Final

environmental statement

related to operation of

INDIAN POINT NUCLEAR GENERATING PLANT UNIT NO. 2

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

DOCKET NO. 50-247

September 1972

Volume II

UNITED STATES ATOMIC ENERGY COMMISSION

DIRECTORATE OF LICENSING

APPENDIX XII-1

50-247

ADVISORY COUNCIL
ON
HISTORIC PRESERVATION
WASHINGTON, D.C. 20240

MAY [illegible]

RECEIVED MAY 15 1972

Dear Mr. Rogers:

RE: Indian Point No. 2 Consolidated Edison Company

This is in response to your request for comments on the environmental impact statement identified by a copy of your cover letter attached to this document. The staff of the Advisory Council has reviewed the submitted impact statement and suggests the following, identified by checkmark on this form:

_____The final statement should contain (1) a sentence indicating that the National Register of Historic Places has been consulted and that no National Register properties will be affected by the project, or (2) a listing of the properties to be affected, an analysis of the nature of the effects, a discussion of the ways in which the effects were taken into account, and an account of steps taken to assure compliance with Section 106 of the National Historic Preservation Act of 1966 (80 Stat. 915) in accordance with procedures of the Advisory Council on Historic Preservation as they appear in the Federal Register, March 15, 1972.

_____In the case of properties under the control or jurisdiction of the United States Government, the statement should show evidence of contact with the official appointed by your agency to act as liaison for purposes of Executive Order 11593 of May 13, 1971, and include a discussion of steps taken to comply with Section 2(b) of the Executive Order.

__✓__The final statement should contain evidence of contact with the Historic Preservation Officer for the State involved and a copy of his comments concerning the effect of the undertaking upon historical and archeological resources.

_____Specific comments attached.

Comments on environmental impact statements are not to be considered as comments of the Advisory Council in Section 106 matters.

Sincerely yours,

03

Robert R. Garvey, Jr.
Executive Secretary

cc: Dr. Louis C. Jones, Chairman, New York State Historic Trust,
Parks and Recreation, Building - 2 state campus, Albany, New York 1226
w/inc.

THE COUNCIL is charged by the Act of October 15, 1966, with advising the President and Congress in the field of Historic Preservation, recommending measures to coordinate governmental with private activities, advising on the dissemination of information, encouraging public interest and participation, recommending the conduct of special studies, advising in the preparation of legislation, and encouraging specialized training and education. The Council also has the responsibility to comment on Federal or Federally-assisted undertakings that have an effect on cultural property listed in the National Register.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Docket No. 50-247

APR 14 1972

Mr. Robert Garvey, Executive Director
Advisory Council on Historic Preservation
Suite 1100
801 19th Street, N.W.
Washington, D.C. 20006

Dear Mr. Garvey:

I am forwarding for your review and comment 1 copy of the environmental impact documentation identified in the enclosure to this letter.

The draft environmental statement was prepared by my staff in accordance with the statement of general policy and procedure on implementation of the National Environmental Policy Act of 1969, as set out in Appendix D of the Commission's regulations 10 CFR Part 50. All comments on this draft environmental statement must be received by this office by May 13, 1972. Recent delays in the receipt of comments on draft environmental statements from several agencies have resulted in significant delays in preparation of final environmental statements. We desire your comments but must emphasize the need for timeliness.

Please contact me or my staff regarding any problems which may be encountered in these matters. Mr. Gene A. Blanc of my staff has been designated for day-to-day contact in this area.

Sincerely,

for A. Giambusso
Lester Rogers, Director
Division of Radiological and
Environmental Protection

Enclosure:
List of Documents Transmitted

04

cc: Chairman New York State
Historic Trust, Parks and Recreation
Building 2, State Campus
Albany, New York 12226

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

May 25, 1972

50-247

Mr. Lester Rogers
Director, Division of Radiological and
Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

We have had the draft environmental statement for the Consolidated Edison Company of New York Indian Point Unit No. 2 reviewed in the relevant agencies of the Department of Agriculture. Comments from the Soil Conservation Service, an agency of the Department, are enclosed.

The Forest Service has not yet completed its review and will communicate directly with you at a later date if they have any comments.

Sincerely,

T C Byerly

T. C. BYERLY
Assistant Director
Science and Education

Enclosure

SOIL CONSERVATION SERVICE, USDA

Comments on Draft Environmental Statement Prepared by U. S. Atomic Energy Commission on the Proposed Issuance of an Operating License for Indian Point Unit No. 2, Nuclear Generating Plant

Chapter IV

In a number of places this chapter mentions site preparation and landscaping. This section could be improved by saying prompt vegetative measures, landscaping work, etc., will be done to reduce erosion in the area disturbed and denuded in the construction operations.

Page IV-3 - Paragraph B-2 - last sentence

From at least one standpoint, the information in this sentence can be improved by stating whether the 275 employees needed to operate and maintain the facilities will be imported or made up of local employment forces.

Page VII-8

The last two sentences in paragraph 5 seem to have a redundant wording on observable effects.

Page X-11 - first paragraph under C

This paragraph brings out good points. The question occurs to the reviewer, "what are the average monthly homeowners' cost for such delays?"

Page XI-1 - last paragraph

The first sentence in this paragraph is a little difficult to understand. It sounds like "gas operation of the Indian Point Unit No. 2 should be financially preferred over the older oil-fired plants." Perhaps the of in this sentence is not needed.

In the next sentence, should the words, lesser adverse, be followed by effects.

Page XI-2

On the first line, "latter" would appear to be more appropriate than "later."

Page XI-18 - paragraph g. Employment

Here it would be well to mention whether employee will come from the local force or will they be imported from outside this region.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Washington, D. C.

AUG 16 1972

1940

Mr. Lester Rogers, Director
Division of Radiological & Environmental Protection
Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

We have reviewed the draft environmental statement related to the Proposed Issuance of an Operating License to the Consolidated Edison Company of N.Y. for the Indian Point Unit No. 2 Nuclear Generating Plant - Docket No. 50-247. Our comments follow:

The primary concern to land vegetation will be from production of sulfur dioxide (SO_2) by the burning of fossil fuels. Apparently, pollution from this source will be reduced once the Plant begins operation.

No mention is made of the possible effects of Chlorine gas on nearby vegetation, when Chlorine is added to incoming water. It may be of benefit to know if there is damage from this gas near the Plant site. The problem of noise pollution seems to have been considered since the applicant plans to use land vegetation in noise reduction and visual enhancement of the Plant.

The applicant seemingly has made plans to carry out a continuous monitoring program to detect any adverse effects from the Plant operation on the surrounding environment. This effort should be a primary requirement in keeping the Plant in operation.

Sincerely,

THOMAS C. NELSON
Deputy Chief

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, N. Y. 10007

REPLY TO
ATTENTION OF:
NANEN-E

24 May 1972

50-247

MAY 30 1972

Mr. Lester Rogers, Director
Division of Radiological and
Environmental Protection
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

This is in reply to your letter of 14 April 1972, requesting comments on the draft environmental statement prepared by your staff for Indian Point 2.

Comments concerning the statement are as follows:

a. Page ii - item e. According to the application submitted by Consolidated Edison for a Section 13 Permit under the Refuse Act of 1899, submitted on 24 June 1971 and revised 27 October 1971, the total average flow for units 1 and 2 is 1,954 cfs. However, the value reported in the statement is 2600 cfs. This discrepancy should be clarified. In addition, the permit application reveals temperature differentials during summer and winter of 14°F and 28° F respectively. Throughout the statement, reference is made to a temperature differential of 15° F. It is suggested that this value be clarified to indicate whether it represents an average value throughout the operating year or for the summer months only.

b. Page III-12, Second paragraph. Con Edison's application for a Section 10 permit to modify the discharge structure and install a steel outfall section consisting of 12 submerged openings was approved on 24 November 1970. Application for a Section 13 permit under the Refuse Act Permit Program was made on 24 June 1971 and was revised on 27 October 1971. The applicant was requested by EPA to provide additional information on various environmental aspects which were deemed necessary to properly evaluate their application. The estimated date for final action on the Section 13 Permit is 31 December 1972.

c. Page 1-4 (See attached Sheet).

d. Page 1-5 (See attached Sheet).

08

e. Page V-4. The flow of 1,200,000 gpm appears to be based upon the maximum design flow of 2600 cfs and not average conditions (i.e. 877,000 gpm).

f. Page VII-4. Throughout the discussion on this page, reference is made to a maximum flow of 840,000 gpm and 30,000 gpm service water. However, on page V-4, reference is made to a flow of 1,200,000 gpm, which although being greater than the previous flow, is not considered maximum. It is suggested that description of flow be prefaced by maximum, minimum or average conditions to avoid confusion.

Sincerely yours,

for F. R. PAGANO
Chief, Engineering Division

AGENCY	DATE OF ISSUANCE	PERMIT, LICENSE, ETC.
Federal	4-3-57	Section 10 Permits
Department of the Army New York District Corps of Engineers		Permit No. 5236 to construct wharf, screenwells and discharge tunnel, to install pipes, to dredge and place fill.
	1-8-60	Permit No. 5891 to construct a dike in Lents Cove, Hudson R.
	2-23-66	Permit No. 7184 to place fill.
	3-15-66	Permit No. 7184-A to approve revised plans and to construct a discharge channel extension wall and a screenwell structure, to place fill and to dredge.
	1-19-67	Permit No. 7184-B to approve revised plans to supersede plans approved by Permit No. 7184 and 7184-A.
	9-29-67	Permit No. 7562 to construct a screenwell, bulkheads and a discharge channel, to dredge, to place dredged material behind bulkheads and to install temporary dolphins.
	11-24-70	Permit No. 7562-A to approve revised plans to supersede plans approved by Permit No. 7562. Additionally to install a steel outfall section consisting of 12 submerged openings.
	12-11-67	Permit No. 7589 to dredge flotation channel and to construct ramp in Lents Cove, Hudson R.
	Applied 6-24-71 Estimated Date of Issuance 12-31-72	Section 13 permits to authorize discharge and control thermal, chemical and other waste discharges.

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

May 15, 1972

50-247

Mr. Lester Rogers, Director
Division of Radiological &
Environmental Protection
U.S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

The draft detailed statement on the Environmental Considerations by the U.S. Atomic Energy Commission Related to the Proposed Issuance of an Operating License for the Indian Point Unit Number 2 Nuclear Generating Plant, Docket Number 50-247, which accompanied your letter of April 14, 1972, has been received by the Department of Commerce for review and comment.

In order to give you the benefit of the Department's analysis, the following comments are offered for your consideration.

In our opinion, the statement addresses a number of environmental topics and is candid in its appraisal of possible impact and probable adverse effects upon the Hudson River estuary and associated aquatic life.

There are several references to the Hudson River Policy and Technical Committees that require clarification. The statement gives the impression that the Policy and Technical Committees provide firm guidelines and direction to those research activities on the Hudson River that are paid for by the applicant. Such is not the case.

In regard to the above comment, we offer the following suggestions. The first paragraph on Page I-9 states that "the Ecological Studies . . . are directed by the Hudson River Technical and Policy Committees . . .". It would be more accurate to note that the ecological studies are usually coordinated with these committees, or that opinions on the design and conduct of the studies are solicited from these committees. The same paragraph implies that the Bureau of Sport Fisheries and Wildlife is concerned only with non-commercial fish and that the National Marine Fisheries Service is concerned only with commercial fish. This delineation has no factual basis, and any reference that suggests such a dichotomy of responsibilities and interest should be eliminated.

The first paragraph on Page V-57 again states that ecological studies are directed by the Hudson River Policy and Technical Committees. Additionally, it is stated that the "Committees outline and supervise the studies . . ." The committees do not outline the studies, although as mentioned previously, their opinions and suggestions may be solicited by the applicant. Use of the verb "supervise" denotes a direct association and degree of guidance that does not accurately reflect the actual situation. The true situation should be described.

The first paragraph on Page V-59 states that "These studies will be directed by the Hudson River Policy and Technical Committees . . ." Again, this does not reflect the factual situation.

A more adequate reference to the Technical and Policy Committees than employed elsewhere in the statement appears in the first paragraph on Page VIII-5, where it is noted that "The applicant uses the advice of the Hudson River Policy and Technical Committees . . . to plan for fish protection and for types of environmental monitoring programs . . ."

In the second paragraph on Page XI-26, it is said that ". . . the company has asked the Hudson River Policy and Technical Committee to conduct a ten-million dollar 5-year study . . ." So far as we are aware, the Policy Committee will not be conducting any studies on the Hudson River. On this same page (last paragraph) we note that an expression of opinion by a Dr. Gerald Lauer is attributed to the many aquatic biologists that have been consulted by the company. If this opinion is endorsed by all those to whom it is, at least by implication, attributed, it should be so stated.

Anadromous fishes that may be significantly affected by plant operation are listed on Page VII-7. The American shad is not listed, even though it is a fairly important commercial species and spawns upstream from the plant. If for some reason this species is not jeopardized during its migrations past the plant, an explanation for this lack of effect should be of interest.

With regard to environmental radioactivity, the frequency of sample collection (at least every 6 months) should be mentioned, and benthic animals should be analyzed for radioactivity. On Page II-19, benthic organisms mentioned as being common in the Indian Point area include barnacles, clams, polychaete worms and amphipods. Clams are good biological indicators for radioactivity and would be the preferred organism in this instance. Fish species should be selected on the basis of their feeding habits so that both herbivores and carnivores are represented.

We find that we are unable to make a technical evaluation of the AEC staff's statement of the radiological consequences of gaseous releases to the atmosphere. No meteorological assumptions are listed nor can they be inferred from the references. For example, the discussion in the first paragraph on V-64 concerning average annual concentrations in the atmosphere references the document, "Meteorology and Atomic Energy -1968", as the source of an atmospheric transport computer program. We do not find any such computer program in the document. Also on page V-64 in the discussion on gaseous effluents and their average ground level concentration in each of 16 wind sectors, no mention is made of what specific wind statistics were used to make the concentration estimates and, more importantly, what the effect of river valley air channelling would be, especially since the population centers tend to be in the valley.

The accidental releases are equally vague with regard to meteorological assumptions, although we understand from the "proposed Annex to Appendix D" that these assumptions are 1/10 as conservative as found in the AEC Safety Guides Nos 3 and 4 for Boiling Water and Pressured Water Reactors, respectively. No rationale is given for such an assumption.

From the discussion on Page III-45 regarding 4 large decay tanks which are filled one at a time with gaseous effluents and which have a capacity to permit a holdup time of at least 45 days, it appears that releases from these tanks will be at very irregular and infrequent times. The annual diffusion model which is customarily used in evaluating long-term consequences is only applicable if the release is routine and not biased toward any particular time or over any particular period.

We concur with the AEC analysis expecting no substantive weather modification from the facility's once-through cooling system involving heat dissipation into the atmosphere by the heated river water. The facility is also not expected to have any significant hydrological interactions.

In section II-8E, the last paragraph, it might be pointed out that an earthquake of intensity VII (a modified Mercalli scale) occured in New York City in 1884.

In section II-14, the 5th line reads "Tornadoes are almost unknown in New York, . . .". This is not quite true although New York State has a low incidence of tornadoes. The probability of a tornado striking a point in the area of the proposed nuclear plant is approximately .00048.

We hope these comments will be of assistance to you in the preparation of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

50-247

OFFICE OF THE ADMINISTRATOR

JUN 3 1972

Mr. L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Muntzing:

The Environmental Protection Agency has reviewed the draft environmental statement for the Indian Point-2 Nuclear Plant and we are pleased to provide our comments to you.

The major potential environmental impact of operating the Indian Point-2 Nuclear Plant involves the effects of the once-through cooling system on aquatic biota. We agree with the Atomic Energy Commission that the potential for severe environmental effects exists for this facility and, therefore, are recommending implementation of a closed-cycle cooling system at the earliest date practicable.

Where the evidence indicates that once-through cooling will damage the aquatic environment, a plant under construction may be permitted to operate, but with a commitment to offstream cooling (provided that the environmental impact of the offstream cooling technique adopted is acceptable). In circumstances of substantial environmental impact, the backfitting may have to be done under an implementation schedule that requires reduced heat discharge and restricted operating levels during the times of peak environmental stress. Where the discharger can demonstrate that there is no substantial evidence of damage from once-through cooling, the plant should receive a permit to operate, but with a commitment to perform environmental monitoring and to go to offstream cooling if this monitoring produces evidence of substantial damage.

With respect to the radiological aspects of the facility, more information should be presented regarding proposed additions to waste treatment systems, and assumptions used in certain dose evaluations should be substantiated.

We will be pleased to discuss our comments with you or members of your staff.

Sincerely,

Sheldon Meyers

Sheldon Meyers
Director
Office of Federal Activities

Enclosure

EPA#D-AEC-00047-07
TAD#0026-72

ENVIRONMENTAL PROTECTION AGENCY

Washington, D.C. 20460

June 1972

ENVIRONMENTAL IMPACT STATEMENT COMMENTS

Indian Point #2 Nuclear Generating Plant

TABLE OF CONTENTS

INTRODUCTION AND CONCLUSIONS

The Environmental Protection Agency has reviewed the draft environmental impact statement for the Indian Point-2 Power Plant prepared by the U.S. Atomic Energy Commission and issued April 13, 1972. Following are our major conclusions:

1. We agree with the conclusion of the AEC that the present once-through cooling system has a potential for causing significant long-term damage to aquatic biota in the Hudson River. Thus, we recommend the adoption of a closed-cycle cooling system at the earliest date practicable.

2. Should the AEC determine that operation of the plant is essential to meet critical power demands, we believe that power output should be limited to the lowest level necessary to satisfy that demand. We agree that monitoring be performed by the discharger, and believe that a commitment must be made to further limit power output and go to offstream cooling if this monitoring produces evidence of substantial damage. We recommend that estimated environmental damage for various levels of power output be included in the final statement.

3. In order to achieve lowest practicable radwaste discharge levels the present waste treatment system and all proposed modifications should be utilized to their full capabilities.

4. The proposed modifications to the treatment systems should be described in detail in the final statement.

5. The site metorology and all areas of consideration which utilize the diffusion climatology analysis should be reevaluated using more complete on-site data collected during the past 10 years of operation of Indian Point-1.

Radioactive Waste Management

The draft detailed statement evaluates the radioactive waste treatment systems based on the equipment which will be used during the first fuel cycle. The statement indicates that by the end of this first cycle the applicant will have installed additional waste treatment equipment which will further reduce the radioactive discharges below the levels estimated in the statement. These modifications include a blowdown treatment system consisting of a filter-demineralizer; an additional demineralizer on the waste disposal system evaporator condensate line; and charcoal filters on the plant vent to reduce radioactive iodine concentrations from auxiliary building and containment purging.

We are unable, from the information presented in the statement, to determine if these modifications will, in fact, reduce the effluents from Indian Point-2 to the lowest practicable levels. Therefore, the final statement should describe these modifications in detail, including proposed operating procedures and estimated time schedule of installation and operation. The anticipated effectiveness of reducing the effluents should also be described. A description of the type of demineralizers used in the blowdown treatment system is especially important, since blowdown is indicated as the major source of radioactive liquid effluents. For example, ^{137}Cs, ^{134}Cs and ^{99}Mo contribute the bulk of the blowdown activity, and it may be necessary to employ a special demineralizer, which is particularly effective in removing these radionuclides, to achieve the anticipated decontamination factor (DF). Dissolved solids in the blowdown may result in rapid loading of the demineralizer and loss of DF. If it will be necessary to regenerate these demineralizers, the regenerant solution should be processed by the evaporator or solidified at the drumming station. If the demineralizers are not regenerable, the load increase to the solid waste disposal facility should be discussed as well as the impact on solid waste transportation.

In the final statement, the discussion of these modifications should include the possibility of alternate or additional techniques of treating radioactive blowdown. Many PWR's are installing evaporator capability to treat steam generator blowdown, and we believe that this alternative is a feasible one that could at least be considered in a cost-benefit analysis.

The liquid waste system diagram in Figure III-14 of the statement shows bypasses of the various treatment systems. A commitment should be made by the applicant to utilize the waste treatment systems it has provided. The commitment is especially important regarding the steam generator blowdown which the statement has shown to be the greatest contributor to liquid radioactive waste in the environment. The applicant should routinely utilize the blowdown treatment system during conditions where primary-to-secondary leakage occurs.

