Effects on benthic invertebrate life are also possible because of the depth that the warm water plume can reach.

At some states of the tide the discharge plume will attach to the bank of the estuary. When this occurs, the more productive shallows and their associated benthos will be affected by thermal pollution.

During the 3 months of the ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge survey, the discharge temperatures ranged from 94°F to 103°F (page 62). The delta T was a mean of 17.17°F and a maximum of 18.8°F. Accordingly, these temperatures would cause lethal conditions of organisms entrained into the thermal plume. Thermal effect extends considerably beyond any mixing zone. For example the Massachusetts Institute of Technology dynamic network model was reported in the show the appreciable effect of Indian Point generating station, which was predicted to increase river temperature by > 1°F for more than 10 miles of estuary.

2.5 Effects on a balanced, indigenous population of fish, shellfish and wildlife in the Hudson.

In the discussion above it was noted that many species are undergoing major changes in abundance. If by balance we mean the populations are stable this cannot be the case.

Henderson and Seaby (2000) state “Large temporal changes in fish species abundance together with a small decrease in total species richness and diversity suggest that the Hudson estuary ecosystem is far from equilibrium. There is a small long-term decline in both species richness and diversity within the fish community. These losses are not confined to rare or infrequent visitors. A number of common or once abundant fish have long-term trends of declining abundance including tomcod, Atlantic sturgeon, bluefish, weakfish, rainbow smelt, white perch and white catfish. The rate of decrease in abundance of a number of these species is in their range of 5-8% per annum. If these trends were to continue, they will quickly result in profound changes in the fish community.

Cold water loving species such as the tomcod are close to their upper thermal tolerance, so that any increase in river temperature will introduce a stress that will contribute to their observed decline.

3 The problems with the mixing zone as contained in the new draft SPDES permit condition

The DEC Proposes to allow the station a 75 Acre mixing zone to encompass the area of the discharge where thermal and numerical standards cannot be met. The suggested rule is.

"b.. The thermal discharge from the Indian Point nuclear facilities shall assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the Hudson River. In this regard, the Department has approved the permittee's request for a thermal discharge mixing zone pursuant to 6 NYCRR section 704.3 for the 5-year term of this SPDES permit. The water temperature at the surface of the Hudson River shall not be raised more than 1.5 degrees Fahrenheit (from July through September, when surface water temperature is greater than 83 degrees Fahrenheit) above the surface temperature that existed before the addition of heat of artificial origin (6 NYCRR section 704.2[b][5][iii]) except in a mixing zone of seventy-five (75) acres (total) from the point of discharge. The thermal discharge from the Indian Point nuclear facilities to the Hudson River may exceed 90 degrees Fahrenheit (6 NYCRR section 704.2[b][5][i] of the State's Criteria Governing Thermal Discharges) within the designated mixing zone area, the total area of which shall not exceed seventy-five (75) acres (3,267,000 square feet) on a daily basis."

In the analysis document supplied (Alternative Mixing Zone Explanation – 3 May 2011) the estimated size of the mixing zone was determined by estimating the maximum area of the plume at 89°F (as there is a 1°F margin of predictive tolerance model).

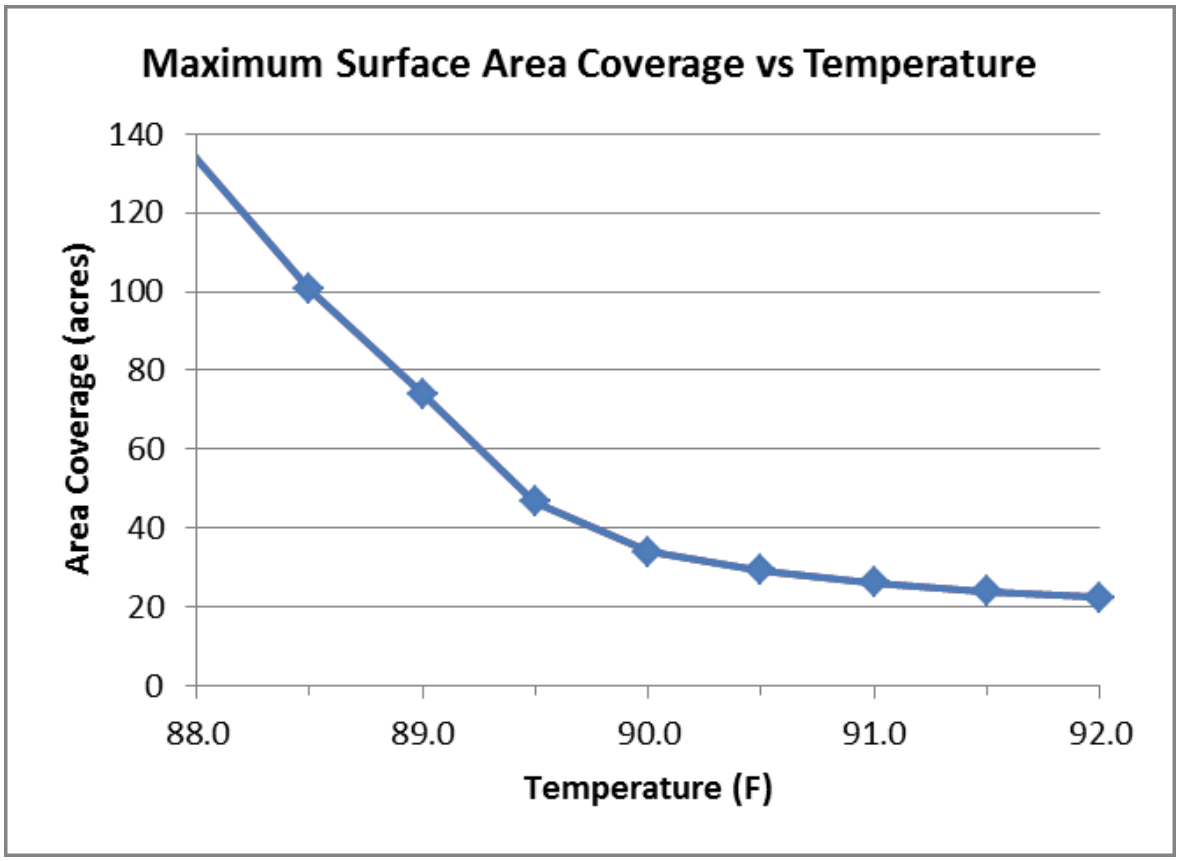

Figure 5. Maximum surface area coverage as defined by surface temperature – Note that at 89°F the area is about 75 Acres.

This is the area defined from the "extreme scenario" and is therefore unlikely to occur. It is unclear whether these 75 acres represent the swept area of the plume or the maximum extent at any one time. This equates to an area of over 68 American football pitches where the water temperature is allowed to exceed 90°F. As the plume attaches to the shore it effectively means that for 1.69 miles downstream and 0.7 miles upstream the banks could be bathed in water that is hot enough to damage and kill the littoral organisms (Table 2 below). Even under typical conditions over a mile of the important littoral habitats (+/- 0.5m miles in each direction) will be swept by water which could be over 90°F and can be over 100°F (page 92, ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge section 4.2.4.2) and could be lethal to organisms exposed into it. As the plume will move in response to the tidal conditions (see section 8.1 The Plume), areas within the mixing zone will undergo very large daily temperature variations.

Table 2: Maximum and typical extent of thermal plume mixing zone in downstream and upstream directions. (Alternative Mixing Zone Explanation – 3 May 2011)

	Maximum Extent		Typical Extent	
	Distance (ft)	**Distance (mi)**	**Distance (ft)**	**Distance (mi)**
Downstream	8,900	1.69	3,000	0.57
Upstream	3,700	0.71	2,800	0.53

4 Other Issues

4.1 Climate Change

Water temperatures in the Hudson are increasing. This is clearly demonstrated by the statistically significant increase in mean average annual water temperature measured at Poughkeepsie Water Treatment Facility which was recently analysed in detail by Seekal and Pace (2011)[4]. They found that the Hudson River has warmed by 0.945 °C since 1946. The mean annual temperature in recent years is about 2°C (3.6°F) above that recorded in the 1960s. The rising trend is illustrated in Figure 6 below.

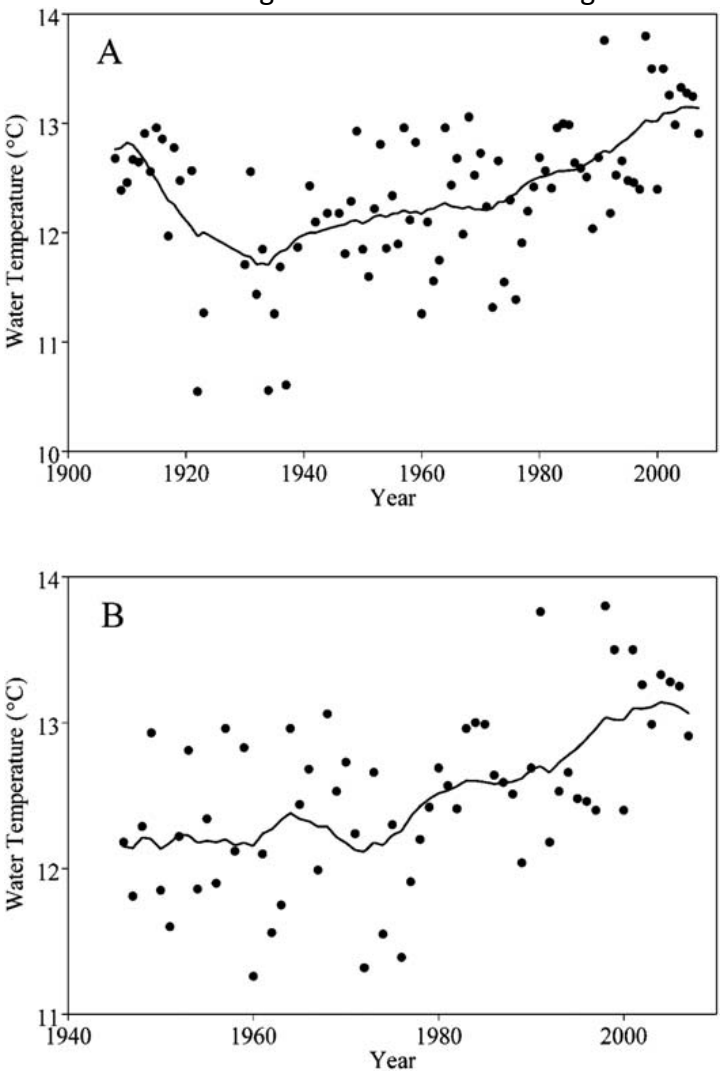

Figure 6: Average annual water temperature (°C) as measured at Poughkeepsie's Water Treatment Facility, A) 1908 to 2007 and B) 1946 to 2007. The trend lines are locally weighted regressions. Reproduced from Seekal and Pace (2011)[5]

[4] Seekal, D. A. & Pace, M.L. (2011) Climate change drives warming in the Hudson River Estuary, New York (USA). Journal of Environmental Monitoring. DOI: 10.1039/c1em10053j

[5] Seekal, D. A. & Pace, M.L. (2011) Climate change drives warming in the Hudson River Estuary, New York (USA). Journal of Environmental Monitoring. DOI: 10.1039/c1em10053j

Examination of the daily temperatures for 2005 plotted against the mean, minimum and maximum temperatures from 1951 to 2004, show that the temperature for several summer months in 2005 was close to the maximum ever recorded (see Figure 7). However, in the winter, it also reached some of the lowest temperatures recorded over a 53 year period. In summary, the temperature regime is becoming more extreme.

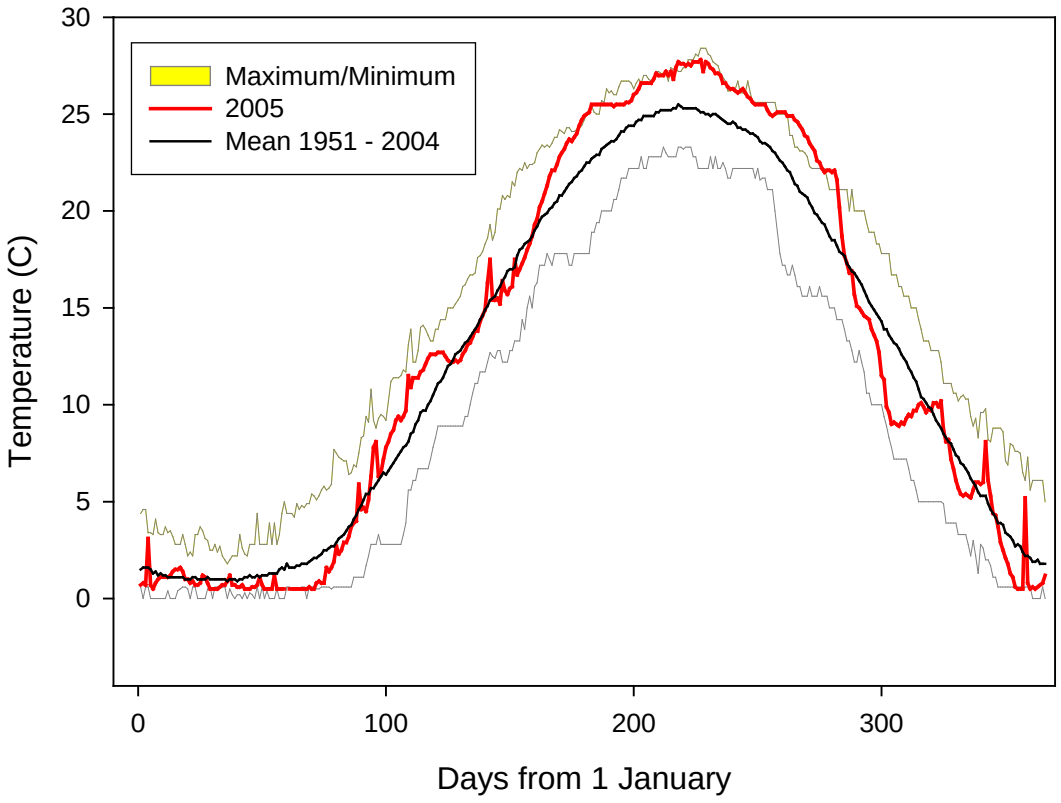

Figure 7: Poughkeepsie Water Treatment Facility data; mean, minimum, and maximum temperature (°C) for each day of the year, 1951 to 2004, with 2005 data plotted in red. – Data from 2005 Year Class Report – Appendix B Table B - 5.

We can conclude that with current trends the river in the vicinity of Indian Point even with no thermal input will certainly break the 83 °F threshold soon. Further, this threshold will certainly be breached during a summer heat wave in August.

4.2 Ambient temperature is incorrectly evaluated

A key issue relates to the potential of the river during summer to exceed an ambient temperature of 83 °F. In the ASA (2010) report the **predicted** ambient temperature with **no** thermal discharge from **any** plant was 82.2 °F (p 109). This value (82.2°F) was calculated for the period 8 to 30 July 2010.

The assertion that ambient temperature never exceeds 83 °F is wrong:

The surface ambient temperature reached a maximum of 82.2°F, always under the 83°F threshold where the allowable plume temperature rise is limited to 1.5°F versus the 4°F. Therefore, only the spatial extent of the cross sectional area and surface width of the 4°F were calculated to determine compliance.
(ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge, page 118, section 6.3. para 3)

The following arguments show this to be the case.

- The river is known to exceed 83 °F at Poughkeepsie water works. To get examples of temperatures above 83 °F (28.33°C) examine the water temperatures recorded in Appendix B of the year class reports. For example the maximum temperature observed between 1951 and 2008 was above 83°F in August.
- Note that **all** the observations at Poughkeepsie for temperatures over 83 °F are recorded for August. ASA used July data for their modelling, this is not the month with the highest recorded water temperatures.
- The maximum ambient temperature claimed by ASA (2010) is a modelled value not a recorded value. To reach this value they have attempted to remove the thermal inputs from all thermal discharges. However, the temperature of the estuary is known to be raised generally by thermal discharges so it is inevitable that the water will be warmer than their value. In practice, the ambient temperature has to be the actual ambient water temperature observed not a hypothetical value as if there were no thermal pollution.

4.3 Worst Case incorrectly analysed

Section 5.2.3 ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge states that as the ambient temperature was below the threshold for the 1.5°F (i.e. 83°F) during the time of the survey, the model was not run to determine the plume extents for the stricter 1.5°F limit. The thermistor used to determine the ambient temperature (no 27) reached 82.2°F

> *The thermistor station 27 location was used as a proxy for the ambient temperature. The surface ambient temperature reached a maximum of 82.2°F, always under the 83°F threshold where the allowable plume temperature rise is limited to 1.5°F versus the 4°F. Therefore, only the spatial extent of the cross sectional area and surface width of the 4°F were calculated to determine compliance. (*ASA 2010 Field Program and Modeling Analysis of the IPEC Discharge page 118)

Taking into account that the sampling was done before the typical seasonal maximum in August, the likelihood of the climate change, and the variations in summer temperatures it seems highly likely that the 83°F limit will be reached in some years.

The DEC asked for a worst case scenario as shown below

"The conservative approach used by Department staff to predict "worst-case" is the MA7CD10 (7 day, 10 year low flow) and the lowest flow for the available record period, background temperature in the river of 90 degrees Fahrenheit (at "slack ebb begin" and "slack flood begin" tide conditions), and during thermal stratification periods. This was discussed at the meeting on March 22, 2010. Moreover, and as noted in its July 3, 2009 letter to Entergy, the Department requires the model to be run at these critical conditions, and the results compared to the thermal criteria in 6 NYCRR § 704.2. Furthermore, in-stream data must be gathered during July-September critical periods and used to verify correct calibration of the model. All predictions are to be performed at All Plants at Capacity (APAC) conditions."
NYDEC April 2, 2010 401 Denial at 12

By not considering the correct "worst case" scenario the impacts are understated.

4.4 Bank Attachment

The plume as modelled by ASA (2011) attaches to the bank for a considerable distance downstream, and to a considerable depth. As shown by the isotherms in the images Below, and the infrared images highlighting the surface extent of the thermal plume released from Indian Point in Figure 4, the plume spreads a considerable distance across the river.

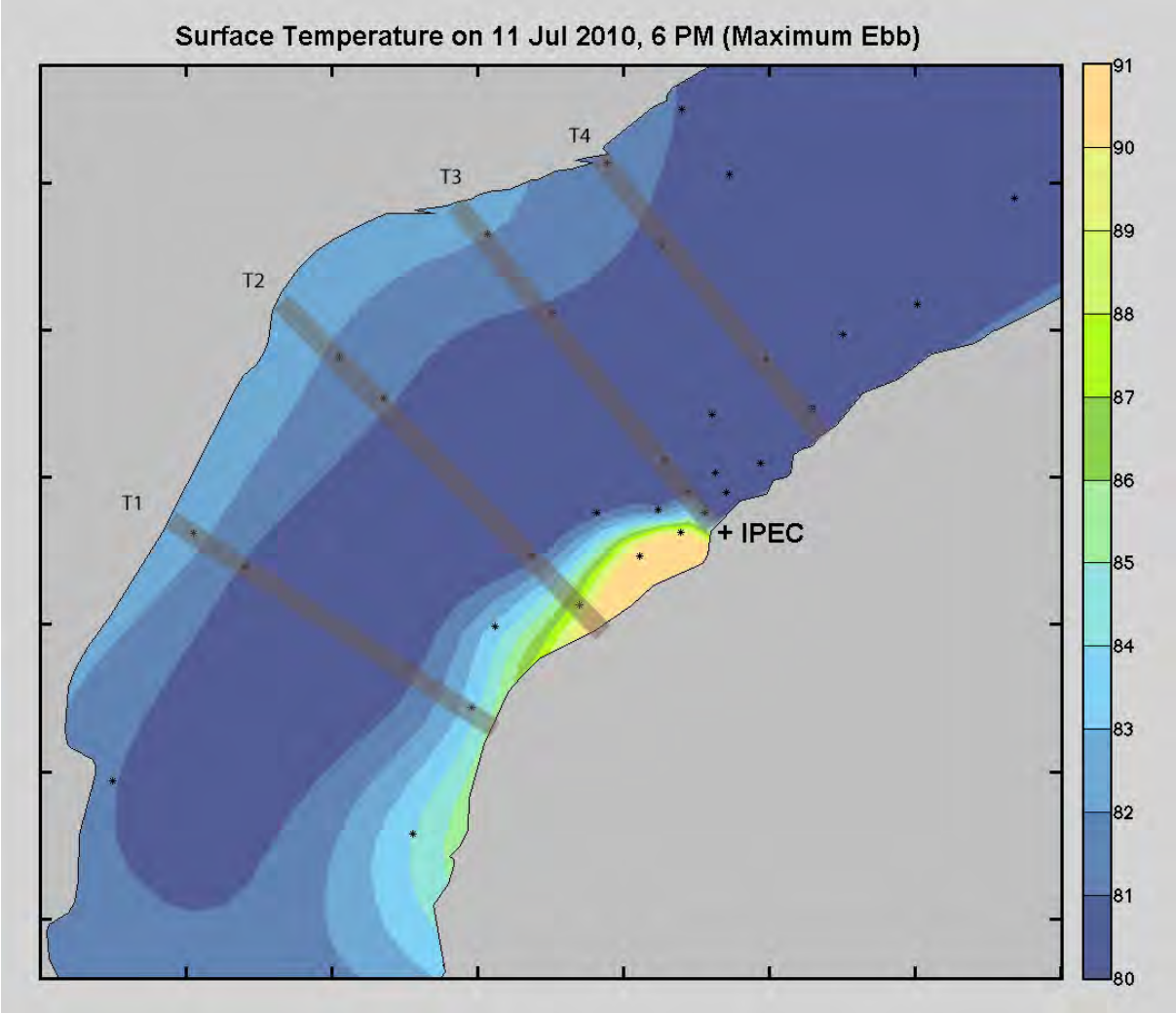

Figure 8: Figure 1-2. Plan view of surface temperatures near IPEC on 11 July 2010 at 1800 during maximum ebb. Color scale (in degrees F) shows the interpolated horizontal temperature distribution.

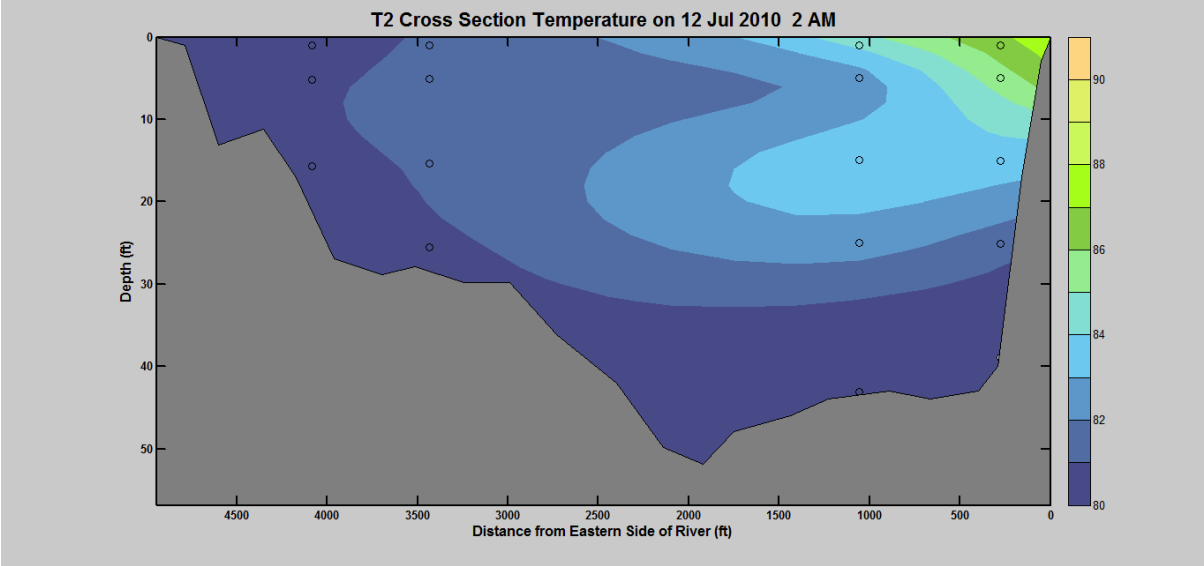

Figure 9: Figure 1-14. Vertical section of temperatures at T2 transect on 12 July 2010 at 0200 during slack before ebb. Color scale (in degrees F) shows the interpolated vertical temperature distribution.

