

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
CONSOLIDATED EDISON COMPANY) Docket No. 50-247
OF NEW YORK, INC.) (Extension of Interim
(Indian Point Station,) Operation Period)
Unit No. 2))

CON EDISON'S PROPOSED FINDINGS OF FACT
AND CONCLUSIONS OF LAW
IN THE FORM OF AN INITIAL DECISION

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TABLE OF CONTENTS

	Page
I. Preliminary Statement	1
II. Evidence on the Issues in Controversy . . .	24
A. Improvement of the Data Base and Analytical Tools	24
Data Relating to Impingement and Entrainment	24
Compensation in the Striped Bass Population	31
Equilibrium Reduction Equation Method for Impact Assessment	32
Contribution of the Hudson River Striped Bass to the Atlantic Coastal Fishery	36
Power Plant Impact on Fish Species Other than Striped Bass, and on Other Aquatic Biota	39
Mathematical Modeling	41
Availability of Mitigating Measures . .	45
B. Other Benefits of the Proposed Action .	50
C. Costs of the Proposed Action	58
D. Alternatives to the Proposed Action . .	69
E. Interaction with EPA Proceeding	76
III. Conclusion	81

PRELIMINARY STATEMENT

(1) Consolidated Edison Company of New York, Inc. ("Con Edison") is the holder of Facility Operating License No. DPR-26 ("the License"), a full-term, full-power license for Indian Point Station, Unit No. 2 ("Indian Point 2"). On June 6, 1975, Con Edison filed an "Application for Facility License Amendment for Extension of Operation With Once-Through Cooling" at Indian Point 2 with the Director of Nuclear Reactor Regulation, pursuant to § 50.90 of the Regulations of the Nuclear Regulatory Commission ("NRC" or "Commission").^{1/} The application requested an amendment of Paragraph 2.E(1)(c) of the License to permit continued operation of Indian Point 2 with the installed once-through cooling system until May 1, 1981. Paragraph 2.E had been issued as a license amendment on April 14, 1974 pursuant to a decision of the Atomic Safety and Licensing Appeal Board ("the Appeal Board") on April 4, 1974.^{2/} ALAB-188 required, as a condition of the License, that

[o]peration of the Indian Point Unit No. 2 with once-through cooling system will be permitted during an interim period, the reasonable termination date for which now appears to be May 1,

^{1/} 10 C.F.R. § 50.90 (1976).

^{2/} Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), ALAB-188, 7 AEC 323 (1974).

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^{2/} Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), ALAB-188, 7 AEC 323 (1974).

1979. Such interim operation is subject to the following conditions:

(b) The finality of the May 1, 1979 date is also grounded on a schedule under which the applicant, acting with due diligence, obtains all governmental approvals required to proceed with construction of the closed-cycle cooling by December 1, 1975. In the event all such governmental approvals are obtained a month or more prior to December 1, 1975, then the May 1, 1979 date shall be advanced accordingly. In the event the applicant has acted with due diligence in seeking all such government approvals, but has not obtained such approvals by December 1, 1975, then the May 1, 1979 date shall be postponed accordingly.

(c) If the applicant believes that the empirical data collected during the interim operation justifies an extension of the interim operation period or such other relief as may be appropriate it may make timely application to the Atomic Energy Commission [now the NRC]. The filing of such application in and of itself shall not warrant an extension of the interim operation period.^{3/}

The ALAB-188 decision also imposed a condition to the License requiring Con Edison to file with the Commission "reports of its analysis of data collected during interim operation which bear on the environmental effects of once-through cooling on the aquatic biota of the Hudson River."^{4/}

(2) At the time the Appeal Board decided ALAB-188, the body of information pertaining to the effects of once-through cooling at Indian Point 2 on the Hudson River was incomplete. For example, there were necessarily no data

^{3/} 7 AEC at 407-08.

^{4/} Id. at 408.

gathered from an entire year of full-power operation at Indian Point 2. Hence the Appeal Board's and Regulatory Staff's conclusions as to potential future impacts of once-through cooling were perforce in large part based on conservative assumptions. That this problem existed was recognized.^{5/} Indeed, the Appeal Board noted that the final decision whether cooling towers must be constructed had not yet been made.^{6/} For this reason, the Appeal Board allowed that new evidence collected after that decision might "justif[y] an extension of the interim relief, or such other relief as may be appropriate."^{7/}

(3) In the period following the decision in ALAB-188, Con Edison developed an extensive data collection and analysis program to determine the effects of once-through cooling on the Hudson River aquatic biota.^{8/} Although Con Edison believed that this research program might in the future demonstrate that once-through cooling was environ-

^{5/} ALAB-188, 7 AEC at 391. See also Southern California Edison Co. (San Onofre Nuclear Generating Station, Units 2 and 3), ALAB-189, 7 AEC 410, 412 (1974): "It may well turn out that neither the extent of the impact nor the precise nature of any needed modifications in the cooling system will be ascertainable unless and until the operation of the facility has commenced."

^{6/} 7 AEC at 406, ¶ 3.

^{7/} Id. at 408.

^{8/} Tr. 128-29; Testimony of Dr. K. Perry Campbell, Dr. John P. Lawler, Dr. Kenneth L. Marcellus, Dr. Mallory S. May and Dr. James T. McFadden, ("Campbell, Lawler, Marcellus, May & McFadden") following Tr. 255, at 2-3.

mentally supportable at Indian Point 2, an insufficient data base to reach this ultimate conclusion existed in 1975.^{9/} However, due to the lead time required to bring a closed-cycle cooling system on line in time to meet the May 1, 1979 termination date for once-through cooling, Con Edison deemed it necessary to apply in June 1975 for a two-year extension of the period of interim operation.^{10/} The purpose of this extension was to enable Con Edison to present the results of its ecological study program and to enable the Regulatory Staff to review those results before irretrievable commitments to closed-cycle cooling had to be made.^{11/}

(4) The Environmental Report ("ER") submitted by Con Edison in support of the extension application on June 6, 1975 stated that the "empirical data collected" to that time justified an extension of interim once-through operation, as required by Paragraph 2.E(3) of the License.^{12/} The ER as originally filed contained or referred to substantial data and analyses dealing with the impacts of once-through cooling on the Hudson River biota, including in

^{9/} Tr. 130.

^{10/} Tr. 130-31.

^{11/} Tr. 131.

^{12/} Environmental Report to Accompany Application for Facility License Amendment for Extension of Operation with Once-Through Cooling for Indian Point Unit No. 2 (June 1975), Con Edison Ex. OT-1.

particular the striped bass.^{13/} A list of the reports and analyses utilized or referred to in the ER may be found at §§ 8.1 and 8.2 of that document.^{14/}

(5) On July 31, 1975, Con Edison submitted Supplement No. 1 to the ER, which responded to inquiries from the Regulatory Staff. This Supplement contained information bearing on the following matters raised by the Regulatory Staff:

(a) the impact of a two-year extension for Indian Point 2 upon the cooling system schedule designated for Indian Point 3; ^{15/}

(b) the interrelationship between the EPA NPDES proceedings and the extension request proceedings; ^{16/}

(c) the anticipated schedule for the filing of the "First Annual Report for the Multiplant Impact Study of the Hudson River Estuary," prepared for Con Edison by Texas Instruments, Inc. ("TI"); ^{17/}

(d) the evolution of the striped bass Life-Cycle Model, stating that the original "Completely-Mixed" version had been used in the Indian Point 2 operating license proceedings; that the "Transport Model" supplanted the Completely-Mixed Model, and comprised part of the scientific testimony before the Appeal Board in ALAB-188; that the ER for the extension request utilized a revised Transport

^{13/} See ER 2-1 to 2-2.

^{14/} In response to a request by the Board, Con Edison also submitted a list of the data and analyses filed by Con Edison since the Indian Point 2 operating license hearing which relate to the Appeal Board's conclusions in ALAB-188. See, Letter from Leonard M. Trosten to Samuel W. Jensch, Nov. 10, 1976.

^{15/} ER Supp. No. 1, 9-2 to 9-5.

^{16/} Id. at 9-6 to 9-7.

^{17/} Id. at 9-8.

Model which incorporated data from late 1973 and 1974, and refined certain dynamic concepts in that model; 18/

(e) the description of a new model still under study at that time, to be first reported in a "Report on the Development of a Real-Time Two Dimensional Model of the Hudson River Striped Bass Population"; 19/ and

(f) the desirability of granting the requested two-year extension in order to allow Con Edison the necessary time to complete its biological study program. 20/

(6) On August 8, 1975, Con Edison submitted Supplement No. 2 to the ER, which was incorporated as Appendix D, "First Annual Report for the Multiplant Impact Study of the Hudson River Estuary," dated July, 1975. This two-volume report contained new material resulting from a multiplant study begun by TI in April 1974, and provided empirical evidence relating to the condition of the striped bass and other fish populations in the Hudson during 1973 and 1974. Supplement No. 2 was especially important in presenting empirical results from the first entire year of full-power operation at Indian Point 2 and reflecting the effects of other power plants on the Hudson.^{21/} In addition,

18/ Id. at 9-9 to 9-13.

19/ Id. at 9-12.

20/ Id. at 9-13.

21/ See generally ER Supp. No. 2, Vol. 1, at II-1.

Supplement No. 2 reported empirical evidence of the existence of compensation dynamics in the Hudson River striped bass fishery.^{22/} The entire ER has been admitted into evidence.^{23/}

(7) The ER, as supplemented, contained three approaches to impact assessment:

(a) Evaluation of a two-year extension through estimation of effects on the striped bass population in relation to reproductive capacity of the adult stock. This technique did not assume compensation as a variable in the model and comprised a "worst case" approach.^{24/}

(b) Utilization of the striped bass Life-Cycle Model, which estimated cropping of the first-year class of striped bass and the impact of such cropping upon the adult population. This model did assume compensation as an operative factor.^{25/}

(c) Survey of actual impacts occurring at Indian Point 2 and other Hudson River power stations in 1973 and 1974, as estimated in Supplement No. 2. Although evidence of compensation was apparent from the new data, it was not incorporated into the analysis in the Multi-Plant Report.^{26/}

The ER concluded that the impact resulting during the requested extension of the interim operation period would not cause irreversible or irreparable damage to the striped bass

^{22/} Id. at II-14 to II-16.

^{23/} Con Edison Ex. OT-1; Tr. 215. All Exhibits are listed below ¶ 25.

^{24/} ER § 2.1.3.1.2.

^{25/} ER § 2.1.3.1.3 and App. A.

^{26/} ER Supp. No. 2, Vol. 1, § II-D.

population in the Hudson River.^{27/}

(8) On October 3, 1975, notice of the filing of the extension application appeared in the Federal Register.^{28/} Con Edison filed a timely request for a hearing on the extension application on October 14, 1975. Soon thereafter, the New York Atomic Energy Council and the Hudson River Fishermen's Association ("HRFA") petitioned for leave to intervene in the extension proceeding. An Atomic Safety and Licensing Board ("the Board") was established for the proceeding November 5, 1975^{29/} and on November 25, 1975, the Board granted leave to intervene to the above two parties. A Notice of Hearing was published in the Federal Register on February 6, 1976.^{30/}

(9) During the last quarter of 1975, Con Edison submitted additional ecological information to the Commission, in the form of written study reports and computer data tapes and cards.^{31/} Of particular importance was the November 19, 1975 submittal entitled "Report of Lawler, Matusky & Skelly on Development of a Real-Time, Two Dimensional Model of the Hudson River Striped Bass Population,"

^{27/} ER § 2.1 See also pp. 58-9, infra.

^{28/} Fed. Reg. 45,874 (1975).

^{29/} 40 Fed. Reg. 52,669 (1975).

^{30/} 41 Fed. Reg. 5,459 (1976).

^{31/} See generally Tr. 1506.

dated October 1975, mentioned in Supplement No. 1 to the ER.^{32/} This report represented a sophisticated advance in Hudson River impact analysis through modeling in that tidal classifications were considered on a three-hour average rather than weekly average, thus providing greater realism in the movement of life stages.

(10) In July 1976, the Regulatory Staff issued a "Draft Environmental Statement for Facility License Amendment for Extension of Operation with Once-Through Cooling for Indian Point Unit No. 2," NUREG-0080 ("DES"). In that document the Regulatory Staff stated that

[o]n the basis of the evaluation and analysis set forth in this Statement and after weighing the environmental, economic, technical, and other benefits against costs and risks and considering available alternatives, the staff concludes that the action called for under the National Environmental Policy Act of 1969 (NEPA) and the former Appendix D to 10 C.F.R. 50, is issuance of an amendment to the Facility Operating License No. DPR-26 authorizing the extension of the period for once-through cooling to May 1, 1981.^{33/}

(11) Specifically, the DES found as a major benefit of the delay the postponement of construction commencement during the period needed to conduct further studies on the type of closed-cycle system to be constructed,

^{32/} Con. Edison Ex. OT-1.