According to the statement, under conditions of primary-to-secondary leakage, steam releases from the blowdown flash tank will contain significant amounts of iodine-131. Recognizing that the amount estimated by the AEC is 0.62 Ci/yr, which exceeds the facility's technical specifications limit and, according to the applicant's meteorology, appears to exceed 10 CFR 50 Appendix I limits for iodine at the site boundary, the venting of this steam should be avoided. We note that Figure III-15 [illegible]ustrates a connection between the blowdown flash tank and the main condenser, for the purpose of routing the steam flash. We suggest that routine employment of this path would achieve the desired reduction in the release of ^{131}I to meet the aforementioned standards and specifications.

Experience gained at other PWR's has shown that the magnitude of leakage from the secondary system is comparable to steam generator blowdown. During periods of primary-to-secondary leakage, secondary system leakage will also be contaminated. The draft detailed statement, however, does not provide an estimate of the volume or radionuclide concentrations associated with this leakage. Further, it is not clear from the FSAR or the Environmental Report whether secondary system leakage can be routed to the waste treatment system. The FSAR does indicate, from the anticipated volumes of liquid to be processed by the waste treatment system (Table 11-1.4), that this source has probably not been considered for such treatment. The final detailed statement should provide complete estimates of liquid and gaseous sources of radioactivity from secondary system leakage during primary-to-secondary leakage conditions.

The holdup capacity for the gaseous waste treatment system, which consists of four decay tanks serving Units 1 and 2, is not clearly expressed in the statement for the situation where both units are in operation simultaneously. It is stated that the system has the capability "...to permit a holdup time of 45 days for Unit-2, and up to 60 days holdup for Unit-1." This can be interpreted to mean that the system has either 45 days capacity for Unit-2 alone or 60 days capacity for Unit-1 alone. Clarification of the combined capability of this system, when both units are operating simultaneously, should be made in the final statement. The applicant's technical specifications for Unit-2 requires a minimum holdup time of only 20 days, even though the capability of the system is stated as 45 days for Unit-2. To be consistent with the intent of "low as practicable," the applicant should utilize the gaseous decay system to the full extent of its capability. This is especially significant since most of the radioactivity (as estimated both by the applicant in his environmental report and the AEC in the statement) is due to xenon-133 with a 5.27 day half-life.

Dose Assessment

The dose estimates for the ingestion of fish as presented in the statement are not consistent with the liquid effluent discharge estimates given. It appears that effluents due to the discharge of steam generator blowdown, [illegible] leakage, have been neglected in computing this ingestion dose. The final statement should discuss the assumptions for liquid effluent levels and concentration factors used to calculate the dose due to the ingestion of fish.

The doses computed from release of liquid effluents assume a dilution flow from the cooling system of approximately 10^6 gal/min. Considering the problems of fish kills due to the high condenser cooling flow and the possibility of the necessity to reduce the cooling flow considerably to avoid or reduce these fish kills, the statement should discuss the effect of such reduced flow on the doses involved both on individual and man-rem bases.

A limited number of measurements made at operating pressurized water reactors have indicated that direct external radiation exposure from large outdoor water storage tanks (such as the condensate storage tank) could be a significant contributor to the radiation dose received by people living close to the plant. Neither the applicant nor the AEC has estimated the potential radiation exposure from this source; such estimates should be included in the final statement. The location of the tanks in relation to the nearest residence and the visitor's information center should be indicated. Although the period of exposure is short, the applicant expects the number of visitors to the center to be large. Because of the proximity of the information center to the plant (as compared to off-site population groups), estimates of the population radiation dose (expressed as man-rem/yr) should be made, including the expected number of visitors per year and the average external radiation dose rate from plant effluents and direct shine at the visitors center.

Transportation and Reactor Accidents

In its review of nuclear power plants, EPA has identified a need for additional information on two types of accidents which could result in radiation exposure to the public; (1) those involving transportation of spent fuel and radioactive wastes and (2) in-plant accidents involving reactor systems.

Many of the factors in accident analysis are common to all nuclear power plants; the environmental risk for each type of accident is therefore amenable to a general analysis. Although the AEC has done considerable work for a number of years on the safety aspects of such accidents, we believe that a thorough analysis of the probabilities of occurrence and the expected consequences of such accidents is necessary. A general study would result in a better understanding of the environmental risks than would a less-detailed examination of the questions on a case-by-case basis. An understanding has been reached with the AEC that they will conduct such analyses, with EPA participation, concurrent with reviews of impact statements for individual facilities and will make the results public in the near future. We believe that any changes in equipment or operating procedures for individual plants, required as a result of these analyses, could be included without appreciably changing the overall plant design. If major redesign of the plants to include engineering changes were expected, or if an immediate public or environmental risk were being taken while these two issues were being resolved, we will, of course, make our concerns known and an updated impact statement may be necessary.

The statement concludes "...that the environmental risks due to postulated radiological accidents are exceedingly small." The conclusion is based on the standard accident assumptions and guidance issued by the AEC for light-water-cooled reactors as a proposed amendment to Appendix D of 10 CFR Part 50 on December 1, 1971. EPA commented on this proposed amendment in a letter to the Commission of January 13, 1972, indicating the necessity for a detailed discussion of the technical bases of the assumptions involved in determining the various classes of accidents and expected consequences. We believe that the general analysis of accidents mentioned above will be adequate to resolve these points and that the AEC will apply the results to all licensed facilities.

Site Meteorology

We note that the AEC stated it has used the applicant's meteorological data from the environmental report supplement to estimate doses due to the discharge of gaseous effluents at Indian Point.

We feel that use of this data is questionable, since it appears to be based primarily on 1955-1957 work done by New York University and some intermittent data gathered since that time. Although the applicant began meteorological monitoring in 1955, and this monitoring has been more or less continuous since that time, the data used to establish the climatology is only partial data from the years 1955, 1956, 1957, 1969, and 1970. The period of record of this data is not clearly defined, but it appears to vary from ten months to as little as two months in any given year.

Since Consolidated Edison has had an operating nuclear power reactor at this site since 1962, at least ten years of continuous on-site meteorological data should be available. We feel that this data should be employed to establish the climatology for the site, and that the results of the meteorological analysis using this data should be utilized to establish the various dose estimates for the operations at the site. The reevaluation should be presented in the final environmental statement.

NON-RADIOLOGICAL ASPECTS

Water Quality and Biological Effects

In general, the draft environmental impact statement properly identifies and assesses most of the probable significant water quality and biological effects that will arise as a consequence of power generation at the Indian Point nuclear plant and indicates areas where additional information is necessary. Thus, after consideration of these factors, we agree with the conclusion of the AEC that, in the operation of this plant, there is "...potential for long-term environmental impact on the aquatic biota inhabiting the Hudson River..." This impact, due to the operational characteristics of the once-through cooling system, will arise primarily because of impingement on the protective screens of the intake structure; chemical, mechanical, and thermal effects of entrainment; and the excessive heat loads in the river created by the cooling water discharge. Also, we agree with the AEC that this impact on aquatic biota may result in "...permanent damage to the fish population in the Hudson River, Long Island Sound, the adjacent New Jersey coast, and the New York Bight."

New York State classifies the Hudson River at Indian Point as Type SB. Under state water quality standards for SB waters thermal discharges may not be injurious to "...edible fish or shellfish or the culture or propagation thereof." Since fish will be killed, clearly state water quality standards will be violated.

We commend the AEC for their forthright expression of the probable environmental impacts and identification of areas where information is lacking. Thus, we support their commitment to protect the environment by requiring the applicant to initiate additional studies of alternate cooling systems and to design and implement a comprehensive monitoring program to determine the practicality and need of a closed-cycle cooling system. We believe, however, that, based on currently available information, if the Indian Point plant is to operate within applicable New York State standards and in a manner adequate to protect aquatic biota, a closed-cycle cooling system will be necessary.

We appreciate the difficulty in balancing the objective to protect the environment with that of supplying needed additional electrical power in the New York City area. In response to this demand, the AEC suggests it will be beneficial to operate the Indian Point plant while the additional studies are being conducted and while monitoring data is being collected. From an environmental standpoint, however, we cannot support operation of this plant unless it can be demonstrated that such operation will not result in a violation of New York State water quality standards or lead to a significant adverse impact on aquatic biota. The final statement should describe any measures that will be taken to attain these goals, should it prove necessary to operate the plant before resolution of current environmental problems. Should the AEC determine that electrical energy needs of the region override environmental considerations, the final statement should predict the extent of both short- and long-term environmental damage expected at 25, 50, 75, and 100% of full power.

Our analysis of the engineering aspects of the Indian Point plant, the hydrologic characteristics of the Hudson River at the plant site, and the biological system of the lower Hudson indicates that in order to adequately protect the aquatic biota, the following thermal criteria should be applied:

I. Passageway

a) Maximum Temperature — 83°F October-June; 86°F July-September

b) Increase in Temperature ΔT

October-June — T = 4° to max of 83°F

July-September — T = 1.5°F to max of 83°F, if T norm is $\leq$ 83°F

T = 1.5°F to max of 86°F, if T norm is $\geq$ 83°F

c) Passageway to be 50% of cross-section and/or volumetric passageway or artificial fishway; in addition 1/3 of surface from water edge to water edge.

II Non-Passageway

a) Maximum Temperature 90°F

b) Mixing Zone Dimensions

No standards as to dimensions

Note: (1) Temperature measurements applicable to any part in stream.
(2) Increase in temperature based on elevation above monthly average of daily maximum temperature.

These criteria embody the strictest standards from the Federally approved New York State standards as published in "Technical Bulletin No. 36 - Thermal Aspects of Discharges on Water Resources "and New York State promulgated standards as described in "Criteria Governing Thermal Discharges (Heated Liquids)." We recommend that the ability to meet these criteria be considered in the evaluation of various alternative cooling systems.

The draft statement indicates that fish kills due to impingement will probably be higher for Unit 2 than that experienced for Unit 1. Although operating the Indian Point plant on a load-following basis will probably reduce such kills during some periods, the AEC should consider requiring the applicant to modify the intake structure and/or install mid-stream protective screens. The final statement should describe any such measures that will be taken to prevent excessive impingement during the period when the once-through cooling system is to be used.

Since excessive amounts of residual chlorine are extremely toxic to aquatic life, it is suggested that, either the quantities of sodium hypochlorite used be reduced to a safe level, or alternative means of condenser cleaning be explored. In the past, EPA has recommended that levels of chlorine in the receiving water should not exceed 0.1 mg/l for more than 30 minutes/day or 0.05 mg/l for more than 2 hours/day. The final statement should specify the procedures to be used to assure that the discharges of chlorine are below levels that would cause significant environmental damage.

The draft statement indicates that a number of chemicals will be discharged from the Indian Point plant. Although the toxic levels of most of these will not be exceeded routinely, the final statement should consider the synergistic effect of two or more chemicals that are present at concentrations near their respective toxic levels. Also, the effect of water temperature in the discharge plume on the toxic effects of the various chemicals should be discussed.

COST-BENEFIT ANALYSIS

This statement is the first to incorporate the AEC proposed guidelines for cost-benefit analyses. This approach is helpful in providing a tabular format for comparing environmental effects. Its application in this statement, however, points out several major weaknesses. The environmental cost tabular format does not allow for estimating the combined effects of thermal, mechanical, and chemical effects on aquatic life. The format does not provide for the incorporation of the time variable, making it virtually impossible to separate short and long term effects (assuming the data were available). Several of the items are difficult to relate to environmental costs. For example, the evaluations of cooling capacity in units of BTU/hr (or acre-ft. of elevated temperature) and consumption of water in millions of gallons per day are not meaningful numbers per se. Several other items--for example, salt deposition and fogging--require considerably more analysis to be meaningful indicators of environmental costs. To date, a meaningful measure of the principal benefits of electric power has not been identified.

The statement does not provide an adequate base of information to choose between the six proposed alternate coolant systems. In fact, the practicality and availability of brackish water cooling towers are questioned by the AEC (p. XI-0).

A spray pond, on the other hand, is estimated to exert severe adverse environmental effects in the form of salt deposition, water consumption, fogging, and icing. Estimates of chemical discharges from cooling towers, however, are "...not available at this time." It is recommended that the costs and benefits of the various alternative cooling systems be described in some detail, since these alternatives will be considered to reduce the environmental impact of the operation of Indian Point-2.

The statement points out the need for a broader perspective in environmental considerations than current procedures provide. By the end of the decade, the electric generating capacity on the Hudson River within five miles of the Indian Point site will increase from the current 800 Mwe to over 6000 Mwe. The Bowline Unit I will be operational within the next few months and the Lovett Plant, already in service, is situated less than a mile downstream from Indian Point. Yet the statement only considers the combined impact of Indian Point Units I and II. There should be an analysis of the combined impact of Indian Point I, II, and III as well as the previously mentioned plants on nearby sites.

ADDITIONAL COMMENTS

During the review we noted in certain instances that the statement does not present sufficient information to substantiate the conclusions presented. We recognize that much of this information is not of major importance in evaluating the environmental impact of the Indian Point-2 Nuclear Plant. The cumulative effect, however, could be significant. It would, therefore, be helpful in determining the impact of the plant if the following information were included in the final statement:

Radiological Aspects

1. In estimating radioactivity releases from the liquid waste disposal system, a decontamination factor (DF) of 10,000 for all radionuclides, except iodine and tritium is assumed for the waste evaporator. Actual experience, however, has shown much lower DF's. The bases for such a high DF should be presented in the final statement.

2. Table III-7 indicates conditions at Unit-2 may result in operation at ^{131}I discharge levels which would exceed the technical specifications limit of 0.18 Ci/yr for ^{131}I, if not controlled. It should be noted, however, that even at this limit, using the applicant's meteorological diffusion parameters for the site boundary and the AEC's suggested deposition velocity, it appears the 10 CFR 50 Appendix I guidelines would be exceeded. The final statement should discuss this problem.

3. The dose from the ingestion of fish presented in the statement could not be verified using the various effluent levels and concentration factors presented in the statement. The assumptions and sources used to evaluate this dose should be given in [illegible]

Non-Radiological Aspects

1. Ozone is an air pollutant which has been included in the National Primary and Secondary Ambient Air Quality Standards, therefore, the production of ozone by the high voltage transmission lines constructed to distribute electricity generated at this facility should be discussed. Concentrations of ozone in the vicinity of these lines should be estimated for various atmospheric conditions, and related to potential effects on man and wildlife.

2. The AEC states that the Hudson River has a high buffering capacity for sodium hydroxide, lithium hydroxide, and sulfuric acid. According to the Raytheon Report, however, the discharge of ion exchange resins caused pH changes of up to 2 units. The AEC should provide additional information which shows that discharge of sodium hydroxide, lithium hydroxide, and sulfuric acid will not alter the pH.

3. The septic tank system appears inadequate to meet secondary effluent quality. This condition will deteriorate completely when Unit No. 3 goes on line. Therefore, we recommend reevaluation of provisions for the handling of sanitary and

laundry wastes. The final statement should include information on septic tank sludge disposal.

4. The effects of soda ash and potassium chromate (toxic to some organisms in the discharge canal) should be evaluated in conjunction with the effects of other chemicals.

5. As impingement on the intake screens has resulted in significant fish losses, detailed reference should be included on the proposed disposition of those organisms impinged.

6. An oil spill prevention, containment, and countermeasure plan should be included in the statement.

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

50-247

IN REPLY REFER TO:
PWR/ER

May 10, 1972

Mr. Lester Rogers
Director, Division of Radiological and Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

This is in response to your letter of April 14, 1972, requesting comments on the Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of an Operating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant, dated April 13, 1972.

The Federal Power Commission's Bureau of Power has previously commented on the need for the Indian Point Unit No. 2 nuclear generating plant in its letter dated December 22, 1971. These comments were included in a Bureau of Power staff report made in response to AEC's letter dated December 7, 1971, requesting comments on the Consolidated Edison Company's application for interim authorization to operate the Indian Point Unit No. 2 at 50 percent of full power.

It is noted that the basic data included in the capacity-demand-reserve margin evaluation made by the FPC Bureau of Power staff in its December 1971 report is that used in Table X-1 of your April 13, 1972 Draft Detailed Statement; therefore, the following comments will update those made in our December 22, 1971 letter.

The FPC Bureau of Power staff completed an analysis of the 1972 summer load-power supply situation for the contiguous United States on April 17, 1972. As of that date, based on available data from the AEC, it appeared that the Indian Point Unit 2 might be able to achieve a significant level of power sometime in the summer, but would not be commercially available on May 31, 1972, our cut-off date for determination of firm summer resources.

The Company reported its expected June 1, 1972 power resources to be 9,293 megawatts (8,823 dependable generating capacity plus 470 megawatts firm purchases) and its estimated summer peak demand to be

Mr. Lester Rogers

8,400 megawatts. The resulting reserve margin is 893 megawatts, or 10.6 percent. This margin is less than the size of its largest unit, and only 45 percent of the median 1,977 megawatts of forced outages and deratings the Company experienced at the time of the weekly peaks for a fifteen week 1971 summer period. The Company expects to improve its position with the installation of 174 megawatts of barge mounted gas turbines in June and a like amount in July, but it also plans to retire 243 megawatts of old fossil fired capacity in July which, if carried out, would have an offsetting effect. The Company is also continuing its efforts to increase its firm purchases for the period.

For the New York Power Pool, including the Consolidated Edison Company, the situation is only slightly better. As of June 1, 1972, the Pool's resources are projected to be 22,474 megawatts with an estimated peak demand of 19,510 megawatts, resulting in a reserve margin of 2,964 megawatts or 15.2 percent. For the Pool, a median of 3,056 megawatts of forced outages and deratings at time of weekly peak was experienced for the 1971 fifteen week summer period.

In the light of the foregoing and even though the Indian Point No. 2 nuclear unit was not considered as firm capacity in the summer load forecast, the staff of the Bureau of Power concludes that all reasonable efforts should continue to bring this unit into service at the earliest possible date. The need for added capacity to safeguard against the contingencies of forced outages, as well as the desirability of implementing scheduled preventive maintenance programs, is self evident.

Very truly yours,

T. A. Phillips
Chief, Bureau of Power

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

IN REPLY REFER TO:

August 1, 1972

50-247

RECEIVED AUG 2 1972 U.S. ATOMIC ENERGY COMMISSION

Mr. Daniel R. Muller
Assistant Director for
Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter of July 24, 1972, requesting comment on the need for the Indian Point Unit No. 2 of the Consolidated Edison Company at both 50 percent and 100 percent power ratings for the 1972-73 winter and 1973 summer peak load periods on both the Applicant's system and that of the New York Power Pool.

The Federal Power Commission's Bureau of Power has previously commented on the need for the Indian Point Unit No. 2 nuclear generating plant in its letters dated September 24, 1970, December 22, 1971 and May 10, 1972. Since the commercial operating date of this unit now is forecasted for fall and winter of 1972-1973, the following comments will update the comments submitted previously.

These comments are directed to a review of the need for the facilities as concerns the adequacy and reliability of the affected bulk power systems and matters related thereto. These comments, prepared by the Bureau of Power staff, are in accordance with the National Environmental Policy Act of 1969 and the Guidelines of the President's Council on Environmental Quality dated April 23, 1971.

In preparing these comments, the staff has considered the AEC Draft Detailed Statement dated April 13, 1972, the Applicant's Environmental Report and supplements thereto; related reports made in response to the Commission's Statement of Policy on Reliability and Adequacy of Electric Service (Order No. 383-2); and the FPC staff's independent analysis of these documents together with related information from other FPC reports. The staff of the Bureau of Power generally bases its evaluation of the need for a specific bulk power facility upon the load-supply situation for the critical peak load period immediately following the availability of the facility. However, the useful lives of such facilities are generally 30 years or longer, and they will continue to serve the needs of the utility's customers during their service lives.

Mr. Daniel R. Muller

Need for the Facility

The 873-megawatt Indian Point No. 2 nuclear generating unit is now scheduled for commercial operation in the fall of 1972 or winter of 1972-73 and to be available to meet the 1972-73 winter and the 1973 summer peak periods. The Unit had been scheduled to be in commercial service prior to the 1972 summer peak and to be available to assist in meeting the Applicant's system demands during that period but suffered delays which prohibited its availability by that time.