COMMENTS OF RIVERKEEPER ON NYSDOS PUBLIC NOTICE F-2012-1028 – APPLICATION OF ENTERGY FOR COASTAL CONSISTENCY CERTIFICATION FOR THE PROPOSED RELICENSING OF INDIAN POINT (October 30, 2013)

Attachment 6

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

INITIAL POST-HEARING BRIEF AND PROPOSED FINDINGS OF FACT ON BEHALF OF INTERVENORS RIVERKEEPER, INC., NATURAL RESOURCES DEFENSE COUNCIL, INC., AND SCENIC HUDSON, INC., IN SUPPORT OF DENIAL OF THE APPLICATION FOR A WATER QUALITY CERTIFICATION FOR INDIAN POINT UNITS 2 AND 3; CWA § 401 APPEAL ISSUE NUMBER 2: CONSISTENCY WITH THE BEST USAGES OF THE HUDSON RIVER

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December 21, 2012

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I. PRELIMINARY STATEMENT

Pursuant to 6 NYCRR § 624.8[a][5], Riverkeeper, Inc., Natural Resources Defense Council, Inc., and Scenic Hudson, Inc. (collectively and hereinafter "Riverkeeper"), respectfully submit this Post-Hearing Brief on Issue for Adjudication No. 2, "Best Usages," in the above-captioned SPDES permit renewal proceeding and Clean Water Act ("CWA") § 401 Water Quality Certification ("WQC") administrative appeal.

On April 2, 2010, the New York State Department of Environmental Conservation ("NYSDEC") denied the April 6, 2009 joint WQC application of Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. (hereinafter and collectively "Entergy"). Entergy is required to obtain a WQC in connection with its application for a twenty-year operating license renewal for Indian Point reactors Unit 2 and Unit 3 (hereinafter and collectively either "Indian Point" or "the Facility") from the U.S. Nuclear Regulatory Commission ("NRC").

NYSDEC's April 2, 2010 Notice of Denial of Entergy's Application for WQC found, *inter alia*, that the Indian Point's continued operation in once-though cooling mode (either as currently configured or with cylindrical wedgewire ["CWW"] screens) would impair (or have the potential to impair) the best usages of the Hudson River and would therefore be inconsistent with the best usages of the Hudson River for fishing and for fish, shellfish and wildlife propagation and survival (**Entergy Exhibit 9,** April 2, 2010 letter from William R. Adriance, Chief Permit Administrator, NYSDEC, to Dara F. Gray, Entergy Nuclear Operations, Inc. ["NYSDEC 401 Denial"], at 10-11, 17-18). The NYSDEC 401 Denial further specifically found that CWW screens would not result in entrainment reductions commensurate with those that could be obtained by a closed-cycle cooling system (*id.* at 18).[1]

On April 29, 2010, Entergy elected an administrative appeal remedy by seeking an adjudicatory hearing on the NYSDEC 401 Denial pursuant to 6 NYCRR § 621.10[a][2]. On July

[1] Section 401 of the CWA requires an applicant to obtain, as a condition for the issuance of a federal license or permit, a certification from the state the applicant and the activity at issue will satisfy state water quality standards and other relevant state laws and standards (CWA §§ 401[a] and [d], 33 U.S.C. §§ 1341[a] and [d]). Pursuant to the plain language of 6 NYCRR § 608.9, an applicant for a WQC must "demonstrate compliance" water quality standards, effluent limitations, and other state statutes, regulations and criteria otherwise applicable to the federally-licensed activity (*see also In the Matter of the Application of Seven Springs, LLC,* ALJ Ruling on Issues and Party Status [August 23, 2002] 2002 N.Y. ENV LEXIS 42 at *96).

10, 2010, Riverkeeper petitioned for full party status in Entergy's appeal. Riverkeeper was granted full party status, and all of Riverkeeper's proposed CWA § 401 issues were advanced for adjudication by the December 13, 2010 *Ruling on Proposed Issues for Adjudication* issued by NYSDEC Administrative Law Judge (ALJ) Maria E. Villa.[2]

Proceedings were held to hear examinations of witnesses and to receive evidence presented by Riverkeeper, NYSDEC and Entergy at NYSDEC's Central Office in Albany, New York on October 17 through October 20, 2011, October 24 through October 28, 2011, November 15 through November 16, 2011, January 11, 2012, January 17 through January 18, 2012, January 23, 2012, July 31 through August 3, 2012 and on August 7, 2012.[3]

II. ISSUE FOR ADJUDICATION

ALJ Villa's Issues Ruling stated the "best usages" issue for adjudication as:

> Whether Department Staff properly denied the WQC application based upon its determination that the operation of Units 2 and 3, either in once-through cooling mode, or with the installation of cylindrical wedge wire screens, will be inconsistent with the designated best usages of the waters of the Hudson for recreational fishing purposes, primary contact recreational purposes, and suitable fish habitat?[4]

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[2] Riverkeeper's proposed the following two specific issues with respect to the topic of best usages which were consolidated and advanced to adjudication:

> Whether extended operation of Indian Point with a once-through cooling water intake structure, as currently operated or with installation of cylindrical wedge wire screens, will be inconsistent with the designated best use of the Hudson River as suitable fish habitat, and;
>
> Whether extended operation of Indian Point with a once-through cooling water intake structure, as currently operated or with installation of cylindrical wedge wire screens, will be inconsistent with the designated best use of the Hudson River for recreational fishing purposes.

Ruling on Proposed Issues for Adjudication (December 13, 2010) at 44. The issue, as identified in the Issues Ruling, is intended to include consideration of the topics articulated in Riverkeeper's petition (Memorandum from ALJ Maria E. Villa to Service List, Re: Entergy Indian Point SPDES Proceeding/Section 401 Permit Proceeding [July 15, 2011]).

[3] 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 for the limited purpose of developing a joint record (*see* Memorandum from ALJ Maria E. Villa to Service List, Re: Entergy Indian Point SPDES Proceeding/Section 401 Permit Proceeding [July 15, 2011] at 4).

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

III. APPLICABLE REGULATORY FRAMEWORK

A. NYSDEC CWA § 303 Water Quality Standards

Section 303 of the CWA (33 U.S.C. § 1313) requires states to establish water quality standards which serve the dual purposes of establishing the state's management goals for individual water bodies and providing the legal basis for control decisions under the CWA, including the imposition of water-quality-based controls above and beyond the technology-based controls which are also required by the CWA (40 C.F.R. §§ 130.0[b] and 131.2). Water quality standards consist of designated uses for waters and water quality criteria for such waters based upon such uses (40 C.F.R. § 131.3[i]). As management goals, designated uses apply to waterbodies whether or not the uses are presently being attained in such waters (40 C.F.R. § 131.3[f]).

NYSDEC establishes water quality standards classifying New York waters which "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 the growth and propagation thereof. . . or the use of such waters for . . . recreational and other reasonable purposes" (ECL § 17-0301[4]). NYSDEC has classified the waters of the Hudson River in the vicinity of Indian Point as Class "SB" saline surface waters (6 NYCRR §864.6). The best usages of Class SB waters are primary and secondary contact recreation and fishing, and such waters "shall be suitable for fish, shellfish and wildlife propagation and survival" (6 NYCRR §701.11).

Water quality standards must also include a statewide antidegradation policy (*PUD No. 1 v. Washington Dep't of Ecology*, 511 U.S. 700, 705 [1994] *citing* 40 CFR § 131.12). NYSDEC implements the antidegradation policy through technology-based and water-quality based controls, as well as the use classifications and water quality criteria contained in New York's water quality standards (NYSDEC Technical Operation Guidance Series ["TOGS"] [Antidegradation] 1.3.9 at 1-2). The antidegradation policy requires that existing instream uses must be maintained and protected (40 C.F.R. § 131.12[a][1]; NYSDEC TOGS 1.3.9 at 1-2). No activity which could partially or completely eliminate an existing use may be authorized by a

CWA § 401 WQC (*PUD No. 1*, *supra* 511 U.S. at 718, *citing* 40 C.F.R. § 131.12[a][1]). Thus, an applicant for a WQC must demonstrate compliance with both designated and existing uses.[5]

Existing uses which are actually attained in the water body on or after November 28, 1975 must be maintained and cannot be (even partially) eliminated, whether or not such uses are included in the water quality standards as designated uses (40 C.F.R. §§ 131.12[a][1], 131.3[e] and 131.10[h][1]; *PUD No. 1*, *supra* 511 U.S. at 718, *citing* 40 C.F.R. § 131.12[a][1]). Existing use protections apply to all waters (*Ohio Valley Envtl. Coalition v. Horinko,* 279 F. Supp. 2d 732, 740 [S.D. W. Va. 2003], *citing* 40 C.F.R. § 131.12[a][1]). As EPA has observed, the antidegradation policy "protects the highest use attained in the water body on or after November 28, 1975" (*id.* at 751).

Accordingly, to the extent a higher existing use than those presently designated in the water quality standards is attained in a water body, the existing use is the "minimum" best usage of the water body, and is "designated" as such as by operation of law for CWA permitting and WQC purposes (*see PUD No. 1*, *supra* 511 U.S. at 718, *citing* 40 C.F.R. § 131.12[a][1]; NYSDEC TOGS 1.3.9 at 2 [directing the application of water quality-based effluent limitations to provide for the protection and maintenance of attained higher existing uses above those included in standards currently assigned to waters]).

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[5] The distinction between existing uses and designated uses is relevant only to the regulatory processes by which a state establishes and revises its water quality standards pursuant to CWA § 303[c][1] (33 U.S.C. § 1313[c[[1]). Section 101(a)(2) of the CWA establishes as a national goal "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and . . . provides for recreation in and on the water," wherever attainable (commonly referred to as the "fishable/swimmable" goals of the CWA, *see* 33 U.S.C. § 1251[a][2]). If a water body is designated for a use that requires less stringent criteria than a use that is being attained (that is, an existing use), the State must revise the use of that water body to reflect the use that is being attained. EPA Water Quality Standards Handbook at 2.8.

Accordingly, "[a]ny water body segment with water quality standards that do not include the uses specified in section 101(a)(2) of the Act shall be re-examined every three years to determine if any new information has become available. If such new information indicates that the uses specified in section 101(a)(2) of the Act are attainable, the State shall revise its standards accordingly." (40 C.F.R. § 131.20[a]; EPA Water Quality Standards Handbook at 6.1.4). Designated uses can be established at (or downgraded to) a less than "fishable/swimmable" level of use by way of a structured scientific assessment called a use attainability analysis under 40 CFR § 131.10[g], but this could only occur in the context of revisions to a state's water quality standards (CWA § 303[c][1]; 33 U.S.C. § 1313[c][1]). But existing uses which were attained as of November 28, 1975 cannot be eliminated (40 CFR §§ 131.12[a][1]; 131.3(e) and 131.10[h][1]). Thus, EPA's regulations provide that "[w]here existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained." (40 C.F.R. § 131.10[i]; *see also* 40 CFR §§ 131.3[e], 131.3[f], 40 C.F.R. § 131.10[i]).

The antidegradation policy also protects existing water quality which is sufficient to support designated uses (40 C.F.R. § 131.12[a][2]; NYSDEC TOGS 1.3.9 at 2). 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.[6]

(*Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 [1993]; *see also Islander E. Pipeline Co., LLC v. Conn. Dep't of Envtl. Prot.*, 482 F.3d 79, 120-21 [2d Cir. 2006]).

B. NYSDEC CWA § 401 Water Quality Certifications

The objective of the CWA is to restore and maintain the chemical, physical and biological integrity of the nation's waters (CWA § 101[a], 33 U.S.C. § 1251[a]). This objective is to be achieved by compliance with the Act, including compliance with permit requirements (*Weinberger v. Romero-Barcelo,* 456 U.S. 305, 313 [1982]). The CWA also seeks attainment of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife." (CWA § 101[a][2], 33 U.S.C. § 1251[a][2]). In order to realize these objectives, the CWA expressly recognizes, preserves and protects the primary responsibilities and rights of states to prevent, reduce and eliminate pollution (CWA § 101[b], 33 U.S.C. § 1251[b]).

The CWA defines pollution as "the man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water." (CWA § 502[19]; 33 U.S.C. § 1362[19]). New York's Environmental Conservation Law ("ECL") defines pollution even more broadly to include "the presence in the environment of conditions and or contaminants in quantities of [sic] characteristics which are or may be injurious to human, plant or animal life or

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[6] ECL § 17-0501 similarly prohibits activities which cause or contribute to a violation of water quality standards, and is "broadly written and any activity which, in fact, results in or contributes to a violation of water quality standards is within its ambit."(*In the Matter of Niagara Mohawk Power Corp.*, Decision of the Commissioner [May 1, 1991], 1991 N.Y. ENV LEXIS 36 at *3-4).

to property or which unreasonably interfere with the comfortable enjoyment of life and property throughout such areas of the state as shall be affected thereby" (ECL § 1-0303[19]).

While the National Pollutant Discharge Elimination Permit System ("NPDES") program established under CWA § 402 (33 U.S.C. § 1342) focuses on the regulation of "pollutants," the CWA does not stop at controlling the "addition of pollutants," to waters, but deals with "pollution" generally in order to achieve its goals (*S.D. Warren Co. v. Maine Board of Envtl. Prot.*, 547 U.S. 370, 385 [2006], *quoting* CWA § 502[16], 33 U.S.C. § 1362[19]). State-issued WQC for federally-licensed activities "are essential in the scheme to preserve state authority to address the broad range of pollution" and states may regulate any activity altering the integrity of water associated with a federal license proceeding under CWA § 401 (*S.D. Warren Co.*, *supra* 547 U.S.at 383).[7]

Applicants for a federal licenses to conduct any activity which may result in any discharge to navigable waters must first obtain a certification from the State that the activity will comply with the applicable provisions of sections 301, 302, 303, 306, and 307 of the CWA and any other appropriate requirement of State law (CWA §§ 401[a] and [d], 33 U.S.C. §§ 1341[a] and [d]). An assessment pursuant to CWA § 401 thus requires the reviewing agency to ensure compliance not simply with numerical water quality criteria, but also with the designated uses of the subject waterway and the antidegradation policy (*PUD No. 1*, *supra* 511 U.S. at 714-15, 718-19); *In re Mirant Bowline, LLC* [March 19, 2002], 2002 N.Y. ENV LEXIS 22 at *46).

CWA § 401 further requires a finding that proposed activity as a whole (and not simply the discharge that triggered the review) will comply with all State water quality standards and other appropriate requirements of state law (CWA § 401[a] and [d], 33 U.S.C. § 1341[a] and [d]; *PUD No. 1*, *supra* 511 U.S. at 711-12; *S.D. Warren Co.*, *supra* 547 U.S. at 386). Accordingly, a state may impose water quality-based limitations via a WQC which are not specifically tied to a "discharge" because the text of CWA § 401[d] "refers to the compliance of the applicant, not the discharge" (*PUD No. 1, supra* 511 U.S. at 712, citing CWA § 401[d], 33 U.S.C. § 1341[d]).

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[7] NYSDEC is vested with authority to abate and prevent the pollution of waters of the state in accordance with both water quality standards and in connection with the State Pollutant Discharge Elimination System (SPDES) program (ECL § 17-0303). NYSDEC must use all known, available and reasonable methods to prevent and control pollution of the waters of the State (*Matter of Port of Oswego Auth. v Grannis*, 70 A.D.3d 1101, 1104 [3d Dep't 2010], *quoting* ECL §17-0101 *and citing* ECL § 17-0501[17]).

Thus, the 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 laws and regulations" (*Application of Seven Springs, LLC*, ALJ Ruling on Issues and Party Status [August 23, 2002], 2002 N.Y. ENV LEXIS 42 at *96). 6 NYCRR § 608.9, entitled "water quality certifications" provides in pertinent part as follows:

> 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. (6 NYCRR § 608.9[a]).

NYSDEC's analysis under CWA § 401 and 6 NYCRR § 608.9 must address

> [a]ll 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 [which] 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]).

(*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).

Ensuring compliance with water quality standards via CWA § 301[b][1][C] (33 U.S.C. § 1311[b][1][C]) is therefore a necessary function of a CWA § 401 certification (*PUD No. 1, supra* 511 U.S. at 712). What this means is that CWA § 401 and 6 NYCRR § 608.9 expressly incorporate the requirements for NPDES/SPDES permitting into the CWA § 401 analysis. As applied via CWA § 401[d], CWA § 301[b][1][C] "contains a broad enabling provision which requires States to take certain actions, including those necessary to meet water quality standards . . . *and is not limited to discharges*." (*PUD No. 1, supra* 511 U.S. at 712-713, *citing* CWA § 401[d], 33 U.S.C. § 1341[d] and CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C] [emphasis supplied]).

NYSDEC's CWA § 401 analysis must therefore apply the more stringent of the applicable technology-based or the applicable water quality-based controls in connection with establishing cooling water intake limitations (*In re Dominion Energy Brayton Point, L.L.C.*, 12 E.A.D. 490 [EPA Envtl. App. Bd.] [February 1, 2006], 2006 EPA App. LEXIS 9, *350, *citing* CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C] and *PUD No. 1, supra* 511 U.S. at 711-13; 6 NYCRR § 608.9; *see also* ECL § 17-0811[5] and 6 NYCRR § 701-1.11[a][5] [requiring "any more stringent limitations, including those. . . necessary to meet water quality standards. . ."]).[8]

Conditions must be imposed pursuant to CWA § 301[b][1][C] in order to meet water quality standards "regardless of the decisions made with respect to technology and economics in establishing technology-based limits" (*In re: Scituate Wastewater Treatment Plant,* [NPDES Appeal No. 04-17] 2006 EPA App. LEXIS 22, 10 [April 19, 2006]). CWA § 301[b][1][C] "requires unequivocal compliance" with applicable water quality standards "and does not make any exceptions for cost or technological feasibility" (*Brayton Point, supra* 2006 EPA App. LEXIS at *332 n. 205, *quoting In re City of Moscow*, 10 E.A.D. 135, 168 [EAB 2001], and *citing In re City of Fayetteville, 2 E.A.D. 594*, 600-01 & n.15 [CJO 1988] [same] and *U.S. Steel Corp. v. Train*, 556 F.2d 822, 838 [7th Cir. 1977]; *accord PUD No. 1, supra* 511 U.S. at 713, *quoting* CWA § 301[b][1][B]; 33 U.S.C. § 1311[b][1][C]).

[8] Entergy must of course demonstrate compliance with CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C], 40 C.F.R. § 122.44[d], ECL § 17-0811[5] and 6 NYCRR § 750-1.11[a][5] in order to obtain its requested SPDES permit from NYSDEC as well.

Indian Point must operate consistently with both the designated uses of the Hudson River and the water quality criteria of 6 NYCRR § 704.5 (as well as the antidegradation policy) (*see PUD No. 1, supra* 511 U.S. at 714-715, *quoting* CWA § 303[c][2][A], 33 U.S.C. 1313[c][2][A]; *id.* at 718, *citing* 40 C.F.R. § 131.12[a][1]). In some circumstances, criteria alone will not suffice to protect the designated use (*id.* at 715, *citing* 40 C.F.R. § 131.3[b]).

In order to obtain a WQC, Indian Point is required to unequivocally comply with the Hudson River's best usages, without regard to the feasibility, technology, or modified cost-benefit considerations which govern the "best technology available" ("BTA") analysis (CWA § 316[b], 33 U.S.C. § 1326[b]; 6 NYCRR § 704.5), and must do so "within the shortest reasonable time" pursuant to specific steps outlined is a compliance schedule (ECL § 17-0813[2]; 6 NYCRR § 750-1.14[a]).

IV. BURDEN AND STANDARD OF PROOF

Entergy must demonstrate, by a preponderance of the evidence, that its proposal to operate Indian Point will be in compliance with all applicable laws and regulations administered by NYSDEC (6 NYCRR §§ 624.9[b][1] and [c]; *see also* 6 NYCRR § 608.9). *Section III, supra* sets forth the applicable laws and regulations which are pertinent those aspects of the issue of best usages which have been adjudicated to date.

V. ADVERSE ENVIRONMENTAL IMPACT ESTABLISHED

The August 15, 2008 Assistant Commissioner's Interim Decision determined conclusively that an adverse environmental impact exists as a result of the once-through cooling water system at Indian Point (*In the Matter of Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC,* Interim Decision of the Assistant Commissioner, 2008 N.Y. ENV LEXIS 52, *34 [hereinafter "Interim Decision"]). Entergy's January 2008 study entitled *Entrainment and Impingement at IP2 and IP3: A Biological Impact Assessment* (the "AEI Report," **Entergy Exhibit 27**), is therefore not entitled to consideration to the extent that it conflicts with the Assistant Commissioner's determination (September 9, 2011 Ruling on Advance Written Objections at 5).

To the extent the AEI Report's definition and discussion of "adverse environmental impact," or any other portion of the AEI Report, is inconsistent with the Interim Decision, it is to be accorded no weight (*id.*). According to Entergy's lead retained biologist, the AEI Report equates adverse environmental impact with the impairment of best usages. [9] All of the best usages testimony of Entergy's retained biologists was premised upon the discredited AEI Report and appendices thereto,[10] with the exception of a single sur-rebuttal opinion which was not disclosed until the testimony was offered at the hearing on January 17, 2012.[11]

VI. RESERVATION OF RIGHTS AND INTEGRATION OF PROPOSED FINDINGS AND CONCLUSIONS

The Tribunal has segregated the CWA § 401 issues into discrete topics for the purposes of receiving pre-filed testimony and conducting adjudicatory hearings.[12] The NYSDEC 401 Denial found that the continued operation of Indian Point as proposed by Entergy would be inconsistent with the Hudson River's best usages on a variety grounds including, without limitation, radiological leaks, impacts to endangered species and thermal impacts (NYSDEC 401 Denial at 11-13, 22-23). Riverkeeper accordingly incorporates by reference its Initial and Rebuttal Post-Hearing Briefs on Issue No. 3 (Radiological Issues), respectively dated April 27, 2011 and October 4, 2011, and respectfully requests that the Tribunal integrate Riverkeeper's arguments herein with its arguments on Radiological Issues with respect to the Tribunal's overall conclusions regarding the NYSDEC 401 Denial.

Riverkeeper also respectfully reiterates the following additional reservations of its rights with respect to Entergy's appeal of the NYSDEC 401 Denial:

(1) By letter to the Tribunal dated July 13, 2011, Riverkeeper objected to any evidence offered by Entergy which postdated April 2, 2010 in support of Entergy's appeal of the April 2, 2010

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[9] *See* Riverkeeper Initial Brief Proposed Finding of Fact ¶ 169.
[10] **Entergy Exhibits 27** and **27[A]-[D]**.
[11] A so-called "Analysis of Theoretical Lost Yield to Fishermen" was prepared and presented, over Riverkeeper's objection, by Dr. Young in response to the pre-filed rebuttal testimony of NYSDEC Staff Biologist Chuck Nieder. Tr. 3361:5-7; 3364:11-18; 3386:5 to 3392:14 and **Entergy Exhibits 131** and **132**.
[12] Entergy Nuclear Indian Point Units 2 and 3 Section 401 Water Quality Certification Proceeding, Issues List, December 13, 2010, at ¶ 2.

NYSDEC 401 Denial.[13] In a decision dated July 15, 2011, ALJ Villa ruled that evidence which post-dated the NYSDEC 401 Denial would be received in this joint SPDES proceeding and CWA § 401 appeal in connection with the joint adjudicatory hearings.[14] Entergy has thus continued to submit additional evidence and arguments in support of its CWA § 401 appeal which were not before NYSDEC Staff at the time of the NYSDEC 401 Denial. Riverkeeper is constrained, without prejudice, to address all such evidence and arguments herein.

(2) At the January 17, 2012 hearing, Riverkeeper reserved its rights to recall Entergy's experts with respect to endangered species, thermal discharge and CWW screen construction impact and operation impact issues[15] in connection with the issue of best usages.[16] Accordingly, Riverkeeper submits the following proposed findings and facts and conclusions of law without prejudice to Riverkeeper's rights to introduce additional evidence and provide further briefing with respect to the topic of best usages, and without prejudice to its position that any evidence submitted by Entergy which post-dates the NYSDEC 401 Denial is not relevant to Entergy's administrative appeal of the same.

(3) As is set forth more fully in *Section VIII[A]-[D], infra*, even if NYSDEC had issued a WQC, water quality-based entrainment controls would have been required, along with compliance schedule interim measures pursuant to ECL § 17-0813[2] and 6 NYCRR § 750-1.14[a].

