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United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1437
Supplement 38, Vol.4

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

Office of Nuclear Reactor Regulation

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Draft Report for Comment

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Proposed Action	Issuance of renewed operating licenses DPR-26 and DPR-64 for Indian Point Nuclear Generating Unit Nos. 2 and 3, in Buchanan, NY
Type of Statement	Supplement to Final Supplemental Environmental Impact Statement
Agency Contact	Michael Wentzel Office of Nuclear Reactor Regulation Mail Stop O-11F1 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 Telephone: 301-415-6459 E-mail: michael.wentzel@nrc.gov
Comments	Any interested party may submit comments on this supplement to the final supplemental environmental impact statement. Please specify NUREG-1437, Supplement 38, Volume 4, draft supplement to final, in your comments. Comments must be received by August 20, 2012. Comments received after the expiration of the comment period will be considered if it is practical to do so, but the NRC cannot assure that consideration of late comments will be given. Comments may be submitted electronically by searching for docket ID NRC-2008-0672 at the Federal rulemaking Web site, http://www.regulations.gov. Comments may also be mailed to the following address: Chief, Rules, Announcements, and Directives Branch Division of Administrative Services Office of Administration Mail Stop: TWB-05-B01M U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 Please be aware that any comments that you submit to the U.S. Nuclear Regulatory Commission will be considered a public record and entered into the Agencywide Documents Access and Management System. Do not provide information you would not want to be publicly available.

ABSTRACT

This supplement to the final supplemental environmental impact statement (FSEIS) for the proposed license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 incorporates new information that the U.S. Nuclear Regulatory Commission (NRC) staff has obtained since the publication of the FSEIS in December 2010.

This supplement includes corrections to impingement and entrainment data presented in the FSEIS, revised conclusions regarding thermal impacts based on newly available thermal plume studies, and an update of the status of the NRC's consultation under section 7 of the Endangered Species Act with the National Marine Fisheries Service regarding the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus)*.

CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

BACKGROUND

By letter dated April 23, 2007, Entergy Nuclear Operations, Inc. (Entergy) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue renewed operating licenses for Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3) for additional 20-year periods.

Under Title 10 of the *Code of Federal Regulations* (10 CFR) 51.20(b)(2) and the National Environmental Policy Act of 1969, as amended (NEPA), the renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) states that the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," issued May 1996.

The NRC published its final supplemental environmental impact statement (FSEIS) for IP2 and IP3 in December 2010. After the NRC published the FSEIS, the staff identified new information that necessitated changes to its assessments in the FSEIS. This new information is derived from the following:

- Entergy provided comments on the FSEIS that included new information on the entrainment and impingement field data units of measure,
- Entergy provided comments on the Essential Fish Habitat Assessment that also included new information on the data units of measure, and
- Entergy completed and submitted to the New York State Department of Environmental Conservation a new study that characterizes the IP2 and IP3 thermal plume.

To address this new information, the NRC staff has prepared this supplement to the FSEIS in accordance with 10 CFR 51.92(a)(2) and (c), which address preparation of a supplement to a final environmental impact statement for proposed actions that have not been taken, under the following conditions:

- There are new and significant circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, or
- The NRC staff determines, in its opinion, that preparation of a supplement will further the purposes of NEPA.

In addition to supplementing the FSEIS for the reasons stated above, the NRC is also taking this opportunity to document the completion of the consultation process under section 7 of the Endangered Species Act of 1973, as amended (ESA), with the National Marine Fisheries Service (NMFS) regarding the shortnose sturgeon (*Acipenser brevirostrum*) and the subsequent reinitiation of consultion due to NMFS's listing of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) population in the New York Bight as endangered.

PROPOSED ACTION

The proposed action remains the same as that stated in the FSEIS (at pages 1-6–1-7):

> The proposed Federal action is renewal of the operating licenses for IP2 and IP3 (IP1 was shut down in 1974). IP2 and IP3 are located on approximately

239 acres of land on the east bank of the Hudson River at Indian Point, Village of Buchanan, in upper Westchester County, New York, approximately 24 miles north of the New York City boundary line. The facility has two Westinghouse pressurized-water reactors. IP2 is currently licensed to generate 3216 megawatts thermal (MW(t)) (core power) with a design net electrical capacity of 1078 megawatts electric (MW(e)). IP3 is currently licensed to generate 3216 MW(t) (core power) with a design net electrical capacity of about 1080 MW(e). IP2 and IP3 cooling is provided by water from the Hudson River to various heat loads in both the primary and secondary portions of the plants. The current operating license for IP2 expires on September 28, 2013, and the current operating license for IP3 expires on December 12, 2015. By letter dated April 23, 2007, Entergy submitted an application to the NRC (Entergy 2007a) to renew the IP2 and IP3 operating licenses for an additional 20 years.

PURPOSE AND NEED FOR ACTION

The purpose and need for action remains the same as stated in the FSEIS (at page 1-7):

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing operating license, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an operating license is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or matters within the State's jurisdiction—including acceptability of water withdrawal, consistency with State water quality standards, and consistency with State coastal zone management plans—or the purview of the owners, such as whether continued operation makes economic sense.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (GEIS Section 1.3):

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decision makers.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954, as amended, or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether a particular nuclear power plant should continue to operate. From the perspective of the licensee and the State regulatory authority, the purpose of renewing the operating licenses is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's licenses.

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
ADAMS	Agencywide Documents Access and Management System
BSS	Beach Seine Survey
CFR	Code of Federal Regulations
CHGEC	Central Hudson Gas and Electric Corporation
CMR	conditional mortality rate
DPS	distinct population segment
EIS	environmental impact statement
EMR	entrainment mortality rate
Entergy	Entergy Nuclear Operations, Inc.
ESA	Endangered Species Act of 1973, as amended
FSEIS	final supplemental environmental impact statement
FSS	Fall Shoals Survey
ft	feet
GEIS	NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants”
IMR	impingement mortality rate
IP2 and IP3	Indian Point Nuclear Generating Unit Nos. 2 and 3
LOE	line of evidence
LRS	Long River Survey
m	meter(s)
NEPA	National Environmental Policy Act of 1969
NMFS	National Marine Fisheries Service
NRC	U.S. Nuclear Regulatory Commission
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
RIS	representative important species
SEIS	supplemental environmental impact statement
SOC	strength of connection
SPDES	State Pollutant Discharge Elimination System
WOE	weight of evidence
YOY	young of year

1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) staff prepared this supplement to the final supplemental environmental impact statement (FSEIS) for Indian Point Nuclear Generating Units 2 and 3 (IP2 and IP3) in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 51.92(a)(2) and (c), which address the preparation of a supplement to an FSEIS for proposed actions that have not been taken, if the following conditions apply:

- There are new and significant circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, or
- The NRC staff determines, in its opinion, that preparation of a supplement will further the purposes of NEPA.

The NRC staff prepared this supplement to the FSEIS because it received new data, analyses, and comments from several sources that potentially changed, and in some cases did change, the staff's conclusions in the FSEIS. This supplement contains the text, tables, and figures that changed as the result of this new information.

Three sources provided information that changed the staff's conclusions in the FSEIS.

First, in comments to the NRC dated March 29, 2011, Entergy Nuclear Operations, Inc. (Entergy) (Entergy 2011b, AKRF 2011b) provided new information regarding the entrainment and impingement field data that it had previously provided to the NRC for its aquatic resource impact assessment in Entergy (2007), a December 2007 supplement to its license renewal application. In its letter dated March 29, 2011, Entergy (2011b) said that these changes would:

> …not alter, but rather confirm, NRC's ultimate conclusion in the FSEIS that potential impacts to aquatic species as a result of theoretical entrainment and impingement at IPEC are no more than MODERATE.

Second, comments submitted on behalf of Entergy (Goodwin Proctor 2011, AKRF 2011a) on the FSEIS and the NRC staff's Essential Fish Habitat Assessment contained related new information. When the NRC staff considered this information, the staff found that the information necessitated some minor changes to the aquatic ecology findings in Sections 4.1.2 through 4.1.3 of the FSEIS and Appendices H and I. Chapter 2 of this supplement provides corrected tables and conclusions resulting from the NRC staff's analysis of the new information. Where specific changes or corrections to FSEIS information occur, this supplement references the affected FSEIS section, page, and line numbers.

Third, since the publication of the FSEIS, Entergy submitted to the New York State Department of Environmental Conservation (NYSDEC) a triaxial plume study (Swanson et al. 2011a) as part of its State Pollutant Discharge Elimination System (SPDES) permit renewal application. Entergy undertook this study in response to the NYSDEC's 2010 Notice of Denial (NYSDEC 2010). Based on this new information, as well as Entergy's response to the NYSDEC staff's comments on the study (Mendelsohn et al. 2011, Swanson et al. 2011b) and the NYSDEC staff's conclusions regarding its review of the study and response to comments (NYSDEC 2011), the NRC staff has revised its conclusions regarding the impacts of heat shock to aquatic species. Chapter 3 of this supplement presents these revised conclusions.

In addition to supplementing the FSEIS for the reasons stated above, the staff is also taking this opportunity to update the status of consultations under section 7 of the Endangered Species Act of 1973, as amended (ESA) with the National Marine Fisheries Service (NMFS). Chapter 4 of this supplement updates the information contained in Section 4.6.1 of the FSEIS to document

the completion of consultation regarding the shortnose sturgeon (*Acipenser brevirostrum*), and summarizes the biological opinion and associated incidental take statement (NMFS 2011e) that NMFS issued in October 2011 as a result of that consultation. Additionally, Chapter 4 of this supplement provides a summary of the reinitiation of consultation regarding the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) that resulted from NMFS's February 2012 listing of Atlantic sturgeon as an endangered species under the ESA.

Where appropriate, **bold** text indicates specific text corrections or additions to the FSEIS and **bold strikeout** indicates deletions from the text.