The Applicant based its need for the Indian Point Unit No. 2 on the capacity resources available to meet the 1972 summer peak loads, and the reserve margins available to provide a margin of safety against normal electric system operating contingencies. The Commission's letter of May 10, 1972 reported a 1972 summer peak reserve margin of 893 megawatts or 10.6 percent of peak load. The capacity of the Indian Point Unit No. 2 was not included in the Applicant's capacity resources since commercial operation was not expected until after the beginning of the peak load period on June 1, 1972. Subsequently, the critical reserve margin conditions forecast for the Applicant's system did occur during the week of July 17-21, 1972 when voltage reductions of three and five percent were effected due to shortages of generating capacity.

The Applicant's need for the capacity of Indian Point Unit No. 2 during the 1972-73 winter peak and the 1973 summer peak load periods to meet the electric loads of its system and also that of the New York Power Pool in which the Applicant is a member, is indicated by the following tabulations which have been prepared to show the relationship of the total electric resources available to meet the system's loads and the reserve margins expected to be available at those times. These gross reserve margins provide for such contingencies as scheduled maintenance, unscheduled outages of equipment, and errors in load forecasting.

Mr. Daniel R. Muller

Estimated 1972-73 Winter Peak Load-Supply Situation

	Consolidated Edison Co.	New York Power Pool
Conditions for 100 Percent Power Rating (873 Megawatts)		
Total Resources - Megawatts	11,394 1/	26,681
Net Peak Load - Megawatts	6,425	18,540 2/
Reserve Margin - Megawatts	4,969	8,141
Reserve Margin - Percent of Peak Load	77.3	43.9
Conditions for 50 Percent Power Rating (436 Megawatts)		
Total Resources - Megawatts	10,957 1/	26,244
Net Peak Load - Megawatts	6,425	18,540 2/
Reserve Margin - Megawatts	4,532	7,704
Reserve Margin - Percent of Peak Load	70.5	41.6
Conditions for 20 Percent Power Rating (175 Megawatts)		
Total Resources - Megawatts	10,696 1/	25,983
Net Peak Load - Megawatts	6,425	18,540 2/
Reserve Margin - Megawatts	4,271	7,443
Reserve Margin - Percent of Peak Load	66.5	40.1

1/ Includes net firm purchases of 40 MW
2/ Includes net firm sales of 22 MW

Mr. Daniel R. Muller

Estimated 1973 Summer Peak Load-Supply Situation

	Consolidated Edison Co.	New York Power Pool
Conditions for 100 Percent Power Rating (873 Megawatts)		
Total Resources - Megawatts	11,008 1/	27,490
Net Peak Load - Megawatts	8,850	20,840 2/
Reserve Margin - Megawatts	2,158	6,650
Reserve Margin - Percent of Peak Load	24.4	31.9
Conditions for 50 Percent Power Rating (436 Megawatts)		
Total Resources - Megawatts	10,531 1/	27,053
Net Peak Load - Megawatts	8,850	20,840 2/
Reserve Margin - Megawatts	1,681	6,213
Reserve Margin - Percent of Peak Load	19.0	29.8
Conditions for 20 Percent Power Rating (175 Megawatts)		
Total Resources - Megawatts	10,270 1/	26,792
Net Peak Load - Megawatts	8,850	20,840 2/
Reserve Margin - Megawatts	1,420	5,952
Reserve Margin - Percent of Peak Load	16.0	28.6

1/ Includes net firm purchases of 40 MW
2/ Includes net firm sales of 22 MW

The Applicant states that the minimum reserve margin criteria for it, as a member of the New York Power Pool, is currently 14 percent of the peak load and all members of the Pool have committed themselves to increasing their reserve margins capacity to 18 percent of peak load by 1975. The reserve margins for both the Applicant's system and the New York Power Pool for the 1972-73 winter peak and the 1973 summer peak load period more than meet the 14 percent criteria. The Applicant has maintained a reserve margin of 20 percent on its system which it feels is necessary to meet the operating

Mr. Daniel R. Muller

problems of the Consolidated Edison Company's system. In order to meet this reserve margin in the 1973 summer peak load period, the 100 percent power rating of 873 megawatts for the Indian Point Unit No. 2 is needed. Furthermore, the Consolidated Edison system has experienced problems in meeting peak loads in the past when the theoretical reserve margins have been substantially above 20 percent of forecast peak.

The capacity of the Indian Point Unit No. 2 is not critical to the Applicant's reserve capacity for the 1972-73 winter peak period, however, the availability of this capacity can allow maintenance of other operating units not now possible. Delays are frequently experienced in bringing large new units of this size into commercial operation, and thorough testing and maturing of this unit prior to the summer peak period should improve reliability substantially.

While the 16.0 percent reserve associated with Indian Point No. 2 at 20 percent power may not appear to be critically low, the deterioration between the summer of 1972 and the summer of 1973 inability of the Consolidated Edison Company to import power must be considered. The new fossil-fired station at Roseton accounts for 480 megawatts of Con Edison's capacity during the summer of 1973. However, due to litigation in the New York State courts the Rock Tavern-Ramapo 345-kilovolt circuit associated with this new generating capacity will not be in service during the summer of 1973. The unavailability of the Rock Tavern-Ramapo circuit will reduce the ability of Applicant to import power from the winter-peaking upstate members of the New York Power Pool, Ontario and New England from the present value of 1,200 megawatts to 720 megawatts. This reduction in import capacity is particularly serious since during the past several summers during peak load periods Con Edison has regularly purchased power to the limit of its transmission capacity.

Transmission Facilities

A single 345-kilovolt overhead transmission line will deliver the output of the Indian Point Unit No. 2 to the Buchanan Substation. The line will parallel an existing 138-kilovolt line and will use the same right-of-way. Line design and construction conforms to guidelines for minimal impact on the environment including the Federal Power Commission's Order No. 414 dated November 27, 1970.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

50-247

JUL 13 1972

JUL 14 1972

Mr. Lester Rogers, Director
Division of Radiological and
Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

This is in response to your letter dated April 14, 1972, wherein you requested comments on the draft environmental impact statement for Indian Point No. 2, Consolidated Edison Company.

This Department has reviewed the health aspects of the above project as presented in the documents submitted. We offer no comments.

The opportunity to review the draft environmental impact statement is appreciated.

Sincerely yours,

Merlin K. DuVal, M.D.

Merlin K. DuVal, M.D.
Assistant Secretary for
Health and Scientific Affairs

50-247

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JUN 29 1972

Dear Mr. Muntzing:

This is in response to Mr. Rogers' letter of April 14, 1972, requesting our comments on the Atomic Energy Commission's draft statement dated April 13, 1972, on environmental considerations for Indian Point Nuclear Generating Plant, Unit No. 2, Westchester County, New York.

General

The statement seriously questions, as do we, the validity of some data presented by the applicant. In several places in the statement the AEC staff has disagreed with the computations and conclusions provided by the applicant.

It appears that the exact quantification of many of the probable environmental impacts cannot be made at this time. However, the data presented on Indian Point No. 1 (Chapter V) leaves no question that Indian Point No. 1 has a serious environmental effect on aquatic life in the river, especially fish. The statement presents a rather convincing analysis of the probable impacts of Unit No. 2 on aquatic life, especially as a threat to fish.

In addition, the statement in Table III-1 and on page III-7 and at other points recognizes the operation by sometime in 1974 of additional fossil and nuclear generating units, not now operating, on the Hudson River. These include Bowline Nos. 1 and 2, five miles below Indian Point, Roseton Nos. 1 and 2, 22 miles above, and Indian Point No. 3 at the site of Indian Point Nos. 1 and 2.

The environmental impacts of these five units are not included in the environmental impact assessments of this statement, although Indian Point No. 3 was apparently included in heat dissipation models by the applicant (page III-34) and the electric generating capacity of all five is included in the assessments of power supply available.

When operational, these five units will increase the daily discharge of heat to the Hudson River between Albany and 59th Street by about 113 percent over discharges when Indian Point No. 2 is operating. Heat discharge will be increased about 260 percent over present discharge levels listed in Table III-1, when Indian Point No. 2 and the other five units go into operation.

The additional 415 billion BTU/day discharge of those five units in a 28-mile reach of river, in addition to the 310 billion to be discharged by Indian Point Nos. 1 and 2 and the Danskammer and Lovett Units, suggests that damages of Indian Point Units 1 and 2 will likely be but a small part of the damages occurring to aquatic resources during the next two to four years.

Therefore, the opportunity to evaluate the operation of Indian Point Units 1 and 2 over the next two to four years, and to determine the effects of those operations on the Hudson River conditions considered in the statement is foreclosed by the imminent addition of these five units to the Hudson River.

There is no assurance that the effects of any given unit may not be significantly greater when considered simultaneously with the others.

It appears a virtual certainty that significant impacts on the biota can be expected from the operation of Indian Point Nos. 1 and 2 with once-through cooling. These include entrainment of planktonic organisms including egg, larval, and fry stages of important fish, along with zooplankton and phytoplankton. Major losses may continue from impingement of large fish on screen structures. Toxic conditions from use of anti-fouling chemicals appear a certainty, and adverse impacts of huge quantities of heat discharged to the river are predictable as are probable conditions of lower dissolved oxygen levels.

Significant impacts are predictable on the fishery resources not only of the Hudson River but also of the New Jersey and Long Island coastlines.. It appears necessary to correct the problems of Indian Point Nos. 1 and 2 and prevent additional problems at the other stations if the fishery resources of the Hudson River are to be managed and used for the public good.

Despite the extensive efforts undertaken in the past by the applicant to solve the problems of Unit No. 1 and to avoid problems in Unit No. 2, it does not appear that there is yet a basis to conclude that the efforts promise complete success short of discontinuation of pumping operations.

Nevertheless it seems reasonable to accept the staff's conclusion (page XI-55) that the short-term (2-4 years) operation of Unit No. 2 would not be expected to cause irreversible environmental damage to the aquatic biota.

However, the Department of the Interior is acutely aware of the likelihood of significant irreversible damage to the aquatic life should Unit No. 2 be operated as now proposed. The probable loss of fish eggs, larvae, and juveniles due to entrainment, and impingement at the Indian Point facilities in the magnitudes estimated, together with the related loss of faunal and floral plankton forms is unacceptable to this Department on a long-term basis.

The AEC proposal given in item 5.f page v to postpone a decision on corrective measures until the second year after steady state operation is achieved, suggests that any meaningful action to prevent significant environmental damage would not begin until three or more years from now. Construction time of one to three years could postpone effective preventative actions for up to six years. We consider this unacceptable since the predictable "short-term" damage to aquatic resources is of a sufficient magnitude to justify the best available corrective action now. Further quantification of the damage to the aquatic resources seems irrelevant to the basic objective of preventing the significant damage to these resources.

We presume that during the last several years the applicant has made meaningful studies of the alternative cooling systems in order to prepare the alternative section of the environmental statement. With these studies as a base, the design of an effective closed cycle cooling system within six months seems reasonable. Construction of the facilities within 12 to 30 months, depending on the system selected, should also be possible under a priority construction program.

Therefore, this Department recommends that the operating license for the Indian Point No. 2 should contain the following stipulations:

1. Within six months, the applicant shall present to the Atomic Energy Commission completed plans for a closed-cycle cooling system which will eliminate the need to withdraw cooling water from or discharge it into the Hudson River, except for quantities necessary as makeup water and blowdown discharges, respectively, from a closed-cycle cooling system. The plan shall include appropriate measures to minimize the effects of those limited withdrawals and discharges upon aquatic life.

2. The applicant shall construct and place in operation at the earliest possible time, and in no case later than July 1, 1975, the closed-cycle cooling system required in stipulation number 1 above.

3. During the interim period, any operation of Indian Point No. 1 and No. 2 with a once-through cooling system should be held to the minimum by drawing on other sources of power available to the applicant's system, and by publicly discouraging all unnecessary uses of electric energy within its service area, consistent with existing authorities.

4. The applicant should be required to adopt and employ all practical measures which may be developed in order to minimize any significant adverse impacts of the plant operation on the biota during the interim period.

5. The environmental study program outlined on page V-59 should be conducted as proposed, except that there should be no decrease in sampling efforts until an appropriate study interval after the closed-cycle cooling system becomes operational.

6. The proposed studies should include constant monitoring of the operations of Indian Point Nos. 1 and 2 in order to determine when severe adverse impacts are occurring and, where possible, operation of the plant should be shut down or reduce generation when major fish kills or other serious impacts are occurring at the plant.

7. The applicant will consult with the Bureau of Sport Fisheries and Wildlife on the development of the above studies as well as any plan which has the purpose of minimizing environmental degradation.

Comments addressing specific topics follow.

Land Use

The reference to the applicant's Supplement No. 1, which shows the layout of the buildings, park and lake area, should be page 2.3.1-2 instead of 2.21-2 as given on page V-1.

Cumulative Impacts

The statement pertains primarily to Unit No. 2, with some considerations being given to the cumulative effects of both Units Nos. 1 and 2. Since the construction of Unit No. 3 is about 70 percent complete and is scheduled to be operational in 1973, we believe that AEC would be remiss in meeting its obligation under P.L. 91-190 if the final statement were not expanded to include the effects of Unit No. 3.

It further appears that a more detailed discussion of the heat dissipation capacity of the entire Hudson River compared to the total heat load imposed by the various heat sources should be included in the statement. It appears that the cumulative thermal loading could appropriately be considered at this time. The New York Department of Environmental Conservation published an article in the New York Fish and Game Journal entitled, "Thermal Loading in the Marine District" in the July 1970 issue. This article pointed out the need to understand the ecology of the marine waters and the limits of tolerance of the member organisms in order to assess the environmental effects resulting from the operation of steam electric plants.

Impingement on Travelling Screens

Fish kills occurring on the travelling screens in the cooling water intake are discussed on page V-30 and V-46; however, the method of disposition of fish, and other accumulations on the screens is not described. The method of disposal of these solid wastes should be described in the final environmental statement.

Plant Dismantling and Decommissioning

The disposition of the site after the end of the useful life of the reactors needs to be clarified. It is stated on pages V-75 and V-76 that the reactor will be entombed with associated highly radioactive components and it is anticipated that this action would have no significant radiological impact on the environment. However, a basis for this conclusion is not given. We suggest that the statement include information on the anticipated quantities and longevities of the radioactive materials to be buried, the expected integrity of the entombing structures, and data on ground water. The burial of highly radioactive materials on the banks of the Hudson River would be a questionable action, particularly if long-lived radionuclides are involved.

Environmental Impact of Postulated Accidents

Section VI gives an adequate evaluation of impacts resulting from postulated accidents through Class 8 for airborne emissions. However, the environmental effects of accidental releases to water is lacking. Some of the accidents described in Table VI-1 could result in releases to the Hudson River and the effects could last for centuries. As we have stated in comments on previous environmental statements, we do not think that an analysis of only airborne emissions constitutes a complete evaluation of the possible impacts resulting from a major accident.

We also think that Class 9 accidents resulting in both air and water releases should be described and the impact on human life and the remaining environment discussed as long as there is any possibility of occurrence.

Alternative Fuels and Sources

The statement on page XI-3 refers to recent studies which indicate that coal-fired plants may lead to a radiation dose exposure to the general public similar to or greater than exposures derived from operation of powerplants using pressurized water reactors. We do not believe that there is uncontestable evidence to support this statement. If AEC retains this information in the final environmental statement, we suggest that the radiological impact of Unit No. 2 should only be compared with modern fossil-fuel steam-electric plants with current emission control equipment.

Recreation

We believe that assessment of the impacts on recreational water for both primary and secondary contact activities should be expanded. The transfer of 14 acres to the Village of Buchanan to be developed by the Village as a public marina should increase the recreational value of boating; however, little or no mention is made of the effects of other water associated recreational activities.

Planned Environmental Studies

As we have stated previously, we believe sampling intensity, as mentioned on page V-59, should not be decreased until the effects of Units 1, 2, and 3 have been determined. Entrainment studies should also be continued until such time as definitive information has been gathered. These stipulations should be placed in the study plan outlines and included in the study discussions in the statement. We recommend that the operating license require the applicant to consult with the Bureau of Sport Fisheries and Wildlife on the development of the detailed plan to minimize environmental harm. We also request that this Department be advised of the plan when completed and review and comment on it in regard to our expertise and jurisdiction.

Benefit Description of Alternative Plant Designs

The benefits claimed on page XI-57 from research, local taxes and employment should be separated from other benefits in this table. The AEC's "Guide for Submission of Information on Costs and Benefits," dated May 1972, correctly distinguishes between these items and the generation of electricity and the production of other products. We also concur with the statement on page 4 of that report "that the calculation of indirect benefits is a complex and controversial matter, frequently involving a large number of assumptions." As further pointed out, the claiming of such benefits could result in multiple accounting. It appears that this statement has shown benefits for the additional local taxes and employment without indicating that there would also be attendant increases in taxes paid by local and regional customers and that there would also be some increase in local services for the approximately 400 people expected to work at the plant.

Although significant benefits may be realized by the local community, these funds are ultimately paid by the local community and the other customers of the applicant, therefore, from a regional viewpoint taxes are essentially a transfer of funds and should not be indicated as benefits.

We appreciate this opportunity to comment on the statement. We hope these comments will be useful to you in the preparation of the final environmental statement.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Mr. L. Manning Muntzing
Director of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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50-247

25 MAY 1972

Mr. Lester Rogers, Director
Division of Radiological and
Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

This is in response to your letter of 14 April 1972 addressed to Mr. Herbert F. DeSimone, Assistant Secretary for Environment and Urban Systems, concerning the revised draft statement, environmental report and other pertinent papers on the Indian Point Unit No. 2 Nuclear Generating Plant, Westchester County, New York.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted and we have no comments to offer. It is our determination that the impact of this project upon transportation is minimal and we have no objections to the project.

This Department previously reviewed this project as indicated in our letter dated 25 January 1971 to Mr. Harold L. Price of the Atomic Energy Commission.

The opportunity to review and comment on the Indian Point Unit No. 2 Nuclear Generating Plant is appreciated.

Sincerely,

W. M. Benkert

W. M. BENKERT
Rear Admiral, U. S. Coast Guard
Chief, Office of Marine Environment
and Systems

NEW YORK STATE HISTORIC TRUST Parks & Recreation • State Campus • Albany, N.Y. 12226 • 518 457-4194

May 12, 1972

Mr. Lester Rogers, Director
Division of Radiological and
Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 205215

Docket No. 50-247
(Indian Point #2, N. Y.)

Dear Mr. Rogers:

The New York State Historic Trust has carefully examined the environmental statement prepared for this project. I am pleased to reply on behalf of the State Liaison Officer for Historic Preservation, the Chairman of the New York State Historic Trust.

In general, the New York State Historic Trust agrees with the Historical Impact Statement on Page V-2 of the Draft Statement on the Environmental Considerations and the sites mentioned in the Appendix at 2.1.3-2. However, the New York State Historic Trust regrets the already unsatisfactory visual impact of the Indian Point Construction on the historic environment of the Stony Point Battlefield and of the Palisades Interstate Park, both of which are Registered National Historic Landmarks. The New York State Historic Trust further hopes there will be no additional damaging effects in those surroundings.

I hope this information will be useful.

Very truly yours,

Mark Lawton

Mark Lawton
Director

ML:WGT:ve

RONALD W. PEDERSEN
FIRST DEPUTY COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY

50-247

June 1, 1972

Dear Sir:

The State of New York has completed its review of the "Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of an Operating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant" Docket No. 50-247, by the U. S. Atomic Energy Commission, Division of Radiological and Environmental Protection, Issued April 13, 1972.

In preparing the attached comments, we have taken into consideration the views of all appropriate State agencies including the New York State Atomic Energy Council. Many of the comments are quite detailed and directed to very specific points in the statement with the aim of clarifying and improving the final statement.

The statement is commendable in that it has identified the environmental impacts and adverse effects of the operation of Unit No. 2. It does not, however, fully discuss the relationship of Indian Point with respect to the cumulative and synergistic effect of its operation and that of a number of other power plants in a relatively short section of the Hudson River.

It is also important to note that a number of observations in the statement are based upon operation of Unit No. 2 beginning in the summer of 1972. However, because of various delays, earliest operation would be beyond the summer 1972 peak demand period.