(4) Given the limited nature of the issues which have been adjudicated to date, the analysis of best usages under CWA § 401 will require this Tribunal to evaluate additional issues including, without limitation, thermal discharges, endangered species and CWW screen construction and operation impacts.[17]

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[13] July 13, 2011 Letter from Deborah Brancato, Esq. (counsel for Riverkeeper) to ALJs Maria E. Villa and Daniel P. O'Connell at 2. Therein, however, Riverkeeper noted that evidence may be incompetent for one purpose but admissible for another purpose (*id.* at 2, n. 4, *citing People v. Liller,* 20 N.Y.2d 727,731 [1967]; *Lynch v. Ford,* 60 A.D.2d 880, 881 [2d Dep't 1978]).

[14] July 15, 2011 CWA § 401 Application Status Ruling at 4.

[15] Information with respect to the aquatic (construction and operational) impacts of Entergy's proposed CWW screen has not been provided by Entergy as required by the Interim Decision (*see* Interim Decision, 2008 N.Y. ENV LEXIS 52 at *50-52) and was not before NYSDEC on or before April 2, 2010. *See* Riverkeeper June 29, 2012 Motion for a Scheduling Order With Respect to CWW Screens. While Riverkeeper maintains its relevance objection to Entergy's provision of post-denial WQC application materials, the facts adduced in the hearings to date and the findings proposed herein note that Entergy's proposed CWW screen array aquatic impacts demonstrate separate and independent grounds for finding that the continued operation of Indian Point, as proposed by Entergy, would violate best usages and antidegradation. *See* Riverkeeper Initial Brief Proposed Findings of Fact ¶¶ 111-117 and 135-144, *Section VII* hereof, *infra*.

[16] Tr. 3434:20 to 3435:13; 3542:1-5; 3542:13-20.

[17] *See* December 14, 2012 *Scheduling Order Ruling* at 6.

(5) Notwithstanding the foregoing, and given Entergy's failure or refusal to include CWW screen construction and operational aquatic impact information in its WQC application or in connection with the hearings to date, Riverkeeper submits that Entergy has failed to meet it burdens of production and persuasion with respect to aquatic impacts associated with its CWW screens in the context of best usages (6 NYCRR §§ 624.9[b][1] and [c]; 6 NYCRR § 608.9).[18]

VII. PROPOSED FINDINGS OF FACT

The record[19] compiled on the topic of Issue for Adjudication No. 2 – "Best Usages," reveals the following material facts, which the tribunal should adopt as findings of fact pursuant to 6 NYCRR § 624.13[a][1]:

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[18] *See* Note 15, *supra.*

[19] *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 (IP3),* Transcript of Adjudicatory Hearing before Daniel P. O'Connell, ALJ, Maria E. Villa, ALJ, M-F Reporting, Inc., (October 17, 2011, pages 1-314 (Cylindrical Wedgewire Screens I ("CWW")); October 18, 2011, pages 315-777 (CWW); October 19, 2011, pages 778-1031(CWW); October 20, 2011, pages 1032-1283(CWW); October 24, 2011, pages 1284-1671 (CWW); October 25, 2011, pages 1672-2152 (CWW); October 26, 2011, pages 2153-2346 (CWW); October 27, 2011, pages 2347-2625 (CWW); October 28, 2011, pages 2626-2653 (CWW); November 15, 2011, pages 2654-2972 (Radiological Materials ("Rad"); November 16, 2011, pages 2973-3070 (Rad)); *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 (IP3)*, Transcript of Adjudicatory Hearing before Daniel P. O'Connell, ALJ, Maria E. Villa, ALJ, Reporter: Alan H. Brock, RDR, CRR, Farmer Arsenault Brock LLC (January 17, 2012, pages 3345-3737(Best Usages ("BU")); January 18, 2012, pages 3738-3894(BU); July 31, 2012, pages 4126-4228 (BU); July 31, 2012 (Cylindrical Wedgewire Screens II "CWWII"), pages 4229-4389; August 1, 2012, pages 4390-4747 (CWWII); August 2, 2012, pages 4748-5116 (CWWII); August 3, 2012, pages 5117-5332 (CWWII); August 7, 2012, pages 5333-5437 (CWWII)); *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 (IP3)*, 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 (Rad); January 23, 2012, pages 3895-4125 (Rad)).

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 portions of the hearing referenced above will herein simply be cited as "Tr. __." However, while the because there is inconsistency as to whether the pre-filed written testimony of DEC Staff's, Riverkeeper's, and Entergy's witnesses was included in the pagination of the stenographic transcripts or appended at the end of said transcripts and therefore not included in the pagination, said

A. The Hudson River Estuary

1. The Hudson River acts as an important nursery and breeding ground for fish, is one of the most biologically diverse estuarine water bodies in North America, and has long been recognized as an ecologically and economically valuable national, State, and local resource, as well as an integral part of the North Atlantic coastal environment (Nieder July 22, 2011 Direct at 2:18-20; Henderson July 22, 2011 Direct at 6:19-22 and 6:34-36).

2. The Hudson River is rich with aquatic life, providing habitat for the early, sub-adult, and adult life stages of many aquatic species, including a number of game, commercial, and forage fish species (**Entergy Exhibit 120**, NYSDEC FEIS for the Hudson River Power Plants [2003] at 1 of 93).

3. The Hudson River estuary supports huge populations of small forage fish such as bay anchovy which are prey for the larger predatory species, is the migratory route by which anadromous[20] and catadromous[21] fish move between their spawning and feeding grounds and, upriver and downriver from Indian Point, provides critical habitat for most estuarine-dependent fisheries originating from the Hudson River (Nieder September 30, 2011 Rebuttal 30:18-22; Henderson July 22, 2011 Direct at 6:22-24).

4. North of Indian Point, Hudson River miles 44-56 are the major spawning area along the Hudson for striped bass (Nieder September 30, 2011 Rebuttal 30:22-23).

5. Just to the south of Indian Point, Haverstraw Bay provides extensive nursery grounds for migratory fish species including striped bass, American shad and Atlantic sturgeon (Nieder September 30, 2011 Rebuttal 30:23 to 31:3).

6. The Hudson River estuary, particularly the river area around Indian Point, serves as a spawning and nursery ground for important fish and shellfish species, such as striped bass,

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pre-filed written testimony will be referenced herein by the date, page and line of the pre-filed testimony. Where citations are made to pre-filed testimony on issues other than Issue for Adjudication No. 2- "Best Usages," that pre-filed testimony will be identified by both date and subject matter, with "CWW" referring to testimony on the cylindrical wedgewire screen issue.

[20] Anadromous fish live in the sea and migrate to fresh water to breed. An example is the American shad (Henderson July 22, 2011 Direct at 6, note 1).

[21] Catadromous fish spend most of their lives in fresh water, then migrate to the sea to breed. The most well-known example is the American eel (Henderson July 22, 2011 Direct at 6, note 2).

American shad, Atlantic and shortnose sturgeon, and river herring (Nieder July 22, 2011 Direct at 2:23 to 3:3).

7. Haverstraw Bay also provides feeding grounds for bay anchovy, Atlantic menhaden, and blue claw crab as well as both Atlantic and short-nosed sturgeon (Nieder September 30, 2011 Rebuttal 31:3-5; Henderson July 22, 2011 Direct at 6:25-26).

8. Traditionally, the Hudson River has functioned as an abundant temperate estuary, rich in high fish biodiversity, with more than 140 fish species living in the estuary which has been a popular and, at times, prosperous commercial and recreational fishing environment (Nieder July 22, 2011 Direct at 2:20-23; 3:3-4 Henderson July 22, 2011 Direct at 6:31-32).

9. The Hudson River is rich with aquatic life, providing habitat for the early, sub-adult, and adult life stages of many aquatic species, including a number of game, commercial, and forage fish species (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 1 of 93).

10. Indian Point is located near major estuarine fish spawning and nursery grounds and surrounded by several Hudson River Significant Tidal Habitats designated by the New York State Department of State, including Hudson River miles 44-56, Iona Island Marsh, Camp Smith and Annsville Creek, and Haverstraw Bay (Nieder September 30, 2011 Rebuttal 29:20 to 30:4).

11. The importance of the river area near Indian Point at River Miles 40-60 was recently recognized in June 2011 when the New York State Department of State, in cooperation with NYSDEC, proposed to revise the State's Significant Coastal Fish and Wildlife Habitat documentation for habitat areas located along the Hudson River (Nieder September 30, 2011 Rebuttal 30:4-21; Henderson July 22, 2011 Direct at 13:19-22).

12. The Hudson River up to the federal dam in Troy has also been designated as essential fish habitat ("EFH") by the National Marine Fisheries Service ("NMFS") (Nieder July 22, 2011 Direct at 4:15-16; Henderson July 22, 2011 Direct at 6:26-29).

13. The eight federally managed species of fish found in the EFH-designated Hudson River estuary near the Facility are: Atlantic sea herring, bluefish, Atlantic butterfish, red hake, black sea bass, summer flounder, winter flounder, and windowpane flounder (hereinafter and collectively, the "EFH Species") (Nieder July 22, 2011 Direct at 4:16-20).

14. The Hudson River is an important regional source for both harvested fish stocks and prey (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 4).

15. Because most fish species have experienced population declines since the most recent NRC licensing was completed for Indian Point plants, NMFS has designated the Hudson River as EFH in order to better manage adverse anthropogenic effects on fisheries (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 4).

16. The Buchanan reach of the Hudson River where the Facility is located is a tidally-dominated habitat that serves as a migratory corridor, spawning habitat, and nursery area for an unusually diverse species assemblage of resident or diadromous fishes, crustaceans, shellfish, and many lower trophic level prey items (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 3).

17. For the immediate Indian Point area, designated EFH includes acreage that produces organisms that are under direct federal stewardship as well as prey items for species further downriver and offshore (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 4).

B. The Indian Point Facility

18. Indian Point Units 2 and 3, which are located on the east bank of the Hudson River in the Village of Buchanan, Westchester County each utilize a once-through cooling water intake system, with cooling water intake structures ("CWIS") in (and with a shared discharge canal to) the Hudson River (Nieder July 22, 2011 Direct at 9:1-4).

19. A once-through cooling system operates by withdrawing water from its source, passing the withdrawn water through the steam condensers one time, and then discharging the withdrawn water to the source at a higher temperature (known as thermal discharge). (Nieder July 22, 2011 Direct at 9:4-6).

20. The design rate of the cooling water intake system for each Indian Point Unit is 840,000 gallons of water per minute (GPM), for a combined cooling water intake capacity of approximately 2.5 billion gallons of Hudson River water per day. (Nieder July 22, 2011 Direct at 9:9-11).

21. Indian Point Unit 2 began commercial operation in 1973 (**Entergy Exhibit 27,** AEI Report at 16).

22. Indian Point Unit 3 began commercial operation in 1976 (**Entergy Exhibit 27,** AEI Report at 16).

C. Existing and Applicant-Proposed Facility Impacts

23. The use of once-through cooling systems by the mid-Hudson power plants has been a major conflict of use that has gone unresolved for decades **(Riverkeeper Exhibit 58,** NMFS October 12, 2010 EFH Consultation Letter at 4).

24. NYSDEC Commissioner's Policy #52, entitled "Best Available Technology (BTA) for Cooling Water Intake Structures" (July 10, 2011) [22] (hereinafter "NYSDEC CP-52") defines "adverse environmental impact" as "the fish and shellfish killed or injured through entrainment and impingement by the operation of cooling water intake structures" (Nieder September 30, 2011 Rebuttal at 10:21-23; Tr. 1871:21-23 (Nieder Pre-Filed Rebuttal); NYSDEC CP-52 at 2).

25. "Entrainment" is the incorporation of all life stages of fish with intake water flow entering and passing through a CWIS and into a cooling water system (Nieder September 30, 2011 Rebuttal at 11:2-4; NYSDEC CP-52 at 3).

26. Entrainment occurs when smaller life stages of aquatic organisms like plankton, eggs, and larvae are drawn into a CWIS and are injured or killed in the process (Nieder July 22, 2011 Direct at 64:6-7; **Entergy Exhibit 120**, NYSDEC FEIS for the Hudson River Power Plants [2003] at 16 of 93).

27. Each year Indian Point causes the mortality of more than a billion fish from entrainment of various life stages of fishes through the plant and impingement of fishes on intake screens **(Entergy Exhibit 26[b]**, NYSDEC SPDES Permit Biological Fact Sheet at 1 of 8; Henderson July 22, 2011 Direct at 9:29-36 and Table 1 thereto).

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[22] NYSDEC, Commissioner's Policy 52, *Best Available Technology (BTA) for Cooling Water Intake Structures* (July 10, 2011), *available at* http://www.dec.ny.gov/docs/fish_marine_pdf/btapolicyfinal.pdf (last visited December 16, 2012).

28. The Facility produces increasing death rates of all entrained organisms (Tr. 3698:3-7 [Barnthouse by RvK]).

29. In the normal water body ecosystem, many small benthic, planktonic, and nektonic organisms (including early life stages of fish and shellfish organisms) serve as prey for larger organisms that are found higher on the food chain **(Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 16 of 93).

30. Adverse environmental impact includes the total number of aquatic organisms killed by a CWIS (Nieder July 22, 2011 Direct at 66:2-4).

31. The majority of entrainment at Indian Point has historically occurred between May 1 and August 15 of any calendar year (the entrainment season) (Nieder May 30, 2012 CWWII Direct at 36:5-6).

32. When larvae are present in the river, a direct linear one-to-one relationship exists between flow reductions taken at Indian Point at Indian Point and the number of fish entrained (Tr. 1688:9-15 [Young by RvK]).

33. Indian Point's CWISs have been operated at nearly 100% capacity during the entrainment season in recent years (Nieder May 30, 2012 CWWII Direct at 37:6-7).

34. In order for Entergy to reduce entrainment at Indian Point by any appreciable amount using the CWIS technology currently in place at the Facility, a significant reduction in the capacity utilization of the CWISs would need to be implemented between May 1 and August 15 of each calendar year (Nieder May 30, 2012 CWWII Direct at 36:7-10).

35. Protective outages taken at Indian Point during the entrainment season in 1985, 1986, and 1987 resulted in reductions in the capacity utilization of the CWIS as well as an annual average reduction in entrainment of 45.2% (Nieder June 29, 2012 CWWII Rebuttal at 65:10-15).

36. The Hudson River water is an element of the river's aquatic habitat, but circulating water and organisms though the Facility alters that portion of that element of the aquatic habitat which is drawn into and discharged from the Facility ([Tr. 3548:15-23 to 3549:1-6; 3547:13-22; 3533:1-10 [Entergy Panel by RvK]).

37. While being cycled through the Facility, the Hudson River's water does not constitute suitable habitat for aquatic organisms (Tr. 3556:4-8 [Heimbuch by RvK]).

38. As entrained organisms pass through the Facility's cooling system they are subject to mechanical, thermal, and/or toxic stress from physical impacts in the pumps and condenser tubing, pressure changes, sheer stress, thermal shock, chemical toxemia induced by antifouling agents such as chlorine, high temperatures, large changes in temperature and other physical damages due to abrasion (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 16 of 93; **Riverkeeper Exhibit 3,** *Entrainment, Impingement and Thermal Impacts at Indian Point Nuclear Power Station* [Pisces, 2007] at 3; Tr. 3551:10 to 3553:23 [Entergy Panel by RvK]; Nieder July 29, 2012 Direct at 7:3-6).

39. The AEI Report (**Entergy Exhibit 27**) did not evaluate the physical parameters of the habitat as affected by Indian Point's entrainment (Tr. 3700:3-6 [Barnthouse by RvK]).

40. As the Facility is currently configured, or with the addition of CWW screens, organisms would be drawn in through the CWIS, through the circulating water pumps, run through the condensers and then discharged through a diffuser into the discharge canal (Tr. 3549:7 to 3551:1 [Entergy Panel by RvK]).

41. Mortality rates of entrained organisms can be as high as 97%, depending on the species and life stage entrained, so it is the standard practice to assume 100% mortality when assessing the impact of entrainment. (Henderson July 22, 2011 CWW Direct at 11:16-17; Henderson July 22, 2011 CWW Direct at 11:14-16).

42. Survival, should it occur, is species-and site-specific, and needs to be demonstrated by appropriate field studies (Henderson July 22, 2011 CWW Direct at 11:17-18).

43. NYSDEC assumes that entrainment results in 100 percent mortality of the entrained organisms unless a lesser mortality rate at the facility is clearly demonstrated to NYSDEC staff based NYSDEC-approved, contemporary, site-specific studies, but Entergy has not conducted such studies of entrainment survival for the CWW screens (Nieder July 22, 2011 Direct at 66:19-22; Nieder September 30, 2011 Rebuttal at 11:4-7, *citing* NYSDEC CP-52 at 3; Tr. 5104:20 to 5105:2 [Young by RvK] and Tr. 5085:18 to 5086:6 [Young by RvK]).

44. Due to difficulty in collecting entrainable organisms from a fine mesh[23] wedge wire screen, entrainment survival for fine mesh wedgewire screens is not known (**Staff Exhibit 19,** EPA 316(b) Rule March 28,2011 Technical Development Document at 6-54).

45. NYSDEC has rejected Entergy's estimations of entrainment survival at the Facility because such estimations are based on prior studies at Indian Point from nearly 30 years ago which cannot be used to accurately identify current entrainment survival at Indian Point; no such current, site-specific study was undertaken at Indian Point (Nieder July 22, 2011 Direct at 66:23 to 67:5; Nieder June 29, 2012 Rebuttal at 44:1-3).

46. The data used by Entergy for their entrainment survival estimates only showed entrainment survival in appreciable numbers for three species; striped bass, white perch and Atlantic tomcod (Tr. 3750:23 to 3751:1-3 [Young Re-cross by RvK]).

47. "Impingement mortality" is the death of all life stages of fish as a result of being entrapped on the outer part of a CWIS or against a screening device during periods of water withdrawal. (Tr. 1872:7-10; Nieder September 30, 2011 Rebuttal at 11:7-10; NYSDEC CP-52 at 3).

48. Because of the close proximity of Indian Point to major spawning and nursery grounds, the entrainment of eggs, larval and young juvenile fish by Indian Point is of primary concern (Henderson July 22, 2011 Direct at 14:9-10).

49. Indian Point's CWISs cause an adverse environmental impact (from impingement and entrainment) of over a billion aquatic organisms per year, resulting in impacts to Hudson River fish populations (Nieder July 22, 2011 Rebuttal at 119:15-20; Interim Decision, 2008 N.Y. ENV LEXIS 52 at *27-34).

50. Indian Point's CWISs cause adverse impacts to the billion individual organisms that they kill every year, and such organisms do not survive and propagate (Tr. 3459:3-15, 3457:13-23 [Barnthouse by DEC]).

51. NYSDEC has determined that the loss of over one billion fish of all life stages (from eggs through adult) to entrainment and impingement at Indian Point has an adverse

[23] While there is no widely accepted definition of "fine mesh," EPA's uses 5mm as the threshold for what constitutes fine mesh. (**Staff Exhibit 19,** EPA 316(b) Rule March 28, 2011 Technical Development Document at 6-49, n. 30).

environmental impact and, therefore, does not comply with the applicable best use standard for the Hudson River by not assuring the survival and propagation of fish. (Nieder September 30, 2011 at Rebuttal 14:1-10).

52. CWISs also cause multiple types of undesirable and unacceptable adverse environmental impacts (other than entrainment and impingement), including reductions of threatened, endangered or other protected species; damage to critical aquatic organisms, including important elements of the food chain; diminishment of a population's compensatory reserve; losses to populations including reductions of indigenous species population, commercial fisheries stocks, and recreational fisheries; and stresses to overall habitat, communities and ecosystems as evidenced by reductions in diversity or other changes in system structure and function (Nieder July 22, 2011 Direct at 9:12-20).

53. Just as the immediate losses from entrainment and impingement are of critical importance in assessing CWIS impacts on best usages, the potential long-term changes resulting from impacts to aquatic organisms and aquatic habitat should also be examined (Henderson July 22, 2011 Direct at 3:41 to 4:2).

54. The U.S. Environmental Protection Agency ("EPA") has recognized that the loss of large numbers of aquatic organisms may affect not only stocks of various species and their compensatory reserve, but also the overall health of ecosystems, in the Hudson River in particular (Nieder July 22, 2011 Direct at 9:20 to 10:8, citing 69 Fed.Reg. 41,587-88 [July 9, 2004]).

55. Entrainment is unselective, and kills species ranging from algae, small crustaceans and insects to shrimp, young crabs and further up the food chain to the early stages of fish, and therefore degrades the plankton at the base of the food web and consequently impacts organisms higher up the food chain (Henderson July 22, 2011 CWW Direct at 11:31-34).

56. If an organism is unnaturally killed by the Facility, it can no longer play a part in ecosystem functions as a predator, prey or habitat modifier (Henderson September 30, 2011 CWW Rebuttal to Barnthouse at 4:1-2).

57. The adverse environmental impacts associated with entrainment and impingement are comparable to habitat degradation (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 53 of 93).

58. Indicators of a significantly impaired habitat may include, without limitation, reduced carrying capacity, changes in community structure (food chain relationships, species diversity), reduced productivity, and/or increased incidence of disease or mortality. (**Entergy Exhibit 76,** Entergy August 15, 2011 Comments on New York Department of State proposed revisions to Significant Coastal Fish and Wildlife Habitat Designations, *Exhibit 1* thereto, NYSDOS Draft Hudson River Miles 40 to 60 Coastal Fish and Wildlife Rating Form [hereinafter "NYSDOS Habitat Rating Form"] at 4).

59. The operation of Indian Point in once-through cooling mode, with or without the addition of CWW screens, is not compatible with waters designated as Significant Coastal Fish and Wildlife Habitat because it destroys or significantly impairs the viability of the habitat (Henderson July 22, 2011 Direct at 13:10-17; Tr. 3683:3 to 3687:5 [Barnthouse by RvK] and Tr. 3687:19 to 3690:19 [Barnthouse by RvK], citing **Entergy Exhibit 76,** Entergy August 15, 2011 Comments on New York Department of State proposed revisions to Significant Coastal Fish and Wildlife Habitat Designations, *Exhibit 1* thereto, NYSDOS Habitat Rating Form at 3-4).

60. The Department of State has determined, in conjunction with NYSDEC, that entrainment or impingement from installation and operation of water intakes and in-river construction activities in the proposed Hudson River Miles 40-60 Significant Tidal Habitat could have significant impact on juvenile and/or adult fish concentrations, including endangered species (Nieder May 30, 2012 Direct at 52:5-11).

61. A determination of whether or not Entergy's proposed project is consistent with coastal policies is a requirement before said project would be permitted to be constructed and operated, regardless of whether or not the pending Hudson River Mile 40-60 Significant Tidal Habitat designation is formally adopted (Nieder September 30, 2011 Rebuttal at 72:18-21).

62. Degrading an aquatic organism's habitat makes the habitat less suitable for that organism and thus harms that aquatic organism. (Tr. 3619:21 to 3620:15 [Entergy Panel by RvK]).

63. The adverse environmental impacts associated with entrainment and impingement affect the entire community of organisms that inhabit the water column (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 53 of 93).

64. Entrainment is a stressor on both individual aquatic organisms and, at some level (large or small) on populations and communities of aquatic organisms (Tr. 3585:18 to 3586:5 [Barnthouse by RvK]).

65. The adverse environmental impacts associated with entrainment and impingement diminish a portion of the forage base for each species that consumes plankton (drifting organisms in the water column) or nekton (mobile organisms swimming through the water column) so there is less food available for the survivors (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 53 of 93).

66. In an intact ecosystem, plankton and nekton serve as compact packets of nutrients and energy, with each trophic (food chain) level[24] serving to capture a diffuse resource and make it more concentrated (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 53 of 93).

67. Small fish, in turn, serve as forage for the young of larger species, which serve as forage for larger individuals, and so on up the food chain, more correctly understood as a trophic pyramid (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 54 of 93).

68. The adverse environmental impacts associated with entrainment and impingement short-circuit the trophic pyramid and compromises the health of the natural community (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 54 of 93).

69. NMFS is particularly concerned with the potential for Indian Point's once-through cooling operations leading to reduced production or availability of prey, which constitutes an indirect or cumulative adverse effect that diminishes the quality of designated essential fish habitat (**Riverkeeper Exhibit 58** October 12, 2010 NMFS EFH Consultation Letter at 9).