^{33/} DES at ii.

in that "the applicant's research program may provide additional relevant results."^{34/} The Regulatory Staff estimated that "the first year of the proposed extension will allow the staff and other governmental agencies and interested parties to finish ongoing studies aimed at providing a more complete and sound scientific basis for a reasoned decision than was available at the end of 1974."^{35/} On the "costs" side, the Regulatory Staff declared that the impact on the Hudson River striped bass fishery was "the major unavoidable adverse impact of the proposed delay",^{36/} but that "[t]he Staff has assessed this loss as not likely to lead to irreversible changes over the long term. The Applicant has assigned a value of \$283,000 to the loss; the Staff has not assigned a value to it but considers it to be small."^{37/}

(12) Following issuance and circulation of the DES pursuant to the requirements of the National Environmental Policy Act of 1969 ("NEPA"),^{38/} comments were submitted by a number of agencies and organizations, including Region II of the Environmental Protection Agency ("EPA"), the United States Department of Commerce, the Federal Power Commission,

^{34/} Id. at § 4.1.2.

^{35/} Id. at §§ 3.2.5.1 and 4.1.2.

^{36/} Id. at i, § 6.1.

^{37/} Id. at i, § 6.4.2.

^{38/} 42 U.S.C. §§ 4321 et seq. (Supp. V, 1975).

the Energy Research and Development Administration, numerous state and local entities, and several environmental organizations. The proposed two-year extension was supported by the New York State Public Service Commission, the Westchester County Board of Legislators, the Mayor and Planning Commission of Peekskill, New York, the Town of Cortlandt, New York, and the Village of Buchanan, New York.^{39/}

(13) In the meantime, during the summer and early fall of 1976, Con Edison provided additional ecological information to the Staff, including responses to the Regulatory Staff's questions on Supplement No. 2 to the ER, and revisions to the 1974 river sampling data collected by TI.

(14) On October 4, 1976, Con Edison moved for a prehearing conference in this proceeding. The conference was convened on October 27, 1976.^{40/}

(15) On October 13, 1976, the Village of Buchanan, in which the Indian Point 2 facility is situated, petitioned for leave to intervene in this extension proceeding. The Board granted the Village's petition on November 5, 1976.

(16) An FES was issued in mid-November, 1976. The Regulatory Staff's position in the FES differed from that in

^{39/} See generally Final Environmental Statement for Facility License Amendment for Extension of Operation with Once-Through Cooling - Indian Point Unit No. 2, NUREG-0130 (Nov. 1976) ("FES").

^{40/} 41 Fed. Reg. 49,898 (1976).

the DES in that it concluded that a one-year, rather than a two-year extension of operation with once-through cooling was warranted, and hence recommended a termination date of May 1, 1980 for the interim operation period allowed by the License.^{41/} A major factor in the Regulatory Staff's change in position related to Con Edison's argument that a two-year extension would allow completion of ecological studies which, in Con Edison's belief, might well demonstrate that closed-cycle cooling should not be required at Indian Point 2.^{42/} The Regulatory Staff rejected this possibility,^{43/} and asserted that a one-year extension would be adequate to "preserve the choice of closed cooling system and to obtain the improvement in biological evaluation."^{44/} Apparently key to this aspect of the Staff's analysis was the belief that "[t]he one year extension would provide an opportunity for the review and evaluation of all available information."^{45/} Addressing the costs associated with the loss of striped bass and other fish species at the plant, the Staff

^{41/} In view of the extension granted under the "all necessary governmental approvals" clause of the License, see p. 13 infra., this Staff position amounted to a recommendation for denial of Con Edison's request for an extension to May 1, 1981. Significantly, Indian Point 2 did not operate during the 1976 striped bass spawning season. Testimony of Dr. Henri M. Gueron, following Tr.

^{42/} ER § 1.1.

^{43/} FES § 4.1.2.

^{44/} Id. § 4.1.5.

^{45/} Id. § 6.4.1.

stated that it found "these losses to be small."^{46/}

(17) On November 18, 1976 the Attorney General of the State of New York ("the Attorney General") petitioned for leave to intervene. The Board granted this petition on December 3, 1976.

(18) On November 30, 1976, the Board in a companion proceeding issued a partial initial decision designating a natural draft wet cooling tower as the preferred system of closed-cycle cooling for Indian Point 2, and determined that all necessary governmental approvals for construction of such a tower had been received by December 1, 1976.^{47/} This order was supplemented on December 27, 1976, when the Board ruled that the new termination date for operation with once-through cooling, under the automatic extension provision of Paragraph 2.E(1)(b) of the License was May 1, 1980.^{48/} These decisions are now before the Appeal Board on exceptions filed by Con Edison.

(19) On January 12, 1977, Amendment No. 27 to the License was issued in conformance with the Licensing Board's orders.^{49/} Hence, the issue before the Board in the instant

^{46/} Id. § 4.2.

^{47/} Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), LBP-76-43, 4 NRC 598 (1976).

^{48/} Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), LBP-76-46, 4 NRC 659 (1976).

^{49/} 42 Fed. Reg. 4225 (1977).

extension request proceeding has become whether a one-year extension, to May 1, 1981, is warranted.^{50/}

(20) The parties to this proceeding were as follows:

Con Edison
Regulatory Staff
HRFA
New York State Energy Office ("State Energy
Office") (successor to New York State Atomic
Energy Council)
Attorney General
Village of Buchanan

(21) The fundamental factual questions in this proceeding are as follows:

- (a) What is the environmental impact of the proposed action?
- (b) Has Con Edison's Ecological Study Program developed a more reliable data base or new analytical tools that were not available at the time of the Indian Point 2 operating license hearings?
- (c) Is there a substantial possibility that after evaluation of the results of Con Edison's Ecological Study Program the Commission might conclude, on the basis of a benefit-cost analysis, that closed-cycle cooling should not be required for Indian Point 2?

In view of the presentations of the parties, the resolution of the second and third of these issues depends upon the following principal sub-issues:

^{50/} In the event the Appeal Board or higher authority rules that an automatic extension to a date later than May 1, 1980 has occurred, the effect of the proposed action in this case would be correspondingly reduced, although the May 1, 1981 date would continue to be the requested extension date.

- (a) Whether Con Edison has presented significant empirical data and new analytical tools which aid in the estimate of plant impact on striped bass populations;^{51/}
- (b) Whether Con Edison has presented significant empirical data and new analytical tools on contribution of the Hudson River striped bass population to the Atlantic Coastal fishery;^{52/}
- (c) Whether Con Edison has submitted significant empirical data and new analyses on impingement of striped bass;^{53/}
- (d) Whether Con Edison has submitted significant empirical data and new analyses on plant impacts on fish species other than striped bass;^{54/} and
- (e) Whether Con Edison has submitted significant new information data on stocking and other mitigation measures.^{55/}

The foregoing can all be summarized in the ultimate question whether the benefits (quantified and unquantified) of the proposed action exceed its costs (quantified and unquantified).^{56/}

^{51/} See pp. 24-49 infra.

^{52/} See pp. 36-39 infra.

^{53/} See pp. 24-31 infra.

^{54/} See pp. 39-40 infra.

^{55/} See pp. 45-48 infra.

^{56/} See pp. 50-68 infra.

(22) Evidentiary hearings before the Board on the extension request ran a total of seven days, in two separate sessions: December 7, 8, 9 and 10, 1976, and February 23, 24 and 25, 1977. All parties to the proceeding participated to some degree in the hearings, although the Attorney General and the Village of Buchanan were not present at the February hearings, and neither HRFA nor the State Energy Office participated in the last day of the evidentiary sessions.

(23) Limited appearances were made by:

- (a) State Senator Bernard G. Gordon, Thirty-Seventh Senatorial District, State of New York;
- (b) Elmer Maloney, Clerk, Westchester County Board of Legislators, on behalf of Edward M. Gibbs, Westchester County Legislator, First District;
- (c) Andrew Rofay, Director of Intergovernmental Relations for the Westchester County Executive; and
- (d) Nash Castro, General Manager, Palisades Interstate Park Commission.

All four persons making limited appearances gave statements in favor of Con Edison's extension request.^{57/}

57/ Tr. 115, 105, 111, 1059.

(24) Fifteen witnesses were called to testify. Con Edison presented 12 witnesses and the Regulatory Staff presented three witnesses. These witnesses, listed with the days on which each testified, were as follows:

Con Edison Witnesses

Dr. K. Perry Campbell	Dec. 7 & 8; Feb. 24 & 25
Salvatore A. Dambra	Feb. 25
Dr. Thomas L. Englert	Feb. 24 & 25
Dr. Henri M. Gueron	Feb. 24 & 25
John R. Jannarone	Dec. 7
Dr. John P. Lawler	Dec. 7, 8, 9 & 10
Dr. James T. McFadden	Dec. 7, 8 & 9; Feb. 24
Dr. Kenneth L. Marcellus	Dec. 7, 8 & 9; Feb. 25
Dr. Mallory S. May, III	Dec. 7 & 8; Feb. 24
Carl L. Newman	Dec. 7
Dr. Joseph M. O'Connor	Dec. 9; Feb. 24
John J. Szeligowski	Dec. 7; Feb. 24 & 25

Regulatory Staff Witnesses

Dr. Robert P. Geckler	Dec. 9 & 10; Feb. 24
Dr. Robert L. Spore	Feb. 23 & 24
Dr. Webster Van Winkle	Dec. 9 & 10; Feb. 23 & 24

(25) The documentary evidence in the record at the close of the hearings consisted of the following:

Staff Exhibits

- OT-1 Final Environmental Statement for Facility License Amendment for Extension of Application With Once-through Cooling, Indian Point Unit No. 2 (NUREG-0130), November 1976
- OT-2 W. Van Winkle, S. W. Christensen, and G. Kauffman, Critique and Sensitivity Analysis of the Compensation Function Used in the LMS Hudson River Striped Bass Models

Con Edison Exhibits

- OT-1 Environmental Report to Accompany Application for Facility License Amendment for Extension of Operation with Once-through Cooling for Indian Point Unit No. 2 (as supplemented)
- OT-2 Texas Instruments, Inc., Report on Relative Contribution of Hudson River Bass to the Atlantic Coastal Fishery, December 1976
- OT-4 Texas Instruments, Inc., Predation by Bluefish in the Lower Hudson River, February 1976
- OT-5 Texas Instruments, Inc., Hudson River Ecological Study in the area of Indian Point -- Thermal Effects Report, September 1976
- OT-6 Texas Instruments, Inc., Fisheries Survey of the Hudson River -- March-December 1973, Vol. IV, Revised Edition, June 1976
- OT-7 Texas Instruments, Inc., Hudson River Ecological Study in the area of Indian Point, 1974 Annual Report
- OT-8 Texas Instruments, Inc., Final Report of the Synoptic Subpopulation Analysis Phase 1: Report on the Feasibility of Using Innate Tags to Identify Striped Bass (Morone saxatilis) From Various Spawning Rivers, September 1975
- OT-9 Texas Instruments, Inc., Semiannual Progress Report for Hudson River Ecological Study in the Area of Indian Point 1 January - 30 June 1974, April 1975

- OT-10 Texas Instruments, Inc., Feasibility of
Culturing and Stocking Hudson River Striped
Bass, 1974 Annual Report, November 1975
- OT-11 Texas Instruments, Inc., Indian Point Impinge-
ment Study Report for the Period 1 January
1974 through 31 December 1974, November 1975
- OT-12 New York University Medical Center, Institute
of Environmental Medicine, Hudson River
Ecosystems Studies -- Effects of Temperature
and Chlorine on Entrained Hudson River
Organisms, Progress Report for 1975
- OT-13 New York University Medical Center, Institute
of Environmental Medicine, Hudson River
Ecosystem Studies, Effects of Entrainment by
the Indian Point Power Plant on Biota in the
Hudson River Estuary -- Addenda to the 1973
Report
- OT-14 New York University Medical Center, Institute
of Environmental Medicine, Mortality of
Striped Bass Eggs and Larvae in Nets, A
Special Report to Consolidated Edison Company
of New York, July 1976
- OT-15 New York University Medical Center, Institute
of Environmental Medicine, Hudson River
Ecosystem Studies Effects of Entrainment by
the Indian Point Power Plant on Biota in the
Hudson River Estuary -- Progress Report for
1973
- OT-16 New York University Medical Center, Institute
of Environmental Medicine, Hudson River
Ecosystem Studies -- Effects of Entrain-
ment by the Indian Point Power Plant on
Biota in the Hudson River Estuary -- Progress
Report for 1974
- OT-17 "Unit 1, River Water Discharge, May 1974
to Data Sheet, September, 1976, Indian Point
Station; River Water Discharges by Circula-
tion, Unit No. 3, Annual and Semiannual
Operating Reports for Indian Points, May
1974-Spring 1976"
- OT-18 Letter from EPA Region II to Carl L. Newman,
February 24, 1975

OT-19 Letter from EPA Region II to Carl L. Newman,
May 8, 1975

(26) In addition, the Board, over Con Edison's objection^{58/} took official notice of large portions of the operating license stage FES for Indian Point 3.^{59/} However, this FES, which was never subject to cross-examination due to the stipulated settlement of the Indian Point 3 proceedings,^{60/} was not given official notice for the truth or probative value of the material contained therein, but merely to show the Regulatory Staff's position as to the once-through cooling system issues as of the time that FES was published in February 1975.^{61/}

(27) Con Edison requested that the Board take official notice of two letters written by EPA Region II to Mr. Carl L. Newman, a Vice President of Con Edison.^{62/} The first, marked as Con Edison Exhibit OT-18 for Identification, was dated February 24, 1975, and informed Mr. Newman of EPA's determination to issue a National Pollutant Discharge Elimination System ("NPDES") permit for Indian Point 2. The second, marked as Con Edison's Exhibit OT-19 for Identification, was dated May 8, 1975, and transmitted a

^{58/} Tr. 1095.