2.0 IMPINGEMENT AND ENTRAINMENT DATA CORRECTIONS

2.1 Corrections to Section 4.1.2, "Entrainment of Fish and Shellfish in Early Lifestages," and Its Related Appendices

In a letter to the NRC dated March 29, 2011 (Entergy 2011b; AKRF 2011b), Entergy provided new information supplementing the entrainment and impingement field data that it had previously provided to the NRC for its aquatic resource impact assessment. This new information appears in "Technical Review of FSEIS for Indian Point Nuclear Generating Unit Nos. 2 and 3" (AKRF 2011b). In its technical review, AKRF (2011b) stated that the units of the entrainment catch densities provided by Entergy are expressed as the number caught per 1,000 cubic meters (m^3). Because Entergy did not originally provide the units used in the FSEIS to assess impacts, the NRC staff believed the units to be the number caught/m^3 based on historical documents provided by Entergy, comments by Entergy and its consultants on the draft SEIS, and phone conversations among Entergy, Entergy's consultants, and NRC staff. Thus, the entrainment losses the FSEIS reported for each of the representative important species (RIS) used in the NRC staff's analysis are too large by a factor of 1,000.

In the FSEIS, the NRC staff estimated the number entrained for a given week as the product of the mean density entrained and the combined weekly flow for IP2 and IP3. The error in the entrainment catch density directly affects Figure 4-3 in Section 4.1.2, and the error is repeated in Figure H-5 in Appendix H. In these figures, the total number entrained on the right axis should be in units of numbers × 10^8 instead of numbers × 10^{11}. The corrected Figures 4-3 and H-5 appear below. In addition, these changes affect two portions of text in the FSEIS.

Lines 2 and 3 of page 4-14 in the FSEIS are corrected as follows:

> The total number of identified fish entrained has decreased at a rate of 187 ~~**billion**~~ **million** fish per year since 1984.

Lines 1–3 of page H-22 in the FSEIS are corrected as follows:

> Linear regression (n=6; p<0.01) indicated that the number of identified fish entrained decreased at a rate of 187 ~~**billion**~~ **million** fish per year, a result consistent with the decrease observed in the number of fish impinged.

The change in units of the entrainment catch densities also affects the 75th percentile of the number of each life stage entrained and the annual estimate of the number entrained presented in Tables I-39 and I-42 of Appendix I. In Table I-39, the units should be numbers × 10^3 instead of numbers × 10^6. In Table I-42, the units should be numbers in the thousands instead of numbers in the millions. The corrected tables appear below.

Figure 4-3 on page 4-15 in the FSEIS is corrected as follows:

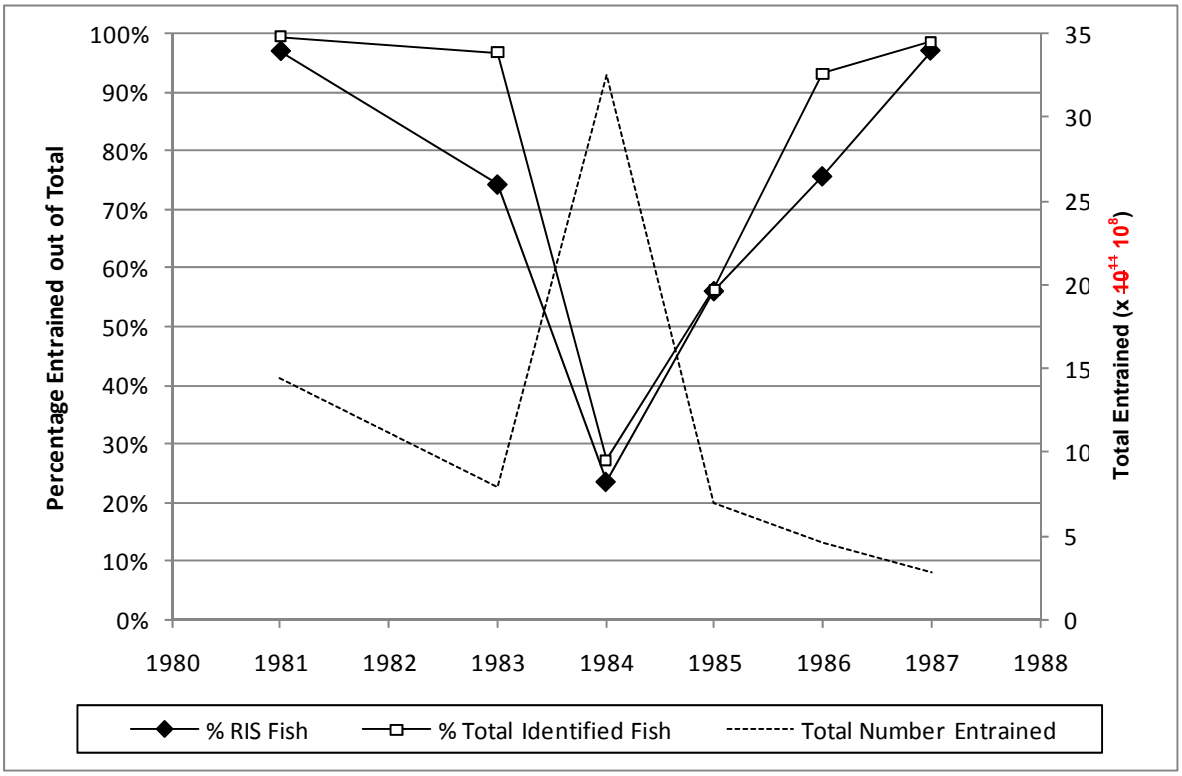

Figure 4-3. Percentage of entrainment composed of RIS fish and total identified fish relative to the estimated total entrainment at IP2 and IP3 combined (data from Entergy 2007b)

Figure H-5 on page H-23 in the FSEIS is identical to Figure 4-3 in the FSEIS and is corrected as follows:

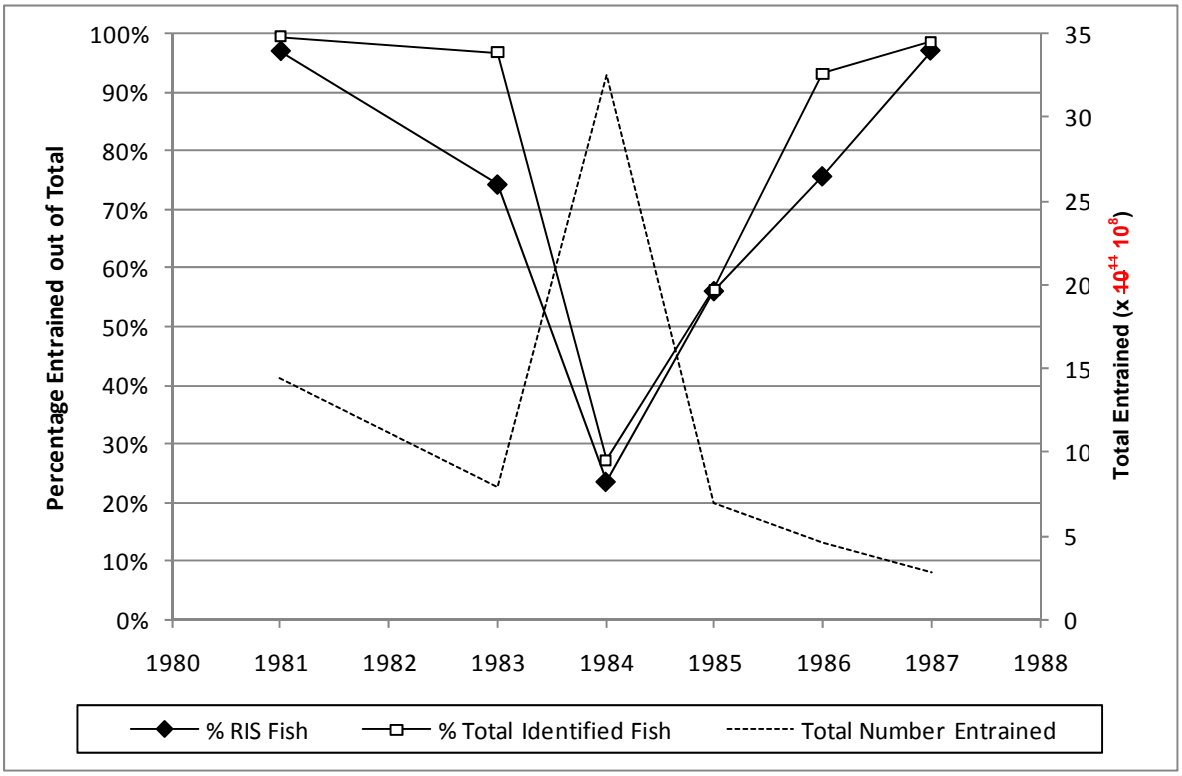

Figure H-5. Percentage of entrainment composed of RIS fish and total identified fish relative to the estimated total entrainment at IP2 and IP3 combined (data from Entergy 2007b)

Table I-39 on page I-54 in the FSEIS is corrected as follows:

Table I-39. Percentage of Each Life Stage Entrained by Season and the Contribution of Major Taxa Represented in the Samples.

Calculations are based on the 75th percentile over years (1981 and 1983–1987) of each season's number of fish entrained. No entrainment sampling occurred in October–December.

Life Stage	Season 1 Jan–Mar	Season 2 Apr–Jun	Season 3 Jul–Sep	75th Percentile over Years
EGG	3%	20%	78%	210,801×~~10^6~~ 10^3
Rainbow Smelt	99%	2%	0%	
Bay Anchovy	0%	92%	100%	
White Perch	0%	4%	<1%	
Alosa species	1%	2%	0%	
YOLK-SAC LARVA	8%	89%	3%	23,140×~~10^6~~ 10^3
Atlantic Tomcod	100%	0%	0%	
Herring Family	0%	91%	<1%	
Bay Anchovy	0%	2%	94%	
Striped Bass	0%	5%	1%	
Hogchoker	0%	0%	3%	
POST YOLK-SAC LARVA	<1%	52%	48%	618,393×~~10^6~~ 10^3
Atlantic Tomcod	100%	<1%	0%	
Alosa species	0%	37%	<1%	
Bay Anchovy	0%	11%	58%	
Anchovy Family	0%	2%	39%	
White Perch	0%	12%	1%	
Striped Bass	0%	17%	1%	
Herring Family	0%	20%	<1%	
JUVENILE	2%	44%	54%	10,989×~~10^6~~ 10^3
White Perch	96%	10%	10%	
Atlantic Tomcod	0%	67%	2%	
Weakfish	0%	1%	50%	
Bay Anchovy	0%	1%	17%	
Rainbow Smelt	0%	9%	3%	
Striped Bass	0%	6%	5%	
Anchovy Family	0%	1%	4%	
Alosa species	0%	2%	2%	
White Catfish	4%	<1%	0%	
Blueback Herring	0%	<1%	3%	
UNDETERMINED STAGE	10%	77%	13%	4,469×~~10^6~~ 10^3
Atlantic Tomcod	100%	<1%	0%	
Morone species	0%	88%	2%	
Bay Anchovy	0%	9%	83%	
Anchovy Family	0%	0%	10%	
Alosa species	0%	0%	4%	

The title of Table I-42 on page I-58 of the FSEIS is corrected as follows:

Table I-42 Annual Estimated Number of RIS Entrained at IP2 and IP3 (~~millions~~ thousands of fish)

The contents of the table remain accurate and, therefore, are not duplicated in this supplement.