[24] The term "trophic level" refers to the feeding habits or food relationship of different organisms in a food chain (Nieder July 22, 2011 Direct at 22:14-15).

70. NMFS considers the mortalities of billions of aquatic organisms caused by Indian Point to be highly significant, with attendant impacts to coastal fisheries (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 9).

71. Entrainment not only reduces the number of adult fish species whose eggs and larvae are entrained by a CWIS, but also depletes the species' ability to survive unfavorable environmental conditions and, perhaps most significantly, diminishes the forage base, which disrupts the food chain, transferring energy from higher to lower trophic levels and compromising the health of the entire aquatic community (Nieder July 22, 2011 Direct at 22: 9-14).

72. While an individual bay anchovy might ordinarily serve as food for a juvenile striped bass or a common tern, entrainment would render it useful only as food to lower trophic level organisms, and it would be unable to provide its other ecosystem functions (**Entergy Exhibit 120,** NYSDEC FEIS for the Hudson River Power Plants [2003] at 54 of 93).

73. The Facility's continued withdrawal of approximately 2.5 billion gallons of Hudson River water per day and the infliction of mortality to roughly one billion aquatic organisms per year result in an adverse environmental impact which would be inconsistent with the designated best usages of Hudson River waters for fishing and impair those best usages because such unnatural mortality does not assure the survival and propagation of Hudson River fish species (Nieder July 22, 2011 Direct at 8:8-12; Nieder September 30, 2011 Rebuttal 47:13-16).

74. Indian Point's high unnatural mortality in an area that is biologically critical for the recovery of several estuarine fish species (alewife, blueback herring and American shad) does not ensure the best usage of the Hudson River for fishing, fish propagation and survival (Nieder September 30, 2011 Rebuttal 31:16-19).

75. Application of Entergy's Spawning Stock Biomass Per Recruit (SSBpR) model to data available for striped bass in the AEI Report shows that impacts attributable to Indian Point would reduce the spawning potential ratio of the Hudson River striped bass population by 8% compared to an unfished population (Barnthouse July 22, 2011 Direct at 40:13-18).

76. For a population subjected to mortality due to cooling water withdrawals, the probability of a spawned egg surviving to age one is decreased **(Riverkeeper Exhibit 61,**

Barnthouse & Heimbuch *et al.* *Indicators of AEI Applied to the Delaware Estuary* [The Scientific World, May 18, 2002] at 180; Tr. 3657:4-13; 3658:6-7 [Barnthouse by RvK]).

77. Indian Point's operations kill more recreational and commercial fish species annually than are taken by any other permitted recreational or commercial fishery on the Hudson River (Nieder September 30, 2011 Rebuttal 44:8-10).

78. The mortality of American shad and river herring caused by impingement and entrainment at Indian Point is on par with, or greater than, that associated with recent recreational and commercial fishing takes (Nieder September 30, 2011 Rebuttal 39:10-12).

79. Given the large number of fish killed by Indian Point, and the current decimated state of several recreational fish stocks on the Hudson River, NYSDEC has determined that the continued inadvertent mortality of fish at Indian Point impairs the best usage of the Hudson River for fishing by not assuring the propagation and survival of recreationally and commercially important fish species (Nieder September 30, 2011 Rebuttal 39:12-16).

80. Losses at Indian Point are distributed primarily among seven (7) species of fish, including bay anchovy, striped bass, white perch, blueback herring, Atlantic tomcod, alewife, and American shad. Of these, Atlantic tomcod, American shad, and white perch numbers were known to be declining in the Hudson River at the time NYSDEC issued its draft SPDES permit for the Facility (**Entergy Exhibit 26[b]**, NYSDEC SPDES Permit Biological Fact Sheet at 1 of 8).

81. Indian Point's indiscriminate killing of over one billion fish of all life stages each year destroys not only potential recruits to the eight representative important species or "RIS" species included in the AEI Report,[25] but also kills potential prey species, and kills and injures threatened and endangered species such as Atlantic sturgeon and shortnose sturgeon (Nieder September 30, 2011 Rebuttal 50:10-14).

82. Threatened and endangered species such as Atlantic and shortnose sturgeon can be killed directly by impingement and entrainment, injured by contact to fish return systems or harmed indirectly by the loss of food species caused by Indian Point, or by a general reduction in

[25] The AEI Report's RIS species include: (1) striped bass; (2) white perch; (3) American shad; (4) Atlantic tomcod; (5) alewife; (6) blueback herring; (7) bay anchovy; and (8) spottail shiner (**Entergy Exhibit 27**, AEI Report at 7).

the habitat quality caused by the impacts of the intake and outfall (Henderson July 22, 2011 Direct at 12:18-23).

83. The harm inflicted on endangered shortnose sturgeon impairs the best usage of the Hudson River for the propagation and survival of sturgeon (Henderson July 22, 2011 Best Usages Direct at 12:37-38, *citing* **Entergy Exhibit 9**, NYSDEC 401 Denial at 23).

84. The impingement and entrainment of over one billion fish of all life stages annually contributes to a substantial unnatural mortality to Hudson River fish populations that have seen dramatic declines over the past decade (Nieder September 30, 2011 Rebuttal 44:15-18).

85. Five EFH species (red hake, Atlantic butterfish, windowpane, winter flounder and bluefish) have been known to be entrained at Indian Point (Tr. 3531:5-12 [Barnthouse by DEC]; Entergy September 30, 2011 Panel Rebuttal at 36:1-11 [Table 10]).

86. Operating the Facility as currently configured leads to direct impacts to EFH Species and their prey in the mid-Hudson region (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 9).

87. EFH species such as winter flounder have shown a long-term population decline over the operating period of Indian Point, and winter flounder eggs were recorded in recent entrainment sampling conducted by Entergy in connection with in-river testing of CWW screen efficacy (Tr. 3636:11-19 [Young by RvK]; **Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

88. The 2003 NYSDEC draft SPDES permit for the Facility required closed cycle cooling (or equivalent entrainment reductions via an alternative technology) in order to meet the "best available technology" water quality standard of 6 NYCRR § 704.5 for minimizing CWIS adverse environmental impacts, but only required annual 42 unit-day generation outages as an interim compliance measure (while the Facility would be still operating in once-through cooling mode), having found that cost of perpetual annual 32-week facility generation outages would be "wholly disproportionate" to the environment benefit derived under 6 NYCRR § 704.5 (**Entergy Exhibit 26,** NYSDEC Permit Fact Sheet at 4).

89. On February 12, 2010, Entergy submitted a report to NYSDEC entitled "Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3 (**Entergy Exhibit 8**) that concluded that CWW intake technology existed that could potentially reduce, but not minimize, entrainment by Indian Point's CWISs (Nieder July 22, 2011 Direct at 11:20 to 12:1; Henderson July 22, 2011 CWWI Direct at 5:6-9; **Entergy Exhibit 8** at v and 63).

90. Entergy's proposed compliance alternative to meet New York's "best available technology" standard of 6 NYCRR § 704.5 consists of one hundred and forty-four (144) 2.0 millimeter slot-width 72-inch diameter Johnson "T-72" CWW screens, each of which is roughly 19 feet long (Beaver May 30, 2012 CWWII Direct at 7:14-28).

91. Larvae are fragile organisms and can be easily damaged by impacts with CWW screens, particularly on a repeated basis (Henderson September 30, 2011 CWW Panel Rebuttal at 10:21-22).

92. Contact injuries to eggs and larvae from CWW screens increase in proportion to screen-organism contact times (**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 6-40).

93. Entergy contends that the CWW screens will all be oriented "approximately" parallel to the Hudson River's sweeping flow, but this would actually increase screen-to-organism contact times as organisms would have to travel the full length of the CWW screen before returning to the water body (Beaver May 30, 2012 CWWII Direct at 8:7-8; **Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 6-40).

94. Screen-organism contact time would be increased with longer screens (Henderson September 30, 2011 CWW Barnthouse Rebuttal at 15:17-18).

95. Thus, even organisms which are not entrained or impinged by the CWW screens could be killed by being bounced down the 144 inches of filtration surface of the proposed CWW screens (Henderson September 30, 2011 CWW Barnthouse Rebuttal at 15:18-19).

96. For the cylindrical wedge-wire screen array proposed by Entergy, an aquatic organism could encounter more than one cylindrical wedge-wire screen (Tr. 5086:7-14 [Entergy Panel by RvK]).

97. Larvae that cannot avoid the screens may impact the surface of multiple screens as they pass along the CWW screen array, and with each tidal reversal, the larvae may be pulled

repeatedly along the CWW screen array (Henderson September 30, 2011 CWW Panel Rebuttal at 17:7-9).

98. At slack water tides, larvae will not be moved away from or along the screen by water movement, so they will likely suffer multiple screen encounters as they are repeatedly moved by the current towards the screen, until they are exhausted and pass through or are impinged upon the screen. (Henderson September 30, 2011 CWW Panel Rebuttal at 4:30 to 5:1-7).

99. Whether or not an organism is excluded from a CWIS, entrainment-related environmental impacts are not minimized unless the excluded organisms survive and ultimately are returned back to the water body (**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-19).

100. Studies on the effect of impingement on fine mesh screens on larval fish which give measurements of the resulting mortality also provide indications of some of the processes that cause impingement mortality associated with CWW screens (Henderson September 30, 2011 CWW Panel Rebuttal at 10:34-35 to 11:1).

101. Entergy's consultants based their estimates of survival of excluded fish for the wedge-wire screens on information from studies of fine-mesh screens (Tr. 1759:13-16 [Young by RvK]).

102. "Converts" are larvae and eggs which are excluded from entrainment by a screen but become impinged on the screen mesh (**Staff Exhibit 19**, EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-16).

103. CWW screens also present the potential for "gilling," whereby a larva's head is excluded but the posterior portion of the body passes through the slot (Nieder September 30, 2011 Rebuttal at 112:4-6, *citing* **Riverkeeper Exhibit 38**, *Field Evaluation of Wedgewire Screens for Protecting Early Life Stages of Fish at Cooling Water Intake Structures*, EPRI, Chesapeake Bay Studies, Final Report [June 2006] at 5-4, n. 2).

104. "Gilling" is a form of lethal impingement to fish larvae (Nieder September 30, 2011 Rebuttal at 112:9-10).

105. In the case of "converts," impingement mortality is an appropriate measure of the biological performance of a technology (**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-16).

106. The survival of converts on fine mesh screens is very poor, and in some cases comparable to the extremely low survival of entrained organisms (**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-16 to 2-17).

107. The mortality of eggs off a fine mesh screen converted to impingement approaches 20 to 30%, while the mortality of larvae off a fine mesh screen is rarely less than 80%(**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-17).

108. A facility that simply excluded entrainable organisms (with no attention being paid to whether they survive or not) may in fact be causing the same level of mortality as a facility with no entrainment controls at all (**Staff Exhibit 19,** EPA 316[b] Rule March 28, 2011 Technical Development Document at 2-17).

109. Entergy's CWW screen efficacy estimates do not address the mortalities to aquatic organisms which would impact the CWW screens without being entrained, or "converts" which would be impinged upon the CWW screens (Tr. 5086:22 to 5087:11 [Heimbuch by RvK]).

110. Impinged larvae would be further injured if they were stuck on the CWW screens when the airburst system activated and dislodged them with a 200 pound-per-square-inch burst (Tr. 5105:8-16 [Heimbuch by RvK]).

111. Entergy's proposed CWW screens would be mounted on twelve (12) plenums located in the bed of the Hudson River, with twelve (12) screens per plenum (Beaver May 30, 2012 CWWII Direct at 7:20-29).

112. Other components associated with Entergy's proposed CWW screen array system which would be installed in the Hudson River include header pipes, transition boxes, and airburst system pipes (Beaver May 30, 2012 CWWII Direct at 7:29 to 8:6; **Entergy Exhibit 165[A],** *Phase I Technical Report: Wedgewire Screen Array Design* [ENERCON, April 2012] at 20.)

113. Entergy's revised CWW screen array system design also includes an airburst system building located on pilings in the Hudson River (Tr. 4306:19-23 [Beaver by DEC]).

114. Entergy's proposed CWW screen array system would involve the dredging of 91,400 cubic yards of material from the Hudson River (Tr. 4425:10-16 [Beaver by DEC]).

115. Entergy's proposed CWW screen array system would result in the disturbance of over five acres of River bottom (Nieder May 30, 2012 CWWII Direct at 47:1-5).

116. Entergy has not yet quantified the amount of fill material which would be placed in the Hudson River in connection with Entergy's proposed CWW screen array system (Tr. 4509:10-21 [Beaver by RvK]).

117. The reports, documents and testimony provided by or on behalf of Entergy to NYSDEC do not provide an adequate analysis or review of the potential aquatic resource impacts which would result from the construction and operation of the proposed system of 144 T-72 2.0 mm slot-width CWW screens, nor do the materials show that CWW screens will minimize entrainment at Indian Point (Nieder May 30, 2012 CWWII Direct at 52:17-23).

D. Additional Inconsistencies of CWW Screens with the Designated Best Usages of the Estuary

118. The Facility's regulatory baseline entrainment is 1.2 billion organisms per year (**Entergy Exhibit 6[a]**, Appendix A to *Biological Assessment of Alternative Intake Technologies for Indian Point Units 2 and 3*: Biological Analysis of Selected Cooling System Alternatives for Indian Point Energy Center [ASA] at 32, Table 10).

119. NYSDEC's calculation baseline which is used for estimating reductions from impingement and entrainment assumes the use of a once-through cooling system with shoreline intakes oriented parallel to the shoreline and 3/8-inch mesh conventional traveling screens which is operated at the full rated capacity 24 hours a day, 365 days a year (NYSDEC CP-52 at 2-3).

120. The 2 mm CWW screens proposed by Entergy would result in a 51% to 62% reduction in from the NYSDEC's calculation baseline of 1.2 billion entrained organisms (Tr. 5140:21-23 [Nieder by Entergy]; Nieder May 30, 2012 CWWII Direct at 33:9-13; Henderson May 30, 2012 CWWII Direct at 3:21-25).

121. CWW screen entrainment reductions of approximately 60% do not minimize adverse environmental impacts, is statistically insignificant and falls far short of the Assistant Commissioner's requirement that alternative technology proposal reductions be commensurate with closed cycle cooling (90 to 95% reduction from the Department's calculation baseline)

(Nieder May 30, 2012 CWWII Direct at 33:9-23 and **Entergy Exhibit 26**, NYSDEC Permit Fact Sheet at 3).

122. By improperly calculating entrainment reductions to include entrainment survival and flow reductions from the full-flow baseline, and converting entrainment losses to age-one equivalents, Entergy's most recent estimated entrainment reductions for its proposed 2 mm CWW screens is 77% from the regulatory baseline (Young May 30, 2012 Direct at 22:16-21; 27:1 to 29:5).

123. A 77% reduction from the regulatory baseline is 276,000,000 organisms entrained per year by the Facility (0.77 * 1,200,000,000 = 276,000,000).

124. At the hearing on January 17, 2012, Entergy's consultant opined, based on a then-estimated 73.5% reduction in entrainment for 2 mm CWW screens, that 262,000,000 organisms would be entrained per year by the Facility (Tr. 3740:17 to 3741:21 [Young Redirect by Entergy]).

125. Adverse aquatic environmental impacts occur whenever there will be entrainment or impingement damage as a result of the operation of a specific CWIS (Nieder September 30, 2011 Rebuttal 12:11-13, *quoting* **Staff Exhibit 80**, *Draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500*, [EPA, 1977] at p. 11).

126. Killing a single early life stage organism (egg or larvae) of a species which has suffered a long-term decline in abundance contributes to the decline in abundance of that species (Tr. 3728:9 to 3729:5 [Barnthouse by RvK]).

127. The addition of CWW screens would not minimize the Facility's adverse environmental impacts and would not be consistent with the Hudson River estuary's best usages of fishing and suitability as habitat for fish, shellfish and wildlife propagation and survival, because the Facility would still withdraw large quantities of water and entrain tens of millions or more aquatic organisms on an annual basis (Henderson July 22, 2011 Direct at 5:40 to 6:1).

128. The continued operation of Indian Point Units 2 and 3, as currently configured or with CWW screens, would be inconsistent with the best usages of the Class "SB" waters of the Hudson River for secondary contact recreation and fishing, and would not be suitable for fish propagation and survival (Nieder September 30, 2011 Rebuttal at 1:16-21).

129. None of Entergy's proposed CWW screen configurations (in terms of screen size and through-slot velocity) would comply with the best usages of the Hudson River estuary (Henderson July 22, 2011 Direct at 4:10-15).

130. The use of CWW screens at Indian Point as proposed by Entergy would be inconsistent with Hudson River best usages (including impact EFH species and habitat) because CWW screens are untested for the application proposed (Nieder July 22, 2011 Direct at 15:20 to 16:4).

131. The use of CWW screens at Indian Point as proposed by Entergy would be inconsistent with Hudson River best usages for fish propagation and survival (including impacts to EFH species and habitat), because CWW screens would not minimize adverse environmental impact to aquatic organisms (Nieder July 22, 2011 Direct at 27:17 to 28:5).

132. CWW screens are not a feasible and proven available technology for Indian Point and even if they were, since CWW screens would not reduce the Facility's cooling water demand or reduce entrainment as effectively as closed-cycle cooling, the continued operations of Indian Point (even with installation and operation of CWW screens) would still impair the Hudson River best usages for fishing, fish propagation and survival (Nieder September 30, 2011 Rebuttal 47:38 to 48:13).

133. The withdrawal of large quantities of water, irrespective of the installation of CWW screens, will still not minimize the adverse environmental impacts of Indian Point and would not be consistent with the Hudson River estuary's best usages of fishing and suitability as habitat for fish, shellfish and wildlife propagation and survival (Henderson July 22, 2011 Best Usages Direct 5:40-43).

134. Based upon NYSDEC staff's best professional judgment, and a review of relevant scientific and industry literature on this topic, including many reports or studies authored by or participated in by members of Entergy's retained biological team, Entergy's witnesses have not made a compelling or convincing offer of proof that Indian Point's continued operations, either in once-through cooling mode or with its proposed 2.0 mm CWW screen system, would be consistent with the best usages of Hudson River waters for fishing, or fish propagation and survival (Nieder September 30, 2011 Rebuttal at 3:2-9).

135. There would also be both construction and operational phase adverse environmental impacts to the Hudson River from the placement of the proposed CWW screen array in the bed of the river (Henderson July 22, 2011 CWW Direct at 17:18-20).

136. During construction there will inevitably be disturbance to the river bed, with associated impacts to the benthic ecosystem (which would vary depending on the footprint of the final design) and resulting turbidity and other pollution from the riverbed (Henderson July 22, 2011 CWW Direct at 17:20 to 18:1; *see generally* **Entergy Exhibit 169,** *IPEC CWW Dredging Step I – Draft White Paper Postulated Contamination Characterization*, [November 2011]).

137. The footprint of the installation of CWW screens as proposed would alter the physical and biological river environment, displace the benthic organisms and displace aquatic habitat in the area where the CWW screens would be sited (Tr. 4141:4-7, 4141:17 to 4142:1, 4145:8-12 [Mattson by RvK]; Henderson July 22, 2011 CWW Direct at 18:1-3).

138. The proposed CWW screen array location would be in what is presently a "still water" zone at flood tide, because the Facility's existing discharge and intakes create significant flow irregularities in front of the intakes compared with the natural river flow. (Powers June 29, 2012 CWWII Rebuttal at 9:21to 10:3 citing **Entergy Exhibit 165[a]**, *Phase I Technical Report: Wedgewire Screen Array Design* [ENERCON, April 2012] ["Array Report"] at 10-11 and 12 and **Riverkeeper Exhibit 69,** Enercon *Project Report for Determination of Optimal Location for Placement of CWW Screen Arrays* at 8 of 18).

139. Installing 144 CWW screens in the Hudson River at the location proposed by Entergy would further decrease river currents in the area of the array (Powers June 29, 2012 CWWII Rebuttal at 9:12-13).

140. A 144-screen CWW screen array in the Hudson River would attenuate the ambient current velocity in the location where the array would be located (Tr. 1212:12-18 [Gessler by RvK]).

141. Reducing the velocity in a water body will create particular types of habitat which become attractive to some life stages of fish. (Tr. 5299:13-15 [Henderson by Entergy]).

142. Fish larvae are known to seek out refuges to escape fast currents and thereby avoid being swept along with the prevailing current (Nieder June 29, 2012 CWII Rebuttal at 58:9-11).

143. In-river structures attract larvae by providing velocity shelters (Henderson May 30, 2012 CWWII Direct 12:19, *citing* **Riverkeeper Exhibit 67,** *Larval Fish Use of Dike Structures on a Navigable River*, J. Niles and K. Hartman, North American Journal of Fisheries Management [June 25, 2009]).

144. In addition, some species could see higher entrainment because they will be attracted to CWW screens (Nieder September 30, 2011 Rebuttal at 93:21 to 94:1-8, *citing* **Staff Exhibit 30,** *Cylindrical Wedge-Wire Screen Investigation in Offshore Lake Michigan for the J. H. Campbell Plant,* Gulvas and Zeitoun [1979]).

E. The Restoration and Maintenance of the Estuary's Best Usages

145. In order to maintain the best usages of the Hudson River, the impact of impingement and entrainment (I&E) of all life stages of all species must be minimized, irrespective of whether or not a direct impact to a fish population or fish stocks from I&E can be detected (Nieder September 30, 2011 Rebuttal at 20:16-23).

146. NYSDEC has determined that the only way to restore the best usages of the Hudson River for fishing, fish propagation and survival of river herring and American shad is to significantly restrict or eliminate human-caused mortality (Nieder September 30, 2011 Rebuttal at 21:1-3).

147. River herring stocks are extremely low since 1988 (Nieder September 30, 2011 Rebuttal at 43:8-10).

148. In order for Hudson River herring stock to recover, NYSDEC has proposed to significantly reduce fishing mortality by closing much of the watershed to commercial herring fishing, which will significantly restrict the livelihood of Hudson River commercial fishermen (Nieder September 30, 2011 Rebuttal at 19:21-23, *citing* **Staff Exhibit 83,** *Draft: NYSDEC Sustainable Fishing Plan for New York River Herring Stocks* [Hattala et al., 2011] and 20:7-8).

149. The current annual mortality to river herring caused by entrainment and impingement at Indian Point is much greater than recent Hudson River commercial fishing harvests of river herring, and impairs the best usage standard to ensure the Hudson River shall be suitable for herring fishing, fish survival and propagation (Nieder September 30, 2011 Rebuttal at 19:23 to 20:16 and 29:18-20).

150. According to the most recent Indian Point entrainment monitoring data, the Facility entrains nearly 500,000,000 river herring per year, which constitutes the largest portion of all of the early life stage RIS species entrained annually by the Facility (Henderson July 22, 2011 Direct at 9:29-36 and Table 1[26] thereto; *see also* Nieder September 30, 2011 Rebuttal at 20:12-13).

151. NYSDEC fisheries biologists responsible for managing the State's marine and estuarine fisheries have determined that even the taking of less than 50,000 river herring each year will likely prevent the propagation and survival of Hudson River herring species (Nieder September 30, 2011 Rebuttal at 29:15-18).

152. Historically the Hudson River had a large seasonal shad spawning run, and was an important commercial shad fishery (Henderson July 22, 2011 Direct at 7:27-28).

153. The health of the estuarine habitat and the free passage through the Hudson River estuary is essential for the well-being of shad populations over an extensive area of the Atlantic east coast of the United States (Henderson July 22, 2011 Direct at 7:30-32).

154. During their migrations, and their early juvenile stages in particular, shad suffer impingement and entrainment losses caused by Indian Point (Henderson July 22, 2011 Direct at 7:33-34).

155. The American shad population in the Hudson River is at its lowest level in recorded history (Nieder September 30, 2011 Rebuttal at 41:16-17).

156. In order to restore the shad fishery, in 2010 DEC implemented a moratorium closing all commercial and recreational fishing of American shad in the Hudson River (which remains in place), having concluded that the human-caused mortality of even one adult shad through fishing must stop to ensure the survival and propagation of the species (Nieder September 30, 2011 Rebuttal at 18:19-23; 19:5-7).