The attached comments are illustrative of our concerns and we request that they be given your utmost consideration. Thank you for the opportunity to review and comment upon this document.

Sincerely,

United States Atomic Energy Commission
Washington
D. C. 20545

Attention: Director, Division of Radiological and Environmental Protection

Enclosure

STATE OF NEW YORK

- COMMENTS -

on the

"Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of an Operating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant"

Docket No. 50-247

by the

United States Atomic Energy Commission, Division of Radiological and Environmental Protection

Issued: April 13, 1972

1. General Comment - On the thirty mile stretch of the Hudson River extending north and south from Indian Point there are ten power generating stations either operating, under construction or planned for the future. Those presently operating include Indian Point No. 1, Lovett and Danskammer. Five stations are under construction at the present time and these include Indian Point Nos. 2 and 3, Bowline 1 and 2 and Roseton. Two additional plants have been proposed by Con Edison known as Verplank 1 and 2. At least six of these stations will be located within a one and one-half mile section of the River (Indian Point 1, 2, and 3, Lovett and Verplank 1 and 2). Although it is recognized that all of those plants are not the subject of the environmental statement under consideration, it is quite difficult to obtain a valid appraisal of Indian Point No. 2 without the

recognition of the cumulative and synergistic effect of the operation of possibly ten plants in such a short section of the river.

2. Page i-3. - While the applicants' declared intent to develop a portion of the property for recreational and educational purposes and the grant of 14 acres of property to the municipality for the development of a marine facility at Lent's Cove is commendable, the project does detract from the view of the shoreline and upland area as seen from the river. This fact should be indicated.

3. Page i-3.c. - In connection with the area used in transmission line rights-of way, there is a statement that the transmission towers were architecturally designed in accordance with State and Federal guidelines. There is no State guideline on the architectural design of transmission towers. The type of tower most appropriate for use will vary with topography, vegetative cover, background and exposure of the right-of-way. For purposes of minimizing aesthetic insults there is no "best" design. The Statement should describe the design contemplated and discuss the visual impact expected.

4. Page ii, 3.f., III-6 thru III-39, XI-12. - The AEC states that "The conclusions reached by the applicant in regard to the thermal discharges from Units Nos. 1 and 2 in meeting the New York State thermal criteria throughout the entire year have not been adequately demonstrated by the applicant, especially since the submerged jet depth is being changed from 18 feet to 12 feet below mean water level." It is assumed that the AEC will pursue this question further with the applicant prior to approval of an operating license. While there may be questions about the actual dispersion patterns, the model studies, calculations, and field studies

represent a reasonable effort at appraising likely river conditions.

Further modifications, if needed, may be required by the State. Since the New York State Department of Environmental Conservation has stated that there is reasonable assurance the criteria will be met and has adequate follow-up procedures following issuance of the permit, the U.S.A.E.C. assertion on p. ii, 3.f. is questionable.

The AEC review of the mathematical and model predictions by the utility (p. III-6 thru III-39) questions the adequacy of the data available and the resulting conclusions drawn by them and likewise by the N.Y.S. Dept. of Environmental Conservation (since the State has issued a construction permit and has given a certificate of reasonable assurance). However, the USAEC comment is based on an evaluation assuming the discharge from all three units operating and not just Units #1 and #2 (p. III-39). There is no doubt that there are serious concerns already identified by the N.Y.S. -D.E.C. in regard to the ability of the approved diffuser facilities to adequately satisfy thermal criteria with all three units operating.

5. Page ii-3.j and p. V-53 - AEC estimates that "the total yearly recruitment loss for each subsequent year loss in the (striped bass) population may be as high as 15-20% from direct effects of

plant operation". Their analysis is based in part on the prediction that 25% or more of the fish eggs and larvae passing the plant will be entrained and lost. This prediction is only meaningful in terms of the proportion of the total number of eggs and larvae produced annually in the Hudson River which actually do pass by the plant. AEC assumes that a large proportion of the annual production will pass the plant. Insufficient documentation is provided in the statement to validate the use of this assumption.

6. Page iii-3.n - This paragraph states that the operation of Unit No. 2 will permit the applicant to shut down or reduce the use of "older coal-burning plants." The last unit in the Consolidated Edison system using coal was at the Arthur Kill Plant. This unit was shut down by conversion to oil on February 25, 1972. Therefore the phase "older coal burning plants" should be changed to "older oil burning plants" since there are no longer any coal fired plants in the Con Edison system.

7. Page iv-5.c. - The AEC conclusion that the benefits of meeting an urgent short term need for power in New York City outweighs the corresponding environmental costs is only justified to the extent that there will be no irreparable and irreversible effects on the environment.

8. Page iv-5.d. - The name of the agency (s) to whom "the comprehensive program" should be acceptable should be identified.

9. Page v-5-f. - It is felt that the Commission should discuss any proposed action to be imposed on the applicant to minimize environmental

impact with the State before such actions are actually imposed.

10. Pages I-3 thru I-8. - Comments on Permits Issued - The first permit issued to the Con Edison Company was dated August 22, 1966 and applied to the construction of an outfall and the discharge of cooling water resulting from the operation of Unit #1 only. This permit expired five (5) years later on August 22, 1971. Therefore, it is no longer in effect. A construction permit was issued on May 19, 1970 with the understanding that the effluent channel and diffuser, although hydraulically capable of discharging the cooling water from all three (3) units, would only be approved for the eventual discharge of Unit #1 until sufficient ecological and temperature studies could prove adequacy for Units #2 and #3. A modified construction permit was issued on December 10, 1970 for the same basic structure. However, our concerns for not allowing the discharge of Unit #2 were alleviated after having received additional information regarding the proposed discharges from Units #1 and #2. The proposed relocation of the intake structures by Con Edison was a significant improvement and entered into this decision. The USAEC is urged to require Consolidated Edison to establish a firm schedule for implementing this proposed modification. A third modified construction permit was issued on November 4, 1971 because of changes in the design of the adjustable discharge ports and slide gates. The permit conditions were otherwise the same as for the previous permit. Recent inspections indicate that the structure is nearly complete with approximately half of the slide gates installed. The company has been informed that an operation permit to discharge the cooling water from Units #1 and #2 through

the discharge structure will be withheld until all construction called for in the construction permit issued November 4, 1971 is complete and in accordance with the approved plans. Therefore, no permit has been issued nor is one in effect to discharge through the diffuser structure.

The permits listed through the Introduction in the report are accurate except that the November 4, 1971 construction permit is not listed. The permits listed under Chemical Discharges on page I-6 are incidental to the project. One was for the disposal of domestic sewage (6-10-59), while the other two (11-13-70 and 2-10-71) were for the release of cleaning solutions from pipe cleaning operations and were only temporary in nature. They are no longer in effect since the cleaning operations have ceased.

11. Page I-9 - The last sentence of the first full paragraph provides a list of the organizational members on the Fish Advisory Board. This list should be modified to indicate that there is a non-voting member from the New York State Department of Public Service.

12. Page II-1 - The importance of the estuarine nature of the Hudson River, which is described in paragraph 3 is that the upward extent of salt water varies strongly with the input of fresh water into the river and that it may actually be nearly fresh near the river mouth after a heavy rain. This is a misleading statement since this effect can only occur after protracted high flows of fresh water and in most circumstances can only occur during high flows

that are characteristic of the spring runoff.

13. Page II-8 - Statements in regard to the geology of the site appear to be little more than a review of the content of the Preliminary Safety Analysis Report rather than a critique of the possible environmental dangers which might be possible, because of the geological circumstances present there. The terminology used, such as:

"...no truly major faults on or near the site."

"...no danger of a destructive earthquake."

are not sufficiently precise statements. The following statements are suggested as alternatives to those quoted above:

a. No faults are known to exist on the proposed site. A major fault has been mapped extending into the Hudson River from the eastern shore in a line approximately 3000 feet northwest of the site. This fault extends over twenty miles to the northeast of the site and may join faults west of the River which extend into New Jersey to the southwest. One of these faults to the southwest, the Ramapo Fault, separates rocks of Precambrian age (over 800 million years old) from Triassic age (approximately 200 million years old) rocks and represents considerable displacement. On the east side of the river within three miles both north and south of the site are several faults with at least several hundred feet of mappable offset.

b. As presented in the Preliminary Safety Analysis Report, a Modified Mecalli intensity of VI is considered possible in the area on the basis of study of the seismic history of the region.

Using the criteria tentatively proposed by the U. S. Atomic Energy Commission for siting of nuclear power plants in 10 CFR, Part 100, Appendix A, it may be necessary in the future to determine which faults in the area are "active"; active meaning one movement within the last 35,000 years or more than one movement within the last 500,000 years. There is seismic activity in southeastern New York, adjacent Connecticut and New Jersey. Only one focal mechanism has been worked out which shows possible correlation to a known fault. This fault is a Triassic basin border fault in New Jersey. Thus, for further power plant siting an investigation involving a seismic monitoring program with analyses of focal mechanisms to determine whether the motions observed correlate both geographically and geometrically with known faults. If faults are found which appear to be related to seismic activity, they will have to be mapped in detail. Such a mapping program could involve the entire south-eastern portion of New York and adjacent Connecticut and New Jersey.

It can be anticipated that this kind of study will be required for future site investigations and that more detailed geologic mapping will be required.

The original reports by T. W. Fluhr, P.E., and S. Paige, besides their own field work, rely on quoted geologic information no younger than 1936 and mostly as old as 1919 and 1901. With the decision to build still another plant near this site, environmental statements should include detailed geologic investigations of the entire region be synthesized and analyzed and new investigations be undertaken to fill in the gaps in existing data. The geologic reports by T. W. Fluhr, P.E., and S. Paige are not sufficient for basing decisions on future power plant siting in the region around Indian Point.

14. Page II-9 - The discussion of surface water including tidal effects is important but it doesn't give proper recognition to the efforts to regulate flow by the use of headwater reservoirs. It should be noted that reference 9 includes a discussion that states in part "controlled releases ... are designed to keep the minimum flow of the Hudson River downstream from Hadley at the highest possible level, generally about 3,000 cfs ...." (page 7 of Reference 9). Green Island and Rensselaer do not draw any of their water from the Hudson River any longer and probably will not in the future except for emergency purposes.

15. Page II-11 - The first full paragraph contains a statement that peak tidal flow is more than 30 times the input of fresh water. While true, it is probably even more important that the peak tidal flow is about 100 times the fresh water flow at which the river is generally regulated.

16. Page II-19 - The first full paragraph dealing with "Special Ecological Considerations" implies that the Hudson is a major spawning area for striped bass that live in Long Island Sound and the Atlantic Ocean near New York. The importance of the Hudson River as a fishery in and of itself is quite well known, but the implication that this is a major striped bass spawning area for areas other than the western end of Long Island Sound is questionable.

17. Page III-7 - The last two sentences of the first paragraph in section E.1.a. indicates that once-through cooling systems are the simplest and most economical means for cooling. It should also be noted that, with the exception of dry-cooling towers, not in general use, these systems cause less evaporation and generally consume less water during their operation. They also avoid the physical intrusion of towers and they add less visible vapor to the air in the vicinity of a thermal plant.

18. Page III-9 - The status of Technical Bulletin No. 36, "Thermal Aspects of Discharges on Water Resources," has been the subject of much discussion. After New York filed Bulletin No. 36 with the Interior Department, that Department approved New York State standards. When the State formally adopted thermal criteria essentially as previously transmitted to the Department of the Interior, EPA raised questions and has not approved or disapproved them.

19. Page III-11 - "Recommended revisions" should have no place in an evaluation of requirements for approval under existing regulations. Adoption is highly speculative. If new criteria are subsequently adopted, their applicability to, and effect on, the facility would

have to be evaluated at that time.

20. Page III-19 - The first paragraph mentions a control weir in the discharge canal to control jet velocity. This is incorrect, as velocity can only be controlled by port opening adjustment, which controls head on the open ports. Further, the head requirements on the circulating water pumps were partially determined by the water elevation in the discharge canal. The weir could only function as a relief to avoid excess head and backpressure.

21. Page III-35 - The first paragraph contains an expressed concern for raising the port depth from 18 to 12 feet in terms of meeting a 90°F maximum surface temperature restriction. This assumption fails to recognize, for the 12 foot depth, jet development by bottom entrainment that was restrained by the river bed at the 18 foot depth, and verification by hydraulic model studies of better initial dispersion and lower maximum surface temperatures than shown by the same model with an 18 foot port depth. It is believed this concern is not warranted and the maximum surface temperature criterion will be satisfied.

22. Page III-35 - The third paragraph discusses maximum river ambient temperatures and indicates that a maximum river temperature of 81°F has been observed opposite Indian Point in August. The company's analysis takes into account some recirculation. It is necessary to clarify whether the 81°F temperature was a local surface temperature or is average and representative as background ambient across the river. Since these observations were made when Indian Point No. 1 was running, it is expected that slack tide periods

would show slight temperature elevations off shore from the plant. Effects of Unit 1 are accounted for in the combined analysis for 1 and 2 together, and should not be superimposed on the combined analysis. To suggest adding 2°F to the analyses for heat dissipation presumes such a temperature would be uniformly present throughout the cross-section to the depth from which water is withdrawn. This is rejected as without foundation.

23. Pages III-35-36 - In the first paragraph on the submerged discharge math model, there is a discussion of the zone of flow establishment, and an assertion of improper approach. The development of the coefficient for the length of the zone of flow establishment was also based on undistorted hydraulic model studies. Since the length is a constant times width, there seems to be no basis for stating the constant in error, but rather that a different equivalence parameter might have been used to establish the zone distance. It does not appear, as correlated in hydraulic model studies, that this would appreciably change the final length.

24. Page III-36 - The first full paragraph suggests that maximum surface temperatures are not properly evaluated. While the assumptions of distribution in an assumed equivalent plume may not be verifiable, the undistorted hydraulic model gives data for maximum temperature at any point on the surface, and demonstrates ability to meet the maximum surface temperature criterion.

25. Page III-36 - The second complete paragraph deals with the question of interference between jets. While important, it must be recognized

that the nature of these jets is such that most dilution will come from top and bottom, and lateral interference between jets is of less significance. The applicants selected operating mode of alternate ports, with edge to edge spacing of 25 feet, should obviate further discussion of a possible inappropriate equivalence analysis and assumed vs. actual port spacing of 11.25 and 5 feet respectively. Further, if the statement analysis were carried on to no lateral port spacing (a slot), the conclusion seeming to be drawn would be no dilution. This is incorrect; a slot can function as an effective diffuser. The correct conclusion is that considerable additional dilution will occur after jet interference. The primary reliance must be placed on undistorted hydraulic model studies and field verification.

The company has acknowledged that extensive field evaluations and verification are required and will be conducted. There is sufficient flexibility in the diffuser designed for three units to operate various port groupings to determine port inter-relationships and dilution effects.

26. Page III-36 - The final sentence of the second full paragraph, indicating that the jet interference temperature and the surface temperature are synonymous must be refuted. The 81°F temperature, as discussed above, is also rejected as being a temperature which could occur across the entire intake. Significant dilution, as also discussed above, will occur after jet interference. The compounding of two assumptions in error to indicate surface temperature criteria violation must be questioned. The average intake temperature

will not reach 81°F, nor will the maximum surface temperature at the discharge be elevated 12.4°F, as stated. With primary reliance on the undistorted hydraulic model studies, it must be reiterated that the 90°F surface criterion will be satisfied.

27. Page III-37 - In the first paragraph, questions are raised about operation of the jets. The diffuser design, to allow the restriction or closing of some port openings allows a design jet velocity prior to unit three operation, and also at any combination of operating units and circulating water flows. With this flexibility, there should be no cause for concern. The applicant has initially selected alternate ports for operation, but it will be desirable to investigate other combinations. The applicant will be restricted by state discharge permit condition to maintain design velocity at all times during plant operation.

28. Page III. - The second paragraph discusses factors which, it is presumed, invalidate the applicant's review analysis. While the mathematical models do not take the port elevation shift into account, the hydraulic model studies do. The 12 foot discharge configuration has been modeled, with results of a lower maximum surface temperature and a better isothermal pattern than the original 18 foot depth. The primary reason is removal of the interference of bottom impingement by the plume, overcoming drag, and better entrainment under the jets. The jet would not now interdict the bottom, and this should be considered in evaluating ability of free swimming fish to move under the discharge and along the bottom in the vicinity of the discharge.

The question of increased temperature is correctly stated, in terms of less flow and higher temperatures. However, this should not be equated to maximum surface temperature criteria violation, as this mode of operation has been selected for winter use when ambient temperatures are very low.

29. Page III-37 - The discussion of near and far field dissipation mathematical models indicates the need for field verification of model correction factors over a broader range of conditions and temperatures than possible with Indian Point No. 1 alone. It will only be possible to verify at higher flows and heat discharge when Indian Point No. 2 is on line.

The mathematical models are a reasonable approach to describe the phenomena associated with heat discharge and dissipation. They require refinement, and must be correlated to hydraulic model studies and actual field verification. From the data available, and analyses and studies done, it can be concluded with assurance that the Indian Point No. 1 and 2 discharges can be accommodated in the Hudson River within constraints of adopted thermal regulations and water quality requirements. Both mathematical and hydraulic model studies will be reworked as field data is available. The mathematical model assumptions will be re-evaluated in light of operating experience to move to a more confident basis to predict effects of adding Unit No. 3.

30. Page III-38 - The discussion under cross-section temperature distribution model again, as for the dissipation model, criticizes extrapolation outside of confidence limits, of limited data. While

not desirable, use of available data must be made to check theoretical assumptions. As noted above, continued refinement of models will be made as new data is available, but the ability of Unit No. 1 and 2 discharges to meet criteria can be accepted at this time. The hydraulic model studies give balance to the mathematical approach, and have been conducted over a wide range of operating conditions to observe changes. Extensive verification tests will be conducted.

31. Page III - The paragraph on net-nontidal flow recognizes the phenomena, and its usefulness in describing mixing and dilution aspects not accounted for in other ways. However, it is believed, in light of the admitted lack of definitive data to quantify the phenomena, that conclusions should not be drawn on which segments of the flow region participate, and to what extent. Its beneficial effect should be recognized, with qualification and quantification left to field verification studies.

NOTE: While the comments in Nos. 18 through 31 were generated primarily in response to the section on heat in the statement, III,E.,1., pages III-6 to III-39, they should be used throughout the entire statement where questions of thermal discharge arise.

32. Page III-45 - The total calculated liquid release other than H-3 from Units 1 and 2 of 81 Ci will be reduced to 8 Ci when all plant modifications are complete. These modifications are listed in Con Edison's Environmental Report Supplement on page 2.3.7-9 as being the following:

a) modify reciprocating charging pumps and return leakage to C.V.C.S.

b) modify pressurizer spray values.

c) modify waste disposal evaporators.

d) install a polishing demineralizer/filter for waste evaporator condensate.

e) intertie between Units 1 and 2 steam generator blow-down purification system.

There is no schedule given for the completion of these modifications. After all plant modifications are effective, the estimated liquid releases other than H-3 would still exceed the guide of 5 Ci per year given in 10 CFR 50 Appendix I. A statement regarding these modifications should be included, and schedules discussed, as fully as possible. This is particularly important in regard to the steam generator blow-down purificator system as 85% of the anticipated annual release of radio activity from Unit #2 originates from this system and by-passes the existing radwaste system.

33. Page III-46-47 - The report considers the environmental impact of Units 1 and 2 operating simultaneously. On page III-46 the calculated radiological releases from Unit 1 are listed amounting to 40 Ci. On page III-47 the past actual releases are listed and they are close to this level. However, this table omits available data for the last half of 1970 and all of 1971 which should be included. During 1971 the releases reported by Con Edison amounted to 78.5 Ci due mainly to the waste evaporative system being inoperative.

34. Page III-49 - The statement is made that AEC estimates of I-131 releases to the atmosphere are 0.64 Ci, which exceeds the Technical Specifications limit of 0.18 Ci/year. The plant modification listed in the Supplement calls for a charcoal filter in the plant vent but no schedule is given when this will be complete. If the iodine release the AEC is referring to originates from volatile iodine in the steam generator blow-down system there is some question about this by-passing the plant vent. This point should be clarified. Estimated releases after the charcoal filter is installed and the scheduling for installation of the filter should be discussed.