2.2 Corrections to Section 4.1.3, "Combined Effects of Impingement and Entrainment," and Its Related Appendices

In a letter to the NRC dated March 29, 2011, Entergy (2011b) provided new information (in AKRF 2011b) regarding the units associated with the catch density data from the Long River Survey (LRS) and the Fall Shoals Survey (FSS) that Entergy (2007) had previously submitted to the NRC for its aquatic resource impact assessment. In AKRF's (2011b) technical review, the units of the catch densities are expressed as the number caught/1,000 m^3. Entergy did not provide the units for these densities when it originally submitted the data to the NRC. The NRC staff based the units it used in the FSEIS to assess impacts (i.e., number caught/m^3) on information in the mathematical construction of these measures provided in Central Hudson Gas and Electric Corporation (CHGEC) et al. (1999). Thus, the NRC staff overestimated the annual standing crop from the LRS and FSS in the FSEIS for each of the representative important species (RIS) by a factor of 1,000. The NRC staff then used the estimates of the annual standing crop and the estimated entrainment losses to estimate a conditional entrainment mortality rate (EMR), a parameter in the models used in the strength-of-connection (SOC) analysis.

The NRC staff described the calculation of the standing crop from the LRS and FSS in Appendix I, Section I.2.2, of the FSEIS. The NRC staff estimated the LRS and FSS weekly standing crop as the weekly density of fish caught multiplied by the IP2 and IP3 region river volume. The error in the density units for the LRS and FSS produced incorrect estimates of the combined standing crop used in the denominator of the estimated EMR in the FSEIS. The NRC staff also used entrainment losses as input to the numerator and the denominator of the EMR estimates. Because both the numerator and the denominator of the estimated EMR were too large by a factor of 1,000, only those estimates for two RIS (spottail shiner (*Notropis hudsonius*) and white catfish (*Ameiurus catus*)), in which the Beach Seine Survey (BSS) contributed more of the standing crop, were seriously affected. For the remaining RIS, to which the BSS contributed little, the errors in units largely cancelled because of the construction of the EMR as a ratio of the number entrained (which was 1,000 times too large) to the number at risk (number in the river plus the number entrained, both of which were 1,000 times too large). The amount and direction of change in the EMR depends on the relative contributions from the three sampling programs—BSS, FSS, and LRS.

The NRC staff used the EMR in its assessment of the SOC and, ultimately, to determine the final weight-of-evidence (WOE) assessment of the combined effects of impingement and entrainment from IP2 and IP3. The unit of measure error affects the staff's conclusion of High SOC for spottail shiner, but not the conclusion of Low SOC for white catfish. The NRC staff reran the SOC Monte Carlo simulations using the corrected EMRs, and, based on the corrected data, now finds a Low SOC for the spottail shiner. Further, based on the WOE assessment of the combined effects of impingement and entrainment from IP2 and IP3, the NRC staff concludes that the impacts of impingement and entrainment on the spottail shiner are SMALL rather than LARGE.

The changes to the SOC analysis affect FSEIS Table 4-4 (presented below) and several lines of text in Section 4.1.3.3. However, Section 4.1.3.5 is not affected by these changes.

Lines 41–43 on page 4-20 of the FSEIS are corrected as follows:

> Based on the WOE assessment (Table 4-4), the NRC staff concludes that impacts to American shad, Atlantic menhaden, Atlantic sturgeon, Atlantic tomcod, bay anchovy, bluefish, gizzard shad, shortnose sturgeon, **spottail shiner**, striped bass, white catfish, and blue crab are SMALL.

Lines 1–3 on page 4-21 of the FSEIS are corrected as follows:

> The NRC staff concludes that impacts to alewife, rainbow smelt, and weakfish are MODERATE. The staff concludes that impacts to blueback herring, hogchoker, ~~**spottail shiner,**~~ and white perch are LARGE.

Lines 30–41 on page 4-21 of the FSEIS are removed as follows:

> ~~***Spottail Shiner***~~
>
> ~~**The NRC staff concludes that a Large impact is present for YOY spottail shiner because a detectible population decline occurred in the river-wide (1 of 3) and river segment (1 of 1) data sets, and the strength of connection with the IP2 and IP3 cooling system is high. The habitat for the spottail shiner includes small streams, lakes, and large rivers, including the Hudson. This species feeds primarily on aquatic insect larvae, zooplankton, benthic invertebrates, and fish eggs and larvae, and is the prey of striped bass. Spottail shiners spawn from May to June or July (typically later for the northern populations) over sandy bottoms and stream mouths (Smith 1985; Marcy et al. 2005); water chestnut (Trapa natans) beds provide important spawning habitat (CHGEC 1999). Individuals older than 3 years are rare, although some individuals may live 4 or 5 years (Marcy et al. 2005). Spottail shiner is not a marine or anadromous species, so coastal population trend data are not available.**~~

Table 4-4 on page 4-23 of the FSEIS is corrected as follows:

Table 4-4. Impingement and Entrainment Impact Summary for Hudson River YOY RIS

Species	Population Trend Line of Evidence	Strength of Connection Line of Evidence	Impacts of IP2 and IP3 Cooling Systems on YOY RIS
Alewife	Variable	High	Moderate
American Shad	Detected Decline	Low	Small
Atlantic Menhaden	Unresolved[a]	Low[b]	Small
Atlantic Sturgeon	Unresolved[a]	Low[b]	Small
Atlantic Tomcod	Detected Decline	Low	Small
Bay Anchovy	Undetected Decline	High	Small
Blueback Herring	Detected Decline	High	Large
Bluefish	Detected Decline	Low	Small
Gizzard Shad	Unresolved[a]	Low[b]	Small
Hogchoker	Detected Decline	High	Large
Rainbow Smelt	Variable	High	Moderate-Large[c]
Shortnose Sturgeon	Unresolved[a]	Low[b]	Small
Spottail Shiner	Detected Decline	~~High~~ Low	~~Large~~ Small
Striped Bass	Undetected Decline	High	Small
Weakfish	Variable	High	Moderate
White Catfish	Variable	Low	Small
White Perch	Detected Decline	High	Large
Blue Crab	Unresolved[a]	Low[b]	Small

(a) Population trend could not be established because of a lack of river survey data.
(b) Monte Carlo simulation could not be conducted because of the low rate of entrainment and impingement; a Low Strength of connection was concluded.
(c) Section 4.1.3.3 provides supplemental information.

Because of the new information regarding the units of the data for entrainment density and the density of fish caught during the LRS and FSS, the NRC staff corrected the estimates of EMR for American shad (*Alosa sapidissima*), bay anchovy (*Anchoa mitchilli*), hogchoker (*Trinectes maculates*), white catfish, and white perch (*Morone americana*) reported in Appendices H and I. The staff's conclusions of the SOC for these RIS, however, remain unchanged. These changes affect several lines of text in Sections H.1.3.2 and H.1.3.3 and Tables H-16 and H-17, as described below.

Lines 11–12 on page H-47 in Section H.1.3.2 of the FSEIS are corrected as follows:

> The results of this analysis indicated a High strength of connection for ~~nine~~ **eight** species (Table H-16).

Lines 15–16 on page H-47 in Section H.1.3.2 of the FSEIS are corrected as follows:

> For ~~four~~ **five** RIS, the strength of connection was Low (minimal evidence of connection).

Lines 5–10 on page H-49 in Section H.1.3.3 of the FSEIS are corrected as follows:

> Based on the WOE assessment (Table H-17), the NRC staff concludes that the impact levels are Small for ~~eleven~~ **12** species: American shad, Atlantic menhaden, Atlantic sturgeon, Atlantic tomcod, bay anchovy, bluefish, gizzard shad, shortnose sturgeon, **spottail shiner**, striped bass, white catfish, and blue crab. Further, the staff concludes that the impacts are Moderate for three species: alewife, rainbow smelt, and weakfish. Finally, the staff concludes that

the impacts are Large for ~~four~~ **three** species: blueback herring, hogchoker, ~~spottail shiner;~~ and white perch.

Lines 26–38 on page H-50 in Section H.1.3.3 of the FSEIS are removed as follows:

~~***Spottail Shiner***~~

~~**The NRC staff concludes that a Large impact is present for YOY spottail shiner because a detectible population decline occurred in the river-wide (1 of 3) and river segment (1 of 1) data sets, and there was a high strength of connection with the IP2 and IP3 cooling system. The habitat for the spottail shiner includes small streams, lakes, and large rivers, including the Hudson. This species feeds primarily on aquatic insect larvae, zooplankton, benthic invertebrates, and fish eggs and larvae, and is the prey of striped bass. Spottail shiners spawn from May to June or July (typically later for the northern populations) over sandy bottoms and stream mouths (Smith 1985; Marcy et al. 2005); water chestnut (Trapa natans) beds provide important spawning habitat (CHGEC 1999). Individuals older than 3 years are rare, but there is evidence of individuals living four or five years (Marcy et al. 2005). Coastal population trend data were not available for this species.**~~

Table H-16 on page H-48 of the FSEIS is corrected as follows:

Table H-16. Weight of Evidence for the Strength-of-Connection Line of Evidence for YOY RIS Based on the Monte Carlo Simulation

RIS	Strength of Connection	RIS	Strength of Connection
Alewife	High	Hogchoker	High
American Shad	Low	Rainbow Smelt	High
Atlantic Menhaden	Cannot be Modeled[(a)]	Shortnose Sturgeon	Cannot be Modeled[(a)]
Atlantic Sturgeon	Cannot be Modeled[(a)]	Spottail Shiner	~~High~~ **Low**
Atlantic Tomcod	Low	Striped Bass	High
Bay Anchovy	High	Weakfish	High
Blueback Herring	High	White Catfish	Low
Bluefish	Low	White Perch	High
Gizzard Shad	Cannot be Modeled[(a)]	Blue Crab	Cannot be Modeled[(a)]

[(a)] Estimates for model parameters were unavailable or information was lacking. Strength of connection assumed to be Low based on review of impingement and entrainment data.