157. NYSDEC fisheries biologists who are responsible for managing the American shad stock have determined that for the Hudson River to be suitable for American shad survival

[26] As is noted, in his testimony, Table 1 of Dr. Henderson's testimony is a reproduction of Table 2 from DEIS Appendix VI-1-D-2, which presents estimates of entrainment at Indian Point based on monitoring from 1981 through 1987. This is the most recent entrainment monitoring data which Entergy has obtained (Tr. 3616:16:10-23 and 3617:1-8 [Young by RvK]).

and propagation, the unnatural mortality caused by impingement and entrainment at Indian Point must be minimized or eliminated (Nieder September 30, 2011 Rebuttal at 36:1-6; 44:10-13).

158. NYSDEC has determined that Indian Point's current operations impair the best usage of the Hudson River for the recreational and commercial fishing harvest of American shad (Nieder September 30, 2011 Rebuttal at 19:3-5).

159. Since the inadvertent mortality of fish by power plants is not regulated as part of the fisheries management of Hudson River fish stocks, NYSDEC has determined such mortality is not a legitimate use of State fisheries resources and must be minimized, if not eliminated entirely (Nieder September 30, 2011 Rebuttal at 20:16-20; 26:21-23, *citing* **Staff Exhibit 97**, April 29, 1991 letter from NYSDEC Commissioner Thomas C. Jorling to J. Phillip Bayne, President and Chief Operating Officer of the New York Power Authority).

160. Since 1991, the stocks of Hudson River American shad, alewife, and blueback herring have dropped so low that NYSDEC has either significantly reduced the amount of the stock allocated to fishing mortality or has eliminated fishing for those species altogether (Nieder September 30, 2011 Rebuttal at 27:1-7).

161. The value of highly prized recreational and/or commercial fish species such as white perch, striped bass, alewife, blueback herring, and American shad in the context of best usages is more than simply a fish's usefulness to adding numbers to a population since the loss of such fish has socioeconomic impacts (Nieder September 30, 2011 Rebuttal at 27:20 to 28:6, *citing* **Staff Exhibit 6,** *Analysis of Impingement Impacts on Hudson River Fish Populations*: American Fisheries Society Monograph [Barnthouse and Van Winkle, 1988] at 156).

162. Reducing and eliminating the impingement mortality and entrainment of shad, blueback herring and alewife will most certainly increase the number of juvenile and adult fish in these three fish populations which will help them recover to levels where the best usage of fishing for these species could be restored on the Hudson River (Nieder September 30, 2011 Rebuttal 32:18 to 33:2).

163. Since NYSDEC recently eliminated fishing mortality to American shad as a necessary measure to restore the best usage of fishing on the Hudson River for these species, for Dr. Barnthouse to speculate that the annual killing of millions of American shad and river herring by Indian Point operations does not threaten the best usage of the Hudson River for

fishing is flawed regardless of whether Dr. Barnthouse's analyses detected a direct impact or not (Nieder September 30, 2011 Rebuttal 27:9-14).

164. Restoring the designated best usages for fishing, and fish propagation and survival to the Hudson River will require the minimization or elimination of human-induced mortality (Nieder September 30, 2011 Rebuttal 27:14-16).

F. Entergy's Legally and Ecologically Irrelevant and Scientifically Unreliable Population-Level Best Usage Arguments

165. The analysis of Entergy's retained biologists is set forth in their Report, *Entrainment and Impingement at IP2 and IP3: A Biological Impact Assessment* (Barnthouse, Heimbuch, Van Winkle, and Young, [January 2008], **Entergy Exhibit 27,** ["the AEI Report]") (Barnthouse July 22, 2011 Direct at 5:1).

166. According to Dr. Barnthouse, reducing Indian Point entrainment to zero would have no measurable effect on the actual abundance of juvenile or one-year-old fish (Barnthouse July 22, 2011 Direct at 49:9 to 51:11, *citing* Dr. Heimbuch and **Entergy Exhibit 27,** AEI Report, Attachment 6).

167. The AEI Report concludes that that Indian Point's CWISs are not a causal agent of any adverse impacts to Hudson River fish populations or communities (Barnthouse July 22, 2011 Direct at 5:1-3).

168. The AEI Report defines "adverse environmental impact" due to entrainment and impingement as

> adverse changes in important population or community characteristics sufficient to threaten the sustainability of susceptible populations or to cause significant or potentially irreversible changes in population or community structure and function (**Entergy Exhibit 27** at 11).

169. The AEI Report equates "adverse environmental impact" as defined therein with impairment of best usages (Barnthouse July 22, 2011 Direct at 5:19 to 6:1; Tr. 3577:18 to 3578:18 [Barnthouse by RvK]).

170. The only conclusion that can legitimately be claimed from the 2008 AEI Report is the following: based on the methods and analyses selected by the authors of that report, a

population effect caused by impingement and entrainment from Indian Point Units 2 and 3 could not be detected (Nieder September 30, 2011 Rebuttal at 14:11-21; 53:21-15).

171. The AEI Report did not provide any proof that the operation of the CWISs at Indian Point do not cause an adverse environmental impact to Hudson River fish or provide proof that an adverse environmental impact will not happen in the future from the operation of the CWIS at Indian Point (Nieder September 30, 2011 CWW Rebuttal at 32:6-8).

172. Dr. Barnthouse's failure to detect a direct population impact on any of the eight AEI RIS Species as a result of impingement and entrainment based on past conditions and data collections does not provide any assurance that: (1) no impact existed in the past even though they failed to detect one; and (2) past conditions will remain unchanged in the future (Nieder September 30, 2011 Rebuttal at 46:11-18).

173. EPA agrees that the failure to demonstrate a direct impact on one or more fish populations from the operation of a CWIS is not enough to demonstrate that no impact actually has occurred or will occur in the future (Nieder September 30, 2011 Rebuttal 16:16-22, *citing* EPA Phase I 316[b] Regulation Preamble, 66 Fed. Reg. 65256, 65292 [December 18, 2001]).

174. Entergy's retained biologists relied on uncertain and indeterminate methods and assumptions in the AEI Report to evaluate Indian Point's adverse environmental impacts since that report relies heavily on fisheries management methods to reach its conclusions (Nieder September 30, 2011 Rebuttal 47:9-12).

175. Uncertainty and indeterminacy are fundamental characteristics of the dynamics of complex adaptive systems such as fish populations, and predicting the behaviors of these systems cannot be done with absolute certainty, regardless of the amount of scientific effort invested (Nieder September 30, 2011 Rebuttal 47:4-8, *quoting* EPA Phase I 316[b] Regulation Preamble, 66 Fed. Reg. 65256, 65293 [December 18, 2001]).

176. The AEI Report did not prove that Indian Point has no adverse environmental impact on fish populations (Nieder September 30, 2011 CWW Rebuttal at 32:10-11).

177. The AEI Report did not provide any evidence that Indian Point does not impair the best usages of the Hudson River for fishing or fish propagation and survival (Nieder September 30, 2011 CWW Rebuttal at 32:11-13).

178. As the principal investigator in a recent Electric Power Research Institute ("EPRI") report, Dr. Barnthouse reviewed studies where the authors attempted to determine the population impacts caused by the operation of power plant CWISs, and therein, Dr. Barnthouse stated the following:

> It is often said that it is impossible to prove a negative. Although adverse impacts due to I[mpingement] & E[ntrainment] have not been conclusively documented in published studies, this absence does not prove that adverse impacts are not occurring or could never occur.

(Nieder September 30, 2011 Rebuttal at 17:3-11, *quoting* **Staff Exhibit 81,** *Do Power Plant Impingement and Entrainment Cause Changes in Fish Populations? A Review of the Scientific Evidence*, EPRI [2011] Technical Report at 8-2).

179. The above conclusion from **Staff Exhibit 81**, EPRI (2011) at 8-2, contradicts statements in Dr. Barnthouse's testimony indicating that the results of the 2008 AEI Report provide evidence that Indian Point has not had an adverse environmental impact on Hudson River fish species nor that Indian Point will not have an adverse environmental impact on Hudson River fish species in the future (Nieder September 30, 2011 Rebuttal 28:11-19).

180. Dr. Barnthouse also previously concluded that the that data collected through the Hudson River utilities monitoring program would not be useful in detecting any population impacts caused by power plant CWISs short of extinction (Nieder September 30, 2011 Rebuttal 21:4-7 and 42:13-17 *quoting* **Staff Exhibit 4,** September 28, 1979 letter from Lawrence W. Barnthouse, Oak Ridge National Laboratory, to Joel Golumbek, USEPA Region 2 re: riverwide sampling).

181. In 1984, Dr. Barnthouse and colleagues (Barnthouse *et al.* 1984) concluded that the "'ultimate question, 'what will be the long-term effects of once-through cooling on Hudson River fish populations?' was unanswerable"' (Nieder September 30, 2011 Rebuttal 21:19-21, *quoting* **Staff Exhibit 5,** American Institute of Biological Sciences: *Population Biology In the Courtroom: The Hudson River Controversy* [Barnthouse et al., January 1984] at 18).

182. In 1988, Dr. Barnthouse stated in a chapter in an American Fisheries Society monograph that whether or not the mortality to fish as a result of impingement and entrainment (I&E) by the power plants in and of themselves can be demonstrated to cause a direct impact on

a fish population, the fact which cannot be ignored is that I&E mortality does not function "in and of itself" but adds cumulatively to the natural mortality and fishing mortality (Nieder September 30, 2011 Rebuttal at 21:23 to 22:6 *quoting* **Staff Exhibit 6,** *Analysis of Impingement Impacts on Hudson River Fish Populations*: American Fisheries Society Monograph [Barnthouse and Van Winkle, 1988] at 188).

183. Dr. Barnthouse further concluded in this 1988 paper that a long-term impact assessment of impingement mortality on fish populations is simply unattainable (Nieder September 30, 2011 Rebuttal at 22:6-8, *citing* **Staff Exhibit 6,** *Analysis of Impingement Impacts on Hudson River Fish Populations*: American Fisheries Society Monograph [Barnthouse and Van Winkle, 1988] at 188).

184. A publication authored by four other highly respected Hudson River fisheries biologists concluded that it is simply not possible to identify any population impact caused by impingement and entrainment until there was at least 50 years of data collected through the Utility Monitoring Program (Nieder September 30, 2011 Rebuttal at 22:15-22, *citing* **Staff Exhibit 47,** *Fisheries of the Hudson River Estuary* [Limburg, Hattala, et al.]).

185. While the AEI Report included the analysis of 31 years of data, even 31 years of data is inadequate to answer the question posed to Dr. Barnthouse with any reliability, due to the large inter-annual variability in the dataset and an insufficient understanding of underlying biological processes of the Hudson River ecosystem (Nieder September 30, 2011 Rebuttal at 25:22 to 26:1-6, *citing* **Staff Exhibit 6,** *Analysis of Impingement Impacts on Hudson River Fish Populations*: American Fisheries Society Monograph [Barnthouse and Van Winkle, 1988] *and* **Staff Exhibit 85,** *Power Plant Operation on the Hudson River* [McDowell] 2005).

186. Entergy's retained biologists did not consider the objective of the CWA, which is to restore and maintain the chemical, physical, and biological integrity of waters, in determining their definition of adverse environmental impact for the AEI Report, which report does not address the restoration of the physical, chemical and biological integrity of the Hudson River (Tr. 3558:20 to 3559:4, 3559:10-13, 3560:22-23 [Barnthouse by RvK]).

187. Instead, Entergy's retained biologists based their definition of adverse environmental impact on the fishery management policy of the Magnusson-Stevens Act (16

U.S.C. § 1801[a][1]) (Tr. 35579 to 3558:1 [Barnthouse/Young by RvK], *citing* **Entergy Exhibit 27,** AEI Report at 8).

188. Defining adverse environmental impact with respect to Indian Point's CWIS in the context of fishery management, the AEI Report argues that mortality per se could not be considered an adverse environmental impact, because the act of fishing necessarily causes mortality, and thus, according to the Magnuson-Stevens Act, only overfishing that threatens the long-term sustainability of the population is considered adverse (**Entergy Exhibit 27,** AEI Report at 8; Barnthouse July 22, 2011 Direct at 20:9-10; Tr. 3471:3-8 [Barnthouse by DEC]).

189. Thus, the AEI Report focuses on population-level and community-level impacts to evaluate adverse environmental impacts rather than individual mortality because federal fisheries management agencies, under the Magnuson-Stevens Act, allow "harvesting" of fish by fishermen as a "renewable resource" (Barnthouse July 22, 2011 Direct at 16:14 to 17:10).

190. Dr. Barnthouse equates fishing with mortality from CWIS entrainment, describing entrainment as "harvesting," differentiating the two only with respect to the life stage of fish that are killed (Tr. 3598:1-5 [Barnthouse by RvK]; Barnthouse July 22, 2011 Direct at 18:2-6).

191. Having defined adverse environmental impact in terms of population-level impacts, the AEI Report then goes on to conclude, primarily based on correlation analyses, that fishing and/or striped bass predation have caused the decline of several species in the Hudson River, rather than entrainment or impingement by Indian Point (Tr. 3574:7-16 [Barnthouse by RvK]; Barnthouse July 22, 2011 Direct at 34:11-12).

192. For American shad, the AEI Report concludes that overfishing is the most likely cause of recently observed declines in the abundance, with striped bass predation also being an important contributing factor (Barnthouse July 22, 2011 Direct at 35:8-11).

193. Fishing is a designated best usage of the Hudson River estuary at Indian Point, whereas power plant water withdrawals by once-through cooling are not (Henderson September 30, 2011 Panel Rebuttal at 2:13-14).

194. The AEI Report also concludes that the expected increase in prey consumption in recent years by the recovered Hudson River striped bass stock is sufficient to account for observed declines in the young-of-year abundance of white perch, Atlantic tomcod, and river herring (Heimbuch July 22, 2011 Direct at 18:6-10 *citing* **Entergy Exhibit 27[c]).**

195. Since the designated best usages of the Hudson River estuary at Indian Point require that the waters be suitable for the survival of fish, the estuary must support predatory fish as part of the natural function of the ecosystem (Henderson September 30, 2011 Panel Rebuttal at 2:16 to 3:2).

196. Predator-prey relationships are part of the natural conditions of the aquatic habitat, and most of the mortality to early life-stage aquatic organisms is a result of predation (Tr. 3574:20 to 3575:14 [Barnthouse by RvK]).

197. The reduction of shad populations by striped bass predation is part of the natural function of the Hudson River ecosystem (Tr. 3700:23 to 3701:8 [Barnthouse by RvK]).

198. The mortality to fish as a result of impingement and entrainment by Indian Point does not function "in and of itself" but adds cumulatively to the natural mortality and fishing mortality (Nieder September 30, 2011 Rebuttal at 28:7-11, *quoting* **Staff Exhibit 6,** *Analysis of Impingement Impacts on Hudson River Fish Populations*: American Fisheries Society Monograph [Barnthouse and Van Winkle, 1988] at 188).

199. While Dr. Barnthouse's pre-filed testimony and the AEI report did not address whether Indian Point *contributes* to a violation of best usages, on cross exam Dr. Barnthouse explained that the AEI Report found no evidence at all of any correlation between Indian Point's operations and any aspect of the abundance or survival of the RIS populations and that the AEI Report therefore concluded that Indian Point was *not a contributing cause to changes in the abundance of those populations* and therefore has not created an impairment of the Hudson River's best usages (Tr. 3571:17 to 3574:16 [Barnthouse by RvK]; **Entergy Exhibit 27**, AEI Report at 1).

200. The fishery stock assessment methods and correlation analyses used in the AEI Report failed to detect an impact to fish populations or communities but did not conclusively prove that an impact did not exist (Nieder September 30, 2011 Rebuttal at 17:19-23).

201. Correlation can never serve to demonstrate causality (Tr. 3880:6 [Henderson by Entergy]).

202. Since the analyses selected and the data used could not detect an impact, Dr. Barnthouse has mistakenly concluded that no such impact exists and that Indian Point (viewed in

isolation) does not impair the best usages of the Hudson River for fishing, fish propagation or survival (Nieder September 30, 2011 Rebuttal at 38:16 to 39:1).

203. It is the best professional judgment of NYSDEC staff that it is neither appropriate nor correct to suggest that a failure to detect an impact on the AEI RIS species necessarily implies that there is in fact no impact at all to any Hudson River fish population or community (Nieder September 30, 2011 Rebuttal at 14:18-21).

204. The AEI Report narrowly defines "adverse environmental impact" to mean an impact that is at such a magnitude that it caused, or will cause, a measurable change in the abundance of fish and ignores other potential ecological impacts caused by the indiscriminant killing of Hudson River fish (*e,g.*, predator-prey relationships, localized impacts from recreational uses and unauthorized takings of endangered species) (Nieder September 30, 2011 Rebuttal at 14:21to 15:2).

205. Dr. Barnthouse asserts that an impact must be measurable in order to find an impairment of the best usages of the Hudson River, but Dr. Barnthouse simply speculates on what has happened in the past and does not look ahead as NYSDEC must do to in order to preserve and protect the best usages of the Hudson River for future generations (Tr. 3354:4-7. [Barnthouse Live Direct]; Nieder September 30, 2011 Rebuttal at 46:11-18).

G. The Status of the Fish Populations and the Ecology of the Hudson River

206. Generator-sponsored long-term datasets from the Hudson River Basin Monitoring Program (HRBMP) are the primary datasets used by Entergy's consultants in assessing the effects of the Indian Point's CWIS in this case (**Entergy Exhibit 27,** AEI Report at 15-16).

207. The HRBMP is a continuing and extensive annual biological monitoring program that, from 1966 to the present time, has been performed to assess potential impacts of cooling water withdrawals from electric power generating stations (including Indian Point) on the Hudson River ecology (Mattson Direct July 22, 2011 at 4:12-15).

208. The HRBMP data selected for the analysis in the AEI report covers nearly all the period of commercial operation of Indian Point Unit 2 (with a 1973 startup) and the entire period of commercial operation of Indian Point Unit 3 (with a 1976 startup) (**Entergy Exhibit 27,** AEI Report, at 16).

209. Since 1973, the HRBMP has collected data from the Hudson River in an attempt to quantify the size of the populations of 16 species of fish that are found in the Hudson (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 6).

210. Section D of Chapter 4 of the ASA Year Class Reports for 2007 to 2010 (**Staff Exhibit 138)** presents the HRBMP data by providing a visualization of a time series of abundance indices for certain monitored fish species (Tr. 4188:10-12; 4194:14-15; 4193:23 [Mattson by RvK]).

211. If entrainment and impingement were depleting vulnerable populations, then the abundance of one or more of these populations should decline (**Riverkeeper Exhibit 61,** Barnthouse & Heimbuch, *et al., Indicators of AEI Applied to the Delaware Estuary* [The Scientific World, May 18, 2002] at 186; Tr. 3652:17-21 [Barnthouse by RvK]).

212. When dealing with a single species it is clear that the more individuals entrained, the more harm that will result (Henderson September 30, 2011Rebuttal at 11:17-19).

213. Populations decline when their death rate exceeds their birth rate (Henderson July 22, 2011 Direct at 9:6-7).

214. The only mechanisms that humans can use to intervene to control fish populations are to decrease fish mortalities or to improve fish habitat (Tr. 3733:13 to 3734:3-6 [Barnthouse by RvK]).

215. The only way to reduce population-depleting predation upon a species is to reduce the predator (Tr. 3701:9 to 3702:16 [Barnthouse by RvK]).

216. There has been a decline in the abundance of Hudson River white perch since 1974 (Tr. 3611:11-13 [Barnthouse by RvK]).

217. A sustained decline in Hudson River white perch young-of-the year abundance began in 1989 (**Entergy Exhibit 27,** AEI Report at 41).

218. It is widely accepted the present Hudson River white perch population size is probably 50% or less of that present in the 1970s and 1980s (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 24).

219. White perch are showing a decreasing trend in the adjusted abundance index over time, and reached a particularly low point in the late 1990s, though subsequently the species has

staged a mild recovery (Riverkeeper **Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 23-24).

220. White perch abundance has declined over the entire operating period of Indian Point, and while the population has fluctuated without trend since 2004, population levels have not been restored to the levels measured in 1974 (Barnthouse July 22, 2011 Direct at 53:11-13; Tr. 3719:1 to 3720:19 [Barnthouse by RvK]).

221. Despite the recent increase, over the entire time series, there is a statistically significant decline in Hudson River white perch young-of-the-year abundance (**Entergy Exhibit 27,** AEI Report at 36, *citing* AEI Report Appendix B, Table B-13 and Figure B-4).

222. The Atlantic tomcod population is showing considerable year-to-year variation, but appears to be in long-term decline since 1974 (Riverkeeper Exhibit 2, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 25-26 and Figure 22).

223. Atlantic tomcod populations have suffered a significant decline from their 1974 levels and have not been recovered to those 1974 levels (Barnthouse July 22, 2011 Direct at 54:17-21; 56:1-2; Tr. 3721:19 to 3722:1-4 [Barnthouse by RvK]).

224. Atlantic tomcod are commonly entrained and impinged at Indian Point (**Entergy Exhibit 6,** *Biological Assessment of Alternative Intake Technologies for Indian Point Units 2 and 3* [Barnthouse, Heimbuch, Mattson and Young; February 2010] at 9).

225. While the entrainment data available and presented in DEIS Appendix VI-1-D-2, Table 2 do not include Atlantic tomcod, the estimated Conditional Mortality Rate ("CMR")[27] for this species is over 12% (**Riverkeeper Exhibit 3,** *Entrainment, Impingement and Thermal Impacts at Indian Point Nuclear Power Station,* [Pisces, November 2007] at 4-5, n. 1).

226. Bay anchovy populations show a long-term declining trend in abundance, with 10-fold declines in adult abundance from the peak levels observed in the late 1980s (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 27).

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[27] CMR is the probability of a fish dying due to the power plant. It is expressed as a percentage and measures how many fewer Hudson River fish exist at the end of their first year of life (actually at September 1) than would exist if not for the loss to entrainment (**Riverkeeper Exhibit 3,** *Entrainment, Impingement and Thermal Impacts at Indian Point Nuclear Power Station,* [Pisces, November 2007] at 5, n. 1).

227. The AEI Report found that juvenile bay anchovy abundance declined between 1985 and 2004, with more recent data showing bay anchovy are fluctuating without trend (Barnthouse July 22, 2011 Direct at 56:17-20-; Tr. 3725:21 to 3726:10 [Barnthouse by RvK).

228. The Blueback herring juvenile index has decreased over the HRBMP study period (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 32; Tr. 4197:21 to 4198:12 [Mattson by RvK] *citing* **Staff Exhibit 138,** Section D of Chapter 4 of the ASA Year Class Reports for 2007 to 2010, Figure D-7]).

229. River herring (which includes both blueback herring and alewife) young-of-the-year abundance declined abruptly in the mid-1980s and later fluctuated without trend through 2004. While more recent data shows three strong year classes (2005, 2006 and 2008) for alewife, that has not been the case for blueback herring (Barnthouse July 22, 2011 Direct at 56:9-14; Tr. 3724:13-20 and **Entergy Exhibit 29**[28] [Barnthouse by RvK]).

230. While the alewife juvenile index shows a declining trend in the Hudson River since 1974, this trend is far from clear, and possibly the more important feature has been the increase in between-year variability in juvenile abundance (alewife had very low abundance indices in 1998 and 2002, and high indices in 1999 and 2001, which suggests a population that is becoming de-stabilized and more dependent on occasionally good recruitment years). (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 31; Figure 28).

231. The river herring population in the Hudson River has not recovered to the levels present in 1985 (Tr. 3722:21 to 3723:3 [Barnthouse by RvK]).

232. There has been a decline in the abundance of Hudson River rainbow smelt since 1974 (Tr. 3611:14-16 [Barnthouse by RvK]).

233. Juvenile rainbow smelt have disappeared from the HRBMP survey since the mid-1990s (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 33; Tr. 4198:13 to 4199:6 [Mattson by RvK] *citing* **Staff Exhibit 138,** Section D of Chapter 4 of the ASA Year Class Reports for 2007 to 2010, Figure D-8).

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[28] Dr. Barnthouse testified from two pages of **Entergy Exhibit 29,** each of which was marked with an "A" (Tr. 3725:4-7 [ALJ Villa]).

234. In all the plant operational years prior to 1996, rainbow smelt were entrained and impinged by Indian Point (Tr. 4199:7-20).

235. Rainbow smelt have been extirpated (become locally extinct) from the Hudson River (Nieder September 30, 2011 Rebuttal 43:8-10).