35. Page III-59 - Consideration of the environmental effects of the emission of fossil-fuel contaminants is not adequately covered. In Section III, E 4, it is correctly shown that the plant complies with the applicable emission standards. However, in Section V, C or Section VII, B 2, it is not sufficient to state only that the operation of the plant would not greatly increase the level of nonradioactive air pollutants in the area. On the basis of results of diffusion analyses conducted by the Utility for the Fossil-fuel contaminants, the expected contributions by Units 1 and 2 to the pollutant levels can be stated and compliance with the applicable air quality standards can be shown. This should be done.

36. Page V-4 - The end of the first paragraph discusses the need to carefully evaluate the discharges from Units 1 and 2 so that the facilities needed at other or new plants can be evaluated. This is a reminder that observations of plant operation would be essential to an accurate appraisal of what Unit 3 is likely to do to river

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36. Page V-4 - The end of the first paragraph discusses the need to carefully evaluate the discharges from Units 1 and 2 so that the facilities needed at other or new plants can be evaluated. This is a reminder that observations of plant operation would be essential to an accurate appraisal of what Unit 3 is likely to do to river

temperatures. The criticism of the limited background sampling gives even more weight to permitting observations of the effects of Units 1 and 2 while there is still a chance to use the observations to modify Indian Point 3 before it is ready to come on line. The applicant is already required to monitor all discharges. The important question now is the frequency and location of sampling to assure that they will represent the mixing of the plant discharge with the river water.

37. Page V-6 - The second paragraph indicates that the applicant's studies can be expected to answer some of the ecological questions raised by operation of Indian Point 1 and 2 but that other studies should be undertaken and that these needed studies are discussed in Part D-4 (Page V-60). However, review of the "Needed Information" outlined under Part D-4 does not clearly reveal who will carry out the needed studies. A similar problem exists on Page IX-4, Part F, where reference is made to a proposed radiological and non-radiological surveillance program. A clear proposal as to what additional information should be collected, and by whom, should be presented. In addition, the discussion on Page XI-55 of technical specifications to be provided with the operating license does not specify the ecological monitoring surveillance program and necessary administrative controls recommended to assure that adequate data will be collected to assess the biological impact of the operation of this facility. Again the question arises as to

, what additional information should be obtained to assure an adequate appraisal, and what further administrative control should be imposed to enforce the program? The environmental monitoring activities are now being carried out through contract studies evaluated by the State and Federal fisheries agencies.

If these programs are to be effective, they must be clarified and coordinated with the on-going studies under the Federal and State agencies.

38. Page V-6 - The third paragraph indicates that "large numbers of fish may be killed through impingement on the screens that protect the condensers." The expected losses should be further quantified by reference to past and current operating experience.

39. Page V-11 - Chlorine discharge problems discussed in paragraph 2 merit very serious consideration. Mechanisms for controlling biological growth in the condenser while keeping the chlorine discharge concentration as low as possible would be highly desirable. Chlorinating when the condenser flow is reduced and on half a condenser section at a time would appear to be a desirable practice. By keeping the quantity of chlorine discharged to the river as small as possible, sensitive forms would be subject to chlorine for a short period until current and wind action reduced levels below thresholds for entrained non-mobile species.

40. Page V-17 - In connection with the observation made in the fourth paragraph, it would appear that survival in the zone of thermal resistance would become shorter rather than longer as the temperature appraoches the lethal temperature.

41. Page V-36 and 37 - The table V-3 on pages V-36 and V-37 of the report appears to contain a number of errors, particularly the total dose to invertebrates. The concentration values in this table were obtained by dividing the estimated releases by the total yearly flow in the discharge canal. Calculations of the average yearly concentration result in about 25 pCi/l. This will be reduced when plant modifications are complete. The data in table V-3 should be corrected and refined.

42. Page V-52 - The first complete paragraph discusses the possible effects of the destruction of large number of *Neomysis* on the food chain. While *Neomysis* may be killed by passage through the plant, they may still serve to feed other fish that frequent the discharge plume; therefore they may still contribute to the food chain. Consideration of this item should also be included in the AEC statement.

43. Page V-54 - The first two paragraphs discuss factors associated with the movement of larvae through the area where they are susceptible to withdrawal by the Indian Point intake. If some of the larvae move through the area at a higher than average rate as a result of longitudinal dispersion, it would seem logical that others would be held in the area longer resulting in no net change in exposure to withdrawal for the entire populatio

44. Page V-54 - The third paragraph discusses the vertical migration of larvae. A review of the Hudson River Fisheries Investigation's report indicates that the larvae are definitely more concentrated near the bottom during the daytime as indicated in the impact report. A more appropriate interpretation of nighttime conditions, however, appears to be that the larvae are uniformly distributed rather than concentrated toward the top. The statement in the Impact Report is therefore questionable.

If the shift were from the bottom during the day to the top at night then the average movement through the Indian Point area would be approximately as though the larvae were unifromly distributed. Since the larvae are uniformly distributed at night however, then a portion will continue to be carried upstream and the average number of exposures of the population would appear to be still greater than estimated by U.S.A.E.C.

The concentration of larvae subject to withdrawl by virtue of being in the surface waters would be halved, however, since the larvae will be distributed through the cross section rather than concentrated in the surface waters.

45. Page V-64 - The third paragraph should clarify in its reference to page VII-8 whether it is referring to the 5 mrem/yr site boundary dose or the 5 curies per year and 20 pCi/liter limit as meeting the 10CFR50 requirements for "as low as practicable."

46. Page VII-1 - If the sixth of the factors listed as important is believed to be a result of plant operation then the introductory words should be changed to read "Reduction of dissolved oxygen . . ."

47. Page VII-2 - The section relating to "Air Use" should be changed. Bringing Indian Point Unit No. 2 on line would probably not result in the immediate retirement of existing fossil-fired plants since reserve capacity will still be marginal. On the other hand the availability of a base load nuclear power plant should permit reduced operation of these plants and in the long run the addition of Indian Point Unit No. 2 will contribute to the total capacity needed to meet increased demands and to eventually replace the older fossil fired plants that should have been retired some time ago.

48. Page VII-4 - The section on heat dissipation contains an evaluation of expected temperatures based on condenser flow and service water additions. Evaluation of the numerical values given indicates that the mean temperature would be 25^{o}F. (considering condenser flow only) rather than 32.5^{o}F. Although the near field mixing requirements are greater with reduced condenser flow, the far field heat dissipation requirements will remain the same. Since the initial water temperature will be lower when reduced condenser flows will be applied, it should be expected that the 90^{o}F. limit can readily be met. The 4^{o}F. rise limit will then be the controlling requirement. Consolidated Edison Company has acknowledged that further field observations are needed. The effects of port elevation changes have been discussed previously in comments on the submerged discharge model (p. III-37 para. 2). These comments apply here also.

49. Page VIII-1 - The third paragraph should be expanded to deal explicitly with the question of whether it should be necessary to meet all of the electrical demands of customers. Certainly the basic needs mentioned

in the report should be met but a careful examination should also be made of the necessity of meeting all other use demands, especially at all times and at low cost.

50. Page VIII-2 - The first paragraph should be expanded to note that while Indian Point 2 would significanly contribute to Consolidated Edison's nominal reserve margins, it is of perhaps even more importance that it would be expected to have greater reliability than many of the older units counted in the reserve, thus further contributing to the ability of the system to meet peak demands.

51. Page VIII-4 - The section dealing with "Water Usage" note that use of Hudson River water for cooling Indian Point 2 would limit or preclude its use for cooling for other purposes. The statement should also indicate that an immediate use for cooling may have a greater social value than an uncertain future use and an expanded discussion of this should be included.

52. Page VIII-4 - In the third paragraph, "the ultimate impact on the fishery was not evaluated because the effect of Indian Point is still problematical." The contribution of the Hudson to the commercial and sports fisheries is basic to a determination of the potential overall costs to society. Furthermore, the purpose of the Statement is to describe and project, to the fullest extent possible, the ultimate effect on the fishery.

53. Table X-1 - This table should be modified to reflect the latest load and capacity estimates made by Consolidated Edison and the New York Power Pool. It has been retyped to permit the comparison of the new data, which is underlined, and the original data, which has been placed in parentheses. Certain items, which have been difficult to verify either as to the basis for their use or their accuracy,

have been marked. The Consolidated Edison Company capacity estimates for 1972 include the output of Bowline No. 1 (600 MW(e)), 348 MW (e) of barge-mounted gas turbines, and 270 MW (e) of firm power to be purchased from Rochester Gas and Electric. On this basis the estimated reserves without Indian Point No. 2 are 1,921 MW (e) or 22.9%. However, delays in completion of Bowline No. 1 and the barge-mounted gas turbines and the occurrence of peak loads between June 15 and July 15 would reduce these estimated reserves to 503 MW(e) or 11.5% of peak load, which is below the desired reserve margin of 20%. In addition, Consolidated Edison, due to delays in development of new facilities has been forced to maintain on line a large number of old generating plants that would normally have been retired, and as a result an average of 2,350 MW(e) (See footnote 2. Table X-1) of generating equipment is expected to be unavailable for the coming summer. It should be noted that this is approximately 429 MW(e) more than the estimated reserve capacity 1,921 MW(e). If, in addition, Bowline No. 1 is delayed, Consolidated Edison Company could incur a generating capacity deficit of 1,029 MW(e) on any given day.

Actually, the amount of unavailable capacity could be much greater. Consolidated Edsion estimates that for this summer equipment unavailability could range between 1,450 MW(e) and 3,250 MW(e) on any given day. The revised table also explores the effect of having Indian Point No. 2 available at half and full power. In light of recent developments, it appears that the earliest date for commercial operation of Indian Point No. 2 would be beyond the summer 1972 peak demand period.

TABLE X-1 FORECASTED 1972 SUMMER PEAK SITUATION

	Consolidated Edison Company		New York Power Pool	
Conditions Without Indian Point Unit No. 2				
Net Dependable Capability - MW(e)	(9,448)1/	10,321	(24,026)	23,727
Net Peak Load - MW(e)	(8,550)	8,400	(20,040)	19,510
Reserve Margin - MW(e)	(898)	1,921	(3,986)	3,717 3/
Reserve Margin - Percent of Peak Load	(10.5)	22.9	(19.6)	19.0
Reserve Deficiency - MW(e)	(812)	-	(22)	185
Conditions With Indian Point Unit No. 2 (436 MW(e))*				
Net Dependable Capability - MW(e)	(9,884)1/	10,757	(24,462)	24,163
Net Peak Load - MW(e)	(8,550)	8,400	(20,040)	19,510
Reserve Margin - MW(e)	(1,334)	2,357	(4,422)	4,153 3/
Reserve Margin - Percent of Peak Load	(15.6)	28.0	(22.1)	21.3
Needed Reserve Margin Based on Criteria of 20 Percent of Peak Load - MW(e)	(1,710)	4/	(4,008)	4/
Indian Point Unit No. 2 (436 MW(e)) Capability as Percent of Needed Reserves	(25.5)	4/	(10.9)	4/
Reserve Deficiency - MW(e)	(376)	-	-	-
Indian Point Unit No. 2 (873 MW(e))				
Net Dependable Capability - MW(e)	(10,321)	11,194	(24,899)	24,600
Net Peak Load - MW(e)	(8,550)	8,400	(20,040)	19,510
Reserve Margin - MW(e)	(1,771)	2,794	(4,859)	4,590 3/
Reserve Margin - Percent of Peak Load	(20.7)	33.2 2/	(23.8)	23.5 2/
Needed Reserve Margin Based on Criteria of 20 Percent of Peak Load - MW(e)	(1,710)	4/	(4,008)	4/
Indian Point Unit No. 2 (873 MW(e)) Capability as Percent of Needed Reserves	(51.0)	4/	(44.2)	4/
Reserve Deficiency - MW(e)	(61)	-	(851)	-

* Even with operation of Indian Point Unit No. 2 at 50% power, a reserve deficiency of 376 MW(e) in the applicant's system results.

1/ Includes 325 MW(e) of firm power purchases.

2/ Reserve margin must consider the amount of generating capacity that will be unavailable because much of the generating capacity is beyond normal retirement age. Much of the reserve capacity cannot be expected to be available. Based on last summer's experience it is estimated that an average of 2,350 MW(e) will be unavailable because of unscheduled outages. This represents 429 MW(e) more than the estimated reserve of 1,921 MW(e).

3/ Includes deduction of 500 MW(e) down for scheduled maintenance.

4/ A 20% minimum as a reserve margin capacity is an appropriate general rule in many situations. It is not an appropriate minimum for Consolidated Edison because of reasons already outlined in footnote 2.

TABLE X-3

PROJECTED ELECTRIC LOADS AND SUPPLY CONDITIONS
WITHIN THE NORTHEAST AREA AND THE NEW YORK POWER POOL
(WITH AND WITHOUT INDIAN POINT UNIT NO. 2)

		Summer 1972		Winter 1972-73	
Northeast Power Coordinating Council*					
Planned Capability, MW(e)		(54,763)	54,711 2/	(57,488)	59,857 2/
Anticipated Reserves, MW(e)		(13,334)	10,337 3/	(12,062)	13,305 3/
Percent of Projected Peak Load		(32)	25.1	(27)	29.4
Planned Nuclear		(2,824)	1,386	2,835	2,835
Percent of Anticipated Reserve		(21)	10.4	(24)	21.2
New York Power Pool**					
Planned Capability, MW(e) (Including net of transactions and 873 MW(e) from Unit No. 2)		(24,247)	24,600	(25,733)	26,681 4/
Peak Load, MW(e)		(20,040)	19,510	(20,040)	18,540
Anticipated Reserves, MW(e)		(4,207)	4,590 3/	(6,683)	7,241 3/
Percent of Projected Peak Load		(21)	23.5	(35)	39.1
Necessary Reserve at 20% (1) MW(e)		(4,008)	3,902	(3,810)	3,708
Surplus (Deficiency) MW(e)		(199)	688	(2,873)	3,533
Without Indian Point Unit No. 2 (Nuclear, April 1972)		-873		-873	
(Consolidated Edison Co. - Buchanan, New York)					
Net Capability	MW(e)	(23,374)	23,727	(24,860)	25,808
Peak Load	MW(e)	(20,040)	19,510	(19,050)	18,540
Reserve	MW(e)	(3,334)	3,717 3/	(5,810)	6,368 3/
Peak Load	%	(16.6)	19.0	(30)	34.4
Necessary Reserve at 20% 1/	MW(	(4,008)	3,902	(3,810)	3,708
Surplus (Deficiency)	MW(e)	(674)	185	(2,000)	2,660

* Includes New York, New England, and Canadian members.
** Includes net of sale transactions.

1/ FPC Staff Estimate.
2/ With Indian Point No. 2 at 873 MW(e).
3/ Includes deduction for scheduled maintenance.
4/ Winter capacity higher because of improved cooling efficiency.

Source: Letter to J. R. Schlesinger, Chairman of the Atomic Energy Commission, from J. N. Nassikas, Chairman of the Federal Power Commission, October 15, 1971 and evaluation of New York State Department of Public Service made on May 1, 1972, based on Consolidated Edison load and capacity estimates dated March 28, 1972 and report of NPCC dated April 1, 1972.

54. Table X-3 - This table has also been updated to reflect the load and capacity information received from the Northeast Power Coordinating Council on April 1, 1972, and to reflect the changes that were made in Table X-1. This has been retyped to permit comparison of the new information (which has been underlined) and the original information (which has been put in parentheses).

55. Page XI-2 - There does not appear to be adequate recognition that older plants which were originalyy coal-fired have been converted to oil to eliminate fly ash and coal handling problems. At the time these conversions were initiated, they were considered important steps to reduce soot emissions. As new environmental problems have been identified, however, further efforts for improvement have been found necessary.

56. Page XI-5 - The section dealing with purchased power is now out of date. Recent information from Consolidated Edison indicates that they will receive the output from Bowline No. 1 of 600 MW(e) and have firm purchase commitments for 270 MW(e) from Rochester Gas and Electric and an additional 150 MW(e) from PASNY. Negotiations were still underway for 300 MW(e) from Ontario Hydro.

57. Page XI-9 - A statement is made in connection with "Wet Cooling Towers" that all the heat rejected to the wet cooling tower is transferred via evaporation. One hundred percent evaporation takes place only during certain ambient conditions, and these conditions very seldom occur. In actual practice heat is dissipated by a combination of evaporation and sensible heat transfer.

58. Page XI-60 - Table XI-3 includes sections titled "Effects on Water Body of Intake Structure and Condenser Cooling System, 2.1 Primary Producers Consumers and 2.2 Fisheries." The effects of open cycle cooling systems would appear to be the same as, if nor more than, those for the once-through alternative. Since the same volume of water would be withdrawn, but mechanical impact and holding time at elevated temperatures would be increased, it would seem that the onshore effects of these alternatives would be similar to those for the once-through approach. On the other hand, the time the discharge would be above ambient temperatures would be substancially reduced. Thus, all four approaches should be either "Potentially Large" or the 2nd, 3rd, and 4th should be "Equal or Greater than for once through." The text (Pages XI-23ff) does not appear to cover these alternatives.

Line 3.2 on the effects of chemical discharges on aquatic biota seems questionable. Cleaning requirements would be greater in connection with natural draft and mechanical draft open cycle cooling alternatives than with once-through cooling. This, of course, would have a slightly greater effect on aquatic biota. A spray pond should have equal or larger effects than once-through cooling. For the closed cycle systems the blow down should have higher chemical concentrations but would be of much smaller volume. While minor, they certainly wouldn't be zero.

The items in Table XI-3 that are identified as "Same" might be interpreted to mean the same as above or the same as once through. All use of the term "Same" should be replaced with an appropriate number and all blanks should be filled in with either a zero or a statement that the impact is minor, major or unevaluated, as appropriate.

59. On page I-9 and elsewhere in the Statement it is indicated that "ecological studies" are "directed" or are being "supervised" by the Hudson River Technical and Policy Committees. These committees are advisory and can only make recommendations regarding procedures, etc.

60. The statement gives a great amount of consideration to meeting New York State standards however does not give any consideration to New York State Law (Section 275 of the Conservation Law) which deals with the protection of fish.

Comments on the Draft Detailed Statement on Environmental Considerations Related to the Proposed Issuance of An Operating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant

Docket No. 50-247

LOUIS J. LEFKOWITZ
80 Centre Street
New York, New York 10013

Attorney General of the
State of New York

Dated: June 2, 1972

The draft detailed statement prepared by the Division of Radiological and Environmental Protection of the Atomic Energy Commission contains, in our judgment, substantial errors of analysis in three specific areas:

1. Indian Point II's effect on fish and other aquatic life;

2. The feasibility of natural draft closed cycle cooling towers at Indian Point; and

3. The alleged immediate necessity for the power to be generated by Indian Point II.

1. Indian Point II's effect on fish and aquatic life.

In evaluating the effect of Indian Point II on the Hudson River ecosystem, the draft statement treats the effects of the plant in a vacuum, totally ignoring the future presence of two sizable generating stations to be located near Indian Point II -- the Bowline Point and Roseton plants -- in addition to the existing Danskammer and Lovett plants. The cumulative effect of these generating stations will place considerable stress on the Hudson River even before it feels the effects of Indian Point II. None of these stations has undergone or will undergo a NEPA review. In view of the fact that the license being applied for here will extend for 40 years, the failure of the draft statement to relate the effects of Indian Point II to the present and future adjoining stresses on the Hudson River renders the draft statement, with its single-minded focus on Indian Point II, myopic and violative of the teaching of the Calvert Cliffs decision.

Further, the State of New York totally rejects the premise that, in an area of this magnitude, where the entire fate of the Hudson River ecosystem is at stake, future research and analysis of the detrimental effects of this massive power plant should be entrusted to the applicant alone. This amounts to posting a wolf to guard the sheepfold. The inherent conflict of interest which would result from employing the licensee as its own policeman, is underscored by its history of haphazard investigation of fish kills and repeated refusal to gather and supply relevant data concerning fish larvae and other aquatic life.