^{59/} Tr. 1104; Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, NUREG-75/002 (Feb. 1975) ("Indian Point 3 FES").

^{60/} See Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 3), ALAB-287, 2 NRC 379 (1975), vacated in part, stipulation approved, CLI-75-14, 2 NRC 835 (1975).

^{61/} Tr. 1104.

^{62/} Tr. 937, 1597.

copy of the notice of hearing granted to Con Edison to review the NPDES determination. The first letter included a discharge permit under § 402 of the Federal Water Pollution Control Act,^{63/} calling for closed-cycle cooling at Indian Point 2 by May 1, 1979, subject to extensions for good cause shown until as late as July 1, 1981. A memorandum attached to the EPA letter noted that "[c]ompliance [with the closed-cycle cooling requirement] will be required by May 1, 1979, as required by AEC [the former Atomic Energy Commission]." The second letter stated that "the effectiveness of these contested conditions is stayed pending final EPA action pursuant to 40 CFR 125.36." The Board takes official notice of these two letters, and notes that their authenticity as official documents has been shown by the proffer of sworn testimony of the Con Edison employee who is custodian of the originals.^{64/}

(28) The purpose of the present proceeding is to determine whether an extension of the interim operation period to May 1, 1981 is supported by a balancing of the benefits and the costs. As stated by Con Edison, the objective was to obtain time for submission and review of the results of Con Edison's Final Research Report on its Ecological Study Program before work must proceed to meet the deadline

^{63/} 33 U.S.C. § 1342 (Supp. V, 1975).

^{64/} Tr. 1600-01.

for terminating operation of the installed once-through cooling system. At the time the evidentiary hearing convened in December 1976, that report, due in early 1977, had not been issued. As a result, at the Board's request considerable attention was paid in the December hearings to what that report would contain by way of new information not previously available to the Commission.^{65/} On February 18, 1977, Con Edison filed and served that report, entitled "Influence of Indian Point Unit 2 and Other Steam Electric Generating Plants on the Hudson River Estuary, with Emphasis on Striped Bass and Other Fish Populations"^{66/} in accordance with Paragraph 2.E(4) of the License.^{67/} Copies were provided to the Board,^{68/} but this report has not been entered into evidence, in keeping with the limited purpose of the proceeding. The Board notes, however, as indicated in this Initial Decision, that the Final Research Report's contents appear to conform with the descriptions provided during the course of the hearing. To this extent, the Board has been kept advised of related developments occurring during the

^{65/} Tr. 414-18, 468-70, 685-88, 785-91, 802-03, 896, 925-26. The purpose of this inquiry was not to establish the validity vel non of the results of the Ecological Study Program, but rather to determine whether significant information was now available that might lead ultimately to a decision that once-through cooling is proper at Indian Point 2.

^{66/} Hereinafter cited as "Final Research Report."

^{67/} See also Duke Power Co. (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-143, 6 AEC 623, 625-26 (1973); Georgia Power Co. (Alvin W. Vogtle Nuclear Plant, Units 1 and 2), ALAB-291, 2 NRC 404, 411 (1975).

^{68/} Tr. 1061.

course of the proceeding. In addition, the Board notes that on March 15, 1977 Con Edison filed a further application seeking elimination of the condition of the License requiring termination of operation with once-through cooling.^{69/} That application also sought ancillary relief in the nature of an extension of the interim operation period until there has been a final agency decision (and judicial review, if any) with respect to the principal relief just described. Such an extension would, under the application, also reflect the time needed for procurement and construction of a natural draft wet cooling tower system.^{70/}

^{69/} Application to Vacate License Condition, Dkt. No. 50-247 (Mar. 15, 1977); Letter from William J. Cahill, Jr., to Benard C. Rusche, Mar. 15, 1977.

^{70/} Letter from William J. Cahill, Jr., to Benard C. Rusche, Mar. 15, 1977, at 3.

II

EVIDENCE ON THE ISSUES IN CONTROVERSY

A. Improvement of the Data Base and Analytical Tools

(1) The application stated that the purpose of the requested extension is to permit consideration by the Commission of the improved data base available with respect to the impact of operation on the Hudson River fishery. The record shows that the data and analytical tools now available to the Commission are substantially improved over that which existed in 1973 when the original decision was made to require termination of operation with once-through cooling. The data and analysis are also substantially improved over what was available at the beginning of 1975 when the Staff published its Final Environmental Statement in the Indian Point 3 operating license case. These various improvements may be summarized as follows:

(2) Data Relating to Impingement and Entrainment.

At the time of the 1973 hearing operating data were not available for Indian Point 2 because the plant had not yet run. Nor were operationing data available with respect to impacts from the Bowline Point or Roseton Stations. The available data at that time were inadequate to predict or show:

- (a) the duration of the planktonic life stages and hence duration of passive movement by river hydraulics;

- (b) distribution laterally, longitudinally, and vertically throughout the river of the planktonic stages;
- (c) entrainment mortality;
- (d) the fraction of annual striped bass production susceptible to Indian Points 1 and 2 and the other Hudson River power stations, and the percentage reduction in that production due to operation;
- (e) the reduction in contribution of Hudson River-spawned striped bass to the Mid-Atlantic fishery due to Hudson River power station operations. 719

In the ensuing years, such data have become available.

(3) One of the most important areas of new data concerns the entrainment mortality of striped bass. Entrainment mortality was assumed to be 100% by the Regulatory Staff and HRFA in the Indian Point 2 proceedings (i.e., $f_c = 1.0$). Con Edison has submitted many reports not available at the 1973 hearings that shed important new light on this issue by refining the techniques of sampling and analysis of entrained organisms which indicate that entrainment survival is substantially greater than previously estimated. Among these reports are the following:

- (a) New York University, 1974, Effects of Entrainment by the Indian Point Power Plant on Biota in the Hudson River Estuary. Progress Report for 1973 to the Consolidated Edison Co. of New York, pp. 226-251.

71 Campbell, Lawler, Marcellus, May & McFadden at 5-6.

- (b) New York University, 1976, Effect of En-trainment by the Indian Point Power Plant on Biota in the Hudson River Estuary. Progress Report for 1974 to the Consolidated Edison Co. of New York, pp. 261-281.
- (c) New York University, 1976, Mortality of Striped Bass Eggs and Larvae in Nets -A Special Report to Consolidated Edison Company of New York.
- (d) Lawler, Matusky & Skelly Engineers, 1974, 1973 Hudson River Aquatic Ecology Studies - Bowline Point and Lovett Generating Stations. Vol. III, ch. IV., pp. III-7 through III-16. Prepared for Orange and Rockland Utilities, Inc.
- (e) Lawler, Matusky & Skelly Engineers, 1975, 1974 Hudson River Aquatic Ecology Studies at Bowline and Lovett Generating Stations, Vol. III, ch. IX, pp. IX-15 through IV-17. Prepared for Orange and Rockland Utilities, Inc.
- (f) Lawler, Matusky & Skelly Engineers, 1974, 1973 Hudson River Aquatic Ecology Studies at Roseton and Danskammer Point, Vol. II, ch. V., pp. V-36 through V-39. Prepared for Central Hudson Gas & Electric Corp.

(4) At the hearings the Regulatory Staff's witness testified that the 1973 and 1974 data now available are better than those which were available during the original Indian Point 2 hearing,^{72/} and that data on the cropping factor was also improved over that existing at the time of the Indian Point 3 FES.^{73/} In addition, he indicated that,

72/ Tr. 756.

73/ Tr. 1328.

from what he had learned during the December 1976 hearing, the 1975 studies report may contain even more important information.^{74/}

(5) Two major sampling approaches for measuring entrainment were employed, one utilizing nets at the intake and discharge points,^{75/} and the other using larval table techniques.^{76/} The most complete and accurate figures on the f_c factor (which relates to entrainment survival) are those from 1975, but all the data show that with the possible exception of striped bass yolk-sac larvae, the f_c factor is less--generally far less--than the 1.0 figure that was postulated by the Staff and HRFA in the 1973 hearings. Although latent mortality is not included in the f_c factor calculation, this phenomenon was studied by the New York University Medical Center Institute of Environmental Medicine ("NYU") and Ecological Analysts, Inc. ("EAI").^{77/} EAI studies revealed significant survival after 96 hours, indicating that plant-induced mortality is not 100%. Results of the NYU and EAI 1975 studies are reported in the Final Research Report. Statistical and graphical analyses of the results of the 96-hour tests show clearly that calculation of

^{74/} Tr. 760.

^{75/} See items (a)-(d) and (f), in ¶ 3 supra.

^{76/} See item (e) in ¶ 3, supra. However, larval table data from his report were not calculated in f_c .

^{77/} Testimony of Dr. Joseph M. O'Connor ("O'Connor"), following Tr. 1363, at 1.

f_c using only initial mortalities is valid.^{78/} In addition, Con Edison presented testimony utilizing 72-hour tests which may be more meaningful for study of entrainment of early life stages.^{79/} This testimony showed the validity of using 72-hour latent mortality data in the determinations of the f_c factor for the Life Cycle Model.^{80/}

(6) The Regulatory Staff has concurred that an independent reassessment by it is essential with respect to the question of entrainment mortality^{81/} including corrections for differential net-induced mortality and larval-table data.^{82/} The Staff's principal biological consultant, Dr. Webster Van Winkle, testified that he had already commenced this reassessment in the six-month period preceding the hearing session in February 1977.^{83/}

(7) Dr. Van Winkle also cited the use of new values for f factors as another area requiring reassessment in light of Con Edison's new data.^{84/}

^{78/} Campbell, Lawler, Marcellus, May & McFadden at 32.

^{79/} Id.

^{80/} O'Connor at 2.

^{81/} Supplemental Testimony of NRC Staff in Response to Board Comments on Aquatic Impact Analysis, Dr. Webster Van Winkle ("Van Winkle") following Tr. 1069, at 4-5; Testimony of NRC Staff on the Relative Benefits and Costs Associated with applicant's Request for Extension of Operation with Once-Through Cooling at Indian Point Unit No. 2, Dr. Robert Spore and Dr. Webster Van Winkle ("Spore & Van Winkle"), following Tr. 1076, at 15; Tr. 1273-74; 1328.

^{82/} Tr. 1277.

^{83/} Tr. 1274. The evolution of these f factors is described in the ER, App. A, at 14-26.