236. Weakfish populations have been in steep decline in abundance from 1990 onwards (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 36, Figure 33; Tr. 4201:3-9 [Mattson by RvK] *citing* **Staff Exhibit 138,** Section D of Chapter 4 of the ASA Year Class Reports for 2007 to 2010, Figure D-12]).

237. Weakfish are susceptible to entrainment at Indian Point, and were recorded in recent entrainment sampling conducted in connection with Entergy's in-river CWW efficacy testing **(Entergy Exhibit 27,** AEI Report Exhibit "D," thereto at 11 [Table D-2]; **Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

238. According to Entergy's entrainment monitoring data from 1981 through 1988, weakfish constituted 0.56 percent of total entrainment at Indian Point (Tr. 3854:1 to 3855:3 [Henderson by Entergy], *citing* **Entergy Exhibit 28,** RIS Tables at 1]).

239. Similarly, Entergy's entrainment monitoring data from 1981 through 1988 shows that the American shad species-specific entrainment percentage of 0.55 percent of total community of species entrained by Indian Point from 1981 through 1988 shown on **Entergy Exhibit 28,** but that 0.55 percent in fact represents numbers in the order of millions of individuals of that species entrained[29] (Tr. 3855:3-15 [Henderson by Entergy], *citing* **Entergy Exhibit 28,** RIS Tables at 1]).

240. Thus for the species-specific entrainment percentages shown on **Entergy Exhibit 28** there is a difference between the actual number of a particular species entrained and what that number represents as a proportion (percentage) of Indian Point's overall entrainment (Tr. 3855:8-18 [Henderson by Entergy]).

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[29] The numeric total for American shad entrained by Indian Point from 1981 through 1988 is 66,874,590 (Henderson July 22, 2011 Direct at 9:29-36 and Table 1 thereto [As is noted, in his testimony, Table 1 of Dr. Henderson's testimony is a reproduction of Table 2 from DEIS Appendix VI-1-D-2, which presents estimates of entrainment at Indian Point based on monitoring from 1981 through 1987]).

241. As a particular species declines in abundance, the number of that species entrained will decline as well, resulting in a situation where it can appear that entrainment is not having a significant effect because so few of the species remain, even though an even higher proportion of the population is actually being entrained (Tr. 3855:18 to 3856:1 [Henderson by Entergy]).

242. White catfish populations have been in steep decline in abundance from 1990 onwards (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 35).

243. Young-of-the-year white catfish were recorded in the entrainment sampling conducted in Entergy's recent in-river testing of CWW screens (**Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

244. If the adverse impacts from CWIS depleted populations of prey species such as bay anchovy, then the abundance of predator species such as weakfish might also be expected to decline (**Riverkeeper Exhibit 61,** Barnthouse & Heimbuch *et al.*, *Indicators of AEI Applied to the Delaware Estuary* [The Scientific World, May 18, 2002] at 186).

245. There has been a great decline in the American shad population since 1974, and their abundance is now believed to be below the replacement level (Tr. 3408 4-7 [Barnthouse Live Direct]; Tr. 3612:3-10 [Barnthouse by RvK]).

246. The American shad shows a significant decreasing trend in juvenile abundance, having reached its lowest-ever value in 2001, and presently remains at this low level (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 28-29).

247. The AEI Report found that the abundance of young-of-year American shad has declined significantly and extended data now shows that trend continuing (Barnthouse July 22, 2011 Direct at 53:23 to 54:2; Tr. 3720:21 to 3721 [Barnthouse by RvK]; Tr. 4196:12-13 [Mattson by RvK], *citing* **Staff Exhibit 138**, Section D of Chapter 4 of the ASA Year Class Reports for 2007 to 2010, Figure D-5]).

248. The juvenile index for hogchoker in the Hudson River shows a slight decreasing trend though time (**Riverkeeper Exhibit 2,** *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 34 and Figure 31).

249. Entergy's entrainment monitoring data from 1981 through 1988 shows that that hogchoker[30] constituted a species-specific entrainment percentage of 0.23% of total community of species entrained by Indian Point from 1981 through 1988, while Atlantic menhaden[31] made up a species-specific entrainment percentage of 0.02% of total community of species entrained by Indian Point from 1981 through 1988 as shown on **Entergy Exhibit 28** (RIS Tables) at 1 (**Entergy Exhibit 28,** RIS Tables at 1).

250. Whether or not the AEI Report was able to detect a direct cause and effect between the billion fish killed annually by Indian Point's CWISs to fish species population declines does not demonstrate that no impact exists (Nieder September 30, 2011 Rebuttal at 43:10-13, *citing* **Staff Exhibit 81,** *Do Power Plant Impingement and Entrainment Cause Changes in Fish Populations? A Review of the Scientific Evidence*, EPRI [2011] Technical Report at 8-2).

251. Part of the decline of Hudson River fish populations may very well be attributable to the impingement and entrainment of fish by the power industry on the Hudson River (Nieder September 30, 2011 Rebuttal 43:13-17).

252. While the causes of decline and instability are multi-factorial and not solely caused by Indian Point, the Facility appreciably increases the death rates of many fish and therefore directly contributes to the observed population declines (Henderson July 22, 2011 Direct at 9:6-9 and 9:35-36, Table 1, same as DEIS Appendix VI-1-D-2, Table 2).

253. While Dr. Barnthouse uses a variety of approaches to seek to prove that factors unrelated to the operation of Indian Point have brought about the observed declines and changes to the aquatic life of the Hudson River, Dr. Barnthouse does not seek to assess the contribution

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[30] Hogchoker were recorded in recent entrainment sampling conducted in connection with Entergy's in-river CWW efficacy testing (**Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

[31] Atlantic menhaden were recorded in recent entrainment sampling conducted in connection with Entergy's in-river CWW efficacy testing (**Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

of Indian Point to the observed ecosystem-wide changes to the Hudson River (Henderson Rebuttal September 30, 2011at 8:13-23).

254. The purpose of the AEI Report was not to assess the cumulative effects of multiple stressors on aquatic organisms (Tr. 3569:17-22 [Barnthouse by RvK]).

255. Entergy's AEI Report included a community-level trends analysis which sought to determine whether species susceptibility to entrainment and young-of-year abundance were correlated with each other in order to determine whether Indian Point is a causal agent to any identified harm to Hudson River fish communities (Young July 22, 2011 Direct at 8:10 to 9:23, *citing* **Entergy Exhibit 27,** AEI Report, Exhibit "D," thereto).

256. The species included in "Case A" of Entergy's community trends analysis make up 94% of all species captured in the HRBMP beach seine survey and foal shoals survey and, according to Dr. Young, therefore provides a good representation of the Hudson River fish community from August of 1974 through October 2005 (Young, July 22, 2011 Direct at 15:3-6).

257. "Case A" of the AEI Report's community-level trends analysis shows that, in that case, 71% of the species susceptible to entrainment at Indian Point examined in Entergy's community-level trends analysis showed population declines from August of 1974 through October of 2005 (**Entergy Exhibit 27,** AEI Report at 78; Tr. 3634:13-16 [Young by RvK]).

258. The species which showed a population decline in "Case A" of the AEI Report's community-level trends analysis from August of 1974 through October of 2005 were American shad, winter flounder, blueback herring, northern pipefish, tessellated darter, white perch, yellow perch, banded killfish, rainbow smelt, Atlantic tomcod, weakfish and bay anchovy (**Entergy Exhibit 27,** AEI Report Exhibit "D," thereto at 11 [Table D-2]; *see also* Tr. 3636:3 to 3637:10 [Young by RvK [explaining that any species with an "R" value of less than one or a minus in the $Log_{10}R$ column indicated a decrease in population for that species]).

259. The species included in "Case B" of Entergy's community-level trends analysis make up 88% of all species captured in the HRBMP beach seine survey and foal shoals survey and, according to Dr. Young, therefore provide a good representation of the Hudson River fish community from August of 1974 through October 2005 (Young July 22, 2011 Direct at 15:1-6).

260. "Case B" of the AEI Report's community-level trends analysis shows that 73% of the species susceptible to entrainment at Indian Point examined in Entergy's community-level

trends analysis showed population declines from August of 1974 through October of 2005 **Entergy Exhibit 27,** AEI Report at 78).

261. Dr. Henderson has similarly concluded that 10 of 13 key Hudson River species have shown statistically-significant downward long-term population declines over the same time period, including significant negative trends in yearling white perch, juvenile American shad, white catfish and weakfish. (Henderson July 22, 2011 Direct at 8:30 to 9:4, *citing* **Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 15-16 and 38).

262. Many other important species of fish are also showing long-term declines in abundance. For example, the American eel, which was recorded in recent entrainment sampling which Entergy conducted in connection with its in-river testing of CWW screens, has greatly declined (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 38; **Entergy Exhibit 163,** *Wedgewire Screen In-River Efficacy Study at Indian Point Energy Center*, ASA Analysis and Communication, and Normandeau Associates [January 2012] at 4-4, Table 4-1).

263. The species which showed a population decline in "Case B" of the AEI Report's community-level trends analysis from August of 1974 through October of 2005 were American shad, blueback herring, tessellated darter, white perch, rainbow smelt, Atlantic tomcod, weakfish and bay anchovy and striped bass (**Entergy Exhibit 27,** AEI Report Exhibit "D," thereto at 11 [Table D-2]; *see also* Tr. 3636:3 to 3637:10 [Young by RvK] [explaining that any species with an "R" value of less than one or a minus in the Log $_{10}$ R column indicated a decrease in population for that species]).

264. The fish community is not stable in the Hudson River, and the Hudson River ecosystem appears to be declining in terms of stability (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 1).

265. According to Drs. Barnthouse and Heimbuch, a disruption of a balanced indigenous community of fish, as evidenced by a change in the fish community over the operational period of a power plant, is the first indicator of adverse environmental impacts from a power plant's CWIS (**Riverkeeper Exhibit 61,** Barnthouse & Heimbuch et al., *Indicators of*

AEI Applied to the Delaware Estuary [The Scientific World, May 18, 2002] at 169, 174; Tr. 3628:6-10; 3643:19 to 3634:3 [Barnthouse by RvK]).

266. If power station operations were adversely affecting the fish community of an estuary, it is unlikely that all possible effects would occur immediately (**Riverkeeper Exhibit 61,** Barnthouse & Heimbuch et al., *Indicators of AEI Applied to the Delaware Estuary* [The Scientific World, May 18, 2002] at 175).

267. Over the operation of Indian Point from 1974 through 2005, the fish community of the Hudson River Estuary has changed (Tr. 3644:20 to 3645:1 [Banrthouse by RvK]).

268. Unlike the approach they have taken with respect to evaluating the adverse environmental impacts from Indian Point, Drs. Barnthouse and Heimbuch did not investigate causality in their Report entitled *Indicators of AEI Applied to the Delaware Estuary* (hereinafter the "Delaware Report") (Tr. 3628:18-19 [Barnthouse by RvK]).

269. According to Drs. Barnthouse and Heimbuch, the second indicator of adverse environmental impact is a continued downward trend in the abundance of one or more susceptible fish species susceptible to entrainment and impingement (**Riverkeeper Exhibit 61,** Barnthouse & Heimbuch et al., *Indicators of AEI Applied to the Delaware Estuary* [The Scientific World, May 18, 2002] at 169; Tr. 3629:21 to 3630:2 [Barnthouse by RvK]).

270. If a downward trend in the abundance of one or more CWIS-susceptible fish species indicates an adverse environmental impact, then the respective decreases of the abundance of 71% of the species in Case "A" and 73% of the species in Case "B" of Entergy's community-level trends analysis shows an adverse environmental impact as defined in the Delaware Report, since the data selected by Dr. Young covers the entire operating period of Indian Point Unit 3, from 1974 (which pre-dates Indian Point Unit 3's 1976 startup date) through 2005 (**Entergy Exhibit 27,** AEI Report, at 16, 78 *and* Exhibit "D," thereto at 11 [Table D-2]; *see also* Tr. 3636:3 to 3637:10 [Young by RvK]; Tr. 3632:21 to 3633:8 [Barnthouse by RvK]).

271. The fish community in the Hudson River has been changing rapidly since 1985 and is now showing clear signs of increased instability with greater year-to-year variation in abundance (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 14).

272. Peer-reviewed and published scientific literature which describes the change in abundance of several important species and a change in dominant species supports Dr. Henderson's view that the Hudson River ecosystem has undergone considerable change (Tr. 4177:9-14 [Mattson by RvK]; Tr. 4221:7-12 [Mattson redirect by Entergy]; **Staff Exhibit 75,** *Changes in Fish Assemblages in the Tidal Hudson River, New York* [Daniels, et al., American Fisheries Society, 2005] at 471-72).

273. There are clear indications, both at the community and individual population levels, that the populations of fish in the estuary are becoming less stable and showing greater year to year variation in abundance (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 38).

274. All the evidence points to the Hudson ecosystem presently being in a state of change, with declining stability. Neither the ecosystem as a whole nor many of the individual species populations are in a healthy state (**Riverkeeper Exhibit 2**, *The Status of Fish Populations and the Ecology of the Hudson River* [Pisces, 2008] at 39).

H. Indian Point Must Achieve Entrainment and Capacity Utilization Reductions Equivalent to Closed Cycle Cooling in Order to Comply With, Maintain and Restore Hudson River Class "SB" Best Usages

275. A closed-cycle evaporative or hybrid system cooling is a well-established method for cooling power plants which minimizes the level of impingement and entrainment without any uncertainty by virtue of the reduced volume of cooling water extracted (Henderson July 22, 2011 Direct at 10:16-18).

276. The operation of Indian Point with closed-cycle cooling would be more consistent with best usages of the Hudson River for fishing, fish propagation and survival because it would minimize the entrainment and impingement of aquatic organisms (Henderson July 22, 2011 Direct at 10:18-21; Nieder September 30, 2011 Rebuttal at 52:9-15).

277. Minimizing the impacts of the thermal discharge and the entrainment and impingement of aquatic organisms by Indian Point through the application of closed-cycle cooling is particularly required because of the established importance of the Hudson estuary as a nursery for Atlantic east coast fish populations (Henderson July 22, 2011 Direct at 10:21-23).

278. Minimizing Indian Point's adverse environmental impacts through the application of closed-cycle cooling is required in order for Indian Point to avoid impairing, or contributing to the impairment of the Hudson River estuary as suitable habitat for the survival and propagation of fish, shellfish and wildlife (Henderson July 22, 2011 Direct at 10:21-23).

279. The use of closed-cycle cooling is also required in order for Indian Point to avoid impairing, or contributing to the impairment of, the Hudson River estuary as suitable habitat for the survival and propagation of fish, shellfish and wildlife, given that many species are presently experiencing recruitment failure and their populations are declining (Henderson September 30, 2011 Best Usages Rebuttal at 8:13-27).

280. Retrofitting Units 2 and 3 with closed-cycle cooling will result in a reduction in cooling water withdrawals from the Hudson River by about 95%, with attendant reductions in entrainment of up to 98 percent (Nieder June 29, 2012CWII Rebuttal at 62:22 to 63:1-5, *citing* **Staff Exhibit 124,** Response to New York State Department of Environmental Conservation Request for Information on Indian Point Unit 2 and Unit 3 [ASA June 2003]).

281. Reducing Indian Point's water withdrawals by 95% via the application of closed-cycle cooling, would be expected to reduce Indian Point's annual entrainment from 1.2 billion aquatic organisms to 60 million (Henderson July 22, 2011 CWW Direct at 16:33-35).

282. Since CWW screens are not a proven available technology for Indian Point and would not be as effective as closed-cycle cooling in reducing entrainment, the use of CWW screens instead of closed-cycle cooling at Indian Point would still impair the Hudson River's best usages for fishing, fish propagation and survival (Nieder September 30, 2011 Rebuttal at 48:7-13, 52:20 to 53:3, 54:4-15).

283. NMFS agrees with NYSDEC that a closed-cycle cooling system would significantly limit the amount of intake flow and thereby reduce Indian Point's impacts, especially impingement and entrainment, and has determined that implementing this measure is in the best interest of fishery resources and also is the most appropriate option for meeting EFH mandates while allowing Indian Point to continue to operate in an otherwise sensitive ecological area (**Riverkeeper Exhibit 58**, October 12, 2010 NMFS EFH Consultation Letter at 9).

284. With closed-cycle cooling installed at Indian Point instead of once-through cooling, there would be an increase the recruitment of fish and improvement the aquatic resource

of the estuary for the long-term benefit of all water users including humans and wildlife, making the Hudson River more suitable for fish, shellfish and wildlife propagation and survival (Henderson July 22, 2011 Direct at 10:25-29; Henderson September 30, 2011 Panel Rebuttal at 9:1-4).

VIII. PROPOSED CONCLUSIONS

NYSDEC properly denied Entergy's request for a WQC pursuant to CWA § 401 (33 U.S.C. § 1341) and 6 NYCRR § 608.9. The continued operation of Indian Point without reductions in entrainment and impingement achieved by or equivalent to closed-cycle cooling will be inconsistent with the best usages of the Class SB saline surface waters of the Hudson River estuary.

Entergy's proposal for the continued operation of the Facility in once-through cooling mode fails to demonstrate compliance with CWA §§ 401, 301[b][1][C] and 303 (33 U.S.C. §§ 1341, 1311[b][1][C], 1313); 40 CFR §§ 131.12 and 124.44[d]; ECL §§ 17-0501, 17-0811[5], 17-0813[2] and 6 NYCRR §§ 608.9, 701.1, 701.11, 750-1.11[a][5] and 750-1.14[a]. The record fully supports the following conclusions which the Tribunal should adopt as conclusions of law and recommendations pursuant to 6 NYCRR § 624.13[a][1]:

A. NYSDEC Properly Denied WQC Because the Facility Causes and/or Contributes to the Impairment of Class SB Best Usages.

Indian Point's CWIS cause and/or contribute to an impairment of the Hudson River Class "SB" best usages for suitable aquatic habitat for fish propagation and survival and for fishing[32] including, without limitation, the best usage of the Hudson River for the recreational and commercial fishing harvest of American shad.[33]

[32] RvK Initial Brief Proposed Findings of Fact ¶¶ 24-28; 30; 36-39; 50-60; 62-69; 71-73; 79; 82-83; 86; 128; 133.
[33] RvK Initial Brief Proposed Finding of Fact ¶ 158.

1. Indian Point's Existing and Proposed Individual Entrainment Mortality Constitutes a *per se* Impairment of the Hudson River's Best Usages for Fish Survival and Propagation.

The August 15, 2008 Assistant Commissioner's Interim Decision determined conclusively that the Facility's entrainment and impingement of over a billion aquatic organisms per year (all of which are presumed to be killed under the facts of this case[34]) by current operations in once-through cooling mode,[35] causes an adverse environmental impact (*id.* at 17-18). The National Marine Fisheries Services (NMFS) has similarly determined that individual aquatic organism mortality is a significant adverse environmental impact to the local and coastal ecosystems.[36]

Standing alone, CWIS impacts to individual organisms (which are proportionally related to the magnitude of the Facility's once-through cooling water flows in terms of entrainment[37]) inherently cause and/or contribute to the impairment of best usages at the level of individual mortality because organisms killed by a CWIS do not survive and propagate.[38] Since retrofitting the Facility with CWW screens would still result in the entrainment of hundreds of millions or more[39] aquatic organisms per year, that option would not be consistent with the estuary's best usages of fishing and suitability as habitat for fish, shellfish and wildlife propagation and survival.[40]

Even assuming, without conceding, the accuracy of Entergy's CWW screen entrainment reduction estimates for purposes of argument,[41] the Facility would continue to kill roughly two hundred and sixty-two million (262,000,000) early life-stage aquatic organisms per year with

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[34] RvK Initial Brief Proposed Findings of Facts ¶¶ 24-28; 41-43.
[35] RvK Initial Brief Proposed Findings of Fact ¶¶ 18-20.
[36] RvK Initial Brief Proposed Finding of Fact ¶ 70.
[37] RvK Initial Brief Proposed Findings of Fact ¶ 32; 73.
[38] RvK Initial Brief Proposed Findings of Fact ¶¶ 24; 28; 30; 41-46; 50; 64; 73; 125-126; 145; 146; 149; 151; 156-157; 162; 164; 212.
[39] While approximated quantifications of organism mortalities are not necessary for an analysis of compliance with a narrative water quality standard like best usages, and while the entrainment reductions from CWW screens are a disputed area of fact which will be addressed in pending briefing focused on the issue of compliance with New York's water quality criterion 6 NYCRR § 704.5, Entergy witness Dr. Young testified at the hearings on best usages on January 17, 2012 that 262,000,000 organisms would still be entrained annually by Indian Point as retrofitted with CWW screens. RvK Initial Brief Proposed Finding of Fact ¶ 124.
[40] RvK Initial Brief Proposed Findings of Fact ¶¶ 127-134; 282.
[41] CWW screen efficacy is a separate issue and question of material fact which the parties will brief separately going forward. As the record on that issue reflects, Riverkeeper disputes Entergy's estimates for CWW screen entrainment reductions. *See* RVK Initial Brief Proposed Finding of Fact ¶ 120.

CWW screens installed.[42] Any CWW screen entrainment mortalities would be in addition to the mortalities for excluded organisms which would be impinged upon and/or suffer impacts with the CWW screens.[43] Entergy's CWW screen entrainment and impingement estimates do not consider the mortality of excluded organisms which would impact with or be impinged upon the CWW screens,[44] contrary to EPA guidance for estimating CWIS mortalities.[45]

It is the nature (rather than the magnitude) of entrainment and impingement mortality which is fundamentally inconsistent with the fish propagation and survival (and fishing) best usages of the Hudson River (6 NYCRR § 701.11). In the case of Indian Point, however, the magnitude of the Facility's entrainment vastly exacerbates the adverse environmental impacts and impairment of best usages. The operation of Indian Point in once-through cooling mode has also occurred, and continues to occur, in serious conflict with legitimate designated and existing ecological, recreational and commercial uses of the Hudson River.[46] The inadvertent mortality of aquatic organisms by power plants is not regulated as part of the fisheries management of Hudson River fish stocks, and thus NYSDEC has determined that such mortality is not a legitimate use of State fisheries resources and must be minimized, if not eliminated entirely.[47]

Under the literal terms of the CWA, an activity which does not comply with a designated use does not comply with the applicable water quality standards (*see PUD No. 1, supra* 511 U.S. at 715). Consequently, Indian Point's existing and proposed entrainment constitutes a *per se* impairment of best usages by causing and/or contributing to the mortality of individual early life stage aquatic organisms. Such impacts, standing alone, mandated NYSDEC's denial of the requested WQC in the absence of water-quality based entrainment controls which are required under both State and federal law (CWA § 401, 33 U.S.C. § 1341; CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C], 40 C.F.R. § 122.44[d]; ECL §§ 17-0501 and 17-0811[5]; 6 NYCRR §§ 608.9, 701.1, 701.11 and 750-1.11[a][5][i]; *see also PUD No. 1, supra* 511 U.S. at 712-713 [internal citations omitted]; *Brayton Point, supra* 2006 EPA App. LEXIS 9 at *350 [internal citations omitted]). Accordingly, the NYSDEC 401 Denial was fully supported by the facts

[42] RvK Initial Brief Proposed Finding of Fact ¶¶ 123-124.
[43] RvK Initial Brief Proposed Findings of Fact ¶¶ 47; 91-110; 113.
[44] RvK Initial Brief Proposed Finding of Fact ¶ 109.
[45] RvK Initial Brief Proposed Findings of Fact ¶¶ 99; 105; 108.
[46] RvK Initial Brief Proposed Findings of Fact ¶¶ 12, 17; 23; 77-78.
[47] RvK Initial Brief Proposed Findings of Fact ¶159; *see also* ¶ 23.

before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

2. Indian Point's Existing and Proposed Operations Constitute a *per se* Impairment of the Hudson River's Best Usages as Suitable Fish Habitat.