Table H-17 on page H-49 of the FSEIS is corrected as follows:

Table H-17. Impingement and Entrainment Impact Summary for Hudson River YOY RIS

Species	Population Trend Line of Evidence	Strength of Connection Line of Evidence	Impacts of IP2 and IP3 Cooling Systems on YOY RIS
Alewife	Variable	High	Moderate
American Shad	Detected Decline	Low	Small
Atlantic Menhaden	Unresolved[a]	Low[b]	Small
Atlantic Sturgeon	Unresolved[a]	Low[b]	Small
Atlantic Tomcod	Detected Decline	Low	Small
Bay Anchovy	Undetected Decline	High	Small
Blueback Herring	Detected Decline	High	Large
Bluefish	Detected Decline	Low	Small
Gizzard Shad	Unresolved[a]	Low[b]	Small
Hogchoker	Detected Decline	High	Large
Rainbow Smelt	Variable	High	Moderate-Large[c]
Shortnose Sturgeon	Unresolved[a]	Low[b]	Small
Spottail Shiner	Detected Decline	~~High~~ **Low**	~~Large~~ **Small**
Striped Bass	Undetected Decline	High	Small
Weakfish	Variable	High	Moderate
White Catfish	Variable	Low	Small
White Perch	Detected Decline	High	Large
Blue Crab	Unresolved[a]	Low[b]	Small

[a] Population LOE could not be established using WOE; therefore, population LOE could range from small to large.
[b] Strength of connection could not be established using Monte Carlo simulation; therefore, strength of connection was based on the rate of entrainment and impingement.
[c] Section 4.1.3.3 provides supplemental information.

In addition to Tables I-39 and I-42, presented earlier, the new information about the units of measure affects tables in Appendix I. The corrected Table I-40, Table I-41, Table I-43, Table I-46, and Table I-47 in Appendix I of the FSEIS appear on the following pages.

Table I-40 on page I-56 of the FSEIS is corrected as follows:

Table I-40. Method for Estimating Taxon-Specific Entrainment Mortality Rate (EMR) Based on River Segment 4 Standing Crop for the Strength of Connection Analysis

Property of Method		Number Entrained	River Segment 4 Standing Crop
Input Data	Variables	mean density organisms entrained by IP2 and IP3 **(# per 1000 m^3)** Volume of cooling water withdrawn by IP2 and IP3 (1000 m^3/min)	LRS density (by life stage) FSS density of YOY **(# per 1000 m^3)** BSS density of YOY **(# per haul)** River Segment 4 volume (m^3) River Segment 4 shorezone surface area (m^2)
	Frequency	Per week of sampling	Per week of sampling
Summary Statistics	Seasonal (Year specific)	Sum of weekly estimates of number of organisms entrained by IP2 and IP3	Sum of weekly standing crop estimates
	Annual	Sum of Season 1, 1986 with each year's totals from Season 2 and Season 3	Sum of seasonal standing crop estimates for River Segment 4
	EMR	$\frac{\text{75th Percentile Annual Number Entrained}}{75^{th}\text{ Percentile (Annual Number Entrained + Annual Standing Crop)}}$	
	Units of numerator and denominator of EMR	# of organisms	
Years of Data		1981 and 1983-1987	1981 and 1983-1987
Life Stages		Eggs, Larvae, and Juveniles	Eggs, Larvae, and Juveniles (YOY)
Taxonomic Substitutions		Alewife, blueback herring, and unidentified alosids treated collectively as river herring	
		Unidentified anchovy spp. (species, plural) allocated to bay anchovy Unidentified *Morone* spp. allocated proportionally to striped bass and white perch	

The title of Table I-41 on page I-57 of the FSEIS is corrected as follows:

Table I-41 Estimated Annual Standing Crop of Eggs, Larvae, and Juvenile RIS Within River Segment 4 (~~millions~~ thousands of fish)

The contents of the table remain accurate and, therefore, are not duplicated in this supplement.

Table I-43 on page I-59 of the FSEIS is corrected as follows:

Table I-43. Estimate of the River Segment 4 Entrainment Mortality Rate (EMR) and the 95 Percent Confidence Limits for the Riverwide Entrainment CMR (1974-1997)

Taxa	75th Percentile Annual Number Entrained (number x ~~10^9~~ 10^6)	75th Percentile of Number at Risk (number x ~~10^9~~ 10^6)	EMR	Riverwide CMR for Entrainment at IP2 and IP3	
				Lower 95% Confidence Limit	Upper 95% Confidence Limit
Alewife and Blueback Herring	94.9	1003	0.095	0.00747	0.0324
American Shad	0.357	~~8.43~~ 9.26	~~0.042~~ 0.039	0	0.016696
Atlantic Menhaden	0	NA	NA	Not Modeled	
Atlantic Sturgeon	0	NA	NA	Not Modeled	
Atlantic Tomcod	7.65	210	0.036	0.152	0.234
Bay Anchovy	439	~~2064~~ 2065	~~0.213~~ 0.212	0.0925	0.140
Bluefish	0.00291	1.13	0.003	Not Modeled	
Gizzard Shad	0	NA	NA	Not Modeled	
Hogchoker	1.87	~~4.83~~ 4.84	~~0.386~~ 0.385	Not Modeled	
Rainbow Smelt	7.07	27.4	0.258	Not Modeled	
Shortnose Sturgeon	0	NA	NA	Not Modeled	
Spottail Shiner	0.00295	~~0.00838~~ 0.0937	~~0.352~~ 0.031	0.0802	0.104
Striped Bass	71.4	676	0.106	0.181	0.276
Weakfish	3.90	7.17	0.544	Not Modeled	
White Catfish	0.00965	~~0.0848~~ 0.0388	~~0.114~~ 0.249	Not Modeled	
White Perch	63.5	~~840~~ 841	~~0.076~~ 0.075	0.0568	0.108

Table I-46 on page I-61 of the FSEIS is corrected as follows:

Table I-46. Parameter Values Used in the Monte Carlo Simulation

RIS	Survey Used	Linear Slope (*r*)	Upper 95% Confidence Limit of the Slope	Error Mean Square from Regression	CV of Density Data (1979-1990)	EMR	IMR
Alewife	BSS	-0.030	-0.014	0.570	1.245	0.095	0.0020
American Shad	BSS	-0.069	-0.059	0.350	0.744	~~0.042~~ 0.39	0.0005
Atlantic Tomcod	FSS	-0.040	-0.026	0.490	1.035	0.036	0.0300
Bay Anchovy	FSS	-0.075	-0.061	0.505	0.598	~~0.213~~ 0.212	0.0040
Blueback Herring	BSS	-0.024	-0.009	0.530	1.488	0.095	0.0040
Bluefish	BSS	-0.038	-0.022	0.580	0.692	0.003	0.0005
Hogchoker	FSS	-0.034	-0.018	0.580	1.679	~~0.386~~ 0.385	0.0005
Rainbow Smelt	FSS	0.012	0.041	0.576	1.452	0.258	0.0005
Spottail Shiner	BSS	-0.017	-0.005	0.430	1.293	~~0.352~~ 0.031	0.0070
Striped Bass	BSS	0.040	0.052	0.420	0.528	0.106	0.0080
Weakfish	FSS	-0.047	-0.031	0.560	1.085	0.544	0.0005
White Catfish	FSS	0.007	0.010	0.100	3.520	~~0.114~~ 0.249	0.0005
White Perch	BSS	-0.062	-0.045	0.610	0.848	~~0.076~~ 0.075	0.0320

Table I-47 on page I-63 of the FSEIS is corrected as follows:

Table I-47. Quartiles of the Relative Difference in Cumulative Abundance and Conclusions for the Strength-of-Connection from the Monte Carlo Simulation

Taxa	Number of Years	N_0 = 1000			N_0 = 1 x 10^8			Strength of Connection Conclusion
		Median	Q1	Q3	Median	Q1	Q3	
Alewife	20	0.33	0.11	0.59	0.32	0.06	0.55	High
	27	0.36	0.15	0.56	0.33	0.14	0.53	
American Shad	20	~~0.07~~ 0.08	~~-0.04~~ -0.03	~~0.18~~ 0.20	~~0.09~~ 0.08	~~-0.02~~ -0.03	~~0.20~~ 0.19	Low
	27	~~0.08~~ 0.07	-0.01	~~0.16~~ 0.15	~~0.08~~ 0.07	~~0.00~~ -0.01	0.16	
Atlantic Tomcod	20	0.14	-0.04	0.32	0.17	-0.01	0.38	Low
	27	0.18	0.04	0.32	0.18	0.02	0.33	
Bay Anchovy	20	~~0.21~~ 0.19	~~0.09~~ 0.08	~~0.32~~ 0.31	0.20	0.08	0.31	High
	27	~~0.18~~ 0.19	0.10	~~0.26~~ 0.28	0.18	~~0.10~~ 0.09	~~0.27~~ 0.28	
Blueback Herring	20	0.30	0.02	0.60	0.28	0.02	0.60	High
	27	0.43	0.16	0.67	0.40	0.14	0.64	
Bluefish	20	0.13	-0.04	0.29	0.14	-0.03	0.30	Low
	27	0.14	0.02	0.29	0.16	0.01	0.30	
Hogchoker	20	~~0.71~~ 0.72	~~0.39~~ 0.37	~~1.05~~ 1.06	~~0.74~~ 0.76	~~0.41~~ 0.42	~~1.10~~ 1.09	High
	27	~~0.81~~ 0.76	~~0.53~~ 0.50	~~1.10~~ 1.09	~~0.77~~ 0.84	~~0.46~~ 0.56	~~1.06~~ 1.13	
Rainbow Smelt	20	0.77	0.33	1.25	0.81	0.35	1.34	High
	27	0.93	0.52	1.38	1.03	0.63	1.46	
Spottail Shiner	20	~~0.59~~ 0.20	~~0.33~~ -0.07	~~0.88~~ 0.43	~~0.58~~ 0.18	~~0.23~~ -0.06	~~0.90~~ 0.42	~~High~~ Low
	27	~~0.61~~ 0.22	~~0.36~~ 0.01	~~0.88~~ 0.42	~~0.62~~ 0.23	~~0.35~~ 0.01	~~0.87~~ 0.46	
Striped Bass	20	0.45	0.09	0.76	0.45	0.12	0.78	High
	27	0.62	0.27	1.02	0.66	0.31	1.01	
Weakfish	20	0.62	0.39	0.87	0.66	0.42	0.90	High
	27	0.63	0.43	0.84	0.64	0.43	0.83	
White Catfish	20	~~0.19~~ 0.40	~~-0.36~~ -0.20	~~0.76~~ 0.98	~~0.05~~ 0.37	~~-0.46~~ -0.18	~~0.66~~ 1.00	Low
	27	~~0.09~~ 0.39	~~-0.41~~ -0.15	~~0.58~~ 0.91	~~0.09~~ 0.37	~~-0.43~~ -0.19	~~0.58~~ 0.99	
White Perch	20	~~0.16~~ 0.18	~~0.01~~ 0.03	~~0.32~~ 0.35	~~0.20~~ 0.19	~~0.04~~ 0.03	~~0.35~~ 0.34	High
	27	~~0.18~~ 0.19	~~0.06~~ 0.07	~~0.31~~ 0.30	~~0.20~~ 0.17	~~0.07~~ 0.06	~~0.31~~ 0.30	