(a) f₁ Factor - The Appeal Board's 1974 decision supported Con Edison in its estimate of the f₁ factor as less than 1.^{85/} Newly obtained data contained in the following reports confirm this conclusion:

- (1) New York University Medical Center, Institute of Environmental Medicine Effects on Entrainment by the Indian Point Power Plant on Biota in the Hudson River Estuary - Progress Report for 1973 to the Consolidated Edison Company of New York, September 1974.
- (2) New York University Medical Center, Institute of Environmental Medicine A Preliminary Analysis of the Abundance of Four Life History Stage of Striped Bass (Morone saxatilis) Collected in the Intakes of Indian Point Unit 1 and in the Hudson River in front of Indian Point. (August 1974)
- (3) New York University Medical Center, Institute of Environmental Medicine, An Analysis of the Abundance of Four Life History Stages of Striped Bass (Morone saxatilis) Collected in the Intakes and Discharge Canal of Indian Point 1 and in the Hudson River at Indian Point.
- (4) Lawler, Matusky and Skelly, 1973 Hudson River Aquatic Ecology Studies - Bowline Point and Lovett Generating Stations, December 1974.
- (5) Lawler, Matusky and Skelly, Central Hudson Gas & Electric Corporation - 1973 Hudson River Aquatic Ecology Studies at Roseton and Danskammer Point - October 1974 (Revised April 1975).

All calculations in Appendix A to the ER contain data obtained since the 1973 hearing and confirm the Appeal Board's finding that the f₁ factor is considerably

85/ 7 AEC at 384.

less than 1. The Appeal Board also supported a combined f factor value of "considerably less than 1."^{86/} Newly obtained data in relation to the following factors confirm this conclusion:

(b) f_2 Factor. The Appeal Board stated^{87/} that the applicant concluded that f_2 could only be considered as less than 1.0 for Juvenile I fish. The 1973 data permitted calculation of f_2 factors for other life stages, and these are presented in Tables 13, 15, 16 and 17 of Appendix A to the ER. The data were summarized and the collection methods used were described in the reports listed above for f_1 .

(c) f_c Factor. The Appeal Board also stated^{88/} that the applicant concluded that f_c could only be considered as less than 1.0 for Juvenile I fish. The tables referred to above show the calculations for f_c for different life stages as substantially less than 1 based on data collected at Indian Point during 1973. These data are reported in the first report referred to above for f_1 , in particular Table 7-4.

(d) Other f Factors. Appendix A to the ER indicates that other factors, designated f_1 and f_w , have been added to

^{86/} Id. at 385.

^{87/} 7 AEC at 383.

^{88/} Id.

take account of day/night differences indicated by the data. These are described on page 20 of Appendix A. Con Edison considered the new data on f_3 to be insufficient to indicate a difference from the values presented in the Indian Point 2 proceeding.

(8) Compensation in the Striped Bass Population.

An open item of crucial significance in the 1973 hearing was the ability of the Hudson River striped bass to compensate for any reduction in population due to power plant operation or other impacts. The Appeal Board held that "compensation during the entire life-cycle of the striped bass can be expected to be a factor in off-setting losses incurred by" operation of Indian Point 2.^{89/} Empirical evidence of compensation in the Hudson River striped bass population was, however, lacking in 1974.^{90/} Since that time, two independent analyses have been conducted. Empirical data indicating the operation of compensatory mechanisms have been obtained with respect to density-dependent growth,^{91/} predation^{92/} and cannibalism,^{93/} and stock recruitment.^{94/} Density-dependent growth data were obtained from beach seine

^{89/} 7 AEC at 387.

^{90/} Campbell, Lawler, Marcellus, May & McFadden at 46; Tr. 270.

^{91/} Campbell, Lawler, Marcellus, May & McFadden at 47-48.

^{92/} Con Edison Ex. OT-4.

^{93/} Tr. 438-39.

^{94/} Campbell, Lawler, Marcellus, May & McFadden at 47; ER Supp. No. 2, at II-27.

catch/area work performed in July-August 1967-70 and July-August 1972-74. The empirical evidence which has been developed has been used to calibrate the Real-Time Life Cycle Model so that the level of compensation employed is consistent with that determined from the stock recruitment data and the equilibrium reduction equation method. Using this approach, a compensation level of approximately 0.5 value is obtained.^{95/} This figure falls generally in the mid-range level of compensation for those fish stocks for which data has been developed.^{96/} Stock-recruitment estimates were prepared based on the best data available--those drawn from commercial fishery catch-effort records. Those statistics show a close approximation of a Ricker stock-recruitment curve, and thus permit a quantification of the compensatory reserve in the striped bass population.^{97/}

(9) Equilibrium Reduction Equation Method for Impact Assessment. At the hearings Con Edison presented testimony concerning the Equilibrium Reduction Equation Method for assessing plant impact on the striped bass

^{95/} Tr. 272.

^{96/} Id.

^{97/} Campbell, Lawler, Marcellus, May & McFadden at 47.

population. This methodology utilizes the same empirical data as that employed for the life-cycle simulation model, and represents an important new complement to life-cycle simulation. It provides an estimate of the percentage reduction in equilibrium spawning stock size, and includes a recognition of the effects of compensation based on the Ricker stock-recruitment relationship.^{98/} The Regulatory Staff has concluded that this method is one of the subject areas in which an independent assessment is essential in connection with reevaluation of the requirement of a closed-cycle cooling system for Indian Point 2.^{99/} Moreover, this area is one that the at has not previously analyzed, and hence an initial assessment, rather than a reassessment is involved.^{100/}

(10) In light of the fact that the Equilibrium Reduction Equation Method is an analytical tool not considered in the 1973 hearing, and its assessment is one which the Staff deems "essential" to any reconsideration of the ultimate question of cooling systems at Indian Point 2, the Board concludes that the subject is one that should be explored at any future hearing on that ultimate question.

^{98/} Campbell, Lawler, Marcellus, May & McFadden at 20.

^{99/} Van Winkle at 5; Spore & Van Winkle at 16.

^{100/} Tr. 1273.

(11) The Regulatory Staff originally denied the existence of compensation in the Hudson River striped bass population. Since that time it has come to recognize that compensation does exist,^{101/} but its critique of the use made by Con Edison of compensation in modeling^{102/} suggests that the effect of this phenomenon is still an area of controversy between these parties. The Regulatory Staff's biological witness testified that the data regarding compensation were an improvement over the data available for the 1973 hearings and the Indian Point 3 FES.^{103/} He further testified that an independent reassessment of the question is essential to any reconsideration of the cooling system question.^{104/} The Staff has performed a preliminary assessment, and has asked for and received from Con Edison further information beyond that incorporated in the multiplant report filed as Supplement No. 2 to the ER in this case.^{105/}

(12) In addition, Con Edison indicated that the Final Research Report would contain detailed information on other compensatory mechanisms, including cannibalism

^{101/} FES § 3.2.2.3.

^{102/} W. Van Winkle *et al.*, Critique and Sensitivity Analysis of the Compensation Function Used in the LMS Hudson River Striped Bass Models, Staff Ex. OT-2.

^{103/} Tr. 1328.

^{104/} Van Winkle at 4-5; Spore & Van Winkle at 15-16; Tr. 1275.

^{105/} Tr. 1274-75; Spore & Van Winkle at 15-16.

and predation by other species, that have been investigated since the 1973 hearings.^{106/} These subjects area addressed in the Final Research Report.

(13) The Board finds that Con Edison has presented significant new data on the operation of compensatory mechanisms in the Hudson River striped bass population. In view of the significance of this factor in the impact assessment models, these data might lead to a different decision on the necessity for closed-cycle cooling at Indian Point.

(14) Based upon data obtained since the 1973 hearings, Con Edison indicated that the entrainment and impingement impact on striped bass due to plant operation is very low. Considering Indian Point 2 alone, Con Edison estimates the long-term impact due to sustained operation at 1974 and 1975 plant flow condition as follows:

	<u>1974</u>	<u>1975</u>
Entrainment	0.52%	0.54%
Impingement	0.24%	0.43%
Total	0.74%	0.97% ^{107/}

^{106/} Campbell, Lawler, Marcellus, May & McFadden at 48.

^{107/} Id. at 22.

Such levels of impact are extremely small, and have no practical ecological or economic significance. If the Bowline Point and Roseton power plants are also considered in the impact assessment along with Indian Point 2, the corresponding entrainment and impingement impact estimates are also very small:

	<u>1974</u>	<u>1975</u>
Entrainment	0.76%	1.13%
Impingement	1.34%	0.71%
Total	2.10%	1.84% ^{108/}

(15) Although the Regulatory Staff takes the position that these new data will not alter its views on the necessity for closed-cycle cooling,^{109/} the record does not contain any explanation of the basis for this position. Furthermore, we note it is inconsistent with the testimony of Staff witness Van Winkle that new data might change his analysis.^{110/} We find that Con Edison has submitted new data on the impact of plant operations on entrainment of striped bass which might lead to a different decision on the necessity for closed-cycle cooling at Indian Point.

(16) Contribution of the Hudson River Striped Bass to the Atlantic Coastal fishery. Considerable emphasis was placed in the 1973 hearing on the question of the extent of the contribution of the Hudson River to the Atlantic Coastal striped bass fishery. At that time the Chesapeake Bay and

^{108/} Id. at 23.

^{109/} FES § 4.1.2.

^{110/} Tr. 914, 916; see generally Tr. 916-29.

Hudson River were viewed as the primary contributors to the coastal fishery.^{111/} The Appeal Board in ALAB-188 rejected the Staff's claim that the Hudson River was a major source of the Mid-Atlantic striped bass fishery.^{112/} In the ensuing years since ALAB-188, Con Edison developed and conducted a major study effort to identify with greater precision the rivers of origin of coastal striped bass.^{113/} This program involved identification of "innate tags", i.e., tags based on the principle that fish of a particular geographical origin develop distinctive meristic, morphometric and/or biochemical characters which can serve to identify the fish's origin. The study was conducted in two phases. Phase I demonstrated that fish from the Hudson River and the Chesapeake Bay system could be correctly classified as to origin with approximately 80% certainty. Phase I, employing four characters of fish enzymes, provided an additional 3% correct classification.^{114/} In Phase II identification of innate tags was repeated on fish in spawning condition from the Hudson River, the Chesapeake Bay system and the Roanoke River. Five morphometric and meristic characters provided

^{111/} Campbell, Lawler, Marcellus, May & McFadden at 52-53.

^{112/} 7 AEC at 365.

^{113/} Campbell, Lawler, Marcellus, May & McFadden at 55-56.

^{114/} See Texas Instruments, Inc. 1975 Final Report of the Synoptic Subpopulation on Analyses, Phase I: Report on the Feasibility of using Innate Tags to Identify Striped Bass (Morone saxatilis) from Various Spawning Rivers, Con Edison Ex. OT-8; Campbell, Lawler, Marcellus, May & McFadden at 56-67.

maximum correct classification (approximately 75%; enzyme characters were not employed in Phase II classification). The classification procedure developed from discriminant analysis was then applied to striped bass caught in the Atlantic Ocean from Maine to North Carolina.

The first application of the discriminant functions to the oceanic striped bass resulted in the following overall estimates, referred to as "as classified" estimates, of contribution to the Atlantic coastal fishery:^{115/}

	<u>Percentage</u>
Hudson	23
Chesapeake	66
Roanoke	11

Since it was believed, based on the literature, that these estimates contained biases, further statistical analyses were performed in order to reduce these biases.^{116/} This process produced two additional estimates referred to as "iterative" and "adjusted."^{117/} These procedures resulted in the following estimates of contribution:^{118/}

	<u>Percentage</u>	
	<u>Iterative</u>	<u>Adjusted</u>
Hudson	6	7
Chesapeake	91	90
Roanoke	3	3

^{115/} Testimony of Dr. James T. McFadden, Dr. Mallory S. May and Dr. K. Perry Campbell, following Tr. 1464, at Table 1.

^{116/} Id. at 6-7.

^{117/} Id. at 8-11.

^{118/} Id. at Table 1.

(17) Based upon its review of Con Edison's reports and testimony, the Staff has indicated that relative contribution of the Hudson River striped bass to the Atlantic coastal fishery represents another area where Staff re-assessment is "essential"^{119/} and has stated that data in this area is improved over that which existed at the time of ALAB-188, as well as at the time of the filing of the Indian Point 3 FES.^{120/} The Staff has already framed questions to Con Edison in this regard.^{121/} Of particular interest to the Staff is the use of the adjusted and iterative estimates by Con Edison to attain a high level of accuracy in its figures.^{122/} According to Dr. Van Winkle, those estimates "certainly do require reconsideration on this [contribution] issue."^{123/}

(18) The Board finds that Con Edison has presented significant new data on the contribution of the Hudson River striped bass population to the Atlantic coastal fishery. In view of the significance of this subject, these data might lead to a different decision on the necessity for closed-cycle cooling at Indian Point.