The adverse environmental impacts associated with entrainment and impingement are comparable to habitat degradation.[48] Indian Point's continued operation, as currently configured or with the addition CWW screens, would continue to result in multi-faceted adverse environmental impacts[49] which will cause and/or contribute to an impairment of best usages by degrading Hudson River Class SB habitat.[50]

The Class SB best usages require that such waters be suitable as habitat for fish survival and propagation (6 NYCRR § 701.11). Indian Point's entrainment short-circuits the entire aquatic ecosystem and compromises the health of the natural community.[51] Indian Point's adverse environmental impacts are particularly widespread and significant given that such impacts happen in an estuary which provides critical ecological breeding, nursery, foraging and migratory functions and values.[52]

The entire estuary been designated as Essential Fish Habitat (EFH) by NMFS pursuant to the Magnusson-Stevens Act.[53] Indian Point entrains five (5) of the eight (8)[54] EFH species (along with their prey), resulting in direct and indirect adverse environmental impacts to the essential fish habitat.[55] NMFS is particularly concerned with the significance of Indian Point's annual killing of a billion or more organisms as well as the attendant impacts to coastal fisheries,

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[48] RvK Initial Brief Proposed Finding of Fact ¶ 57; *see also* ¶ 52.
[49] RvK Initial Brief Proposed Findings of Fact ¶¶ 29; 52; 54-58; 63; 65-68.
[50] RvK Initial Brief Proposed Findings of Fact ¶¶ 36-39; 40; 52; 57-59; 61-62; 65-67; 69; 82; 127; 130-131; 133; 214.
[51] RvK Initial Brief Proposed Finding of Fact ¶ 68;*see also* ¶¶ 29; 52; 55-58; 62-73; 81-82; 133; 153.
[52] RvK Initial Brief Proposed Findings of Fact ¶¶ 1-9; 12; 16-17; 74.
[53] RvK Initial Brief Proposed Finding of Fact ¶ 12.
[54] The eight federally managed species of fish are found in the EFH-designated Hudson River estuary near the Facility are: Atlantic sea herring, bluefish, Atlantic butterfish, red hake, black sea bass, summer flounder, winter flounder, and windowpane flounder (hereinafter and collectively, the "EFH Species"). RvK Initial Brief Proposed Finding of Fact ¶ 13.
[55] RvK Initial Brief Proposed Findings of Fact ¶¶ 85-86; 130-131.

cumulative effects, and habitat degradation.[56] Additionally, the New York State Department of State has proposed to designate the Hudson River at Indian Point as Significant Coastal Fish and Wildlife Habitat (SCFWH).[57] The operation of Indian Point in once-through cooling mode, with or without the addition of CWW screens, is not compatible with SCFWH waters.[58]

By narrowly defining "adverse environmental impact" to mean an impact that is at such a magnitude that it caused, or will cause, a measurable change in the abundance of fish,[59] Entergy ignores other potential ecological impacts caused by the indiscriminant killing of Hudson River fish.[60] Instead, Entergy proposes to further exacerbate the Facility's habitat impacts by displacing aquatic habitat and biota with the installation of CWW screens on roughly five acres of Hudson riverbed.[61] Such an alteration of the physical aquatic habitat will also create velocity shelters in the Hudson River which will attract fish larvae to the CWW screens and could actually result in higher entrainment for certain species of fish.[62]

Under the literal terms of the CWA, an activity which does not comply with a designated use does not comply with the applicable water quality standards (*see PUD No. 1, supra* 511 U.S. at 715). Indian Point causes and/or contributes to habitat degradation, and will continue to do so if operated as proposed by Entergy. Such habitat degradation constitutes a *per se* impairment of best usages. Such impacts mandated NYSDEC's denial of the requested WQC in the absence of water-quality based entrainment controls which are required under both state and federal law (CWA § 401, 33 U.S.C. §§ 1341; CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C], 33 C.F.R. § 122.44[d]; ECL §§ 17-0501 and 17-0811[5]; 6 NYCRR §§ 608.9, 701.1, 701.11 and 750-1.11[a][5][i]; *see also PUD No. 1, supra* 511 U.S. at 712-713 [internal citations omitted]; *Brayton Point, supra* 2006 EPA App. LEXIS 9 at *350 [internal citations omitted]). Accordingly, the NYSDEC 401 Denial was fully supported by the facts before the agency at the

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[56] RvK Initial Brief Proposed Findings of Fact ¶¶ 69-70.
[57] RvK Initial Brief Proposed Findings of Fact ¶¶ 10-11.
[58] RvK Initial Brief Proposed Findings of Fact ¶¶ 59-60. A determination of whether or not such a proposed project is consistent with coastal policies is a requirement before a project such as this would be permitted to be constructed and operated, *regardless of whether* or not the pending Hudson River Mile 40-60 Significant Tidal Habitat designation is formally adopted. RvK Initial Brief Proposed Finding of Fact ¶ 61.
[59] The AEI Report equates "adverse environmental impact" as defined therein with impairment of best uses. RvK Initial Brief Proposed Finding of Fact ¶ 169.
[60] RvK Initial Brief Proposed Finding of Fact ¶ 204.
[61] RvK Initial Brief Proposed Findings of Fact ¶¶ 59-61; 111-117; 135-138.
[62] RvK Initial Brief Proposed Findings of Fact ¶¶ 139-144.

time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

3. The Operation of Indian Point Under Any Applicant-Proposed Scenario Would Cause and/or Contribute to the Impairment of and/or the Partial or Complete Elimination of Existing Uses in Contravention of the CWA Antidegradation Policy.

The NYSDEC 401 Denial properly implemented the CWA's antidegradation policy to protect and maintain existing Hudson River uses. While the Commissioner previously observed that the water quality of the Hudson River was at a high enough level to support propagation of fish, shellfish, and wildlife and recreation (such as fishing) (*see In re Athens Generating Co.*, Interim Decision of the Commissioner [June 2, 2000], 2000 N.Y. ENV LEXIS 49 at *37), NYSDEC has since acted to *significantly restrict or eliminate* fishing for species such as shad (2010)[63] and herring (2011),[64] and also determined that entrainment and impingement from CWIS must be similarly minimized or eliminated.[65]

This case is also readily distinguishable from *Athens* given that Entergy does not propose to install closed-cycle cooling.[66] The existing Facility in this case operates in once-through cooling mode, causing the impingement and entrainment of over one billion fish of all life stages annually and contributing to the substantial unnatural mortality to Hudson River fish populations that have seen dramatic declines over the past decade.[67]

The population declines of a number of fish species entrained by Indian Point are shown by Entergy's selected[68] generator-sponsored long-term datasets from the Hudson River Basin Monitoring Program (HRBMP) years 1974 through 2010. Such data was collected in an attempt to quantify the size of sixteen (16) Hudson River fish populations and to assess potential impacts of cooling water withdrawals from electric power generating stations (including Indian Point) on

[63] RvK Initial Brief Proposed Finding of Fact ¶ 156.
[64] RvK Initial Brief Proposed Finding of Fact ¶ 148.
[65] RvK Initial Brief Proposed Findings of Fact ¶¶ 145- 164.
[66] RvK Initial Brief Proposed Finding of Fact ¶ 89.
[67] RvK Initial Brief Proposed Findings of Fact ¶¶ 84; *see also* ¶¶ 211; 252.
[68] Entergy's consultants did not select data earlier available HRBMP data (from as early as 1966) (RvK Proposed Finding of Fact ¶ 207), although of Unit 2 began commercial operation with a 1973 startup (*id.* at ¶ 208).

the Hudson River ecology.[69] Since the HRBMP dataset selected by Entergy's consultants (1974-2010) includes the date from which existing uses are established pursuant to the antidegradation policy (November 28, 1975, *see* 40 C.F.R. §§ 131.3[e], 131.12[a][1]) the HRBMP data illustrates the massive declines of populations of species entrained by Indian Point, with attendant community-level impacts and habitat degradation, which has occurred since November 28, 1975.[70]

Indian Point has indisputably contributed to the significant degradation and partial or complete elimination of the Hudson River existing uses of fish survival and propagation,[71] and suitable habitat and fishing.[72] Indian Point's operations impair (and have in fact, contributed to the elimination of) shad fishing on the Hudson River.[73] Going forward, Indian Point's continued operation as proposed by Entergy will not maintain and protect the existing use of fishing.[74]

Notably, the question of whether the Hudson River is or should be listed as "impaired"[75] for any designated use is not (and indeed, could not be) before this Tribunal in a hearing under 6 NYCRR Part 624. Instead, the antidegradation policy is applied prospectively and in a prophylactic fashion under CWA § 401 *to the activity at issue* in order to ensure that existing uses will be maintained and protected, and that no activity which *could* partially or completely eliminate an existing use will be authorized (*PUD No. 1*, *supra* 511 U.S. at 718, *citing* 40 C.F.R. § 131.12[a][1]).

Applying antidegradation prospectively, however, requires consideration of the uses existing on or after November 28, 1975 (40 C.F.R. § 131.12[a][1]; TOGS 1.3.9 at 1-2). The populations of a number of species which are and will continue to be entrained by Indian Point have suffered significant long-term declines (and in the case of rainbow smelt, extirpation) since that date. Such declines illustrate the impairment and/or partial and/or complete elimination of the Hudson River's existing uses of suitable habitat, fish survival and propagation and fishing.

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[69] RvK Initial Brief Proposed Findings of Fact ¶¶ 206; 208; 209.
[70] RvK Initial Brief Proposed Findings of Fact ¶¶ 210; 58; 63; 68; 71; 203; 255-267; 271-274.
[71] RvK Initial Brief Proposed Findings of Fact ¶¶ 232-235 (extirpation of rainbow smelt); *see also* ¶¶ 24; 28; 30; 41-46; 50; 64; 73; 125-126; 145; 146; 149; 151; 156-157; 162; 164; 212.
[72] RvK Initial Brief Proposed Findings of Fact ¶¶ 145-164.
[73] RvK Initial Brief Proposed Finding of Fact ¶ 158.
[74] RvK Initial Brief Proposed Findings of Fact ¶¶ 73-74; 79; 127-128; 132-134; 146; 156; 162-164; 182; 198.
[75] States must compile a list (known as the "303[d] list") of impaired waterbodies which fail to support their designated uses and thus do not meet their water quality standards (CWA § 303[d][1][A], 33 USC § 1313[d][1][A]).

Since 1991, the stocks of Hudson River American shad, alewife, and blueback herring have dropped so low that NYSDEC has either significantly reduced the amount of the stock allocated to fishing mortality or has eliminated fishing for those species altogether.[76] Additional entrainment of any of the population-depleted Hudson River fish species will further exacerbate the impairment and/or partial or complete elimination of the Hudson River's existing uses of suitable habitat, fish survival and propagation and fishing. [77]

Moreover, as noted, the Hudson River's existing best usages of fish survival and propagation and suitable habitat have not been maintained since November 28, 1975. Hudson River American shad populations have declined significantly since 1974, with a continuing downward trend to a current abundance which is now believed to be below the replacement level.[78] Hudson River white perch abundance has declined by roughly 50% since 1974, and is currently fluctuating without trend since 2004, without recovering to the prior abundance levels measured in 1974.[79]

Atlantic tomcod abundance shows a considerable year-to-year variation, but this species has suffered a long-term significant and unrecovered population decline since 1974.[80] Atlantic tomcod are commonly entrained and impinged at Indian Point, with an estimated Conditional Mortality Rate (CMR)[81] for entrainment of this species at over 12%.[82] Bay anchovy populations also show a long-term declining trend in abundance, with the abundance of adults in the Hudson River having declined 10-fold from the peak levels observed in the late 1980s, although this species is currently fluctuating without trend at that lower overall level.[83]

The blueback herring juvenile abundance index has decreased over the HRBMP study period (with young-of-the-year abundance declining abruptly in the mid-1980s), and the reduced population has fluctuated without trend through 2004 and never recovered to the levels present in

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[76] RvK Initial Brief Proposed Finding of Fact ¶ 160.
[77] RvK Initial Brief Proposed Findings of Fact ¶¶ 145- 164.
[78] RvK Initial Brief Proposed Finding of Fact ¶ 245; *see also* ¶¶ 239; 245-247.
[79] RvK Initial Brief Proposed Findings of Fact ¶¶ 216-221.
[80] RvK Initial Brief Proposed Findings of Fact ¶¶ 222-223.
[81] CMR - is the probability of a fish dying due to the power plant. It is expressed as a percentage and measures how many fewer Hudson River fish exist at the end of their first year of life (actually at September 1) than would exist if not for the loss to entrainment. RvK Initial Brief Proposed Finding of Fact ¶ 225 and accompanying footnote.
[82] RvK Initial Brief Proposed Findings of Fact ¶¶ 224-225.
[83] RvK Initial Brief Proposed Findings of Fact ¶¶ 226-227.

1985.[84] The Hudson River alewife juvenile abundance index shows a declining trend since 1974, with an increase in between-year variability in juvenile abundance and more recent data showing three strong year classes (2005, 2006 and 2008).[85] The overall Hudson River river herring population in the Hudson River has not recovered to the levels present in 1985.[86]

Rainbow smelt survival and propagation has been utterly eliminated in the Hudson River. Rainbow smelt were entrained and impinged by Indian Point during all operational years from 1974 through 1996, after which juveniles of this species disappeared from the HRBMP surveys, with the result being that this species has been extirpated from the Hudson River.[87]

Hudson River weakfish and white catfish are other species entrained by Indian Point whose populations have been in steep decline from 1990 onwards.[88] Each of the foregoing species is offered by way of example and not limitation with respect to Indian Point's ecosystem-wide impacts.[89]

Overall, the Hudson River fish community is not stable and the entire Hudson River ecosystem appears to be declining in terms of stability.[90] Over the entire operating period of Indian Point Unit 3, and 39 of 40 years of the operating period of Unit 2,[91] Hudson River existing habitat, fishing and fish propagation and survival uses which were achieved as of November 28, 1975 have been significantly impacted, impaired and/or partially and/or completely eliminated.[92] Indian Point's CWIS appreciably increases the death rates each of the foregoing fish species discussed above,[93] with nearly all of Entergy's selected RIS Species (shad, river herring, white perch and bay anchovy)[94] significantly declining in abundance since November 28, 1975, as discussed above.

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[84] RvK Initial Brief Proposed Findings of Fact ¶¶ 147; 228-229; 231.
[85] RvK Initial Brief Proposed Findings of Fact ¶¶ 229-230.
[86] RvK Initial Brief Proposed Finding of Fact ¶ 231.
[87] RvK Initial Brief Proposed Findings of Fact ¶¶ 232-235.
[88] RvK Initial Brief Proposed Findings of Fact ¶¶ 236-238; 242-245.
[89] *See, e.g.,* RvK Initial Brief Proposed Findings of Fact ¶¶ 248-249.
[90] RvK Initial Brief Proposed Findings of Fact ¶¶ 58; 63; 68; 71; 203; 255-267; 271-274.
[91] Indian Point Unit 2 began commercial operation in 1973 and Indian Point Unit 3 began commercial operation in 1976. RvK Initial Brief Proposed Findings of Fact ¶¶ 21-22.
[92] RvK Initial Brief Proposed Findings of Facts ¶¶ 8; 15; 152; 154-55; 210.
[93] RvK Initial Brief Proposed Findings of Fact ¶¶ 58; 84; 126; 252.
[94] RvK Initial Brief Proposed Finding of Fact ¶ 252 (Table 1 of Dr. Henderson's direct testimony is a reproduction of Table 2 from DEIS Appendix VI-1-D-2, which presents estimates of entrainment for most RIS species at Indian Point based on monitoring from 1981 through 1987).

While closed-cycle cooling operations (or equivalent reductions in entrainment) at Indian Point would be consistent with the maintenance of Hudson River estuary existing uses of suitable habitat, fish survival and propagation and fishing,[95] Entergy and its predecessors in interest have resisted every regulatory effort to achieve such entrainment reductions for nearly forty years (NYSDEC 401 Denial at 3-7).

There is no disagreement among the experts that a vast majority (71% or more) of the studied species which are entrained and/or impinged by Indian Point have shown long-term population declines from the levels which were present in the Hudson River on and after November 28, 1975.[96] Indian Point's entrainment and impingement directly contributes to the observed depleted abundances of those fish species.[97] As even Entergy's witness Dr. Barnthouse acknowledges, the death of a single early life stage organism (egg or larvae) of a species which has suffered a long-term decline in abundance contributes to the population decline of that species.[98] Indian Point has killed billions of early-life stage Hudson River fish and will kill billions more (even assuming the accuracy of Entergy's dubious and disputed CWW screen entrainment reductions)[99] if operated as proposed for the next twenty (20) years.

The antidegradation policy requires that existing in-stream uses must be maintained and protected (40 C.F.R. § 131.12[a][1]; NYSDEC TOGS 1.3.9 at 1-2). No activity which could partially or completely eliminate an existing use may be authorized pursuant to a CWA § 401 WQC (*PUD No. 1*, *supra* 511 U.S. at 718, *citing* 40 CFR § 131.12[a][1]). Accordingly, the NYSDEC 401 Denial properly implemented the antidegradation policy, was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

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[95] RvK Initial Brief Proposed Findings of Fact ¶¶ 275-284.
[96] RvK Initial Brief Proposed Finding of Facts ¶¶ 255-267.
[97] RvK Initial Brief Proposed Finding of Fact ¶ 252; *see also* ¶¶ 49-50; 74; 76; 79; 84; 125; 176-177; 198; 212-213.
[98] RvK Initial Brief Proposed Finding of Fact ¶ 126.
[99] RvK Initial Brief Proposed Finding of Fact ¶ 124; *see also* ¶¶ 120-123.

4. The Operation of Indian Point Under Any Applicant-Proposed Scenario Would Cause or Contribute to Significant Degradation of Water Quality in Contravention of the CWA Antidegradation Policy and ECL § 17-0501.

In addition to protecting existing uses, antidegradation requires the protection and maintenance of water quality itself (40 C.F.R. § 131.12[a][2]; TOGS 1.3.9 at 1-2). By "prevent[ing] the gradual deterioration of the quality of the water body" (*Niagara Mohawk Power Corp. v. State Dep't of Envtl. Conservation*, 82 N.Y.2d 191, 194 [1993]), the antidegradation policy also guards against the degradation of water quantity and quality in non-impaired waterbodies (*Athens*, *supra* 2000 N.Y. ENV LEXIS 49 at *37).

The continued operation of Indian Point without entrainment reductions achieved by or equivalent to closed-cycle cooling will continue to degrade the Hudson River's aquatic habitat.[100] Degradation of water quality which is still high enough to support designated uses cannot be authorized under the antidegradation policy absent a balancing of the potential adverse environmental impacts of the proposed project against its social and economic benefits (*see Athens*, *supra* 2000 N.Y. ENV LEXIS 49 at *38; 40 C.F.R. § 131.12[a][2]; TOGS 1.3.9 at 1).

Entergy denies that Indian Point degrades water quality at all, and makes no attempt to show whether Indian Point's degradation of water quality "is necessary to accommodate important [or significant] economic or social development" (*see* 40 C.F.R. § 131.12[a][2]; TOGS 1.3.9 at 1). The Facility's adverse environmental impacts result in (rather than offset) adverse socioeconomic recreational and commercial impacts to the Hudson River fisheries[101] and will continue to degrade all water quality absent the imposition of water quality-based entrainment controls.

Entrainment reductions achieved by or equivalent to closed-cycle cooling at Indian Point would ensure that Indian Point's continued operation will not degrade the water quality of the Hudson River and will not cause or contribute to a violation of water quality standards[102] (*see Athens*, *supra* 2000 N.Y. ENV LEXIS 49, at *37; 40 C.F.R. § 131.12[a][2]; TOGS 1.3.9 at 1; *see also* CWA § 401[d], 33 U.S.C. § 1341[d]; 6 NYCRR § 608.9; CWA § 301[b][1][C], 33 U.S.C. §

[100] RvK Initial Brief Proposed Findings of Fact ¶¶ 55, 57-59; 62, 65-67; 82; 127-134; 275-284.
[101] RvK Initial Brief Proposed Findings of Fact ¶¶ 8; 74; 77-86; 125-134; 145-164.
[102] RvK Initial Brief Proposed Findings of Fact ¶¶ 275-284.

1311[b][1][C]; 40 C.F.R. § 122.44[d]; ECL §§ 17-0501 and 17- 0811[5] and 6 NYCRR § 750-1.11[a][5][i]; *see also PUD No. 1, supra* 511 U.S. at 711-13 [internal citations omitted] and *Brayton Point, supra* 2006 EPA App. LEXIS 9 at *350 [internal citations omitted]). Accordingly, the NYSDEC 401 Denial properly implemented the antidegradation policy and ECL § 17-0501, was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

B. NYSDEC's Denial of Entergy's Requested WQC Is Consistent With and Implements the CWA's Mandate to Protect and Restore Water Quality and Designated and Existing Uses.

The CWA's objective to restore and maintain the chemical, physical and biological integrity of the nation's waters (CWA § 101[a], 33 U.S.C. § 1251[a]) is achieved by compliance with the CWA, including compliance with permit requirements (*Weinberger v. Romero-Barcelo,* 456 U.S. 305, 315 [1982]). Compliance with the CWA and the compliance with CWA permit requirements (applicable to Indian Point's CWIS pursuant to CWA § 401[d], 33 U.S.C. § 1341[d] and 6 NYCRR § 608.9) includes compliance with water quality-based controls (CWA § 301[b][1][C]; 33 U.S.C. § 1311[b][1][C]; *see also* 40 C.F.R. § 122.44[d]; ECL §§ 17-0501 and 17- 0811[5] and 6 NYCRR § 750-1.11[a][5][i]). The CWA also seeks attainment of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife." (CWA § 101[a][2], 33 U.S.C. § 1251[a][2]). The CWA assigns primary responsibility to the states to prevent, reduce and eliminate pollution (CWA § 101[b], 33 U.S.C. § 1251[b]) in order to achieve the objectives of the Act.

As EPA has explained, the antidegradation policy also sets the ecological baseline for compliance with water quality standards by protecting the highest use attained in the water body on or after November 28, 1975, whether or not the use is included in the water quality standards. (*see Ohio Valley Envtl. Coalition, supra* 279 F. Supp. 2d at 740; *citing* 40 C.F.R. § 131.12[a][1]; *see also* TOGS 1.3.9 at 1-2).

NYSDEC has appropriately determined that the restoration of depleted but once-abundant populations of Hudson River fish species (and the existing uses of fishing, fish survival and propagation and suitable aquatic habitat) will require the minimization of elimination of

CWIS-based aquatic organism mortalities[103] (*see also Brayton Point, supra* 2006 EPA App. LEXIS 9 at *478-79 [finding the EPA Region 1's permitting approach was rational where "the Region stated that, based on its biological analyses, the proposed permit intake limits *along with* 'the strong fishing restrictions that are currently in place' would provide the fishery an *opportunity to recover* and that it believed it *reasonable to expect such a recovery.*'" (emphasis supplied)]).

Although Drs. Barnthouse and Heimbuch posit that reducing Indian Point's entrainment to zero would have no measurable effect on the actual abundance of juvenile or one-year-old fish,[104] the CWA does not require (and reliable science and available data cannot provide, *see Section VIII[E][2], infra*) a demonstration that a measurable increase in population abundances will result from entrainment reductions at Indian Point (*see Bryaton Point, supra* 2006 EPA App. LEXIS 9 at *477-78).

Instead, the CWA § 401 and 6 NYCRR § 608.9 and 6 NYCRR § 624.9[b] and [c] require Entergy to demonstrate, by a preponderance of the evidence, that Indian Point's proposed operations will not cause or contribute to an impairment of the Hudson River's best usages (CWA § 401[d], 33 U.S.C. § 1341[d]; 6 NYCRR § 608.9; CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C]; 40 C.F.R. § 122.44[d][1][i]; ECL §§ 17-0501 and 17-0811[5] and 6 NYCRR § 750-1.11[a][5][i]).[105] By requiring such a demonstration as a prerequisite to obtain a WQC, CWA § 401 and 6 NYCRR § 608.9 function to achieve the CWA objectives of maintaining and restoring water quality which provides for the protection and propagation of fish, shellfish and wildlife (CWA §§ 101[a] and 101[a][2]; 33 U.S.C. §§ 1251[a] and [a][2]).

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[103] RvK Initial Brief Proposed Findings of Fact ¶¶ 146; 148-151; 156-157; 159-160; 162-164.
[104] RvK Initial Brief Proposed Finding of Fact ¶ 166.
[105] Water quality based controls would be required for Indian Point even if there were only a "reasonable potential" of a violation of water quality standards by the Facility (CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C]; 40 C.F.R. § 122.44[d][1][i]). The question is whether the activity at issue "could" violate water quality standards (*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 at *121). The record shows, however, that Indian Point *in fact* causes and/or contributes to a violation of water quality standards. Riverkeeper further submits that this issue was also previously and effectively determined as a matter of law by the Interim Decision (*In the Matter of Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC,* Interim Decision of the Assistant Commissioner, [August 15, 2008] 2008 N.Y. ENV LEXIS 52, *34).