3.0 ASSESSMENT OF THERMAL IMPACTS

In the FSEIS, the NRC staff concluded that the potential impacts of the cooling water discharge from IP2 and IP3 on aquatic species could range from SMALL to LARGE because the staff did not have enough information to quantify the extent and magnitude of the IP2 and IP3 thermal plume. Since publication of the FSEIS, the NRC has obtained additional information from Entergy regarding the thermal plume that enables the staff to make a more informed conclusion regarding thermal impacts.

In January 2011, Entergy submitted to the NYSDEC a preliminary report on a triaxial plume study (Swanson et al. 2011a) as part of its SPDES permit renewal application. Entergy undertook this study in response to the NYSDEC's 2010 Notice of Denial (NYSDEC 2010), which noted that Entergy's previous thermal study (Swanson et al. 2010) did not directly address the period of highest river temperatures, and as such, would require additional confirmatory monitoring to determine whether any modeled results accurately show compliance with thermal standards. The NYSDEC provided Entergy with comments on the new Swanson et al. (2011a) study in March 2011. Within the same month, Mendelsohn et al. (2011) and Swanson et al. (2011b) prepared responses to the NYSDEC staff's review of the study. In a letter dated May 16, 2011, NYSDEC (2011) notified NYSDEC Judges M.E. Villa and D.P. O'Connell that it had finished reviewing the data and information contained in both the study and the response to NYSDEC's comments and that, based on this information and applicable regulations, the NYSDEC staff had determined the following:

> … a thermal mixing zone in the Hudson River near Indian Point not to exceed a maximum of seventy-five (75) acres in total size during any time of a given year (6 NYCRR §704.3) will provide reasonable assurance of compliance with water quality standards and criteria for thermal discharges set forth in 6 NYCRR §§704.1 and 704.2, respectively.

Based on Swanson et al.'s (2011a) triaxial thermal plume study, Mendelsohn et al. (2011) and Swanson et al.'s (2011b) responses to NYSDEC staff comments on the study, and NYSDEC staff's (2011) conclusions regarding the study, the NRC staff has revised its discussion of and conclusions regarding thermal impacts to aquatic species, which appear in Section 4.1.4 of the FSEIS.

Lines 16–26 on page 4-30 in Section 4.1.4.3 of the FSEIS are changed as follows:

> ~~**Entergy has been engaged in discussions with the NYSDEC concerning the thermal impacts of IP2 and IP3 cooling water system operation. As a result of those discussions, the NRC staff notes that Entergy recently performed a triaxial thermal study of the Hudson River from September 9 to November 1 of 2009 (Entergy 2010). Given the months involved in this study, the study period did not include days with the highest average annual water temperature. Entergy has indicated that it will perform modeling of the river based on its field data in order to determine whether the power plant is in compliance with conditions of its permit; it also indicated that it may conduct additional monitoring in 2010. The NYSDEC, in its recent Notice of Denial of Water Quality Certification, indicated that additional verification of any modeled results would be necessary (NYSDEC 2010). Entergy did conduct additional studies in 2010. This issue continues to be subject to NYSDEC authority and review.**~~

In February 2010, Entergy submitted to NYSDEC a preliminary report (Swanson et al. 2010) on a triaxial thermal study of the Hudson River performed during the period of September 9 to November 1, 2009. Because the study did not directly address the period of highest river temperatures, the NYSDEC directed Entergy to perform additional confirmatory monitoring to determine whether any modeled results accurately show compliance with thermal standards (NYSDEC 2010). In January 2011, Entergy submitted to the NYSDEC a new triaxial plume study (Swanson et al. 2011a).

In the new study, Swanson et al. (2011a) reported that the extent and shape of the thermal plume varied greatly, primarily in response to tidal currents. For example, the plume (illustrated as a 4°F (2.2°C) temperature increase or ΔT isotherm in Figure 5-6 of Swanson et al. 2011a) generally followed the eastern shore of the Hudson River and extended northward from IP2 and IP3 during flood tide and southward from IP2 and IP3 during ebb tide. Depending on tides, the plume can be reasonably easily identified and can reach a portion of the near-shore bottom or be largely confined to the surface of the river.

Temperature measurements reported by Swanson et al. (2011a) generally show that the warmest water in the thermal plume is close to the surface, and plume temperatures tend to decrease with depth. A cross-river survey conducted in front of IP2 and IP3 captured one such incident during spring tide on July 13, 2010 (Figure 3-28 in Swanson et al. 2011a). Across most of the river, water temperatures were close to 82°F (28°C), often with warmer temperatures near the surface and cooler temperatures near the bottom. The IP2 and IP3 thermal plume at that point was clearly defined and extended about 1,000 feet (ft) (300 meters (m)) from shore on a cross-river transect of about 3800 ft (1150 m) (interpreted from the figure). Surface water temperatures in the plume reached about 85°F (29°C). Maximum river depth along the measured transect is approximately 50 ft (15 m).

A temperature contour plot at a cross-river transect at IP2 and IP3 illustrates a similar condition on July 11, 2010, during slack before flood tide (Figure 1-10 in Swanson et al. 2011b). Here, the thermal plume is evident to about 2,000 ft (600 m) from the eastern shore (the location of the IP2 and IP3 discharge) and extends to a depth of about 35 ft (11 m) along the eastern shore. The river here is more than 4,500 ft (1,400 m) wide. Bottom temperatures above 82°F (28°C) were confined to about the first 250 ft (76 m) from shore. In that small area, bottom water temperatures might also exceed 86°F (30°C); elsewhere, bottom water temperatures were about 80°F (27°C). The NRC staff notes, however, that these limited-area conditions would not last long, as they would change with the tidal cycle.

In response to NYSDEC's review of the IP2 and IP3 thermal studies (Swanson et al. 2011a), Mendelsohn et al. (2011) modeled the maximum area and width of the thermal plume (defined by the 4°F (2.2°C) ΔT isotherms) in the Hudson River. Mendelsohn et al. (2011) reported that for four cross-river transects near IP2 and IP3, the maximum cross-river area of the plume would not exceed 12.3 percent of the river cross-

section, and the maximum cross-river width of the plume would not exceed 28.6 percent of the river width (Table 3-1 in Mendelsohn et al. 2011).

Swanson et al. (2011a) concluded that IP2 and IP3 are in compliance with NYSDEC water quality standards set forth at 6 NYCRR Part 704.

After line 43 on page 4-31 of Section 4.1.4.4 of the FSEIS, the following text is to be added:

In response to the NYSDEC's 2010 Notice of Denial (NYSDEC 2010), Entergy submitted a new triaxial plume study (Swanson et al. 2011a) to the NYSDEC in January 2011. NYSDEC provided Entergy with comments on the new study (Swanson et al. 2011a) in March 2011. Within the same month, Mendelsohn et al. (2011) and Swanson et al. (2011b) prepared responses to the NYSDEC staff's review of the study. In a May 2011 letter (NYSDEC 2011), NYSDEC staff notified NYSDEC Judges M.E. Villa and D.P. O'Connell that NYSDEC staff had finished reviewing the data and information contained in both the study and the response to NYSDEC's comments and that, based on this information and applicable regulations, NYSDEC staff had determined the following:

> **a thermal mixing zone in the Hudson River near Indian Point not to exceed a maximum of seventy-five (75) acres in total size during any time of a given year (6 NYCRR §704.3) will provide reasonable assurance of compliance with water quality standards and criteria for thermal discharges set forth in 6 NYCRR §§704.1 and 704.2, respectively.**

Lines 2–26 on page 4-32 in Section 4.1.4.5 of the FSEIS are corrected as follows:

~~**In the absence of a completed thermal study proposed by NYSDEC (or an alternative proposed by Entergy and accepted by NYSDEC), existing information must be used to determine the appropriate thermal impact level to sensitive life stages of important aquatic species. Since NYSDEC modeling in the FEIS (NYSDEC 2003a) indicates that discharges from IP2 and IP3 could raise water temperatures to a level greater than that permitted by water quality criteria that are a component of existing NYSDEC permits, the staff must conclude that adverse impacts are possible. Cold water fish species such as Atlantic tomcod and rainbow smelt may be particularly vulnerable to temperature changes caused by thermal discharges. The population of both species has declined, and rainbow smelt may have been extirpated from the Hudson River. The NYSDEC's issuance of a SPDES permit provides a basis to conclude that the thermal impacts of IP2 and IP3 discharges could meet applicable regulatory temperature criteria. The NYSDEC's recent pronouncements and its ongoing re-examination of this issue create uncertainty, and this issue is currently being addressed in NYSDEC administrative proceedings. Accordingly, in the absence of specific studies, and in the absence of results sufficient to make a determination of a specific level of impact, the NRC staff concludes that thermal impacts from IP2 and IP3 potentially could range from SMALL to LARGE depending on the extent and magnitude of the thermal plume, the sensitivity of various aquatic species and life stages likely to encounter the thermal plume, and the probability of an**~~

~~encounter occurring that could result in lethal or sublethal effects. This range of impact levels expresses the uncertainty accruing from the current lack of studies and data. Either additional thermal studies or modeling and verification of Entergy's 2009 thermal study might generate data to further refine or modify this impact level. For the purposes of this Final SEIS, the NRC staff concludes that the impact level could range from SMALL to LARGE. This conclusion is meant to satisfy NRC's NEPA obligations and is not intended to prejudice any determination the NYSDEC may reach in response to new studies and information submitted to it by Entergy.~~

NRC regulations for license renewal environmental reviews establish the primary role of the U.S. Environmental Protection Agency (EPA) (or States, when applicable) in water quality regulations as they relate to impacts on aquatic species. As such, the assessment of impacts from heat shock is within the purview of the responsible government agency. In the case of IP2 and IP3, NYSDEC is the responsible agency.