This policy will inevitably cast a shadow over any future conclusions of the Commission regarding the adverse effects of the plant on the River, based as they would inevitably be on studies drawn up, conducted and evaluated by an applicant which has a vested interest in the results of such studies. Any future study of the effects of Indian Point II must be assigned to an agency or organization which will not have the huge pecuniary stake in the ultimate results of such a study which Con Edison has.

It is also relevant to note that New York Conservation Law § 275 dictates that "No person shall take fish . . . by shutting or drawing off water." The Attorney General has filed suit against Con Edison to recover $1.6 million in penalties, pursuant to Sections 275 and 389(4) of the Conservation Law, resulting from massive fish kills at Indian Point II which occurred during recent testing operations in February 1972. In addition, Con Edison has signed a consent order with the New York State Commissioner of Environmental Conservation under which it is mandated to take affirmative steps designed to prevent such kills. Pursuant to 10 CFR Part 50, App. D, § A.13, the Commission's license should be conditioned on the applicant's meeting all State requirements relating to the protection of Hudson River marine life.

2. The feasibility of natural draft closed cycle cooling towers at Indian Point II.

The draft statement states:

> "The principal objection to using evaporative cooling towers [e.g. natural draft closed cycle cooling towers] at the Indian Point site is the high range of salinity content of the Hudson River (100 to 7000 ppm). The damaging effects of the salt-water drift on metallic objects and plant life could be detrimental. Until such a time as research can produce brackish water cooling towers with very low drift and environmental impact, this use is not practical. (DES, XI-9)."

But nowhere does the draft statement support that conclusion with any data. Its conclusion directly contradicts both the applicant's own analysis and those of the State of New York and the Hudson River Fishermen's Association.

It is beyond dispute that natural draft closed cycle cooling towers at the Indian Point II plant would reduce intake water demand at the site by at least 95%, with attendant enormous reduction of the severe ecological impact on river life inherent in Con Edison's system as presently designed. The construction of this alternative to once-through cooling will assure protection of the vital ecosystem now thriving in the Hudson River.

The applicant itself has stated that cooling towers will not cause problems relating to fogging or saline drift. While they do object to the expense, attendant downtime resulting from connection, and the vapor plume above the towers, Con Edison does acknowledge that brackish-water cooling towers are commercially available (see Comments, Con Edison, C-164), contary to the draft statement.

Ecodyne Cooling Products Co. of Santa Rosa, California, reports that in fact they have officially guaranteed Con Edison and the New York State Public Service Commission that it can provide cooling towers with a drift loss rate of .004-.008% of circulating water flow. At this level of drift loss, Ecodyne has calculated through atmospheric dispersion formulas that there will be "minimal local adverse impact from brackish water natural draft cooling towers."

By placing an air-cooled heat exchanger atop conventional cross-flow natural draft cooling towers, Ecodyne has succeeded in greatly reducing saline drift and nearly eliminating the fog heretofore characteristic of this type of cooling device. Not only will this system eliminate the adverse effects moist, salty air might otherwise have on trees and plants, equipment, roads and homes, but it will also reduce the vapor plume which might otherwise accompany these towers.

The General Public Utilities Service at Morristown, New Jersey, has, like Ecodyne, conducted a year long in-depth study aimed at evaluating the environmental effects of salt water cooling towers. This study proceeded with electrical industry funding and appeared in the environmental report prepared by

Jersey Central Power and Light for its Forked River I plant. Submitted to the A.E.C. in January, this report concluded that salt water cooling towers generate minimal adverse impact on property adjacent to cooling towers.

It appears that much of the material in the draft statement was written prior to the submission of the Forked River I environmental report, and did not benefit from the conclusions reached there. All available information indicates a need for the A.E.C. to reevaluate its position regarding the feasibility of salt water cooling towers, especially in view of the lack of available alternatives to once-through cooling for the protection of the Hudson River ecosystem.

3. The alleged immediate necessity for the power Indian Point II will generate.

As the analysis presented by the Hudson River Fishermen's Association (Comments, pp. 20-23) indicates, there is no authoritative evidence showing the alleged necessity for Indian Point II's power in the immediate future. The plant cannot be put into operation in time for the summer months, when the power demand is greatest. And even for that period, the Federal Power Commission has determined that the 1972 reserve margin of the

New York Power Pool without Indian Point II will be 19.6%, almost double that of a year ago. A 40-year license to operate a massive generating station without adequate environmental safeguards should not be granted on the basis of an alleged but unproven power crisis, where reasonable alternatives exist, such as natural draft cooling towers.

PHILIP WEINBERG
PAUL S. SHEMIN
Assistant Attorneys General
of Counsel

WESTCHESTER COUNTY DEPARTMENT OF PLANNING

PETER Q. ESCHWEILER, A.I.P., COMMISSIONER
JOSEPH R. POTENZA, A.I.P., DEPUTY COMMISSIONER

910 COUNTY OFFICE BUILDING   WHITE PLAINS, N. Y. 10601   914 WHITE PLAINS 9-1300

May 12, 1972

Mr. Lester Rogers, Director
Atomic Energy Commission
Washington, D. C. 20545

Re: Docket Number: 50-247
Indian Point No. 2

Dear Mr. Rogers:

This is to acknowledge receipt by the Westchester County Department of Planning of your letter of transmittal and attachments comprising the above-cited draft environmental impact statement. This department has no comments to add to the statement at this time. However, we may wish to have the opportunity to become a party of interest in future proceedings, and to comment at that time.

Sincerely,

Peter Q. Eschweiler
Commissioner

PQE:mb

Natural Resources Defense Council, Inc.

36 WEST 44TH STREET
NEW YORK, N.Y. 10036
212 986-8310

50-247

Washington Office
1600 TWENTIETH STREET, N.W.
WASHINGTON, D.C. 20009
202 387-2855

April 19, 1972

Mr. A. Giambusso
Division of Radiological and Environmental Protection
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Giambusso:

With reference to your letter of March 21 (Dock.50-247) and subsequent telcons, I have now reviewed the draft detailed environmental statement and I am ready to meet with ORNL and AEC staff personnel at an early date.

The principal subject for discussion is predicted effects upon the populations of Hudson fishes of operation of nuclear power plants at Indian Point. We will be particularly interested to discuss the basis for predictions relating to the following points and such related aspects as may be pertinent:population estimates and mortality rates; compensatory effects; vulnerability to entainment at various stages; quantitative effects upon the population of impingement, and susceptability of various stages to impingement; relation of velocities through screen to impingemnt to mortality effects; effects of the thermal plume on fish behavior; effects of oxygen depletion and chlorine on behavior and mortality; and acceptable limits of mortality at various stages in light of present knowledge.

In addition to myself and Mr. Habicht, please plan on attendence of Mr. Pete Skinner, technical expert for the N.Y. Attorney's office.

You can reach me by telephone at 683 7971. Thank you.

Sincerely,

John R. Clark
301 North Washington St.
Alexandria, Va. 22314

97

Natural Resources Defense Council, Inc.

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50-247

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June 29, 1972

Myron Karman, Esq.
Counsel, Regulatory Staff
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Karman:

Mary Jane Oestmann informed me that you had not received the Comments submitted to the Atomic Energy Commission, dated June 1, 1972. I enclose the same.

Yours sincerely,

Angus Macbeth

AM/js
Enclosures
cc: Mr. Daniel Muller

Comments Submitted to the Atomic Energy Commission on Behalf of the Hudson River Fishermen's Association on the Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of An Operating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant

Docket No. 50-247

99

Submitted by

Angus Macbeth
(Natural Resources Defense Council, Inc.)
36 West 44th Street
New York, N.Y. 10036

Attorney for Hudson River Fishermen's Association

Dated: June 1, 1972

The interest and concern of the Hudson River Fishermen's Association in the environmental impact of Con Edison's Indian Point 2 nuclear plant has focussed primarily on three issues:

1. The effect Indian Point 2 will have on the fish and aquatic biota of the Hudson.

2. The environmental effects of operating natural draft closed cycle cooling towers at Indian Point - a cooling alternative which would save the Hudson River fishery.

3. The need for the power which would be generated by Indian Point 2.

In the draft environmental statement on Indian Point 2, "Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of an Opearating License to the Consolidated Edison Company of New York for the Indian Point Unit No. 2 Nuclear Generating Plant, Docket No. 50-247," the staff deals with these issues with varying degrees of realism and rigor. The report is comprehensive but nevertheless there are major flaws in the analysis of each issue. The AEC staff analysis of each of the three major issues will be discussed in turn and a final section will deal with the cost-benefit analysis.

I. <u>The Effect of Indian Point 2 on the Fish and Aquatic Biota of the Hudson River</u>

The draft statement predicts the possibility of a major impact on the Hudson River fishery:

> "In Unit No. 2, aquatic biota impinged on the intake structure or entrained in the cooling water will be exposed to severe mechanical, chemical (chlorine), and thermal conditions; as a consequence, up to 25% of the average number of eggs and larvae of certain species of fish that annually pass by the Plant may be killed; under the most adverse conditions, up to 100% of some of the entrained planktonic species may be killed; and fish kills of a magnitude two or three times greater than those caused by Unit No. 1 may occur." [Draft Environmental Statement, p. ii]

In reviewing the first 100 months of operation at Indian Point 1, the AEC concluded that "Indications are that several million fish were killed." (DES, XI-7). In other words, the draft environmental statement contemplates <u>annual</u> kills at Indian Point 2 by impingement alone of a million fish or more.

Thus the percentage of fish killed by entrainment and the absolute numbers of fish killed by impingement will be very substantial indeed. Discussing the effect of both entrainment and impingement on the striped bass, the best studied and economically most important fish in the Hudson, the AEC staff concluded:

> "...the total yearly recruitment loss for each subsequent year class in the population may be as high as 15% to 20% from direct effects of Plant operation. Sustained reporductive losses of this magnitude over a long period of time would result in substantial reductions of the striped bass populations that spawn in the Hudson, including those of both the Hudson itself and the area from the south New Jersey coast to Long Island Sound." (DES, V-53)

The staff also pointed out that its analysis of the striped bass will apply to other fish as well:

> "These same arguments apply to other species that spawn in the area and may cause important losses of recruitment to local populations of the alewife, blueback herring, bay anchovy, tomcod, smelt and Atlantic silversides, as well as striped bass. (DES, V-55)*

This analysis has the basic comprehensive approach which is essential to a discussion of the effect of the operation of Indian Point 2 on the Hudson and its biota. But there are major flaws in the analysis. These are discussed below.

A. Failure to give a coherent account of the striped bass life cycle and population data which relates entrainment to impingement

The draft statement provides an analysis of the impingement problem which cites a number of absolute figures on past fish kills (DES, V-29 to V-33; V-46 to 47). The heart of the entrainment analysis discusses the effect on the fish in terms of percentages of the fish population (DES, V-52 to 55). In order to develop a coherent analysis of the effect of the operation of Indian Point 2 on the Hudson fishery it is essential that the impingement and entrainment figures be treated in similar terms, either absolute or percentage. The staff should attempt to develop an analysis along these lines.

John R. Clark, the expert consultant to the Hudson River Fishermen's Association on fish biology, has performed an analysis of this sort for HRFA and it is appended to these comments both for the value of the information it contains and as a pointed example of the kind of discussion which allows

*The omission of white perch from this list appears to be an obvious typographical error and should be corrected.

a full analysis of the effect of plant operation on the Hudson.

A coherent analysis of the type suggested will require fuller discussion of two other items. First, there must be a critical appraisal of the fish impingement data from Indian Point 1 and 2. The most obvious issue raised is the trustworthiness of Con Edison's figures in light of the Raytheon statistics cited in the draft statement which show both much larger total kills than comparative Con Edison figures and a much larger percentage of striped bass in the total kill (DES, V-31). Second, a discussion of the life cycle of striped bass touching on the rate of natural mortality and the period of vulnerability to the Indian Point plants is important to an understanding of the assumptions which underlie the analysis. At the present time figures describing the total effect on the fish population are given with little or no explanation of how those figures were arrived at. Both of these points should be developed and clarified in the final statement.

B. Unsupported reliance on density-dependent and compensatory factors

The draft statement discusses the possible compensatory factors involved in density-dependent influences on the mortality rate (DES,V-53 to 55). This discussion contains very little evidentiary support for the theory that throughout the first year of life striped bass mortality is not density independent.

In fact, the evidence suggests that after the fourth or fifth week after spawning the striped bass mortality is density independent. Recent studies from California suggest this. Sommani, P., "A Study On the Population Dynamics of Striped Bass. (Morone Saxatilis Walbaum) In the San Francisco Bay Estuary", University of Washington Abstract; Turner, Jerry L. and Harold K. Chadwick,"Distribution and Abundance of Young-of-the-year Striped Bass, Morone Saxatilis, In Relation to River Flow in the Sacramento-San Joaquin Estuary" (to be published in Trans. Am. Fish Soc.). In Chesapeake Bay the fishery has been found to vary an order of magnitude depending on the strength of the recruitment. (Mansueti, R.J. & E.H. Hollis. 1963. U. of Md. Nat. Res. Mgt. Educ. Sci. (61); Hollis, E. H., Md. Dept. Ches. Bay Affairs. Final Rep. 1967; Koo, Ches. Sci ___ ____.)

These studies all indicate that striped bass mortality is density independent beginning at a very early stage of life, probably in the second month after spawning. Striped bass appear to be a year class dominant species.

Another major indicator of compensatory factors is the growth rate. Stunted growth might indicate that thinning of the fish population would result in the same weight of fish per acre being spread among fewer, larger fish. There is no indication of stunted growth in the Hudson in comparison to other estuaries. Hudson striped bass at the end of 15 weeks (Carlson, F. T. & J. A. McCann, Hudson River Fishery Investigations 1965 - 1968, Table 24; Rathgen-Miller. 1957. N.Y. F. & G.

Journ. 4 (1)). are the same length as striped bass in the Chesapeake (Mansueti, R. 1958. Md. Dept. Res. & Ed. Contr. No. 112; Hollis, E.H. 1967. Md. Dept. Ches. Bay Affairs. Final Rep. 1967.) and the San Joaquin-Sacramento (Sasaki, S. 1966. Cal. Dept. F. & G. Fish Bull. (136)). They are larger than those in Albemarle Sound. (Trent W.L. 1962. Master's Thesis, N.C. State Col. Dept. of Zoology.)

Comparative data for the early stages of white perch are not available, but at the end of the first year Hudson River white perch (Lauer, McFadden, Raney, Testimony of April 5, 1972 in this proceeding.) are about equal to those in the Chesapeake (Mansueti, R.J. 1961. Ches. Sci. 2 (3-4)) and the Delaware (Wallace, D.C. 1971. Ches. Sci. 12 (4))* At the end of three years Hudson River white perch (Lauer, McFadden, Raney, Testimony of April 5, 1972 in this proceeding) are again equal to those in the Chesapeake (Mansueti, R.J. 1961. Ches. Sci. 2 (3-4)) and the Delaware (Wallace, D.C. 1971. Ches. Sci. 12 (4)).

Finally, there are no indications of overcrowding of the fish population in the Hudson which might also indicate stunted growth and the likely presence of compensatory factors. (Compare Environmental Report Supplement No. 3, S3-25 to 30 with McHugh, J.L. 1967. Estuaries, AAAS Pub. No. 83).

* Estimates for conversion between standard length, total length and fork length must be made.

Both the data on mortality and the data on growth suggest that very early in the life cycle of the striped bass- probably some time in the second month - the killing of striped bass larvae and juveniles begins to have a direct effect on the number of striped bass which survive to the end of the first year. Moreover, the thinning of the larval and juvenile population will not be compensated for by an increased growth rate among the remaining fish.

The staff should re-analyze its position on density-dependent mortality and compensatory effects, taking into account all the available data on the subject. If a case is to be made for the position suggested by the staff in the draft statement, it should be spelled out with much more evidentiary support than appears in the draft statement.

C. <u>Failure to consider the effect of other electrical plants presently operating on the Hudson and scheduled to begin operation in the immediately foreseeable future</u>

Fish kills due to entrainment through power plant condenser systems are a function of the volume of water withdrawn from the River, the degree to which it is heated and the abundance of eggs, larvae and young juveniles in the area where the plant is sited.

Indian Point Units 1 and 2 will withdraw 1,140,000 gpm from the Hudson. (DES, III-6, III-12). The water will be heated 15°F (DES, III-8) and then discharged to the River. Indian Point is situated at River Mile 43, an area which is of very high abundance in striped bass eggs, larvae and young juveniles. (DES, V-45).

The Bowline Point plant of which the first unit is scheduled to go on line in July 1972 and the second unit by 1974 (DES, III-7), will withdraw 768,000 gpm from the Hudson and heat it 13.5°F before discharge to the River (DES, III-8). Bowline Point is at River Mile 38, 5 miles from Indian Point, and there is an abundance there of striped bass eggs, and a great abundance of larvae and young juveniles.

The Roseton plant, of which the first unit is scheduled to begin operation in November 1972 and the second in May 1973 (DES, III-7), will withdraw 650,000 gpm from the Hudson and heat it 15.4°F before discharge. (DES, III-8). The Roseton plant is located at River Mile 65, 22 miles north of Indian Point in a reach of the River where the eggs and larvae of striped bass are abundant.

The Danskammer plant, presently in operation (DES, III-7), withdraws 308,000 gpm from the Hudson and heats it 14.5° before discharge (DES, III-8). The Danskammer plant is located at River Mile 66 and the aquatic biota is the same as that at the Roseton plant.

The Lovett plant, presently in operation (DES, III-7), withdraws 323,000 gpm from the Hudson and heats it 14.8° before discharge (DES, III-8). The Lovett plant is located one mile downstream from Indian Point and the aquatic biota is the same as that at Indian Point.

It is obvious that this total array of plants will have a very significant impact on the Hudson River fishery. The staff has estimated that Indian Point Units 1 and 2 may kill off 25% of the striped bass eggs and larvae which pass the plant. Bowline Point and Roseton together will withdraw a third again as much water as Indian Point 1 and 2 and heat it approximately the same amount. It is conservative to estimate that Bowline Point and Roseton will annihilate an additional 15% of the striped bass eggs and larvae in the Hudson. In addition the Danskammer and Lovett plants are already operating on the Hudson and using substantial amounts of river water for cooling thus adding to the total stress on the River system. The combined effect of the operation of all these plants will decimate the Hudson fish population in a fantastic manner-more than 40% of the striped bass eggs and larvae in the River will be entrained annually.

Con Edison has requested a license to operate the Indian Point 2 plant for a period of forty years. It is, of course, clearly foreseeable that some or all of these four plants will operate during any period for which Indian Point 2 is licensed. Thus Indian Point 2 will operate in an environment on which Bowline Point, Roseton, Danskammer and Lovett will have a significant effect. Bowline Point and Roseton are not scheduled to undergo a N.E.P.A. review. Danskammer and Lovett have not undergone a N.E.P.A. review. Thus these plants cannot be viewed as producing increments of environmental impact which have been or will be reviewed before they are allowed to begin operation. In these circumstances the impact of Indian Point 2 must be weighed in light of the knowledge that within a few years the total impact of the Bowline Point, Roseton, Danskammer, Lovett and Indian Point 1 and 2 cooling systems will be thrust on the Hudson and its biotic life. The AEC must reach a decision as to whether the present cooling system planned for Indian Point 2 is acceptable not only in May or June of 1972, but also in July 1972 when Bowline Unit 1 is operating and two years from now when all the units at Bowline Point and Roseton are withdrawing their vast quantities of water from the Hudson and discharging their heated load to the River with the attendant effects of impingement and entrainment.

Not to consider the clearly foreseeable effects of Bowline Point and Roseton is tantamount to not considering winter operations on the ground that the license was applied for in the spring. The only rational procedure in analyzing the impact of this facility is to take into account the present and the foreseeable future plant operations which are not themselves subject to a similar review under NEPA.

The law follows this rational line and instructs Federal agencies to take a wide and comprehensive view of their duties under the National Environmental Policy Act, 42 U.S.C. §4321, et.seq. In Section 102 of NEPA, federal agencies are directed that "to the fullest extent possible" the policies of NEPA are to be carried out in all of the agency's activities, including, but not limited to, the preparation of environmental impact statements.