(19) Power Plant Impact on Fish Species Other than Striped Bass, and on Other Aquatic Biota. The Board concluded in 1973 that the data then available did not permit

^{119/} Van Winkle at 4-5; Spore & Van Winkle at 15; Tr. 1274.

^{120/} Tr. 1328-29.

^{121/} Tr. 1274.

^{122/} Tr. 1553.

^{123/} Id.

firm conclusions about the impact of oncethrough cooling on fish species other than striped bass.^{124/} In response to this, Con Edison developed and conducted a reasearch program to determine the spatio-temporal distribution and abundance of these species and their vulnerability to power plant impacts. Spawning grounds, type of eggs, larval behavior, movement to shoal areas, and overwintering areas are important elements in assessing susceptibility to power plant impacts.

(20) Con Edison's expert witnesses testified that data concerning impacts on other species had been supplied periodically to the Staff, and that quantified estimates of impact on white perch, Atlantic tomcod and American shad, as well as summary information with respect to other species would be presented in the Final Research Report.^{125/} That Report does in fact present information on these matters. The Staff's biological witness concurred that the impact on Hudson River white perch and tomcod populations was another area where Staff independent reassessment is "essential."^{126/}

^{124/} Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), LBP-73-33, 6 AEC 751, 771 (1973); Campbell, Lawler, Marcellus, May & McFadden at 67.

^{125/} Campbell, Lawler, Marcellus, May & McFadden at 68.

^{126/} Spore & Van Winkle at 16.

(21) Mathematical modeling. Con Edison's efforts since the 1973 hearing have included further development and refinement of the mathematical models that were then employed. At the 1972 and 1973 hearings, a Completely-Mixed Model and the Transport Model were used. The latter was viewed by the Appeal Board in ALAB-188 as "more nearly conforming to reality and superior to other models presented."^{127/} In the June 1975 ER the Transport Model was used again, but with input parameters calculated on the basis of 1973 data not available during the 1973 hearings.^{128/} In addition, a new transport avoidance factor was incorporated into the model equations in order to take into account the fact that the early life stages of striped bass which are found very close to the bottom of the estuary are less subject to horizontal transport than are those later life stages found primarily in the upper strata. The number of segments of the longitudinal direction was also increased from eight to twelve to more accurately model the distribution and abundance of life stages. This model was used to predict the effects on the striped bass population of an extension of the termination of interim operation from May 1, 1979 to May 1, 1981.^{129/} The f factors were refined for

^{127/} 7 AEC at 383.

^{128/} ER § 2.1.3.1.3.

^{129/} Id.

this calculation, and the model estimates presented in the ER therefore are more strongly based on data and much less on assumption than were the results presented in the 1972 and 1973 hearings.

(22) Con Edison's consultant, Lawler, Matusky & Skelly Engineers ("LMS"), also developed, since the 1973 hearings, a third model called the Real-Time Two-Dimensional Model, using a real-time simulation of the tidal action of the Hudson River and its effect on the temporal and spatial distribution of striped bass eggs and larvae. The use of two vertical layers of distribution allows direct simulation of the diurnal movement of larvae between upper and lower strata of the river and the interaction of this migratory phenomenon with the inter-tidal hydrodynamics in these layers. The longitudinal dimension consists of twenty-nine segments, rather than the twelve used in the revised transport model. The new model also more accurately simulates the reduced rate of transport of eggs in the bottom layer of the river, and used hydrodynamic information at three-hour intervals in its analysis, a method preferred by the Appeal Board in ALAB-188¹³⁰ to the Regulatory Staff's "continuous belt" concept. In this model, the mortality rate of adult

¹³⁰ 7 AEC at 383.

fish is expressed as the sum of natural mortality rate and a non-linear fishing stress similar to that included in the Staff's model. These features respond to contentions raised during the Indian Point 2 operating license hearings. Simulation of the biological and behavioral characteristics of the striped bass life stages is improved by separate modeling, of the yolk-sack and post-yolk sac stages thus permitting different mortality, distribution and migration parameters to be specified for each stage. The first results of the Real-Time Model were reported in a "Report on the Development of Real-Time, Two Dimensional Model of the Hudson River Striped Bass Population," submitted to the Commission in November of 1975.

(23) The predictions of plant impact using the Transport Model are substantiated by the results obtained using the Real-Time Model. The Final Research Report^{131/} includes results based upon the Real-Time Model, and uses empirical data collected in 1974 and 1975.^{132/} These data include, as model inputs, the spatial and temporal distribution of striped bass eggs, the f factors associated with each stage, actual plant full-power operation data, and

^{131/} Campbell, Lawler, Marcellus, May & McFadden at 25.

^{132/} Id.

Hudson River hydraulics information. The Final Research Report also includes a calibration of the compensation function in the model to reflect quantitative estimates of the compensatory reserve in the Hudson River striped bass population, based on commercial fishery data and classical, accepted fishery management methodologies. Commercial fishery catch data provided by State and Federal agencies, while subject to some skewing due to factors such as systematic under-reporting of catch, or the weather, are nevertheless the best source available, and are of a quality comparable to the data customarily used in fishery management decision-making.^{133/} The Regulatory Staff has recognized the importance of the compensation function "because the handling of compensation appears to account for the major part of the difference among estimates of percent reduction in the striped bass population."^{134/}

(24) At the hearing the Regulatory Staff introduced a "Critique and Sensitivity Analysis of the Compensation Function Used in the LMS Hudson River Striped Bass Models" for the limited purpose of showing that the Staff disagrees with certain features of the LMS models. This report, which was not offered for its truth but only to show that opinions differed on the matter.^{135/}

^{133/} Tr. 1387-85.

^{134/} Staff Ex. OT-2, at iv.

^{135/} Tr. 1090-94.

(25) Availability of Mitigating Measures. Con Edison offered testimony at the hearing concerning various measures that could be adopted in order to mitigate the effect on river species of plant operation with once-through cooling. These measures included rearing and stocking of striped bass, the use of louvers and angled screens in the cooling water intakes, the employment of air curtains, and the use of submerged weir and continuously operating traveling screens.^{136/} The latter two concepts are the subject of a testing program the results of which will be provide in early 1978.^{137/}

(26) In ALAB-188, the Appeal Board referred to stocking as a potentially viable mitigating measure or alternative to closed-cycle cooling.^{138/} The concept of hatchery rearing and stocking striped bass has been the subject of extensive study by Con Edison since the 1973 hearing, and data obtained have been submitted in the following: Texas Instruments, Inc., Feasibility of Culturing and Stocking Hudson River Striped Bass 1973 Annual Report, July 1974; Texas Instruments, Inc., Feasibility of Culturing and Stocking Hudson River Striped Bass 1974 Annual Report,

^{136/} Campbell, Lawler, Marcellus, May & McFadden at 75-83.

^{137/} Id. at 83.

^{138/} 7 AEC at 402.

November 1975; Texas Instruments, Inc., Second Semi-Annual Report Related to the Feasibility Study for Spawning, Hatching, and Stocking Striped Bass in the Hudson River, November 1974. Substantial numbers of striped bass reared artificially have been stocked. Thus, in 1973, 28,764 fingerlings were stocked from only 89 adults. In 1974 the corresponding figures were 101,524 fingerlings from only 71 adults, and the following year 35 adults led to 188,387 fingerlings.

(27) Tagging studies since 1973 have sought to determine the relative survival rates of wild and hatchery-reared fish from the same stock. Relative survival estimates for 1973, 1974 and 1975 showed little difference in the survival of hatchery-reared and wild fish in the weeks following stocking.^{139/} These data show that although hatchery-reared fish may survive somewhat better than wild fish through the first months after release, any difference in survival rate is small.^{140/} Moreover, a substantial number of hatchery-reared striped bass survive adjustment to the critical winter months, thus indicating the likelihood of long-term survival.^{141/} The uncontroverted evidence in the record shows

^{139/} Id. at 79.

^{140/} Id.

^{141/} Campbell, Lawler, Marcellus, May & McFadden at 80.

that stocking of hatchery-reared striped bass is feasible; that such fish survive as well as, if not better than, wild fish; and that based on the levels of plant impact that have been identified, the hatchery programs could probably produce striped bass fingerlings sufficient to offset power plant impacts.^{142/} If deemed necessary upon a balancing of benefits and costs, a stocking program could be instituted during the period of interim operation with once-through cooling, i.e., prior to May 1, 1981, to offset any impacts.^{143/}

(28) Other mitigation research since the 1973 hearings included a flume study to test the effectiveness of louvers or angled screens in guiding striped bass, white perch and tomcod to a bypass to reduce impingement mortality. These studies showed that such measures could be highly effective for this purpose.^{144/} A report on this research was filed with the Commission.^{145/} Air bubble curtains, however, were not found to be effective as a means of reducing fish impingement.^{146/}

(29) The Board finds, on the basis of new information not available to it in 1973, that hatchery rearing and stocking of striped bass and the use of angled screens or louvers are feasible measures for the mitigation of

^{142/} Id. at 75-76.

^{143/} Id. at 80.

^{144/} Id. at 81-82.

^{145/} See Stone and Webster Engineering Corp., Final Report - Indian Point Flume Study, Consolidated Edison Company of New York, Inc., July 1976, noted in Campbell, Lawler, Marcellus, May & McFadden at 87.

^{146/} Id. at 92-83.

effects of operation of Indian Point 2 with a once-through cooling system. Hence the Board concludes that such measures should be given consideration as possible alternatives to installation of a closed-cycle cooling system if the benefits to be achieved by their use will exceed the cost of their implementation.

(30) The Staff has testified that the data and methodology base have been sufficiently increased and improved since the Indian Point 2 operating license hearing to require either independent reassessment, or in some cases, evaluation for the first time,^{147/} of such new material in order to determine whether closed-cycle cooling ought now to be required at Indian Point 2. Under the guidelines set out in ALAB-188,^{148/} this is the precise situation meriting an extension of the termination date under Paragraph 2.E.(1)(c). Indeed, the Staff recognized this policy in the FES,^{149/} stating that an extension was justified to "review and evaluate all available data", a process which at that time was deemed to be manageable in one year. The Staff's estimate of this evaluation time, however, has since changed dramatically.^{150/} Therefore, to the extent that such evaluation and reassessment

^{147/} Tr. 756-760, 896, 914, 1309, 1328-29, 1274-75, 1297, 1553; Van Winkle at 4-5; Spore & Van Winkle at 15-17.

^{148/} 7 AEC at 368, 376.

^{149/} FES § 6.4.1.

^{150/} Tr. 1153-59, 1167-68.

will require additional time, the Board finds that an extension pro tanto ought to be granted, especially in light of the fact that the interim ecological impacts to the Hudson River biota will be insignificant.^{151/}

^{151/} FES §§3.2.6, 6.3, 6.4.2; Spore & Van Winkle at 26; Tr. 1232-33.

B. Other Benefits of the Proposed Action

(1) As prepared by the Regulatory Staff, the FES did not include a benefit-cost analysis. The FES had only a very brief conclusory section labelled "benefit-cost balance".^{152/} Under cross-examination by Con Edison, the Regulatory Staff's Environmental Project Manager, Dr. Robert P. Geckler, testified that there was no benefit-cost analysis "per se".^{153/} Accordingly, the Board on December 10, 1976 directed the Regulatory Staff to prepare such an analysis for submission at a reconvened hearing to be held at the earliest practicable time.^{154/}

(2) In response to this directive of the Board, in February 1977 the Regulatory Staff presented benefit-cost testimony by Dr. Robert Spore and Dr. Webster Van Winkle. Con Edison testimony was presented by Dr. Henri M. Gueron, Mr. John J. Szeligowski and Dr. Thomas L. Englert, P.E.^{155/} None of the other parties submitted testimony on this subject.

(3) The Regulatory Staff found that the benefits of an extension to May 1, 1981 would be \$10,620,700^{156/} and that the costs would be \$11,053,500.^{157/} Although this

^{152/} FES § 6.4.

^{153/} Tr. 737.

^{154/} Tr. 869-70.

^{155/} Testimony of Dr. Henri M. Gueron, Mr. John J. Szeligowski and Dr. Thomas L. Englert, P.E., ("Gueron, Szeligowski & Englert"), following Tr. 1468.

^{156/} Spore & Van Winkle at 28.