NYSDEC regulations at 6 NYCRR Part 704 establish specific standards that apply to thermal discharges within the State of New York. The standards are set to "assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water" to which heated water is discharged (6 NYCRR 704.1(a)). Section 4.1.4.4 of this FSEIS supplement describes the thermal plume studies (Swanson et al. 2010, 2011a) that Entergy submitted to NYSDEC and NYSDEC's (2011) conclusions regarding these studies. NYSDEC concluded that the results of the thermal plume studies provide reasonable assurance that the IP2 and IP3 discharge is in compliance with NYSDEC's water quality standards and criteria for thermal discharges.

Based on Entergy's thermal plume studies and NYSDEC's conclusions, the NRC staff concludes that the impacts from heat shock to aquatic resources of the lower Hudson River would be SMALL.

This change in the NRC staff's conclusion regarding thermal impacts (heat shock) also affects the Abstract, Executive Summary, Alternatives, and Summary sections of the FSEIS. The NRC staff has revised parts of these sections, as described below.

Line 37 on page iii through line 2 on page iv of the FSEIS Abstract are changed as follows:

> Overall effects from entrainment and impingement are likely to be MODERATE, and impacts from heat shock are likely to be SMALL. ~~Impacts from heat shock potentially range from SMALL to LARGE depending on the conclusions of thermal studies proposed by the New York State Department of Environmental Conservation (NYSDEC).~~

Lines 33–39 on page xviii of the FSEIS Executive Summary are changed as follows:

> The NRC staff concludes that the potential environmental effects for most of these issues are of SMALL significance in the context of the standards set forth in the GEIS with ~~three~~ **two** exceptions—entrainment~~,~~ **and** impingement~~, and heat shock from the facility's heated discharge~~. The NRC staff jointly assessed the impacts of entrainment and impingement to be MODERATE based on NRC's analysis of representative important species. ~~Impacts from~~

~~heat shock potentially range from SMALL to LARGE depending on the conclusions of thermal studies conducted by Entergy and submitted to the NYSDEC.~~

Line 43 on page 8-8 through line 3 on page 8-9 of Section 8.1.1.2 are changed as follows:

Because the closed-cycle cooling system discharges a smaller volume of water, and because the water is cooler than in a once-through system, the extent of thermal impacts ~~– which could range from SMALL to LARGE for the current once-through system, given uncertainty in the facility's thermal impacts –~~ would remain SMALL ~~be reduced~~. ~~Thus, the effects of thermal shock also decline.~~

Lines 35–40 on page 9-4 of Section 9.1 are changed as follows:

The NRC staff concludes that the potential environmental effects for ~~9~~ 10 of the 12 categorized issues are of SMALL significance in the context of the standards set forth in the GEIS. The NRC staff concludes that the combined impacts from impingement and entrainment (each a separate issue) are MODERATE. ~~Impacts from heat shock could range from SMALL to LARGE, based on the large uncertainties discussed in Chapter 4~~.

Lines 8–13 on page 9-5 of Section 9.1 are changed as follows:

For issues of MODERATE ~~or LARGE~~ significance (i.e., issues related to aquatic ecology), mitigation measures are addressed both in Chapter 4 and in Chapter 8 as alternatives based on determinations in the draft New York State Department of Environmental Conservation (NYSDEC) State Pollutant Discharge Elimination System (SPDES) permit proceeding, Clean Water Act Section 401 proceeding, and in draft policy statements published by the State.

4.0 SECTION 7 CONSULTATION

At the time the NRC staff published the FSEIS, the NRC and NMFS had not completed section 7 consultation under the Endangered Species Act of 1973, as amended (ESA) for the shortnose sturgeon (*Acipenser brevirostrum*). During the course of the section 7 consultation, the NRC staff obtained more studies and information on the thermal plume (previously discussed in Chapter 3 of this document). As a result, the NRC staff has revised its conclusions regarding thermal impacts to the shortnose sturgeon based on this new thermal modeling information. Section 2.2.5.5 of the FSEIS, which includes the shortnose sturgeon's life history, remains unchanged. The staff identified one correction to Section 4.6.1 of the FSEIS, shown below.

In addition to supplementing the FSEIS for the reasons stated in Chapter 1 of this supplement, the staff is also taking this opportunity to provide an update on the status of its consulation with NMFS related to Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3). This chapter provides an update on the section 7 consultation history provided in Section 4.6.1 of the FSEIS, as well as a summary of the biological opinion that NMFS issued in October 2011 as a result of consultation. This chapter also provides a summary of the reinitiation of consultation regarding the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Consultation with NMFS regarding the Atlantic sturgeon was reinitiated as a result of NMFS's February 2012 listing of Atlantic sturgeon as an endangered species under the ESA.

4.1 Corrections to Section 4.6.1, "Aquatic Special Status Species"

In the FSEIS, the NRC staff concluded that the potential impacts of heated discharge from IP2 and IP3 on shortnose sturgeon could not be determined because the staff did not have enough information to quantify the extent and magnitude of the IP2 and IP3 thermal plume. Since publication of the FSEIS, the NRC staff has obtained additional information on the IP2 and IP3 thermal plume. Chapter 3 of this document describes the new thermal plume information. Based on Swanson et al.'s (2011a) triaxial thermal plume study, Mendelsohn et al. (2011) and Swanson et al. (2011b)'s responses to NYSDEC staff comments on the study, and NYSDEC staff's (2011) conclusions regarding the study, the NRC staff has revised its discussion regarding thermal impacts to shortnose sturgeon, which appears in Section 4.6.1 of the FSEIS.

Lines 40–43 on page 4-58 in Section 4.6.1 of the FSEIS are changed as follows:

~~**The potential impacts of thermal discharges on shortnose and Atlantic sturgeon cannot determined at this time because additional studies are required to quantify the extent and magnitude of the thermal plume, as discussed in Section 4.1.4 of this SEIS.**~~

In July 2011, the NRC (2011c) supplemented its analysis of the thermal effects from IP2 and IP3 on the shortnose sturgeon that was presented in NRC's (2010) December 2010 revised biological assessment. The NRC staff's (2011c) supplement to the revised biological assessment considered newly available thermal plume information (Swanson et al. 2011a, 2011b; Mendelsohn et al. 2011; NYSDEC 2011) as well as various studies on shortnose sturgeon biology and thermal preferences (Dadswell 1979; Dadswell et al. 1984; Heidt and Gilbert 1978; Ziegeweid et al. 2008a, 2008b). In its July 2011 supplement, the NRC (2011c) concluded that the proposed license renewal of IP2 and IP3 is not likely to adversely affect the Hudson River population of shortnose sturgeon.

NMFS issued its biological opinion in October 2011 (NMFS 2011e). In its biological opinion, NMFS concluded that shortnose sturgeon are likely to avoid the small area of water elevated above the species' preferred temperature range and that—

it is extremely unlikely that these minor changes in behavior will preclude shortnose sturgeon from completing any essential behaviors such as resting, foraging or migrating or that the fitness of any individuals will be affected.

Based on the NRC's (2011c) previous analysis and NMFS's (2011e) biological opinion, the NRC staff concludes that the heated discharge resulting from the proposed IP2 and IP3 license renewal would have SMALL impacts on the shortnose sturgeon.

4.2 History of Section 7 Consultation for Shortnose Sturgeon

Under section 7 of the ESA, the NRC staff (2008b) initiated consultation with NMFS in a letter dated December 22, 2008, upon publication of the draft supplemental environmental impact statement (SEIS) and the staff's (NRC 2008a) original biological assessment, which found that the relicensing of IP2 and IP3 could adversely affect the shortnose sturgeon, which had been listed as endangered under the ESA in 1967. In response to that biological assessment, on February 24, 2009, NMFS (2009) requested additional information from the NRC. NMFS stated that it required this information before it could begin formal consultation. On July 1, 2009, the NRC staff obtained the relevant information from Entergy (2009). On August 10, 2009, the NRC (2009) provided that information (including revised impingement data) to NMFS and stated that the data would be addressed in the FSEIS and in a revised biological assessment. The NRC staff published its FSEIS in December 2010 and transmitted its revised biological assessment to NMFS on December 10, 2010 (NRC 2010b).

On February 16, 2011, NMFS (2011) formally responded to the NRC staff's letter of December 10, 2010, and stated that (1) NMFS currently has all the information it needs to complete a formal consultation, (2) NMFS considers formal consultation to have begun on December 16, 2010, (3) NMFS expects the consultation will conclude within 90 days after it began (i.e., by March 16, 2011) unless extended, and (4) NMFS expects to issue its biological opinion by April 30, 2011. On March 1, 2011, Entergy (2011a) formally notified the NRC staff that it will participate in the consultation process and requested a 45-day extension of the consultation conclusion date in accordance with 50 CFR 402.14(e).

In teleconferences on March 9 and March 11, 2011, NMFS and the NRC staff discussed extending the consultation to allow time for Entergy to submit additional information on the shortnose sturgeon pertinent to the consultation (NRC 2011h). NMFS formally extended the consultation period in a March 16, 2011, letter (NMFS 2011a) for a period of 60 days until June 29, 2011, in accordance with 50 CFR 402.14(e). On April 18, 2011, the NRC staff (2011a) held a Category 1 public meeting during which Entergy presented a data synthesis on the shortnose sturgeon updated with the most recent annual Hudson River monitoring reports. On April 28, 2011, Entergy (2011c) formally submitted to the NRC the information it had presented during this public meeting.