The term "to the fullest extent possible" has been the subject of both Congressional and judicial interpretation. The Senate and House conference, which wrote the phrase into NEPA, stated:

> The purpose of the new language is to make it clear that each agency of the Federal Government shall comply with the directives set out in [Section 102(2)] unless the existing law applicable to such agency's operations does not make compliance possible.... Thus, it is the intent of the conferees that the provision "to the fullest extent possible" shall not be used by any Federal agency as a means to avoiding compliance with the directives set out in Section 102. Rather, the language in Section 102 is intended to assure that all agencies of the Federal Government shall comply with the directives set out in said section "to the fullest extent possible" under their statutory authorizations and that no agency shall seek to construe its existing statutory authorizations in a manner designed to avoid compliance. 115 Cong. Rec. 40417-40418.

In Ely v. Velde, __F.2d__, 3ERC 1280, 1285 (4th Cir. 1971), the Court of Appeals for the Fourth Circuit held that the phrase is "an injunction to all federal agencies to exert utmost efforts to apply NEPA to their operations. In short, the phrase 'to the fullest extent possible' reinforces rather than dilutes the strength of the prescribed obligations."

In Calvert Cliffs' Coordinating Committee v. AEC, __F.2d__, 2 ERC 1779 (D.C. Cir 1971), the Court of Appeals for the District of Columbia carefully considered the phrase, "to the fullest extent possible" and concluded that Section 102 must be complied with (2 ERC at 1782): "unless there is a clear conflict of statutory authority" and further explicitly instructed the Atomic Energy Commission that "the requirement of environmental consideration 'to the fullest extent possible' sets a high standard for the agencies, a standard which must be rigorously enforced by the reviewing courts." (Ibid.) In the revised Appendix D to 10 CFR Part 50 the Commission has set out to apply the instructions of the Court in Calvert Cliffs.

There can be little question that if the environmental effects of the operation of Indian Point 2 are considered "to the fullest extent possible" that consideration will include analysis of the impact which may be foreseen and calculated over the next few years when Indian Point 2 will be operating on the same stretch of river with Bowline Point, Roseton, Danskammer and Lovett which have not and are not scheduled to undergo NEPA review.

The staff obviously recognizes the relevance and importance of these plants when it includes in the draft statement on Indian Point 2 an analysis of the plants' physical relation to the Indian Point site (DES, II-7), their contribution to the heat load on the Hudson (DES, III-7 et seq.) and their importance to the future power supply in the area (e.g. DES, XI-5). The only logical step to take is to consider the impact of Bowline Point, Roseton, Danskammer and Lovett on the fish and aquatic life of the Hudson as well.

In addition, putting off consideration of these plants to any later date will only fragment consideration of a single problem into a multitude of small pieces. Such fragmentation does not make sense in scientific terms or in terms of administrative efficiency. John R. Clark has analyzed the probable effect of Bowline Point and Roseton when they are operating in conjunction with Indian Point 1 and 2. That analysis is appended to these comments for the use of the staff in expanding their analysis to take those plants as well as Danskammer and Lovett into account in developing the final statement.

Common sense, the language of NEPA, the legislative history of the Act and the judicial decisons under the Act all require that the NEPA review on the application for an operating license for Indian Point 2 take into consideration the environmental impact of present or foreseeable actions which are not themselves subject to NEPA review. Nothing less can implement the Act's requirement that its policies and procedures be followed "to the fullest extent possible."

D. Failure to consider relevant law of the State of of New York

The AEC's regulations on the licensing of nuclear power plants state that:

> The Commission will incorporate in all ... operating licenses ... a condition ... to the effect that the licensee shall observe such standards and requirements for the protection of the environment as are validly imposed pursuant to authority established under Federal and State law and as are determined by the Commission to be applicable to the facility that is subject to the licensing action involved. 10 CFR Part 50, App. D, § A.13.

Pursuant to that regulation and the Federal Water Quality Act of 1965, the staff included in the draft environmental statement a careful discussion of the thermal discharge standards of New York State and the status of Con Edison's application for a Refuse Act discharge permit. (DES, III 7-12). In discussing alternatives to the present plant at Indian Point, the staff also rejects the possibility of not providing power "in view of the applicant's obligation under its charter from the State." (DES, XI-1).

The draft statement is totally silent on those elements of state law which deal with the protection of fish.

Section 275 of the New York Conservation Law states: "No person shall take fish ... by shutting or drawing off water." Section 389(4) of the Conservation Law sets a specific civil penalty for violation of Section 275, $500 and "an additional penalty of ten dollars for each fish taken." These statutes involve no weighing and balancing. Section 275 is a simple and direct prohibition and Section 389 is a straightforward civil penalty.

These sections of the law are being actively enforced. In late February approximately 160,000 fish were killed at Indian Point 2 when 2 of the 6 pumps were put through a test run. (DES, V-31). As a result of those kills, the N.Y.S. Commissioner of Environmental Conservation has asked the Attorney General to sue Con Edison for $1.6 million. That suit has been filed and relies on Sections 275 and 389 of the Conservation Law.

Under both the Commission's regulations and in view of the actions taken by the New York State authorities, the AEC should give careful consideration in its statement to possible violation of New York law and require that Con Edison operate the plant within the standards set by the New York legislature for the protection of fish.

In light of the suit by the Attorney General future fines must also be taken into account in the cost-benefit analysis. Present staff estimates indicate that millions of fish will be killed at Indian Point 3. The AEC must recognize that this will cost Con Edison and perhaps its consumers tens of millions of dollars.

E. Proposal to request Con Edison to conduct research on Hudson fish and biota.

Rather than requiring Con Edison to begin immediately the construction of an alternate cooling system at Indian Point, the draft statement proposes that Con Edison undertake a research program on the basis of which future action would be decided:

> An operating license would permit the applicant ... to establish an effective environmental monitoring program in conjunction with an alternative plan to limit the effects on the aquatic system. The applicant shall be required to evaluate and assess the data collected from the monitoring program in order to design and implement an alternative plan or plans to minimize the long-term potential damage to the aquatic biota in the Hudson River. The applicant shall be required to submit to the Commission within the next 6 months a plan or plans of specific detailed design of the best alternative system that it can determine which will result in an optimization of Plant operation and minimal environmental damage.... The Technical Specifications to be provided with an operating license will specify the limitations of specific effluent discharges and the ecological monitoring surveillance program required with the necessary administrative controls, to assure adequate data will be collected for use to assess the biological impact of operation of Indian Point Unit No. 2 on the environment. (DES, XI-55).

There are two major failings in this suggestion. First, it turns over the research function to a party which has been shown to be incompetent in the past and which has a clear and unmistakable interest in the outcome of the research. Second, it fails to set any standard by which damage to the Hudson will be measured.

The staff itself recognizes Con Edison's past incompetence in conducting and reporting research on the Hudson. Speaking generally, the staff has concluded that: "It is apparent that many of Con Edison's conclusions are not consistent with the data acquired by its consultants." (DES, V-55).

The staff drives the point home with an illustration of a Con Edison statement that the eggs and larvae of six key Hudson River fish are not vulnerable to the intake and thermal plume at Indian Point,"Extensive data gathered by the Raytheon Company and by Northeastern Biologists, both of which are consultants for the applicant [Con Edison] clearly show that larvae of the striped bass, alewife, and blueback herring are susceptible to the intake and thermal plume." (DES, V-56).

The self-interest which will permeate Con Edison's research effort is patent and obvious. Common sense dictates that giving Con Edison control of this research project is ridiculous. Moreover the courts have found conditions of this sort in licenses to be absurd. The N.Y.S. Commissioner of Environmental Conservation attached conditions of the same kind to the water quality certificate for Con Edison's Storm King project and they have been struck down by the state court:

> [T]hese conditions would require Consolidated Edison immediately to terminate the operation of its project upon evidence of "violations or contravention of the

> water quality standards assigned to the Hudson River" ... The monitoring of the project to assure that these conditions were fulfilled was delegated to Consolidated Edison. ...It is also urged that in operation the conditions were impractical to the point of being ridiculous in the light of human experience. Consolidated Edison is by these conditions called upon to police itself and if it finds itself violative of the Commissioner's conditions to abandon immediately its multi-million dollar project. This Court hearing no sound contrary argument and failing to imagine any concludes the conditions to be meaningless in law and fact. In the Matter of DeRham v. Diamond - N.Y.S. 2d-, 3 ERC 1903, (N.Y. Sup. Ct. 1972).

The same arguments hold true in this case. Con Edison's interest in Indian Point 2 is just as great as that in Storm King.

The whole research effort is further flawed by the failure to establish any firm criteria by which the results can be measured. This is an abdication of the AEC's duty under NEPA to reach a judgment on the plant. The Commission must put in the scale some level of fish destruction which it finds unacceptable. Any other course fails to focus the controversy over this plant in such a way that it may be resolved. Since it will take at least three years to build an alternate cooling system, there must also be a strict time limit on when the results of research will be evaluated. It is all too likely that the Hudson fishery will be decimated before Con Edison is ready to accept responsibility for the environmental damage it will cause at Indian Point.

It may also be true that the necessary research cannot yield the knowledge which is sought. In discussing the indirect effects of plant operation, the AEC staff says:

> "At Indian Point, the complexity of the interactions of the biota with each other and through natural cycles of salinity and temperature is very difficult. Unfortunately, even if all of the relationships were known, reliable biological predictions of the indirect effects of the operation of the facility could not be developed with the present state of the art."
> (DES, V-35)

If this is true of other research areas as well, then the research program should be dismissed as useless and a judgment made on the plant on the basis of present knowledge.

The AEC is proposing a voyage into complex research with no particular port in mind and on a ship skippered by a captain who has no interest in ever arriving. In the light of human experience this is ridiculous. It may also be scientifically fruitless. The plan should be rejected and the requirement of an alternative cooling system should be imposed immediately.

II. The Effect of Operating Closed Cycle Natural Draft Cooling Towers at Indian Point 2

The installation of natural draft closed cycle cooling towers at Indian Point 2 would reduce withdrawal of water from the Hudson by 95% or more. In consequence there would be similar massive reductions of the harm caused the fish and aquatic biota of the Hudson.

Various objections to this solution have been raised. Con Edison has come to the conclusion that aesthetics and costs are the major objections and it has rejected the notion that saline drift or fogging will cause any serious adverse impact. (Environmental Report Supplement 3).

The draft statement includes statements which support the conclusion that saline drift from natural draft closed cycle cooling towers will be negligible or unimportant. In discussing the effects on people the staff concluded: "...any salts from the natural-draft cooling towers that might reach underground wells will have negligible effect on the water supply." (DES, XI-32). The same conclusion held for effects on plant life: "Since the data show no salt deposition rates in excess of 500-1,000 lbs/acre/year, there will be no environmental costs to plant life in the area associated with these alternatives." (DES, XI-33). With regard to property the AEC concluded that"salt deposition rates are relatively low" and estimated the environmental cost at 0 dollars. (DES, XI-34).

These conclusions are the same as those of Con Edison and the Hudson River Fishermen's Association and Environmental Defense Fund (Eric Aynsley, Testimony of April 5, 1972 in this proceeding). In fact at one point the report specifically states that "The staff accepts the applicant's salt deposition rates" (DES, A-78).

Nevertheless, the draft statement includes the following unsupported statement:

> The principal objection to using evaporative cooling towers [e.g. natural draft closed cycle cooling towers] at the Indian Point site is the high range of salinity content of the Hudson River (100 to 7,000 ppm). The damaging effects of the salt-water drift on metallic objects and plant life could be detrimental. Until such a time as research can produce brackish water cooling towers with very low drift and environmental

impact, their use is not practical.(DES, XI-9).

This surprising statement is supported by no data and is in direct contradiction to the other analysis contained in the draft statement.

The AEC must either support this statement with hard data or abandon it. All the evidence from Con Edison, the Intervenors and the rest of the draft statement suggests that the AEC should abandon this position.

Cooling towers at Indian Point are practical. Saline drift is not a major problem. The AEC should focus on the practical problems at the plant, primarily the cost of cooling tower construction, and not reintroduce the discredited issue of saline drift.

III. Indian Point 2 and Con Edison's power crisis

On April 1, 1972 Con Edison informed the AEC that Indian Point 2 would not be ready to go critical until late June 1972. In October, 1971 Con Edison gave the AEC a schedule of the testing procedures which it must complete at Indian Point 2 before the plant can operate at full capacity (Con Edison, Testimony of October 19, 1971 in this proceeding, at 1-2). Con Edison also stated that this was a "best circumstances" schedule and that a realistic schedule would double the time for testing.

Con Edison requires 69 days for testing under best circumstances and 138 under a realistic schedule. Both realism and the past history of Indian Point 2 indicate that a schedule of 138 days is the only one that can be used with any confidence.

Assuming that Indian Point 2 is ready to begin testing on July 1, 1972, the testing schedule would be completed on November 15, 1972. In other words, Indian Point 2 will be ready for operation during the winter of 1972 at the earliest.

It is obvious that the staff's analysis of the demands on the Con Edison system was written before Con Edison's announcement of April 1, 1972. Throughout the section on power demand, the statement again and again emphasizes the situation in the summer of 1972 (DES, X-1 to 13). In light of Con Edison's own estimates of its testing schedule, this analysis is simply irrelevant to Con Edison's license application. The plant will not be operating during the summer of 1972.

Moreover, this focus on the immediate future is a major flaw in a report prepared for a 40 year operating license. A long-range project needs long-range analysis. This is something which the staff should cure in its final statement.

The analysis of power demand must be undertaken independently by the AEC and not be simply adopted from Con Edison or other governmental agencies. Other agencies and the applicant cannot be relied on for the simple reason that they disagree among themselves to the point where no coherent discussion of the power demand situation can be developed by simply collating agency or Con Edison statements. This can be demonstrated by the figures provided by the FPC, the New York PSC and Con Edison for summer 1972:

Summer 1972

	Con Edison*	PSC Staff*	FPC with IP 2**	FPC without IP 2**
Total Available Capacity (MW) (FPC-Net-Dependable Capability)	10031	8758	9884	9448
Reserves (MW)	1481	208	1334	898
Reserves as % of Peak Load	17.3	2.4	15.6	10.5

* "The New York Power System Generation and Transmission Plans 1971-1980", System Planning Section, Power Division of the New York Dept. of Public Service (12/71) at 10. The Con Ed figures represent a forecast based on all plans being implemented on schedule. The Staff estimate represents staff estimates of delays. Cited in DES at X-13

** DES, X-3. Bureau of Power, FPC (12/71).

These estimates were all made in December, 1971. They vary widely among themselves. They also vary widely from the actual facts as they are known today. In testimony submitted in the Indian Point 2 proceeding on May 18, 1972, Bertram Schwartz, a Vice President of Con Edison, stated that subsequent to July 15, 1972, Con Edison's installed reserves "will reach 24.9% (2095 MW)." (Schwartz testimony at 4). This figure does not include Indian Point 2 or a possible purchase of 95 MW from Long Sault, Inc. These figures are utterly different from any of the predictions.

We are thus left with a chaotic jumble of figures most of which seem to bear little relation to the facts. In this situation the AEC staff cannot simply adopt the figures of one agency or another. It must perform its own analysis of the power demand situation. That is the only way in which an accurate and factual description of the situation can be arrived at.

The analysis must, of course, address itself to the constituent elements of power supply and demand: monthly variation of power demand, retirement and maintanance schedules, purchasing opportunities, power pool agreements, voltage reduction procedures, variations in thermal efficiency, alternative sources of supply to consumers such as the Fitzpatrick plant. This list is suggestive but not exhaustive. No final judgment about the power supply and demand situation can be made without this kind of analysis of the facts. No reliable cost-benefit analysis is possible without this kind of factual foundation.

The applicant and the state and federal agencies can provide useful information with which to commence the power supply and demand analysis, but under NEPA it is the AEC which must make the judgments and that can only be done on the basis of facts which have been independently analyzed. That is the teaching of Greene County Planning Board v. FPC, -F.2d-, 3 ERC 1595 (2d Cir. 1972). It is also the teaching of common sense.

IV. The Cost-benefit analysis

The cost-benefit analysis in the draft statement is remarkable for its lack of any coherent relationship to the analysis which proceeds it. The cost-benefit analysis is largely a summary of the position taken by Con Edison and not that developed by the staff in its own analysis. This is true even at places where the earlier analysis of the draft statement differes markedly from Con Edison's analysis.

Typically, in dealing with the fishery the applicant's estimate of environmental cost of 0 fish/year is set forth and a paragraph of staff comment is followed by three pages of quotation from Con Edison (DES, XI-23 to 27). Since the staff analysis utterly disagrees with Con Edison's estimate it is difficult to see why any of the Con Edison statement is quoted. It is particularly distreesing that the staff supplies no estimate of its own of the environmental cost. In effect, the staff appears to have abandoned its task of reaching an independent conclusion based on the analysis which it has undertaken.

Throughout the cost-benefit chapter there is an ambiguity and confusion in the writing which indicates a fundamental uncertainty on the part of the staff as to what its task is. For instance the paragraphs on environmental costs which appear at DES, XI-18 to 28 repeatedly give the Con Edison's estimate of the environmental cost and follow it with an explanation or commentary from the staff. The tone consistently suggests that the staff feels that its task is to explicate the company's position or, at most, tinker with Con Edison's estimates. This is entirely the wrong procedure. The cost-benefit analysis must grow out of the analysis of the impact of the plant which has been undertaken by the staff. Just as the analysis of the first ten chapters is an independent one which uses Con Edison information but does not treat it as having a special status of unquestionable veracity, so the cost-benefit discussion must also treat Con Edison's presentation as nothing more than useful. The cost-benefit analysis must flow out of the earlier analysis of the staff and not out of the Con Edison analysis, much of which the staff has discredited and discarded.

There are a number of points at which the conclusions of the cost-benefit analysis misstate or ignore the basic analysis performed by the staff. One of the most shocking failures to integrate the cost-benefit analysis to the rest of the statement occurs in the discussion of the Indian Point 2 cooling system where the section on cost-benefit states:

> The staff's analysis of the effects of the present cooling system on the Hudson River indicates that the complex estuarine environment could be irreversibly damaged from long-term operation of Unit No. 2. The staff's analysis was appropriately conservative, in accord with the nature of the environmental risk, and may therefore overestimate the long-term cost. (DES, XI-55)

The cooling system will, of course, have two major effects - the impingement and entrainment of fish. There is nothing to suggest that the broad and general statements on impingement are in any way conservative. The statement on entrainment is explicitly realistic (DES, A-69) and the analysis of compensatory factors and density-dependence probably underestimates the effect on the fish population considerably.

(See comments at I · B above).

There is simply no basis for the conclusion that the staff analysis on the effects of Indian Point 2 on the Hudson biota is conservative. Contradictions of this sort between the factual analysis and the conclusions of the cost-benefit analysis must be rooted out in the final statement. The cost-benefit analysis must flow directly and coherently from the factual analysis.

Finally, the cost-benefit analysis must take into account the fines for the killing of fish which the Attorney General of New York is now seeking from Con Edison and the liklihood of the plant being ordered to cease operation if the fish kills continue. The question of fines for fish kills is discussed fully at I·D above. The staff must estimate the number of larvae, juveniles and adults which will be killed annually at Indian Point 2 and figure into the cost-benefit analysis the fact that Con Edison is incurrring a liability of ten times as many dollars. In other words, if, say, 3 million larvae, juveniles and adults of any species are taken at Indian Point by the drawing off of water, Con Edison will be liable for fines of $30 million under the Conservation Law of the State of New York.

This spring Con Edison was ordered by the New York State Department of Environmental Conservation to cease operation of its pumps at Indian Point 2, an order which remained in effect for at least 2 1/2 months and may not yet be dissolved. This order was based on the illegal fish kills which took place at Indian Point 2 in February. In estimating the possible benefits from the plant, the staff must estimate the liklihood of similar orders in the future. In other words, if the staff believes that substantial fish kills will take place at Indian Point 2, it must include in its calculation of the benefits from the plant the liklihood that the plant will not be allowed to operate for substantial portions of the year.

Con Edison is in an awkward position. It has obligations to provide power to its customers, but if it does so by killing Hudson River fish it makes itself liable for fines at the rate of $10 per fish and it courts the real possibility that the state will order the plant closed down. The AEC cannot blind itself to these difficulties by pretending that the conservation laws of New York do not apply to Con Edison. The State Department of Environmental Conservation and the State Attorney General have made it clear that that is not the case. In weighing the costs and benefits of Indian Point 2 the AEC must take full account of the vast costs which will be imposed on Con Edison if it continues to make the killing of fish a part of the ordinary business of supplying power.