^{157/} Id. at 29.

produced a benefit-cost ratio slightly against the requested amendment,^{158/} the Regulatory Staff witnesses testified that a precise calculation of a ratio was not a proper interpretation of their analysis, which was properly interpreted as showing a ratio "in the neighborhood of 1".^{159/}

(4) Con Edison's witnesses testified that the proposed extension would yield benefits of \$6,797,000 and costs of \$112,000.^{160/} This produced a 60:1 benefit-cost ratio in favor of the proposed extension to May 1, 1981.^{161/}

(5) The Regulatory Staff and Con Edison took basically the same approach to computing benefits. Con Edison, but not the Staff, considered the possibility of success in Con Edison's request to delete from the License the requirement to terminate operation of the once-through cooling system to be a benefit. Con Edison did not, however, include it in the calculated ratio noted above.^{162/} The approach to computing benefits was to calculate the difference between incremental generating costs for cooling tower system construction programs with outages for tie-in of the cooling tower systems beginning May 1, 1980 and May 1, 1981,

^{158/} Tr. 1140-41.

^{159/} Tr. 1153.

^{160/} Gueron, Szeligowski & Englert at 12.

^{161/} Id. at 12.

^{162/} See pp. 55-56 infra.

respectively.^{163/} Both parties used the present value of total incremental generating cost.

(6) The Regulatory Staff and Con Edison used different methods to calculate total generating costs, resulting in different total numbers. The estimate of the present value of total costs presented by Drs. Spore and Van Winkle was \$187,778,600 for the 1980 schedule and \$177,157,900 for the 1981 schedule.^{164/} Con Edison's panel testimony showed a present value of total incremental generating costs of \$325,355,000 for the 1980 schedule and \$318,558,000 for the 1981 schedule.^{165/}

(7) Since this proceeding is concerned solely with the cost differential between the two years, it is unnecessary to review the differences in methodology which produced the different total sums. It is sufficient for purposes of this proceeding to find that, subject to the discussion below, the quantified benefits of the proposed action are between \$6,797,000 and \$10,620,700.

(8) Con Edison takes the position that, in addition to the benefit discussed above, the principal benefit of the requested extension is to provide time for review of the results of Con Edison's Ecological Study Program for

^{163/} Spore & Van Winkle Table 7; Gueron, Szeligowski & Englert Tables 2-4.

^{164/} Spore & Van Winkle Table 7.

^{165/} Gueron, Szeligowski & Englert Tables 2-3.

Indian Point 2.^{166/} This provides the possibility of saving as much as \$325,355,000, the sum Con Edison states as the present worth of the cost of a cooling tower system on the 1980 schedule,^{167/} in the event the Commission should ultimately decide, on the basis of that review, that closed-cycle cooling is unnecessary at Indian Point 2. The Regulatory Staff's witness acknowledged that such a result is a possibility.^{168/} Other evidence indicates that even a very low probability (1%) of this saving justifies the requested license amendment.^{169/}

(9) The Regulatory Staff took the position that there was no measurable benefit in this regard,^{170/} but its support for this conclusion varied throughout the proceeding. The Regulatory Staff initially took the position that additional data provided by the completion of Con Edison's research program would not be expected to change the Staff's position on the ultimate cooling system question.^{171/} The Staff, however, also stated that a possibility existed that the present requirement of a closed-cycle cooling system

^{166/} ER § 1.2.

^{167/} Gueron, Szeligowski & Englert at 12.

^{168/} Tr. 1190; 1234; see also FES § 7.2.1, pt. 1 (3)(2).

^{169/} ER § 4.14.

^{170/} Spore & Van Winkle at 18.

^{171/} FES at 4-1; but see pp. 54-55 infra.

could be reversed. The significance of this possibility was negated on the ground that closed-cycle cooling is mandated by Commission order.^{172/} This latter view is an erroneous statement of the Commission's order because the License's requirement for termination of operation with the once-through cooling system has always been subject to the condition that Con Edison could obtain relief from this provision on the basis of data from operations.^{173/} It is therefore inconsistent and improper to base a denial of an application based on empirical data from once-through operation on the existence of a Commission order which specifically permits this type of application.

(10) The Board is unable to understand how the Regulatory Staff could make the statement that additional data would not change its position before it had seen the data.^{174/} Furthermore, this statement was substantially undermined by testimony of the Regulatory Staff's own witness, Dr. Van Winkle. On December 10, 1976, Dr. Van Winkle testified that he was revising his striped bass model, which was the

^{172/} Id. at 7-2.

^{173/} 7 AEC at 408; License ¶ 2.E(1)(c); cf. Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 3), CLI-75-14, 2 NRC 835, 839 (1975).

^{174/} FES §§ 4.1.2, 7.2.1.

basis for the Staff's evaluation of environmental impacts.^{175/}
He stated that he had seen enough new data that he would
have to reassess his whole "family" of impact curves.^{176/} He
also said that because of the new data there was a possibility
he might change his estimate of entrainment mortality,^{177/}
that the f_I factor is likely to be less than 1,^{178/} that f_I
might be different for different plants rather than the
uniform number previously used,^{179/} and that his new model
would include a range of values for compensation.^{180/} And
finally, Dr. Van Winkle testified on February 24, 1977 that
new data on the contribution of the Hudson River striped
bass population to the Atlantic coastal fishery required
reconsideration of his position.^{181/} The record therefore
does not support the Staff contention that additional data
could not change its position on environmental impacts.

(11) In its benefit-cost testimony the Regulatory
Staff offered an alternative basis for its position that
there is no value to the possibility that the cooling tower

^{175/} Tr. 928-29.

^{176/} Tr. 910.

^{177/} Tr. 914.

^{178/} Tr. 917.

^{179/} Tr. 919.

^{180/} Tr. 926.

^{181/} Tr. 1553.

requirement might be deleted from the License. The Staff testified that this possibility had no value because it was not possible to complete its review of Con Edison's environmental studies and hearings thereon prior to the time commitments are made to the closed-cycle system.^{182/} The Staff was not able to explain the basis for this time constraint, but accepted it as a premise.^{183/} This position ignores the fact that an economic benefit is achieved whenever a decision is finally made not to require a cooling tower.^{184/} Even if substantial construction costs have already been incurred, the avoidance of the balance of the construction and operating costs could constitute a substantial economic benefit.^{185/} Furthermore, even if the tower were fully constructed prior to such a determination, there would still be a substantial cost saving from the avoidance of subsequent annual costs. The Regulatory Staff shows these for the 1980 case as including \$186,300 for maintenance,^{186/} \$15,829,500 for lost capability from derating,^{187/} and \$44,789,400 for replacement energy.^{188/} Thus even if a decision that termination of operation with the once-through cooling system was not

^{182/} Spore & Van Winkle at 17-18.

^{183/} Tr. 1539-41.

^{184/} See pp. 52-53 infra.

^{185/} Id.; Tr. 1677-79.

^{186/} Spore & Van Winkle at 6.

^{187/} Id. at 7.

^{188/} Id. at 9.

required were made after a cooling tower had been built but before it had commenced operation, there would still be an economic benefit according to the Staff's own testimony of \$60,805,200.

(12) Furthermore, the Board notes that Con Edison is not required by the License to commence construction on any particular date. In order to avoid the initial construction expenditures, it might defer commencement of the construction program pending review of the Ecological Study

(15) The Regulatory Staff and Con Edison agree that a non-quantified benefit of the proposed extension would be a deferral of non-water quality environmental impacts. The Staff noted its agreement with Con Edison that construction and operation of the cooling tower could result in damage to esthetically valuable trees and possible deterioration of scenic views. It concluded that deferral of these impacts would be a minor benefit of the proposed action.^{189/} Con Edison viewed the savings from deferral of these impacts as a more significant matter.^{190/} We note that the people of the Village of Buchanan and surrounding communities consider these impacts to be extremely serious.^{191/} In view of this strong feeling expressed by the officials of the communities that would be directly affected by a cooling tower, we must find that deferral of the non-water quality environmental impacts is a significant benefit.

^{189/} FES § 4.1.4.

^{190/} ER § 4.1.3.

^{191/} FES at A-36 to A-42, A-45 to A-48; Tr. 105, 111, 119.

C. Costs of the Proposed Action

(1) Both the Regulatory Staff^{192/} and Con Edison^{193/} testified that the biological costs of the proposed extension are insignificant and this conclusion has not been contradicted by any party to this proceeding.

(2) The Regulatory Staff stated that the long-term impact on the Hudson River ecosystem due to a two-year extension of operation with once-through cooling would not be expected to be large and has essentially no risk of being irreversible.^{194/} The Staff also concluded that the long-term impact on the striped bass population due to the requested extension would be negligible.^{195/} The Staff based this conclusion on Figure 3-1, page 3-3 of the FES, which indicates the output of the Staff's Striped Bass Life-Cycle Model with a relative yield by year to the striped bass fishery for a cooling tower in operation in 1979 and in 1981. The difference in biological impact is indicated by a shaded area on Figure 3-1, which the Staff concluded represented a negligible impact. The Staff adhered to this view of the biological impact throughout the proceedings.^{196/}

^{192/} Spore & Van Winkle at 26; Tr. 1232-33.

^{193/} Campbell, Lawler, Marcellus, May & McFadden at 3; Gueron, Szeligowski & Englert at 12.

^{194/} FES § 3.2.6.

^{195/} FES § 3.2.2.1.

^{196/} Tr. 1230.

(3) Con Edison showed environmental impacts utilizing output of the LMS Life-Cycle Model. This showed maximum impacts on striped bass from multi-plant operation of the Hudson River power plants due to a two-year extension in the range of a 0.64% reduction in adult population occurring after six years.^{197/} For a one-year extension, Con Edison showed a maximum impact in reduction of total adult population of 0.51% after six years.^{198/} These impacts are obviously negligible.

(4) The Staff testimony presented a novel approach to quantifying the costs of the extension request.^{199/} The Staff commenced its analysis with the proposition that the Commission has required a cooling tower at Indian Point 2 and therefore the value to be attached to the probability of irreversible damage to the striped bass population resulting from full-term operation of the plant with once-through cooling was at least as high as the cost of constructing and operating a cooling tower.^{200/} The cost of the cooling tower was taken by the Staff to be the sum present value of incremental generating costs for a cooling tower installed in 1980, and was \$187,778,600.^{201/} The Staff next

^{197/} ER Table 2-17.

^{198/} Gueron, Szeligowski & Englert Table 1.

^{199/} Spore & Van Winkle at 22-24.

^{200/} Id. at 22.

^{201/} Id. at 24, Table 7.

calculated the relative probabilities of incurring an irreversible loss as a result of the two-year extension and as a result of long-term operation by utilizing Figure 3-1 of the FES, which was reproduced as Figure 1 in the Staff's February 1977 benefit-cost testimony. The Regulatory Staff valued the costs of the extension by determining the ratio of the areas between the curves X and Z and X and Y, with those areas adjusted to account for discounting of future effects, and then multiplying the cost of the cooling towers by that ratio.^{202/} The result was a calculation of \$22,107,000 as the cost of the two-year extension, which the Regulatory Staff divided in half to obtain a cost for the one-year extension of \$11,053,500.^{203/}

(5) The Board finds that the initial premise of the Regulatory Staff's analysis is incorrect. Although the Staff infers that the Commission must have valued the potential for damage to the fishery at a cost equal to the cost of a cooling tower, it failed to point to any statement by the Commission or any of its licensing boards indicating that such a calculation was contemplated when the prior provisional decision was made. We note that Amendment No. 6 to the License, which prescribed the

^{202/} Tr. 1223.

^{203/} Spore & Van Winkle at 24, 29; Tr. 1234.

relevant condition, did provide that termination of operation with the once-through cooling system must occur on a stated date, but four conditions were attached to that requirement. In particular, condition (c) permitted Con Edison to apply for an extension of the period of operation with the once-through cooling system "or such other relief as may be appropriate." A reading of the decision which imposed this condition^{204/} makes it clear that the continuation of the research program and the possibility of showing that a closed-cycle system was not required was contemplated.^{205/} This possibility is also reflected in the Appeal Board's Indian Point 3 decision, which points out that only a preponderance of the evidence showing is required for a change in the provisional decision^{206/} and in the Commission's later decision in the same case.^{207/} Accordingly, the view that an irrevocable decision had been made to require a cooling tower without any consideration of the Commission's specific provision for reopening that question is erroneous.

(6) Clearly the decision on which the Staff relied contemplated several possible outcomes. For example,

^{204/} ALAB-188, supra note 2. It is significant that the Staff's economic witness was not aware of this condition. Tr. 1189.

^{205/} Id. at 375-76.