On June 16, 2011, the NRC staff learned that Entergy had submitted a final, verified triaxial thermal model to NYSDEC concerning aquatic conditions at IP2 and IP3. The staff also learned that NYSDEC had relied on that model and Entergy's associated information to reach conclusions about thermal conditions at Indian Point for inclusion in a draft SPDES permit (NYSDEC 2011). The NRC staff (2011b) brought this information to NMFS's attention in an e-mail to NMFS on June 16, 2011.

The NRC staff held three teleconferences with NMFS and Entergy during the weeks of June 20 and June 27, 2011 (NRC 2011d). On June 20, 2011, the NRC staff and NMFS discussed the NRC's statutory authority to implement terms and conditions or reasonable and prudent

measures identified in a biological opinion. On June 22, 2011, the NRC staff, NMFS, and Entergy discussed NMFS's outstanding questions on thermal impacts, impingement, and entrainment of prey species and the design of the IP2 and IP3 cooling system. The NRC staff also requested that Entergy formally submit to NRC the thermal modeling information that Entergy had given to NYSDEC. By letter dated June 29, 2011, Entergy (2011d) formally submitted to the NRC various documents related to the thermal studies it had conducted. During a teleconference on June 29, 2011, the NRC staff, NMFS, and Entergy addressed questions that had arisen during the teleconference on June 22, 2011, and the parties agreed to a revised consultation schedule in which the consultation would end by September 20, 2011, provided that Entergy and the NRC staff would supply NMFS with the information related to NMFS's outstanding questions in a timely manner. The NRC staff (2011c) supplemented its revised biological assessment on July 26, 2011, as a result of the information that Entergy submitted to the staff on June 29, 2011.

NMFS (2011b) issued a draft biological opinion on August 26, 2011. In an e-mail dated September 6, 2011, the NRC staff provided NMFS with Entergy's comments on the draft biological opinion (NRC 2011f). In a separate e-mail on the same day, the staff submitted its comments on the draft biological opinion (NRC 2011e). The NRC staff stated that its comments on the draft biological opinion were complete and that it would respond to the procedural issues raised in NMFS's cover letter to the draft biological opinion in a separate letter. On September 19, 2011, NMFS (2011c) requested more time to complete the final biological opinion. On September 20, 2011, the NRC staff (2011g) sent its letter addressing the issues NMFS had raised in the cover letter to its draft biological opinion.

NMFS (2011d, 2011e) issued its final biological opinion for shortnose sturgeon on October 14, 2011, which concluded the section 7 consultation for the IP2 and IP3 license renewal. The NMFS biological opinion is discussed below.

4.3 Summary of the National Marine Fisheries Service's Biological Opinion for Shortnose Sturgeon

NMFS's (2011d, 2011e) biological opinion includes an incidental take statement for shortnose sturgeon and stipulates a number of reasonable and prudent measures, as well as terms and conditions with which the NRC and Entergy must comply to be exempt from prohibitions of section 9 of the ESA.

Under the biological opinion, IP2 and IP3 may take up to the following numbers of shortnose sturgeon during the terms of their renewed operating llicenses, which NMFS assumed would not begin before the completion of the initial operating licenses for IP2 and IP3:

- 6 shortnose sturgeon at Unit 1,
- 104 shortnose sturgeon at Unit 2, and
- 58 shortnose sturgeon at Unit 3

NMFS included Unit 1, even though it is not in operation, because Unit 2 uses water from the Unit 1 intake as service water.

The biological opinion stipulates four reasonable and prudent measures that require Entergy to (1) implement an NMFS-approved monitoring program, (2) release all live sturgeon back to the Hudson River, (3) transfer any dead sturgeon to NMFS for necropsy, and (4) report all shortnose sturgeon impingements or sightings to NMFS. The terms and conditions provide NRC and Entergy with more specific details on how the reasonable and prudent measures must be carried out. The terms and conditions can be found on pages 64–67 of the biological

opinion. If the NRC renews the IP2 and/or IP3 licenses, compliance with the terms and conditions of the biological opinion will be required, as appropriate[1].

4.4 Reinitiation of Consultation Due to NMFS's Listing of Atlantic Sturgeon

On February 6, 2012, the NMFS listed five distinct population segments (DPSs) of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) under the ESA (77 FR 5880; 77 FR 5914). In the Hudson River near Indian Point, Atlantic sturgeon belong to the New York Bight DPS, which NMFS listed as endangered. The NRC staff had previously addressed the environmental impacts of license renewal on the Atlantic sturgeon in the final SEIS and had requested that NMFS conduct a section 7 conferrence with the staff regarding the Atlantic sturgeon, which was proposed for listing at that time. On May 16, 2012, in response to the listing, the NRC staff (2012) prepared and submitted a biological assessment to NMFS, along with a request to reinitiate section 7 consultation for the newly-listed Atlantic sturgeon. The NRC staff expects to continue consultation with NMFS in 2012 regarding Atlantic sturgeon at IP2 and IP3, and will consider the results of that consultation, as appropriate.

[1] The biological opinion states: "This [incidental take statement] ITS applies to the extended operating period, beginning at the date that the facility begins to operate under the terms of a new license and extending through the expiration date of that license." (NMFS 2011e)

5.0 REFERENCES

References that appear with an Agencywide Documents Access and Management System (ADAMS) accession number can be accessed through NRC's web-based ADAMS at the following URL: http://adams.nrc.gov/wba/.

77 FR 5880. National Oceanic and Atmospheric Administration. "Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Northeast." *Federal Register* 77(24):5880-5912. February 6, 2012.

77 FR 5914. National Oceanic and Atmospheric Administration. "Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast." *Federal Register* 77(24):5914-5982. February 6, 2012.

Endangered Species Act of 1973. 16 U.S.C. 1531, et seq.

[AKRF] AKRF, Inc. 2011a. Review of Estimates of Numbers Entrained Presented in NRC 2009 EFH Assessment and 2010 FSEIS. ADAMS Accession No. ML11286A140.

[AKRF] AKRF, Inc. 2011b. *Technical Review of FSEIS for Indian Point Nuclear Generating Unit Nos. 2 and 3; Sections 4.1.1–4.1.3 and Appendices H and I*. Prepared for Entergy Nuclear Operations, Inc. Hanover, MD: AKRF, Inc. March 28, 2011. ADAMS Accession No. ML110980163.

[CHGEC et al.] Central Hudson Gas and Electric Corporation, Consolidated Edison Company of New York, Inc., New York Power Authority, and Southern Energy New York. 1999. *Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 and 3, and Roseton Steam Electric Generating Stations.* December 1999. ADAMS Accession No. ML083400128.

Dadswell, MJ. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818 (Osteichthyes: Acipenseridae), in the Saint John River estuary, New Brunswick, Canada. Canadian Journal of Zoology 57:2186–2210.

Dadswell MJ, BD Taubert, TS Squiers, D Marchette, and J Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818. NOAA Technical Report NMFS-14. Washington, DC: National Marine Fisheries Service. October 1984. 45 pp. Available at <http://www.nmfs.noaa.gov/pr/pdfs/species/shortnosesturgeon_biological_data.pdf> (accessed January 12, 2012).

[Entergy] Entergy Nuclear Operations, Inc. 2007. Letter from F. Dacimo, Vice President of Operations License Renewal, Entergy, to NRC Document Control Desk. Subject: Supplement to License Renewal Application—Environmental Report References. December 20, 2007. ADAMS Accession Nos. ML080080199. Long River Survey: ML11279A044 and Fall Shoals Survey: ML080080291, ML080080298, ML080080306.

[Entergy] Entergy Nuclear Operations, Inc. 2009. Letter from F. Dacimo, Vice President of License Renewal, to Document Control Desk, NRC. Subject: Transmission of additional requested information regarding sturgeon impingement data. July 1, 2009. ADAMS Accession No. ML091950345.

[Entergy] Entergy Nuclear Operations, Inc. 2011a. Letter from F. Dacimo, Vice President of License Renewal, Entergy, to A. Stuyvenberg, Project Manager, NRC. Subject: Endangered

Species Act consultation for Indian Point Nuclear Generating Unit Nos. 2 and 3. March 1, 2011. ADAMS Accession No. ML110670270.

[Entergy] Entergy Nuclear Operations, Inc. 2011b. Letter from F. Dacimo, Vice President of Operations License Renewal, to B. Holian, Division Director, NRC. Subject: Comments on final supplemental environmental impact statement for Indian Point Nuclear Generating. March 29, 2011. ADAMS Accession No. ML110980073.

[Entergy] Entergy Nuclear Operations, Inc. 2011c. Letter from F. Dacimo, Vice President of License Renewal, Entergy, to A. Stuyvenberg, Project Manager, NRC. Subject: Endangered Species Act consultation for Indian Point Nuclear Generating Unit Nos. 2 and 3. April 28, 2011. ADAMS Accession No. ML11125A071.

[Entergy] Entergy Nuclear Operations, Inc. 2011d. Letter from F. Dacimo, Vice President of License Renewal, Entergy, to NRC Document Control Desk. Subject: License renewal thermal study documents for Indian Point Unit Nos. 2 and 3. June 29, 2011. ADAMS Accession No. ML11189A026.

[Goodwin Proctor] Goodwin Proctor LLP. 2011. Letter from Elise N. Zoli, Goodwin Proctor LLC to David Wrona, Chief, Projects Branch 2, Division of License Renewal, U.S. Nuclear Regulatory Commission. Subject: Indian Point License Renewal - Entergy's Comments on NMFS' Essential Fish Habitat Consultation Correspondence. September 30, 2011. ADAMS Accession No. ML11286A140.

Heidt AR, and RJ Gilbert. 1978. The shortnose sturgeon in the Altamaha River drainage, Georgia. In: RR Odum and L Landers, editors. *Proceedings of the Rare and Endangered Wildlife Symposium*. Georgia Department of Natural Resources, Game and Fish Division, Technical Bulletin WL-4. p 54–60.

Mendelsohn D, C Swanson, and D Crowley. 2011. *Part 1 of Response to the NYSDEC Staff Review of the 2010 Field Program and Modeling Analysis of the Cooling Water Discharge from the Indian Point Energy Center*. Prepared for Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC. South Kingstown, RI: Applied Science Associates, Inc. March 31, 2011. 13 p. Available at <http://www.dec.ny.gov/docs/permits_ej_operations_pdf/indnptpart1resp.pdf> (accessed January 11, 2012).