The only mechanisms for intervention to try to restore fish populations are to decrease fish mortalities and/or to improve fish habitat[106] The only way to reduce population-depleting predation upon a species of fish is to reduce the predator.[107] In this case, Indian Point is the unnatural and illegitimate predator[108] of the depleted fish populations. The loss of highly prized recreational and/or commercial fish species such as white perch, striped bass, alewife, blueback herring, and American shad to entrainment by Indian Point impairs the best usage of fishing, with resultant socioeconomic impacts.[109]

For example, since 1991, the stocks of American shad, alewife, and blueback herring have dropped so low that NYSDEC has either significantly reduced the amount of the stock allocated to fishing mortality or has eliminated fishing for those species altogether.[110] Restoring the designated best usages for fishing, and fish propagation and survival to the Hudson River will require the minimization or elimination of human-induced mortality[111] (*see also Brayton Point, supra* 2006 EPA App. Lexis 9, at *390-91 and *400 [upholding EPA Region 1's conclusion that entrainment and impingement reductions resulting from closed-cycle cooling (coupled with current fishing restrictions) would result in the increased survival of individual organisms which would foster the recovery of fish populations and the ecosystem as a whole]).

Accordingly, NYSDEC's denial of Entergy's requested WQC properly implemented CWA § 401[d] (33 U.S.C. § 1341[d]), 6 NYCRR § 608.9; CWA § 301[b][1][C] (33 U.S.C. § 1311[b][1][C]), 40 C.F.R. §§ 131.12 and 122.44[d]; ECL §§ 17-0501 and 17-0811[5] 6 NYCRR §§ 701.1, 701.11 and 750-1.11[a][5][i] and NYSDEC TOGS 1.3.9 in furtherance of the CWA objective to both maintain and restore[112] water quality which provides for the survival and propagation of fish (*see also* 6 NYCRR § 701.11). Accordingly, the NYSDEC 401 Denial was

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[106] RvK Initial Brief Proposed Finding of Fact ¶ 214.
[107] RvK Initial Brief Proposed Finding of Fact ¶ 215.
[108] Predator-prey relationships are part of the natural conditions of the aquatic habitat (in fact, the most common cause of mortality to early life-stage aquatic organisms is predation). While predation can in some cases result in a reduction of fish populations, predation is part of the natural function of the Hudson River ecosystem (RvK Initial Brief Proposed Findings of Fact ¶¶ 196-197) and thus an aspect of the designated use of fish survival and suitable aquatic habitat, unlike CWIS mortalities (RvK Initial Brief Proposed Findings of Fact ¶¶ 56; 73-74; 84).
[109] RvK Initial Brief Proposed Finding of Fact ¶ 161.
[110] RvK Initial Brief Proposed Finding of Fact ¶ 160.
[111] RvK Initial Brief Proposed Finding of Fact ¶ 164.
[112] RvK Initial Brief Proposed Findings of Fact ¶¶ 145-152; 156-157; 275-284.

fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

C. NYSDEC's 401 Denial Properly Concluded Indian Point Must Achieve Entrainment Reductions By Way Of Or Equivalent to Closed-Cycle Cooling In Order to Comply With Best Usages.

Closed-cycle cooling is a well-established method for cooling power plants which minimizes the level of impingement and entrainment without any uncertainty by virtue of the reduced volume of cooling water extracted.[113] Retrofitting Indian Point with closed-cycle cooling would result in a reduction in the Facility's cooling water withdrawals by about 95%, with attendant reductions in entrainment of up to 98%[114] and would be expected to reduce Indian Point's annual entrainment of 1.2 billion aquatic organisms to just 60 million.[115]

Such entrainment reductions would be consistent with best usages of the Hudson River for fishing, fish propagation and survival.[116] Such entrainment reductions are also required for Indian Point to avoid impairing, or contributing to the impairment of the Hudson River as suitable habitat for the survival and propagation of fish,[117] particularly since many fish species are presently experiencing recruitment failure and their populations are declining.[118] Entrainment reductions achieved by or equivalent to closed-cycle cooling at Indian Point would increase the recruitment of fish, improve the aquatic resources of the estuary, and make the Hudson River more suitable for fish, shellfish and wildlife propagation and survival.[119]

NMFS agrees that implementing closed-cycle cooling at Indian Point is in the best interest of fishery resources and is the most appropriate option for meeting EFH mandates while allowing the Facility to continue to operate in an otherwise sensitive ecological area.[120] Since CWW screens are not a proven available technology for Indian Point and would not be nearly as effective as closed-cycle cooling in reducing entrainment, the use of CWW screens as an

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[113] RvK Initial Brief Proposed Finding of Fact ¶ 275.
[114] RvK Initial Brief Proposed Finding of Fact ¶ 280.
[115] RvK Initial Brief Proposed Finding of Fact ¶ 281.
[116] RvK Initial Brief Proposed Finding of Fact ¶ 276.
[117] RvK Initial Brief Proposed Finding of Fact ¶ 278.
[118] RvK Initial Brief Proposed Finding of Fact ¶ 279.
[119] RvK Initial Brief Proposed Finding of Fact ¶¶ 145-164; 284.
[120] RvK Initial Brief Proposed Finding of Fact ¶¶ 15; 69-70; 283.

alternative compliance option would still impair the Hudson River's best usages for fishing, fish propagation and survival.[121]

Accordingly, NYSDEC's 401 Denial on the grounds that Indian Point's continued operations without entrainment reductions achieved by or equivalent to closed-cycle cooling would be inconsistent with the Hudson River's best usages was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

D. Since the Operation of the Indian Point Without Entrainment Reductions Achieved by Or Equivalent to Closed-Cycle Cooling Will Cause or Contribute to a Violation of Best Usages (Including Antidegradation), a Water Quality-Based Entrainment Control Would Have Been Unequivocally Required Without Regard to Costs or Feasibility As a Matter of Law in Order for NYSDEC to Grant a WQC.

Given that entrainment reductions by way of or equivalent to closed-cycle cooling are required in order for Indian Point avoid causing or contributing to a violation of best usages (including antidegradation, *see Sections VIII[A]-[C], supra*), a water quality based entrainment control would be unequivocally required in order for NYSDEC to grant Indian Point a WQC (*PUD No. 1*, *supra* 511 U.S. at 718, citing 40 CFR § 131.12[a][1]; *id.* at 712, citing CWA § 401[d], 33 U.S.C. § 1341[d]; *id.* at 713, quoting CWA § 301[b][1][B]; 33 U.S.C. § 1311[b][1][C]; *S.D. Warren Co., supra* 547 U.S. at 386; *Brayton Point, supra* 2006 EPA App. LEXIS 9 at *350, citing CWA § 301[b][1][C], 33 U.S.C. § 1311[b][1][C]; *Mirant Bowline, supra* 2002 N.Y. ENV LEXIS 22 at *46; and *Matter of the Application of the PASNY Breakabean, supra* at 5, citing 6 NYCRR § 608.9, CWA § 401[d], 33 U.S.C. § 1341[d] and CWA § 301[b][1][B]; 33 U.S.C. § 1311[b][1][C]; 40 C.F.R. § 122.44[d]; ECL §§ 17-0501 and 17-0811[5]; 6 NYCRR § 750-1.11[a][5][i]).

The "best technology available" ("BTA") questions of whether closed-cycle cooling is an "available" technology at Indian Point and/or whether the environmental benefits of closed-cycle cooling would be "wholly disproportionate" to the costs thereof (6 NYCRR § 704.5) are

[121] RvK Initial Brief Proposed Finding of Fact ¶ 282.

wholly irrelevant where water quality-based entrainment controls are required to avoid causing or contributing to a violation of designated uses, existing uses and antidegradation. Accordingly, 32-week[122] (full facility) generation outages (which NYSDEC found would be needed to achieve reductions similar to closed-cycle cooling[123]) would be unequivocally required in order for NYSDEC to grant Indian Point a WQC — without regard to whether the loss of 62% of Indian Point's gross annual revenue would be "wholly disproportionate" to the environment benefit derived under the BTA analysis contained in the criteria of 6 NYCRR § 704.5.[124]

Indian Point must operate consistently with both the designated uses of the Hudson River and the water quality criteria of 6 NYCRR § 704.5 (as well as the antidegradation policy) (*see PUD No. 1, supra* 511 U.S. at 714-715, *quoting* CWA § 303[c][2][A], 33 U.S.C. 1313[c][2][A]; *id.* at 718, *citing* 40 C.F.R. § 131.12[a][1]; *id.* at 715 *citing* 40 C.F.R. § 131.3[b] [noting that in some circumstances, criteria alone may not suffice to protect the designated use]).

The imposition of a water quality-based entrainment control would also require the establishment of "specific steps in a compliance schedule designed to attain compliance within the shortest reasonable time" (ECL § 17-0813[2]; 6 NYCRR § 750-1.14[a]). The "wholly disproportionate" BTA (6 NYCRR § 704.5) cost considerations (which guided the 2003 Draft SPDES Permit's requirement of annual 42 unit-day generation outages as an interim compliance measure[125]) could not be considered when establishing a compliance schedule for a water-quality based, 32-week (full facility) generation outage entrainment control designed to make Indian Point attain compliance with water quality standards "within the shortest reasonable time" (ECL § 17-0813[2]; 6 NYCRR § 750-1.1[a]).[126]

Ensuring compliance with water quality standards via CWA § 301[b][1][C] (33 U.S.C. § 1311[b][1][C]) is a proper function of the CWA § 401 certification (*PUD No. 1, supra* 511 U.S. at 712). Section 301[b][1][C], in turn, "contains a broad enabling provision which requires

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[122] The draft SPDES permit requires closed cycle cooling in order to meet BTA (6 NYCRR § 704.5), but only required annual 42 unit-day generation outages as an interim compliance measure. RvK Initial Brief Proposed Finding of Fact ¶ 88.

[123] RvK Initial Brief Proposed Finding of Fact ¶ 88.

[124] RvK Initial Brief Proposed Finding of Fact ¶ 88.

[125] RvK Initial Opening Brief Proposed Finding of Fact ¶ 88.

[126] The draft SPDES permit requires closed cycle cooling in order to meet BTA (6 NYCRR § 704.5), but only required annual 42 unit-day generation outages as an interim compliance measure. RvK Initial Brief Proposed Finding of Fact ¶ 88.

States to take certain actions, including those necessary to meet water quality standards . . . and is not limited to discharges" (*PUD No. 1, supra* 511 U.S. at 713, *quoting* 33 U.S.C. § 1311[b][1][C]) and further "requires unequivocal compliance" with applicable water quality standards, without "any exceptions for cost or technological feasibility" (*Brayton Point, supra* 2006 EPA App. LEXIS 9 at *332 n. 205, *quoting In re City of Moscow*, 10 E.A.D. 135, 168 [EAB 2001], and *citing In re City of Fayetteville, 2 E.A.D. 594*, 600-01 & n.15 [CJO 1988] [same] and *U.S. Steel Corp. v. Train*, 556 F.2d 822, 838 [7th Cir. 1977]).

The CWA can mandate the imposition of water-quality based controls without regard to *both cost and feasibility* because denial of a WQC or a SPDES permit may be the only option when a proposed activity could cause or contribute to a violation of water quality standards and water quality-based controls are cost-prohibitive and/or are simply infeasible for a project. The CWA does not require an applicant to do the impossible, but the CWA unequivocally prohibits an applicant from doing what is simply impermissible. Accordingly, CWA § 401 provides that:

> No license or permit shall be granted until the certification required by this section has been obtained or has been waived as provided in the preceding sentence. No license or permit shall be granted if certification has been denied by the State, interstate agency, or the Administrator, as the case may be (CWA § 401[a][1]; 33 U.S.C. § 1341[a][1]; *see also* 6 NYCRR §§ 608.9; 701.1).

Such is the case at bar, which concerns a WQC *denial* rather than a conditional approval (*see* CWA § 401[d], 33 U.S.C. § 1341[d]). Indian Point is *unequivocally* required to achieve water quality-based entrainment reductions by way of or equivalent to closed-cycle cooling "within the shortest reasonable time" (ECL § 17-0813[2]; 6 NYCRR § 750-1.14[a]) in order to keep operating. But Entergy's WQC application did not propose any technology which will achieve such entrainment reductions,[127] nor did Entergy propose a schedule for achieving such reductions within the shortest reasonable time. Accordingly, NYSDEC's 401 Denial was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

[127] RvK Initial Brief Proposed Findings of Fact ¶¶ 43; 59; 89-110; 118-124; 127-134; 282.

E. NYSDEC's Denial of Entergy's Requested CWA § 401 WQC Appropriately Rejected Entergy's Irrelevant and Scientifically Unreliable Population-Level Best Usage Arguments

1. The AEI Report is Erroneously Premised Upon and Mis-Applies Fishery Management Policies and Ignores Fundamental Precepts of Best Usages Under the CWA.

Entergy's retained biologists admittedly did not consider the objective of the CWA (i.e., to restore and maintain the chemical, physical, and biological integrity of waters, *see* CWA § 101[a], 33 U.S.C. § 1251[a]) in determining their definition of adverse environmental impact for the AEI Report.[128] Instead, the AEI Report defines "adverse environmental impact" based upon the fishery management policy of the Magnusson-Stevens Act ("MSA") (16 U.S.C. § 1801[a][1]).[129] The AEI Report thus does not consider mortality *per se* to be an adverse environmental impact because the act of fishing necessarily causes mortality, and the MSA (according to Entergy's retained biologists) only considers overfishing which threatens the long-term sustainability of the population to be adverse.[130] Thus, the AEI Report focuses on population-level and community-level impacts to evaluate Indian Point's adverse environmental impacts because the MSA allows the "harvesting" of fish (albeit by fishermen, a critical point which the AEI Report ignores) as a "renewable resource."[131]

The AEI Report's analytical approach is fundamentally flawed because Indian Point's entrainment is not a legitimate use State fisheries resources.[132] Fishing, on the other hand, *is* a best usage of the Hudson River Class SB waters at issue (6 NYCRR § 701.11). While the AEI Report also blames striped bass predation for the population declines of white perch, Atlantic

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[128] RvK Initial Brief Proposed Findings of Fact ¶ 186.
[129] RvK Initial Brief Proposed Finding of Fact ¶ 187.
[130] RvK Initial Brief Proposed Findings of Fact ¶ 188. Notably, the federal resource management agency equipped with the expertise and authority to interpret and apply the Magnusson-Stevens Act (NMFS) (*see* 16 U.S.C. § 1854 *et seq.* and 50 C.F.R. §§ 600.805 to § 600.930) has found that once-through cooling operations at Indian Point are inconsistent with the NMFS-designated Hudson River essential fish habitat under the Magnusson-Stevens Act. RvK Initial Brief Proposed Findings of Fact ¶¶ 69-70; 85-86; 130-131; 283. In fact, NMFS originally designated the Hudson River as EFH under the Magnusson-Stevens Act in order to better manage adverse anthropogenic effects on fisheries (which have experienced the declines previously described herein) since the most recent licensing was completed for Indian Point. RvK Initial Brief Proposed Finding of Fact ¶ 15.
[131] RvK Initial Brief Proposed Findings of Fact ¶ 189-190.
[132] RvK Initial Brief Proposed Finding of Fact ¶ 159; 193.

tomcod, and river herring,[133] predation is another necessary aspect of the Hudson River's best usages for the survival of predatory fish (6 NYCRR § 701.11) and is a natural function of the ecosystem.[134]

The CWA focuses on maintaining and restoring parameters of water quality which will provide for the survival and propagation of fish (*compare* CWA §§ 101[a] and [a][2], 33 U.S.C. §§ 1251[a] and [a][2] with 16 U.S.C. 1801[a][4]).[135] NYSDEC is appropriately focused on both maintaining and restoring the best usages of the Hudson River.[136] The AEI Report, on the other hand, does not address restoration of the biological, physical and chemical parameters of water quality.[137] Accordingly, the fundamental premises of Entergy's best usages arguments are erroneous as a matter of law.

The CWA (and not the MSA), regulates Indian Point's CWIS (CWA § 401, 33 U.S.C. § 1341; CWA § 316[b]; 33 U.S.C. § 1326[b]). Applying the CWA, NYSDEC's 401 Denial was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

2. The NYSDEC 401 Denial Appropriately Rejected Entergy's Arguments Which Are Premised Upon Scientifically Unreliable Methods That Apply Insufficient Data to Reach Irrelevant Conclusions With Respect to Best Usages.

The AEI Report found no evidence at all of any correlation between Indian Point's operations and any aspect of the abundance or survival of the RIS populations and therefore concluded that Indian Point was not a contributing cause to changes in the abundance of those populations and that Indian Point therefore has not created an impairment of the Hudson River's best usages.[138]

The AEI Report is characterized by a conspicuous absence of reliable scientific conclusions and unsupported by the application of appropriate methods to sufficient data.[139] As

[133] RvK Initial Brief Proposed Findings of Fact ¶ 194.
[134] RvK Initial Brief Proposed Finding of Fact ¶ 195; *compare* ¶¶ 159;193.
[135] RvK Initial Brief Proposed Findings of Fact ¶¶ 186-187.
[136] RvK Initial Brief Proposed Findings of Fact ¶¶ 146; 156; 162-164.
[137] RvK Initial Brief Proposed Finding of Fact ¶ 186.
[138] RvK Initial Brief Proposed Finding of Fact ¶ 199.
[139] RvK Initial Brief Proposed Findings of Fact ¶¶ 170-185; 199-205.

NYSDEC Staff Fishery Biologist and Steam Electric Unit Leader Chuck Nieder has explained, and as the scientific literature illustrates, uncertainty and indeterminacy are fundamental characteristics of the dynamics of complex adaptive systems such as fish populations, and predicting the behaviors of these systems cannot be done with absolute certainty, regardless of the amount of scientific effort invested.[140]

Accordingly, while the fishery stock assessment methods and correlation analyses used in the AEI Report failed to detect an impact to fish populations or communities from Indian Point, those methods and analyses do not prove that an impact does not exist.[141]

As Riverkeeper's fisheries biologist Dr. Peter Henderson explained, correlation can never serve to demonstrate causality.[142] EPA Region 1 in the *Brayton Point* case similarly concluded that while there was a correlation in time between a significant increase in plant operation and a significant decrease in fish abundance, correlation cannot prove a cause-and-effect relationship between entrainment and fish population declines (*Brayton Point, supra* 2006 EPA App. LEXIS 9 at *518).[143] Based on available data, however, EPA Region 1 determined that it was likely that the Brayton Point plant had resulted in a significant negative impact on the fishery at issue (*id.* at 519).

In this case Indian Point's adverse environmental impacts are established as a matter of law (Interim Decision, *supra* 2008 N.Y. ENV LEXIS 52, at *34). The record likewise shows that Indian has caused or contributed to the impairment of the Hudson River's best usages, and that the entrainment and impingement reductions resulting from or equivalent to closed-cycle cooling would result in the increased survival of individual organisms which would foster the recovery of fish populations and the ecosystem as a whole[144](*see also Brayton Point, supra* 2006 EPA App. Lexis 9, at *390-91, *400 and *518-519).

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[140] RvK Initial Brief Proposed Findings of Fact ¶¶ 174-175.
[141] RvK Initial Brief Proposed Finding of Fact ¶ 200.
[142] RvK Initial Brief Proposed Finding of Fact ¶ 201.
[143] According to EPA Region 1, in the case of the Brayton Point Facility, the only way to prove a cause-and-effect relationship between that facility's entrainment and fish population changes would be to shut the plant down, wait for the fish populations to recover, and then monitor changes in fish abundance after turning the plant back on (*see Brayton Point, supra* 2006 EPA App. LEXIS 9 at 518-519).
[144] RvK Initial Brief Proposed Findings of Fact ¶¶ 8; 15; 49-50; 55; 57-59; 62; 65-67; 69-70; 74;76; 77-86; 125-134; 145-164;176-177; 198; 210; 212-215; 276; 279; 280; 275-284.

Even so, whether or not the AEI Report was able to detect a direct cause and effect between the billion fish killed annually by Indian Point's CWIS and the Hudson River fish species population declines does not demonstrate that no impact exists.[145] Moreover, the fundamental scientific premise upon which Entergy's best usages case rests (that community and/or population level impacts from a power plant can be detected even with thirty one [31] years of data) has been rejected by the entire relevant scientific community, including Entergy's own expert witness Dr. Barnthouse.[146]

As Mr. Nieder has explained, the only conclusion that can legitimately be claimed from the 2008 AEI Report is the following: "based on the methods and analyses selected by the authors of that report, a population effect caused by impingement and entrainment from Indian Point Units 2 and 3 could not be detected."[147] Entergy has accordingly failed to meet its burden of both production and persuasion as to whether the continued operation of Indian Point, as currently configured or with the addition of CWW screens, is consistent with the best usages of the Hudson River estuary (6 NYCRR §§ 608.9 and 624.9[b] and [c]).[148]

As Mr. Nieder has further explained, since the analyses selected and the data used could not detect an impact from Indian Point's CWIS, one cannot conclude that no such impact exists and that Indian Point (taken alone) does not impair the best usages of the Hudson River for fishing, fish propagation or survival.[149] It is consequently inappropriate and incorrect, as Mr. Nieder has observed, to suggest that a failure to detect an impact from Indian Point's CWIS necessarily implies that there is in fact *no impact* at all to any Hudson River fish population or community.[150] EPA has similarly observed that the failure to demonstrate a direct impact on one or more fish populations from the operation of a CWIS is not enough to demonstrate that no impact actually has occurred or will occur in the future.[151]

Moreover, by narrowly defining "adverse environmental impact" to mean an impact that is at such a magnitude that it caused, or will cause, a measurable change in the abundance of

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[145] RvK Initial Brief Proposed Finding of Fact ¶ 250.
[146] RvK Initial Brief Proposed Findings of Fact ¶¶ 178-185.
[147] RvK Initial Brief Proposed Finding of Fact ¶ 170.
[148] RvK Initial Brief Proposed Finding of Fact ¶¶ 171-172; 176-177; 179.
[149] RvK Initial Brief Proposed Finding of Fact ¶ 202.
[150] RvK Initial Brief Proposed Finding of Fact ¶203.
[151] RvK Initial Brief Proposed Finding of Fact ¶ 173.

fish[152] the AEI Report ignores other potential ecological impacts caused by the indiscriminant killing of Hudson River fish (e.g., predator-prey relationships, localized impacts from recreational uses, unauthorized taking of endangered species).[153] Indeed, Dr. Barnthouse concedes that the purpose of the AEI Report was not to assess the cumulative effects of multiple stressors on aquatic organisms.[154] While Dr. Barnthouse asserts that an impact must be measurable in order to find an impairment of the best usages of the Hudson River, Dr. Barnthouse is simply speculating on what has happened in the past and not looking ahead as NYSDEC must in order to preserve and protect the best usages of the Hudson River for future generations.[155]

Finally, since NYSDEC recently eliminated fishing mortality to American shad[156] (and restricted commercial herring fishing to 50,000 fish per year[157]) as a necessary measure to restore the best usage of fishing on the Hudson River for these species, for Dr. Barnthouse to speculate that the annual killing of millions of American shad and river herring by Indian Point operations does not threaten the best usage of the Hudson River for fishing is flawed regardless of whether the AEI Report detected a direct impact or not.[158] Accordingly, NYSDEC's 401 Denial was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in these proceedings) and was mandated by the CWA and State law.

IX. CONCLUSION

Based on all the foregoing, and in the light of the objectives of the federal Clean Water Act and its specific implementing provisions, as well as the enumerated provisions of New York's Environmental Conservation Law, NYSDEC's 401 Denial was fully supported by the facts before the agency at the time of the Denial (as well as the facts subsequently adduced in

[152] The AEI Report equates "adverse environmental impact" as defined therein with the impairment of best uses. RvK Initial Brief Proposed Finding of Fact ¶ 169
[153] RvK Initial Brief Proposed Finding of Fact ¶ 204.
[154] RvK Initial Brief Proposed Finding of Fact ¶ 254.
[155] RvK Initial Brief Proposed Finding of Fact ¶ 205; *see also* ¶ 53.
[156] RvK Initial Brief Proposed Finding of Fact ¶ 148.
[157] RvK Initial Brief Proposed Findings of Fact ¶¶ 148-151.
[158] RvK Initial Brief Proposed Finding of Fact ¶ 163.

these proceedings) and was mandated by the CWA and State law. Consequently, Entergy's appeal of NYSDEC's 401 Denial should be rejected.

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