^{206/} ALAB-287, 2 NRC at 387 & n.18; see also ALAB-188, 7 AEC at 357-8, n.143.

^{207/} CLI-75-14, 2 NRC at 839 & n.8.

ALAB-188 and the license amendment based on it leave open the possibility of extensions of interim operation due to empirical data from operations, or due to failure to receive necessary governmental approvals. Other possibilities include deletion of the entire cooling condition or the substitution of various mitigating measures. If one is to infer a value from the earlier decision, that value must reflect the various possible outcomes contemplated by the license condition. The Staff has oversimplified this by making the unsupportable assumption that the decisionmakers had contemplated only one possible outcome, the probability of which was unity.

(7) Furthermore, the Regulatory Staff's attempt to compute a probability factor for increased risk of irreversible damage to the striped bass is not supported by the record. The Staff has taken areas between the two curves, where these curves both fall below the 0.5 value, to compute a probability which it calls ΔP_{LI}^{208} . The Staff concedes that this is not a real probability because its value can exceed 1 and avoids this problem by calling it a "proxy measure" of the probability.²⁰⁹ However, the Staff offered no explanation as to why the difference between

²⁰⁸/ Spore & Van Winkle at 22.

²⁰⁹/ Tr. 1217. It is axiomatic that a probability cannot exceed a value of 1. See id.

these two curves would constitute even a "proxy" probability. The Staff could point to no empirical studies which correlated the probability of irreversible damage with the risk measures utilized by its witnesses.^{210/} Furthermore, the Staff testified that the whole approach to defining this index of irreversible damage is not something that to the best of its knowledge has been done before in fisheries work,^{211/} and that the efficacy of this index as a measure of the probability of irreversible damage has not been validated by field data.—/

(8) The record also indicates that the Regulatory Staff's calculation is extremely sensitive to the figures used for environmental impacts and to the placement of the line which indicates risk of irreversible impact, which is at a level of 0.5 in Figure 1 of the Staff's benefit-cost testimony. The Staff declined to state that Figure 1 represented its best estimate of environmental impacts, but stated that this represented a "severe" case.^{212/} Alternative curves which showed lesser impacts would obviously lead to lower costs according to the Staff's calculation methodology. Furthermore, the Staff indicated that environmental impacts indicated by Figure V-13a in the Indian Point 3 FES^{213/} are

^{210/} Tr. 1231.

^{211/} Tr. 1256.

^{212/} Tr. 1257.

^{213/} Tr. 1260.

^{214/} Indian Point 3 FES at V-161.

also reasonable.^{215/} Those impacts are clearly less than the ones indicated in Figure 1 in the Staff benefit-cost testimony. The difference is primarily that in Figure V-13a, one factor, f_i , is set at 0.5 instead of 1.0.^{216/} Staff witness Van Winkle testified that it is likely that f_i is less than 1.^{217/} If f_i is less than 1 and no other changes are made to the models, the environmental impacts indicated by the Staff's analysis would be less.^{218/}

(9) The Staff stated that it considered 0.50 relative yield as a limit of the index of the risk of irreversible effects on the striped bass population.^{219/} The Staff testified that this was an arbitrarily selected cut-off point,^{220/} and that if the index of risk had been drawn at the 0.4 level instead of 0.5, environmental costs would have been calculated as zero.^{221/}

(10) The Staff characterized its analysis as illustrating "that a situation does exist where the costs

^{215/} Tr. 1247.

^{216/} Tr. 1250.

^{217/} Tr. 917.

^{218/} Tr. 1254.

^{219/} FES at 3-2; Spore & Van Winkle at 25.

^{220/} Tr. 908.

^{221/} Tr. 1259.

of the proposed delay exceed the benefits."^{222/} The Staff agreed that a situation also exists where costs do not exceed benefits.^{223/}

(11) The Staff refused to say that its analysis was the one nearest reality but indicated that the curve selected was above the average of the family of curves it had used to estimate environmental impacts.^{224/}

(12) The Staff testimony contains an inconsistency in the statement that the biological impacts of the extension request are negligible and the finding that the economic costs are \$22,107,000 for a two-year extension^{225/} and \$11,053,500 for a one-year extension.^{226/} The Staff attempted to explain this inconsistency by stating that it was the difference "between biological terms versus economic terms."^{227/} This is an attempted rationalization which does not adequately explain the inconsistency. Since the biological conclusion is unchallenged in the record, we accept that as correct. The inconsistency of this conclusion with the cost estimate

^{222/} Spore & Van Winkle at 27.

^{223/} Tr. 1260.

^{224/} Id.

^{225/} Spore & Van Winkle at 24.

^{226/} Id. at 29.

^{227/} Tr. 1233.

reflects the weakness of the Staff's approach to estimating costs.

(13) In view of the questionable methodology employed by the Regulatory Staff in its computation of costs, the great sensitivity of the analysis to the environmental parameters selected, the refusal of the Staff to indicate the basis for the parameters selected for its analysis other than to say that the curve selected was above the average, in severity, of a family of impact curves, and finally the Staff's own equivocation that its analysis merely illustrated "that a situation does exist where the costs of the proposed delay exceeds the benefits,"²²⁸ the Board finds that the Staff's calculation of the costs of an extension to May 1, 1981 is not supported by the record of this proceeding.

(14) Con Edison computed the monetized costs of the extension principally in terms of the value associated with the reduction in the mid-Atlantic striped bass sport fishery. It used consumer surplus per day to calculate the value of recreational benefits foregone by reason of the proposed action. This value represents the difference between the price that a consumer actually pays for a day of recreation and the price he is willing to pay rather than do without the recreation.²²⁹

²²⁸/ Spore & Van Winkle at 27. see also Tr. 1130, 1141-42, 1152, 1319.

²²⁹/ ER § 4.2.1 & App. C; Gueron, Szeligowski & Englert at 2.

(15) Con Edison obtained the value per fishing day from the guidelines of the Water Resources Council,^{230/} which suggested a value of \$3.00 to \$9.00 for specialized recreation day.^{231/} Con Edison used for its computation a value of \$10.00 per day.^{232/}

(16) The impacts on commercial fishing^{233/} and other species^{234/} were considered. Con Edison noted the lack of a significant commercial fishery in the Hudson River, the lack of impacts on shad, and the lack of any evidence of damage caused by interim operation to other species. It concluded that an extension to May 1, 1981 would result in no measurable economic impact on other species of fish.^{235/}

(17) Con Edison concluded that the cost of a two-year extension was approximately \$283,200 (sum present worth in 1975) and approximately \$112,000 for the one-year extension (sum present worth in 1975) to May 1, 1981.^{236/}

^{230/} Principles and Standards for Planning Water and Related Land Resources, 38 Fed. Reg. 24,778 (1973), at 52.

^{231/} ER at 4-31.

^{232/} Gueron, Szeligowski & Englert at 2; ER App. C at 30-32.

^{233/} Tr. 1595-96.

^{234/} ER at 4-39; Campbell, Lawler, Marcellus, May & McFadden at 68.

^{235/} ER at 4-39; Campbell, Lawler, Marcellus, May & McFadden at 68.

^{236/} Gueron, Szeligowski & Englert at 3-4.

(18) The Board finds that the Con Edison cost estimate is consistent with the undisputed testimony that the biological impacts of the extension request are negligible. Accordingly, we find that the cost of the proposed extension, to the extent it is possible to express these costs in monetary terms, is approximately \$112,000 (sum present worth in 1975).

D. Alternatives to the Proposed Action

(1) The Staff identified various alternative actions in the DES and FES. These included extensions for more or less time,^{237/} retention of the present license condition,^{238/} and reduced flow during the extension period.^{239/} Another alternative, which the Staff apparently failed to consider, is stocking the hatchery-reared striped bass to mitigate the impact of plant operation during an extension of the interim operation period.^{240/}

(2) The Staff's original position, as stated in the DES, was that the request for an extension to May 1, 1981 should be granted.^{241/} In the FES this was changed to the lesser period of May 1, 1980,^{242/} recognizing the fact that an extension to at least that date had occurred due to the lack of necessary governmental approvals for construction of a cooling tower, as provided in Paragraph 2.E(1)(b) of the License.

(3) The FES section that discusses the possible alternative of a "greater or lesser extension of time" refers to extensions of greater or less duration than an

^{237/} FES § 5.2.

^{238/} Id. § 5.1.

^{239/} Id. § 5.3.

^{240/} Campbell, Lawler, Marcellus, May & McFadden at 75-81; 7 AEC at 402.

^{241/} DES § 6.4.3.

^{242/} FES § 6.4.3.

extension to May 1, 1980.^{243/} This is in contrast to the parallel section of the DES, which referred to extensions "for a period of more than two years", i.e. for a period beyond May 1, 1981.^{244/} The FES therefore appears not to evaluate extensions of time beyond May 1, 1981, which is the date proposed by Con Edison, and which constitutes the "proposed action" in this case within the meaning of NEPA.^{245/}

(4) In its benefit-cost testimony presented at the direction of the Board,^{246/} (there being no benefit-cost analysis in either the DES or the FES),^{247/} the Staff witnesses testified that there would be "no measurable benefit, in terms of probability of avoiding an irretrievable commitment of resources,"^{248/} from an extension to May 1, 1981. The reason for this, among other things, is that the NEPA review process with respect to an application by Con Edison to vacate the cooling system license condition would not terminate before the point at which Con Edison would have to commence investment in a closed-cycle cooling system.^{249/} As a result, the Staff saw no purpose to be served by an extension of the termination date for interim operation.^{250/}

^{243/} FES § 5.2.

^{244/} DES § 5.2.

^{245/} 42 U.S.C. § 4332(c) (1970).

^{246/} Tr. 869.

^{247/} Tr. 737-38.

^{248/} Spore & Van Winkle at 14.

^{249/} Id. at 14-18.

^{250/} Tr. 1210-13; FES § 5.2.

(5) The Staff failed, however, to take into account the possibility that such irretrievable commitments could be avoided by extending the period of interim operation to an appropriate date beyond May 1, 1981, to permit conclusion of the environmental review of any application by Con Edison to vacate the license condition.^{251/} The Board is not limited, in this respect, to the relief requested by the Licensee, for NEPA requires that any reasonable alternative to the proposed action be considered.^{252/} The Board considers that the FES prepared by the Staff, as supplemented by the testimony of Drs. Spore and Van Winkle, is deficient in that it fails to consider the possibility of an extension beyond May 1, 1981 as a means of achieving the benefit of avoiding investment in a cooling tower that might be determined by the Commission to be unnecessary upon review of the results of Con Edison's research program.

(6) At the hearing the Regulatory Staff testified that it could not give an estimate of how long it will take to prepare the DES and FES with respect to the results of Con Edison's Final Research Report and application for relief from the cooling condition in the License, other than to indicate that the DES could probably not be prepared

^{251/} Con Edison applied for such relief on March 15, 1977.

^{252/} Natural Resources Defense Council v. Morton, 458 F.2d 827, 833-34 (D.C. Cir. 1972); 10 C.F.R. §§ 51.20(a)(3), 51.23(a), 51.26(a), 51.41 (1977).

before the end of 1977.^{253/} Under the circumstances, the Board concludes that it would not be feasible to prepare a quantified benefit-cost analysis with respect to such an indefinite extension at this time. Nevertheless, the Board notes that even if a final decision is reached on the application to vacate the license condition at some time after initial investment has been made and cooling tower site preparation and/or construction has commenced, a benefit would be achieved from the avoidance of whatever further costs had not yet been incurred. The Staff economic witness indicated a lack of awareness whether Con Edison might benefit to some extent in this intermediate situation.^{254/} The Board believes that this benefit would probably exceed any associated costs, but considers it unnecessary to resolve the matter in light of the ancillary relief requested by Con Edison's March 15, 1977 application. The Board recognizes that the earlier the ultimate decision is made, the greater the possible savings in terms of avoided expenses. For this reason, the Board has included in its Order an appropriate instruction to the Director of the Office of Nuclear Reactor Regulation.

(7) Con Edison has estimated that the total capital cost of a natural draft wet cooling tower is \$100,000,000 if the cutover outage begins in May 1981.^{255/} The Staff's

^{253/} Tr. 1128, 1156.

^{254/} Tr. 1309.