[NMFS] National Marine Fisheries Service. 2009. Letter from M. Colligan, Northeast Assistant Regional Administrator for Protected Resources, NMFS, to D. Wrona, Branch Chief, NRC. Subject: Biological assessment for license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3. February 24, 2009. ADAMS Accession No. ML090820316.

[NMFS] National Marine Fisheries Service. 2011. Letter from P. Kurkul, Northeast Regional Administrator, to D. Wrona, Branch Chief, NRC. Subject: Reply to biological assessment for license renewal of the Indian Point Nuclear Generating Unit Nos. 2 and 3. February 16, 2011. ADAMS Accession No. ML110550751.

[NMFS] National Marine Fisheries Service. 2011a. Letter from P. Kurkul, Northeast Assistant Regional Administrator for Protected Resources, NMFS, to D. Wrona, Branch Chief, NRC. Subject: Extension of consultation period—license renewal of the Indian Point Nuclear Generating Plant, Unit Nos. 2 and 3. March 16, 2011. ADAMS Accession No. ML110830578.

[NMFS] National Marine Fisheries Service. 2011b. Letter from P. Kurkul, Northeast Assistant Regional Administrator for Protected Resources, NMFS, to D. Wrona, Branch Chief, NRC. Subject: Draft biological opinion for license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3. August 26, 2011. ADAMS Accession No. ML11249A012.

[NMFS] National Marine Fisheries Service. 2011c. E-mail from J. Crocker, Fisheries Biologist, to A. Stuyvenberg, Project Manager, NRC. Subject: Schedule for biological opinion (revised proposal). September 19, 2011. ADAMS Accession No. ML11300A037.

[NMFS] National Marine Fisheries Service. 2011d. Letter from P. Kurkul, Northeast Assistant Regional Administrator for Protected Resources, NMFS, to D. Wrona, Branch Chief, NRC. Subject: Biological opinion for relicensing of Indian Point Nuclear Generating Unit Nos. 2 and 3. October 14, 2011. ADAMS Accession No. ML11290A232.

[NMFS] National Marine Fisheries Service. 2011e. *Biological Opinion for Relicensing—Indian Point Nuclear Generating Station F/NER/2009/00619*. October 14, 2011. ADAMS Accession No. ML11290A231.

[NRC] U.S. Nuclear Regulatory Commission. 2008a. *Biological assessment for License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3*. Appendix E to draft NUREG-1437, Supplement 38. 16 p. ADAMS Accession No. ML083540614.

[NRC] U.S. Nuclear Regulatory Commission. 2008b. Letter from D. Wrona, Branch Chief, NRC, to M. Colligan, Northeast Assistant Regional Administrator for Protected Resources, NMFS. Subject: Biological assessment for license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3. December 22, 2008. ADAMS Accession No. ML083450723.

[NRC] U.S. Nuclear Regulatory Commission. 2009. Email from D. Logan, Aquatic Ecologist, NRC, to J. Crocker, NMFS. Subject: Indian Point Section 7—new data from Entergy. August 10, 2009. ADAMS Accession No. ML092220524.

[NRC] U.S. Nuclear Regulatory Commission. 2010a. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 38, Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3. Washington, DC: NRC. NUREG–1437, Supp. 38. December 2010. ADAMS Accession No. ML103270072.

[NRC] U.S. Nuclear Regulatory Commission. 2010b. Letter from D. Wrona, Branch Chief, NRC, to M. Colligan, Northeast Assistant Regional Administrator for Protected Resources, NMFS. Subject: Revised biological assessment for license renewal of the Indian Point Nuclear Generating Unit Nos. 2 and 3. December 10, 2010. ADAMS Accession No. ML102990043.

[NRC] U.S. Nuclear Regulatory Commission. 2011a. Summary of public meeting held on Apr. 18, 2011, between NRC and Entergy to discuss Entergy's shortnose sturgeon and Atlantic sturgeon data at Indian Point Nuclear Generating Unit Nos. 2 and 3. April 22, 2011. ADAMS Accession No. ML111090905.

[NRC] U.S. Nuclear Regulatory Commission. 2011b. E-mail from A. Stuyvenberg, Project Manager, NRC, to J. Crocker, Fisheries Biologist, NMFS. Subject: Indian Point thermal information available on New York DEC website. June 16, 2011. ADAMS Accession No. ML11167A108.

[NRC] U.S. Nuclear Regulatory Commission. 2011c. Letter from L. Bauer, Acting Branch Chief, NRC, to M. Colligan, Northeast Assistant Regional Manager for Project Resources, NMFS. Subject: Supplement to revised biological assessment for license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3. July 26, 2011. ADAMS Accession No. ML11203A100.

[NRC] U.S. Nuclear Regulatory Commission. 2011d. Summary of telephone conference calls held on Jun. 20, 22, and 29, 2011, regarding the ongoing Endangered Species Act consultation for the proposed Indian Point Nuclear Generating Unit Nos. 2 and 3 license renewal. July 29, 2011. ADAMS Accession No. ML11201A306.

[NRC] U.S. Nuclear Regulatory Commission. 2011e. E-mail from A. Stuyvenberg, Project Manager, NRC, to J. Crocker, Fisheries Biologist, NMFS. Subject: NRC staff comments on draft BO for proposed Indian Point license renewal. September 6, 2011. ADAMS Accession No. ML11249A210.

[NRC] U.S. Nuclear Regulatory Commission. 2011f. E-mail from A. Stuyvenberg, Project Manager, NRC, to J. Crocker, Fisheries Biologist, NMFS. Subject: FW: Entergy comments on draft BO. September 6, 2011. ADAMS Accession No. ML11249A145.

[NRC] U.S. Nuclear Regulatory Commission. 2011g. Letter from D. Wrona, Branch Chief, NRC, to P. Kurkul, Northeast Assistant Regional Administrator for Protected Resources, NMFS. Subject: NMFS Letter dated August 26, 2011, regarding the Endangered Species Act, section 7 consultation for the proposed license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3. September 20, 2011. ADAMS Accession No. ML11259A018.

[NRC] U.S. Nuclear Regulatory Commission. 2011h. Summary of telephone conference calls held on Mar. 8 and Mar. 11, 2011, regarding the ongoing Endangered Species Act consultation for the proposed Indian Point Nuclear Generating Unit Nos. 2 and 3 license renewal. April 14, 2011. ADAMS Accession No. ML11089A031.

[NRC] U.S. Nuclear Regulatory Commission. 2012. Letter from J.J. Susco, Acting Chief, Environmental Review and Guidance Update Branch, Division of License Renewal to Patricia A. Kurkul, Northeast Regional Administrator, National Marine Fisheries Service. Subject: Request to Reinitiate Section 7 Consultation for the Indain Point Nuclear Genreating Unit Nos. 2 and 3 Due to Listing of Atlantic Sturgeon. May 16, 2012. ADAMS Accession No. ML12100A082.

[NYSDEC] New York Department of Environmental Conservation. 2010. Letter from W.R. Adriance, Chief Permit Administrator, NYSDEC to D. Gray, Entergy. Subject: 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> (accessed January 11, 2012).

[NYSDEC] New York Department of Environmental Conservation. 2011. Letter from M.D. Sanza, Assistant Counsel, NYSDEC to Administrative law Judges M. Villa and D.P. O'Connell, NYSDEC Office of Hearings and Mediation Services. Subject: Entergy Indian Point Nuclear Units 2 and 3 SPDES Permit Renewal/401 WQC Application Proceedings; DEC Staff's Review of Thermal Information. May 16, 2011. Available at <http://www.dec.ny.gov/docs/permits_ej_operations_pdf/indnptsanzaltr.pdf> (accessed January 4, 2012).

Swanson C, Y Kim, D Mendelsohn, D Crowley, and M Mattson. 2010. *Preliminary Analysis of Hudson River Thermal Data*. South Kingstown, RI: Applied Sciences, Inc. and Bedford, NH: Normandeau Associates, Inc. February 10, 2010. 20 p. Available at < http://www.dec.ny.gov/docs/permits_ej_operations_pdf/elecbdrexhj-k.pdf> (accessed January 11, 2012).

Swanson C, D Mendelsohn, N Cohn, D Crowley, Y Kim, L Decker, and L Miller. 2011a. *2010 Field Program and Modeling Analysis of the Cooling Water Discharge From the Indian Point Energy Center*. Prepared for Indian Point Entergy Center, Buchanan, NY. South Kingstown, RI: Applied Science Associates, Inc. January 31, 2011. 132 p. Available at: <http://www.dec.ny.gov/docs/permits_ej_operations_pdf/indnpthrmlrpt.pdf> (accessed January 11, 2012). ADAMS Accession No. ML11189A026.

Swanson C, D Crowley, Y Kim, N Cohn, and D Mendelsohn. 2011b. *Part 2 of Response to the NYSDEC Staff Review of the 2010 Field Program and Modeling Analysis of the Cooling Water Discharge from the Indian Point Energy Center*. Prepared for Entergy Nuclear Indian Point 2,

LLC and Entergy Nuclear Indian Point 3, LLC. South Kingstown, RI: Applied Science Associates, Inc. March 31, 2011. 27 p. Available at <http://www.dec.ny.gov/docs/permits_ej_operations_pdf/indnptpart2resp.pdf> (accessed January 11, 2012).

Ziegeweid JR, CA Jennings, and DL Peterson. 2008a. Thermal maxima for juvenile shortnose sturgeon acclimated to different temperatures. Environmental Biology of Fish 3:299–307.

Ziegeweid JR, CA Jennings, DL Peterson, and MC Black. 2008b. Effects of salinity, temperature, and weight on the survival of young-of-year shortnose sturgeon. Transactions of the American Fisheries Society 137:1490–1499.

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11. ABSTRACT (200 words or less)
This supplement to the final supplemental environmental impact statement (FSEIS) for the proposed license renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 incorporates new information that the U.S. Nuclear Regulatory Commission (NRC) staff has obtained since the publication of the FSEIS in December 2010.

This supplement includes corrections to impingement and entrainment data presented in the FSEIS, revised conclusions regarding thermal impacts based on newly available thermal plume studies, and an update of the status of the NRC's consultation under section 7 of the Endangered Species Act with the National Marine Fisheries Service regarding the shortnose sturgeon (Acipenser brevirostrum) and Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus).

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
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