^{255/} Gueron, Szeligowski & Englert at 5.

corresponding estimate is \$91,000,000.^{256/} According to the estimated construction schedule provided by Con Edison, preparation of the cooling tower site and excavation would commence one month after contracts had been awarded,^{257/} and would last approximately one year thereafter.^{258/}

(8) In this connection, both Con Edison and the Staff presented uncontradicted evidence that the direct capital cost of cooling tower and related tunnel excavation would be \$13,799,200.^{259/} Con Edison and the Staff also provided estimates of the indirect costs of a cooling tower, including engineering and supervision, administration and supervision, payroll taxes and pensions, interest during construction, escalation and contingency.^{260/} The Board calculated that these indirect costs account for approximately 56% of the total costs estimated by Con Edison and the Staff.^{261/} Some portion of these indirect costs would be ratably applicable to activities during the first year of

^{256/} Spore & Van Winkle Table 2.

^{257/} Tr. 1145-46.

^{258/} ER § 1.3 and Fig. 1-2; Dambra at 1 and Table.

^{259/} ER Table 4.3; Spore & Van Winkle Table 2. In the companion proceeding to designate a preferred alternative closed-cycle cooling system the Staff commented that cooling tower "excavation alone comprises more than 16% of the total" cost. Final Environmental Statement Related to Selection of the Preferred Closed-Cycle Cooling System at Indian Point Unit No. 2, NUREG-0042 (Aug. 1976), § 6.2.2.2(a). NUREG-0042 is referred to and quoted from in the Staff's FES at 7-4 to 7-7. See also FES at 2-8, 3-10.

^{260/} ER Table 4.3; Spore & Van Winkle Table 2.

^{261/} Id.

construction and installation of a cooling tower system. The Board therefore considers that a decision that closed-cycle cooling is not required at Indian Point 2, if made at an early time during that year, would entail very substantial possible savings. Even if made after the completion of that year's activities, it is obvious that a very large portion of the remaining expenditures could be avoided. Particularly where the benefits and costs quantified by the Staff are so nearly in equipoise,^{262/} (being separated, in the Staff's analysis by only \$432,800)^{264/} this possibility must be given recognition in the decisionmaking process.

(9) If the Staff believes that a final decision on the requisite cooling system will not be obtained before the first investment would have to be made in a closed-cycle cooling system,^{265/} the Board considers that it was incumbent upon the Staff to identify the partial savings that might be achieved by an extension to May 1, 1981, or the further partial savings that might be achieved by an extension to some later date. Absent such recognition, it would be a mistake to claim that extensions beyond May 1, 1981 had

^{262/} Tr. 1141, 1152-53.

^{263/} Spore & Van Winkle at 28-29.

^{264/} Tr. 1127, 1144-45.

in fact been evaluated. Moreover, it would also be an error to fail to recognize as a benefit the partial savings that might accrue if a favorable decision were rendered any time after investment had commenced. The Board considers this benefit to be unquantified at present.

(9) Con Edison also presented evidence that "if deemed necessary upon a balancing of the benefits and costs, stocking of striped bass could be continued during the interim operation period as a measure of offset impacts."^{265/} In light of the evidence discussed in Paragraphs II.A.(1)-(30) of this Initial Decision, the Board finds that the impact on the striped bass due to the requested extension until May 1, 1981 is so modest that the benefits of stocking as a mitigating measure do not exceed the costs, and concludes that the extension may be granted without a condition as to stocking of hatchery-reared fish.

^{265/} Campbell, Lawler, Marcellus, May & McFadden at 75-81.

E. Interaction With EPA Proceeding.

(1) In the DES, the Staff commented that "a major benefit" of the requested extension of the interim operation period would be that it "will permit the EPA proceedings to proceed without requiring the applicant to begin construction of a closed-cycle cooling system prior to the EPA decision."^{266/} The Staff stated that "[t]he justification for a second year extension is to provide time for the EPA proceedings and final decision to be completed."^{267/} The first year of delay was justified "in order to preserve the choice of closed-cycle cooling system and to obtain the improvement in the biological evaluation."^{268/}

(2) The EPA decision referred to by the Staff is the disposition of Con Edison's request for an exemption from EPA thermal standards and for a determination that once-through cooling is the best technology available within the meaning of the Federal Water Pollution Control Act.^{269/} Con Edison received a discharge permit effective March 31, 1975.^{270/} That permit requires the termination of once-through cooling at Indian Point 2 by May 1, 1979.^{271/} The

^{266/} DES § 4.1.2.

^{267/} Id. § 4.1.5.

^{268/} Id.

^{269/} FWPCA § 316(a), (b), 33 U.S.C. § 1326(a), (b) (Supp. V, 1975).

^{270/} Con Edison Ex. OT-18.

^{271/} Id., Conditions 10(b), 11(d).

permit provides for extensions of this period until as late as July 1, 1981 upon a showing of good cause.^{272/} The Board takes official notice of the terms of this permit, and of the EPA's subsequent notice granting an adjudicatory hearing.^{273/} Because Con Edison has requested a hearing with respect to the cooling system provisions of the permit, those provisions are automatically stayed pursuant to EPA regulations.^{274/}

(3) In response to the DES, Region II of EPA commented that the proposed extension is "unwarranted and in conflict with EPA's decisionmaking authority."^{275/} EPA asserted that "any action by NRC should await EPA's final decision, according to the regular procedures established for resolving such matters," adding that the extension "would contradict EPA's permit requirements, conflict with EPA's decisionmaking responsibility, and perhaps even prejudice the adjudicatory hearing on the closed-cycle cooling system and compliance schedule." EPA further opined that "the proposed action will serve no practical purpose and may even interfere with the expeditious resolution through

^{272/} Id., Condition 11(d) n.**

^{273/} Con Edison Ex. OT-19.

^{274/} 40 C.F.R. § 125.35(d) (2) (1976).

^{275/} FES at A-10; see also 41 Fed. Reg. 53685, 53687 n.2 (1976).

normal channels of the questions concerning closed-cycle cooling at Unit 2.^{276/} In detailed comments, EPA argued that an extension to May 1, 1981 "would contradict the existing NPDES permit for the plant" and would "confuse the issues currently under consideration by EPA."^{277/} Finally, contrary to the positions of Con Edison^{278/} and the Regulatory Staff,^{279/} EPA claimed -- without citation of any authority -- that "[i]n fact, substantial damage could result from the two-year extension of operation with once-through cooling."^{280/}

(4) The latter allegation, being a bald unsupported claim refuted by uncontradicted evidence from Con Edison and inconsistent with the Regulatory Staff's expert biological evaluation, must be rejected.

(5) Based "especially" on the comments of EPA,^{281/} the Regulatory Staff modified the environmental statement to delete the language quoted at the beginning of paragraph (1) above. The Environmental Project Manager confirmed, under cross-examination, that the EPA comments were instrumental in the change in the Staff's position from one of favoring an extension until May 1, 1981 to one of opposing

^{276/} FES at A-10.

^{277/} Id. at A-11.

^{278/} Con Edison Ex. OT-1, §§ 4.2.1, 6.4 and App. A.

^{279/} FES § 3.2.6.

^{280/} Id. at A-11.

^{281/} Id. § 4.1.1.

such an extension.^{282/} The Staff has failed to point out any other specific factors that can account for this change of position, aside from an invocation of the res judicata concept,^{283/} and selective references to certain comments on the DES by other Federal agencies.^{284/}

(6) At the hearing, the Regulatory Staff testified that it felt it was under an obligation to evaluate the merits of EPA's contentions as to the effect of granting the requested extension to May 1, 1981 on EPA's adjudicatory hearing with respect to Indian Point 2.^{285/} The Environmental Project Manager further testified that he had considered the rationale presented in the EPA comments.^{286/} Despite this, the Regulatory Staff failed to indicate either in general or in particular how approval of Con Edison's request for an extension could interfere with, prejudice, confuse, or contradict the EPA permit or hearing process.^{287/} Moreover, the Staff apparently was unfamiliar with the correspondence between EPA and Con Edison,^{288/} even though Con Edison's

^{282/} Tr. 729, 733, 945.

^{283/} Tr. 733.

^{284/} Id.

^{285/} Tr. 930.

^{286/} Id.

^{287/} Tr. 940-42.

^{288/} Tr. 931.

requests to EPA were referred to in the FES^{289/} EPA's comments on the DES made no reference at all to the provision of the EPA permit that authorized extensions of once-through cooling to July 1, 1981 -- a date later than that sought in this case by Con Edison. It appears to the Board that the Staff was unaware of this critical term of the EPA permit.

(7) The Board also notes that the Regulatory Staff, in a companion proceeding to designate a particular type of closed-cycle cooling system (should one be required at Indian Point 2), has taken the position that the Commission "is, at present, in no way legally circumscribed by the pendency of the EPA proceeding from conducting its licensing under NEPA and the Atomic Energy Act." The Staff there added that the Commission "is free to proceed in this case to carry out its responsibilities under NEPA and the Atomic Energy Act."^{290/} The Board notes that Con Edison and HRFA have expressed agreement with this position.^{291/}

(8) Based on the foregoing, including in particular, the provision for grant of extensions to July 1, 1981

^{289/} FES § 4.1.1; Tr. 930-32.

^{290/} Response of NRC Staff to Appeal Board Questions, Consolidated Edison Co. of New York, Inc. (Indian Point Station, Unit No. 2), Dkt. No. 50-247 (Selection of Preferred Alternative Closed-Cycle Cooling System) (Mar. 4, 1977), at 8-9.

^{291/} See Applicant's Memorandum in Response to [Appeal] Board's Request (Mar. 4, 1977), at 16; Hudson River Fishermen's Association Supplemental Brief in Opposition to Applicant's Exceptions (Mar. 4, 1977), at 8.

in the EPA permit, the fact that the EPA conditions have been stayed, and the absence of a reasoned explanation from any source for EPA's claim that the proposed action will interfere with its processes, the Board finds that an extension of interim operation to May 1, 1981 will not prejudice the EPA proceeding. The FES should therefore be amended by reinstating the DES language quoted in paragraph (1) above.

III

CONCLUSIONS

WHEREFORE, IT IS ORDERED, in accordance with the Atomic Energy Act of 1954, as amended, and Parts 2, 50, and 51 of the regulations of the Nuclear Regulatory Commission, that

(1) Based on the record of this proceeding, including all the exhibits admitted into evidence, the transcript of hearings, and the matters of which official notice has been taken by the Board, the FES must be modified, in accordance with § 51.52(b)(3) of the Commission's regulations. In particular, the FES shall be deemed modified to the extent it is inconsistent with the findings and conclusions in Part II of this Initial Decision.

(2) Since the Board concludes that the benefits of the proposed extension of the period of interim operation exceed the costs, the FES must be so modified and the Application of Con Edison is granted. The Director of the Office of Nuclear Reactor Regulation shall, after making the requisite findings, issue an amendment extending the termination date for the period of interim operation of Indian Point 2 to May 1, 1981 by substituting the date "May 1, 1981" for the date "May 1, 1980" wherever the latter now appears in Paragraph 2.E.(1) of the License.

(3) The Director of the Office of Nuclear Reactor Regulation is further ordered, pursuant to § 51.52(b)(3) of the Commission's regulations, to cause this Initial Decision to be distributed as provided in § 51.26(c).

(4) The Director of the Office of Nuclear Reactor Regulation is further ordered to proceed, and cause his consultants to proceed, with due diligence to complete the requisite review of Con Edison's March 15, 1977 Application to Vacate License Condition, its accompanying Environmental Report, and the previously distributed Final Research Report. The Director shall issue a Draft Environmental Statement (including a

quantified benefit-cost analysis) with respect to that Application no later than February 1, 1978, shall take all necessary steps prior to that time to insure that work on that Statement is awarded the highest priority by the Regulatory Staff and its consultants, and shall require that all comments thereon be submitted within forty-five (45) days from the date of publication of the Council on Environmental Quality's notice of availability in the Federal Register. Thereafter, the Regulatory Staff shall issue a Final Environmental Statement no later than May 1, 1978.

(5) This Initial Decision shall constitute the final action of the Commission forty-five (45) days after its date, unless exceptions are taken in accordance with § 2.762 or the Commission directs that the record be certified to it for final decision. Within seven (7) days after service of this Initial Decision, any party may take an appeal to the Atomic Safety and Licensing Appeal Board by the filing of exceptions. A brief in support of the exceptions shall be filed within fifteen (15) days thereafter (twenty [20] days in the case of the Staff). Within fifteen

(15) days after the service of the brief of appellant (twenty [20] days in the case of the Staff), any other party may file a brief in support of, or in opposition to, the exceptions.

Respectfully submitted,

LeBOEUF, LAMB, LEIBY & MacRAE

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Dated: March 28, 1977

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