Conclusion

When a complete analysis of the impact of Indian Point 2 on the Hudson fishery is undertaken in the context of the other power plants on the River and with proper attention to the laws of the state of New York, the inevitable conclusion emerges that the Indian Point 2 plant can only operate if closed cycle natural draft cooling towers are installed. The Hudson River Fishermen's Association urges the AEC to perform its duty under NEPA by carrying out the full analysis of the plant which is required by the Act, particularly covering the points spelled out in these comments, and at the end of that analysis HRFA respectfully submits that the AEC should condition the operation of Indian Point 2 on the construction of an alternate cooling system, in particular natural draft closed-cycle cooling towers.

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August 22, 1972

Mr. Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

In re: Consolidated Edison
(Indian Point 2)
AEC Docket No. 50-247

Dear Mr. Muller:

I have received a copy of Con Edison's response to the comments of the Hudson River Fishermen's Association on the draft environmental impact statement on the Indian Point 2 facility.

There are various inaccurate representations of the position taken by HRFA contained in the Con Edison document which I think are sufficiently obvious to go without comment at this time. I do, however, feel that it is necessary to comment on the contention that Bowline Point and Roseton are being given sufficient review by the Army Corps of Engineers to meet the terms of the National Environmental Policy Act.

In February 1971, the Corps of Engineers circulated to other governmental agencies, but apparently not to the public, an environmental statement submitted to it by Orange and Rockland Utilities, the operator of the Bowline Point plant. No final environmental statement appears to have been issued.

Mr. Daniel R. Muller, Assistant Director
for Environmental Projects
Washington, D. C. 20545
August 22, 1972

This procedure, which substitutes the analysis of the applicant for that of the agency, is not adequate to meet the requirements of NEPA. The Federal Power Commission attempted the same abdication of its duties in considering an application from the Power Authority of the State of New York. The procedure was challenged by the Greene County Planning Board and condemned by the Second Circuit as failing to meet the requirements of the Act. Greene County Planning Board v. FPC, 3 ERC 1595, 1599-1600 (2d Cir. 1972).

The Corps of Engineers has not even attempted this much with regard to the Roseton plant.

It is equally important that the substantive material included in the Bowline Point reports is of a generalized and unquantified nature that falls far below the reasonable standard which the AEC showed itself striving toward in its draft impact statement on Indian Point 2. Examination of the statements by the AEC will rapidly make their weaknesses apparent and if the AEC staff has any inclination to rely on the material, I urge the staff to undertake a thorough review of it.

The fundamental point remains - the AEC must look at the particular receiving environment in which the Indian Point 2 facility will be placed. This requires that the Commission consider the present and the reasonably foreseeable effects on the estuary which are being or will be caused by other installations. Any other course fails to analyse the impact on the environment as it in fact is and will be.

Finally, as a general matter, I think it is imperative that the Commission adopt a procedure which will allow all parties to a licensing proceeding equal opportunity to respond to the comments which are submitted on a draft environmental impact statement. The counsel for the Regulatory Staff has made the comments in this proceeding available to me from time to time, but that is not a sufficient substitute for a regular communication which provides equal access to documents for all the parties to the proceeding and thus assures that the views of all parties will be fairly represented to the AEC staff.

129

Yours sincerely,

Angus Macbeth

Angus Macbeth
Attorney for Hudson River
Fishermen's Association

AM/sp

BEFORE THE
UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of

CONSOLIDATED EDISON CO. OF NEW YORK (Indian Point, Unit No. 2))	Docket No. 50-247

COMMENTS ON
DRAFT DETAILED STATEMENT
ON THE
ENVIRONMENTAL CONSIDERATIONS
RELATED TO THE PROPOSED ISSUANCE
OF AN OPERATING LICENSE TO THE
CONSOLIDATED EDISON COMPANY OF NEW YORK
FOR THE INDIAN POINT UNIT NUMBER TWO
NUCLEAR GENERATING PLANT

We adopt the comments on the Draft Detailed Statement on the Environmental Considerations submitted by the Hudson River Fisherman's Association.

Respectfully submitted,

Gladys Kessler

Gladys Kessler
Counsel for Citizens Committee
for the Protection of the
Environment

June 2, 1972

BERLIN, ROISMAN AND KESSLER
1712 N STREET, NORTHWEST
WASHINGTON, D. C. 20036

EDWARD BERLIN
ANTHONY Z. ROISMAN
GLADYS KESSLER
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KARIN P. SHELDON

AREA CODE 202
PHONE 833-9070

June 8,1972

Samuel W. Jensch,Esq.
Chairman
Atomic Safety and Licensing Board
U.S. Atomic Energy Commission
Washington, D.C. 20545

In the Matter of: Indian Point,
Unit No. 2,Docket No. 50-247

Dear Mr. Jensch:

The statement of intent to adopt the comments on environmental considerations prepared by the Hudson River Fisherman's Association which was submitted on June 2, 1972 by Gladys Kessler mistakenly noted Ms. Kessler as Counsel for the Citizens Committee for the Protection of the Environment. This should be corrected to read Counsel for the Environmental Defense Fund.

Sincerely,

Karin P. Sheldon

Karin P. Sheldon

KPS/pq

c.c. All parties of record

BEFORE THE
UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of CONSOLIDATED EDISON COMPANY OF NEW YORK (Indian Point, Unit No. 2)	))))))	No. 50-247

CITIZENS COMMITTEE FOR THE PROTECTION OF THE ENVIRONMENT COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

As previously indicated in CCPE's brief in support of its Proposed Findings of Fact and Conclusions of Law (pp.140-142), the AEC has erroneously interpreted NEPA by providing for an evaluation of radiological risks using standards that differ from those applied to the safety review. This results in "stacking the deck" in favor of the license without adequately considering the adverse consequences of an accident. We incorporate herein by reference the comments on pp.140-142 of our Proposed Findings of Fact and Conclusions of Law.

The error is compounded by the fact that the Staff utilizes compliance with the ECCS interim criteria as evidence that in the event of a LOCA, doses to the public will be low. The facts as revealed in the pending National ECCS hearing are to the contrary. Certainly the impact statement should include the views of those experts who differ with the Staff view with respect to the effectiveness of the ECCS system for this plant (Committee for Nuclear Responsibility v. Seaborg, ____ F. 2d ____ (CA D.C., 1971) 3 ERC 1126) and should explain the basis for their conclusion regarding the level of risk and the radioactivity predicted for each accident, particularly the class 8 loss of coolant accident.

Failure to correct these defects leaves the impact statement incomplete and legally deficient.

Respectfully submitted,

Anthony Z. Roisman
BERLIN, ROISMAN AND KESSLER
1712 N Street, N. W.
Washington, D. C.

Counsel for the Citizens Committee
for the Protection of the Environment

June 21, 1972

DOCKET NUMBER
PROD. & UTIL. FAC. 50-247

Scenic Hudson Preservation Conference

500 Fifth Avenue, Suite 1625 • New York, N.Y. 10036 • 212 OXford 5-6204

June 12, 1972

Atomic Energy Commission
1717 H. Street, N.W.
Washington, D.C.

Matter of Consolidated Edison
Company Indian Point Plant No. 2
Docket No. 50-247
Statement of Scenic Hudson Pre-
servation Conference

This statement is submitted by Scenic Hudson Preservation Conference in connection with the current Atomic Safety and Licensing Board proceedings relating to Consolidated Edison Company's proposed Indian Point No. 2 nuclear power station. The statement is submitted because Scenic Hudson's name has apparently been interjected into the proceedings in a fashion which does not accurately reflect its views.

As is well known, Scenic Hudson has long been concerned with the environment and ecology of the Hudson River. In this connection, it has been especially concerned with (1) the scenic values of the Hudson, particularly as it flows through the Highlands a few miles north of Indian Point, and (2) the impact of power plants and other industrial installations on the fisheries resources and general water quality of the River. These are the areas of Scenic Hudson's expertise, and they define the scope of this statement. As to matters of nuclear safety, radioactive releases and the handling of radioactive wastes, Scenic Hudson has no special knowledge; and it neither endorses nor opposes the Indian Point plant on the basis of such consideration.

Scenic Hudson is, however, deeply concerned by the potential impact of the plant on the River's fisheries. In this regard, we point out that the Hudson has been and remains a highly productive estuary, supporting from 35 to 50 species of fish and the necessary food chain and habitat to make these species viable.

Within the entire range of fisheries, each species has both commercial and recreational importance in that each is part of a complex and interrelated biological system which supports fish for Hudson River sportsmen and for sport and commercial fisheries in offshore waters for several surrounding states, each with an important marine economy. Any serious damage to the fishery can be the basis of permanent and irrevocable damage to the River and a broad segment of the population of the Middle Atlantic region, relying on the estuary or its productivity for recreation or for income.

Our concern over the Indian Point plants stems from the fact that the waters of the Hudson are or will be drawn upon for cooling purposes, and that the intake of water, combined with mechanical abrasion and thermal discharges, appears to threaten the River's fisheries with major damage. We understand, for example, that with the open cooling system that it utilizes Indian Point No. 1 draws up to 300,000 gallons per minute of River water for cooling, and further, that approximately 840,000 gallons per minute would be drawn by Indian Point No. 2, utilizing a similar open cooling system. Recent history in the testing of Indian Point No. 2, and the continuing problem related to fish kills at Indian Point No. 1, indicate that these withdrawals alone can be regarded as a major threat to marine life in the Hudson -- and an unnecessary threat since closed-cycle cooling is possible in today's technology.

The problems of the past in the operation of the Indian Point No. 1 plant have at times been related to thermal effects, and the most recent fish kills at Indian Point No. 2 have been attributed to mechanical problems having to do with intake. The numbers of fish killed or subject to future kills have been thoroughly covered by the Hudson River Fishermen's Association and the Atomic Energy Commission staff report. The net effect forecast by both as a result of the operation of the Indian Point No. 2 represents a serious loss to the fisheries of the Hudson. Contrary to the statements issued by Con Edison regarding size, species and survival, the mortality is important in that each marine organism is either a predator or a food for a predator -- hence part of the cycle which cannot reasonably be sacrificed; nor can it be reasonably tolerated in the face of an alternative method of cooling that is clearly available.

This alternative method of cooling is, of course, closed cycle cooling. As applied to Indian Point, this would probably involve cooling towers; and it is in this connection that Scenic Hudson's name has apparently been interjected into the proceeding -- it being suggested that we would never stand for cooling towers on the grounds of esthetic objections. This misrepresents our position.

Scenic Hudson is deeply concerned with scenic values along the Hudson and, as such, it vigorously opposes the use of cooling towers (and, for that matter, the construction of power plants altogether), where special scenic qualities are involved. But Indian Point, as it presently stands is not such a case. The site has already been despoiled by Indian Point No. 1 unit and its high stack; by the completed plant structures of Indian Point No. 2; by the hulk of Indian Point No. 3 as it nears completion; by the huge towers and supported wires which cross the Hudson at this point; and by the general maze of transmission towers and wires which serve as a back drop for the plants.

Under the foregoing circumstances, the addition of cooling towers at Indian Point, while no esthetic enhancement, will hardly result in irrevocable scenic damage since the damage has already been done by the vast industrial complex which already exists there. On the other hand, the addition of cooling towers and a closed cycle cooling system would provide at least some protection for the fisheries of the Hudson and, as a consequence, and under the circumstances described, is clearly to be preferred to the open cycle system currently proposed by Con Edison.

We do not mean to suggest, however, that cooling towers and closed cycle cooling are a complete answer to the dangers threatened to the fisheries. In this regard, it is our belief that any analysis of the damage to fisheries resources must be related in measurement to the operation of all plants now existing or under construction within the spawning and nursery areas of striped bass and other Hudson River fish.

Furthermore, there are many other users of Hudson River water within immediate and nearby areas. No meaningful evaluation can be drawn without a consideration of the impact on the entire Hudson River fishery of the total of its water users. Single project or plant projections tend to be totally self-serving for the applicant or for the licensing agency and can in no way indicate the point at which the River will be unable to support a continuing and surviving production.

Equally unsatisfactory is any offer to produce a hatchery to replace mortalities since many of the species subject to impingement or thermal effect have never been successfully produced under controlled conditions; and certainly there is no history of success in the replacement of these species in an estuarine environment. Therefore, any such offer, no matter how sincerely made, must be considered simply good public relations.

Respectfully submitted
SCENIC HUDSON PRESERVATION CONFERENCE
500 Fifth Avenue, Suite 1625
New York, New York 10036

Theresa Rotola

By: Mrs. Theresa Rotola
Executive Secretary

Committee To End Radiological Hazards
166 Second Avenue
New York, New York 10003

Mary Hays Weik
Secretary
GR 7-5935

Director, Division of Radiological
and Environmental Protection
U.S. Atomic Energy Commission
Washington, D.C. 20545 - May 19,1972 -

Re: Invited Citizens' Comments on the Environmental Impact of the Propos Issuance of an AEC Operating Licen to Con-Ed's Indian Pt.Nuclear Reac DOCKET NO.50-24

Dear Sir:

Thank you for sending at my request the AEC's "Draft Detailed Statement" prepared by your department on the subject named above. It is obvious that such a repo from an independent agency having no connection, actual or implied, with the Atomic Energy Commission - which itself both sited and regulates the project concerned - woul have been more convincing. Our comments on the Statement's contents follow:

In issuing this evaluation of the environmental impact of a proposed second nuclear reactor at Indian Point, the U.S.Atomic Energy Commission has placed on the public rec an amazing collection of irrelevant, useless,and deliberately confusing items, which do little to throw any light on the situation involved:

1) Its concern for the fate of Hudson River fish entirely overshadows any concern fo the area's human residents. While infinite details are given on the reactions of various aquatic organisms - the "thermal tolerance" of macroinvertebrates, the "reproductive habits of zooplankton species," etc., etc. - no reference is made to the alarming mortality record found among residents of nearby local communities directly downwind to the plant, as shown in local statistics of the region recorde in the enclosed Chart of Deaths from Brain & Breast Cancers and Leukemia, found in the same "Cortlandt Town" area before and after the nuclear plant was built. (A)

2) The Report's figures on "low-level" radioactive releases from the plant are of little significance, since it ignores completely the well-known facts on serious internal damage by "contact radiation" from chronic low-level doses ingested or inhaled, as pointed out on the enclosed page of comments by the Viennese physicist Dr. Karl Nowak. These omitted facts make the Report's alleged "minimal and harmles plant releases, both deceptive and absurd.

3) Since the "radiation limits" permitted in the Indian Point area by the AEC's "10CFR20" and "10CFR100" standards are fantastically high (44,000 curies a day, 16 million curies a year, a possible 3,000 rads in individual thyroid doses, as cited in the AEC's "Initial Decision" on the 1969 Construction Permit for Indian Point 3), even the "low percentages" of those Limits presently alleged in use in the Draft Environmental Statement would be themselves quite substantial and damagi (I doubt that the thousands of dead fish found in a recent Indian Point "fish kill actually needed the "impingement" on metal screening grates to finish them off!)

4) It seems obvious that the alarming escalation shown almost a year ago on the enclosed sheet of official mortality records for the surrounding Cortlandt Town region, demands - far from a new permit for operation of an additional second Nucle Plant, 4 times larger than Indian Point I - an immediate shutdown of all Indian Po nuclear facilities, with the "dismantling and entombment" of this deeply contaminated installation described on pages V-75 and V-76 of your Draft Report, to preven a problem of unprecedented disaster for populations of this area for centuries to c

Surely there must be a better way of reclaiming a wasteful and ruinous investment in nuclear power than by killing off the helpless citizens of the Indian Point area!

COPIES TO OTHER INTERESTED PARTIES 137 2775 Sincerely, Mary H. Weik Mary Hays We

THE YORKTOWNER, WEDNESDAY, SEPTEMBER 8, 1971

Cancer and Leukemia Rise Around Indian Point

Committee Chief Note Spurt In Mortality Near Nuclear Plant

by Mary Hays Weik

A significant new report has just been issued by the Committee To End Radiological Hazards of New York City, on health conditions around the Indian Point atomic plant. The report shows percentage of increase in deaths by Brain and Breast Cancers and Leukemia in the Cortlandt Town area directly surrounding the atomic plant, during the 5 years 1963-67, after the plant began to operate in August '62, as compared with the 5 years, 1957-61, just before its start. Included population figures for 1960 and 1965 show that cancer increase has far outstripped population growth.

The report is based on figures contained in the N.Y. State Health Dept. report, "Review of Mortality Statistics In the Northwestern Section of Westchester County." The State report is a curious document. It was published shortly after this writer revealed, as a citizen intervenor at the 1969 Indian Point Hearing an unusual number of Cancer Deaths in an area of Montrose downwind to the atomic plant. The State report shows an obvious intention to confuse and mislead the public; for the local map it includes so confuses the boundaries of the area involved in the Montrose cancer deaths as to make difficult a localized study of the problem.

Neither State nor County Health Department seems worried by the situation shown by their own figures. I was surprised to receive a "personal copy" of the report from State Commissioner of Health Dr. HOLLIS S. INGRAHAM, who had refused to honor my citizen's subpoena to testify at the 1969 Indian Point Hearings. In a letter to the AEC sent me with the report, Dr. Ingraham said: "We find no evidence of increase in . . cancer mortality in the vicinity of Indian Point;" and DR. DONALD R. REED, President of the Westchester County Board of Health, in a letter to a local citizen listing figures which amounted to an increase of 22% in MONTROSE and an increase of 150% in BUCHANAN, wrote : "These figures would indicate to me that the cancer deaths have not increased in the villages of Buchanan or Montrose(!)."

The latest (1971) Rand-McNally Commercial Atlas shows Montrose population as 2200. But the State report cited submerges the Montrose village figure in a vague total, numbering 22,000, called the "Rest of Cortlandt Town." (This greatly dilutes, of course, the Montrose cancer mortalities.) Yet local records show that 3 out of the 4 brain cancer deaths reported in 1963-67 for this Cortlandt area of 22,000 were actually registered from the Montrose section I described in "The Montrose Catastrophe" - population, less than 500!

Unfortunately (for them), the people who prepared the delusive State report made one false step: In making their report, they revealed local statistics not available to the general public or reported in "U. S. Vital Statistics" (because the communities involved are too small for individual mention). In other words, the report brought into the open statistics heretofore available only to the two Health Departments. These figures happen to be most significant.

The cancer deaths shown in the New York committee's statement (taken from Tables VII and Table VII A of the State "Review of N W Westchester County" cited above) though damning as evidence, would appear to be small in number. They will certainly be labeled as such and called "unimportant" by AEC and Con-Edison attorneys. But this is far from true, as any honest statistician knows. For:

1) By the State figures, Peekskill, Buchanan, and Croton-on-Hudson are now implicated in the Indian Point cancer problem. (What about other - unnamed - Westchester communities?)

2) In 11 out of 12 community situations named, an unbroken increase of cancer deaths is shown. In the 12th, Peekskill, the number of brain cancers remained the same in the two periods covered. Yet, even there, unreported 1968-71 figures may now have changed the picture.

3) If such an increase could occur with only the 265-megawatt Indian Point I reactor in operation what would result with the addition of the 873-meg. Reactor II — 4 times as large as Indian Point I?

4) If such an increase could occur with only Indian Point I's "Pressurized Water" 265-meg. reactor, imagine the effect of adding, as planned, Reactors III, IV and V (of 1100-meg. each) all of "Boiling Water" type - since airborne radioactive releases from this type of reactor are known to be enormously larger. . What will be the effect downwind then?

CANCER DEATH RECORD IN "CORTLANDT TOWN" AREA SURROUNDING INDIAN POINT, NY, ATOMIC PLANT, BEFORE & AFTER PLANT'S START IN 1962

From Official Mortality Statistics in 1969 New York State Dept. of Health Publication, Review of Mortality Statistics in Northwestern Section of Westchester County - Tables VII&A: "Number of Deaths (Brain and Breast Cancers & Leukemia) for Cortlandt Town (Including) Peekskill City, 1957 - 1967" ***

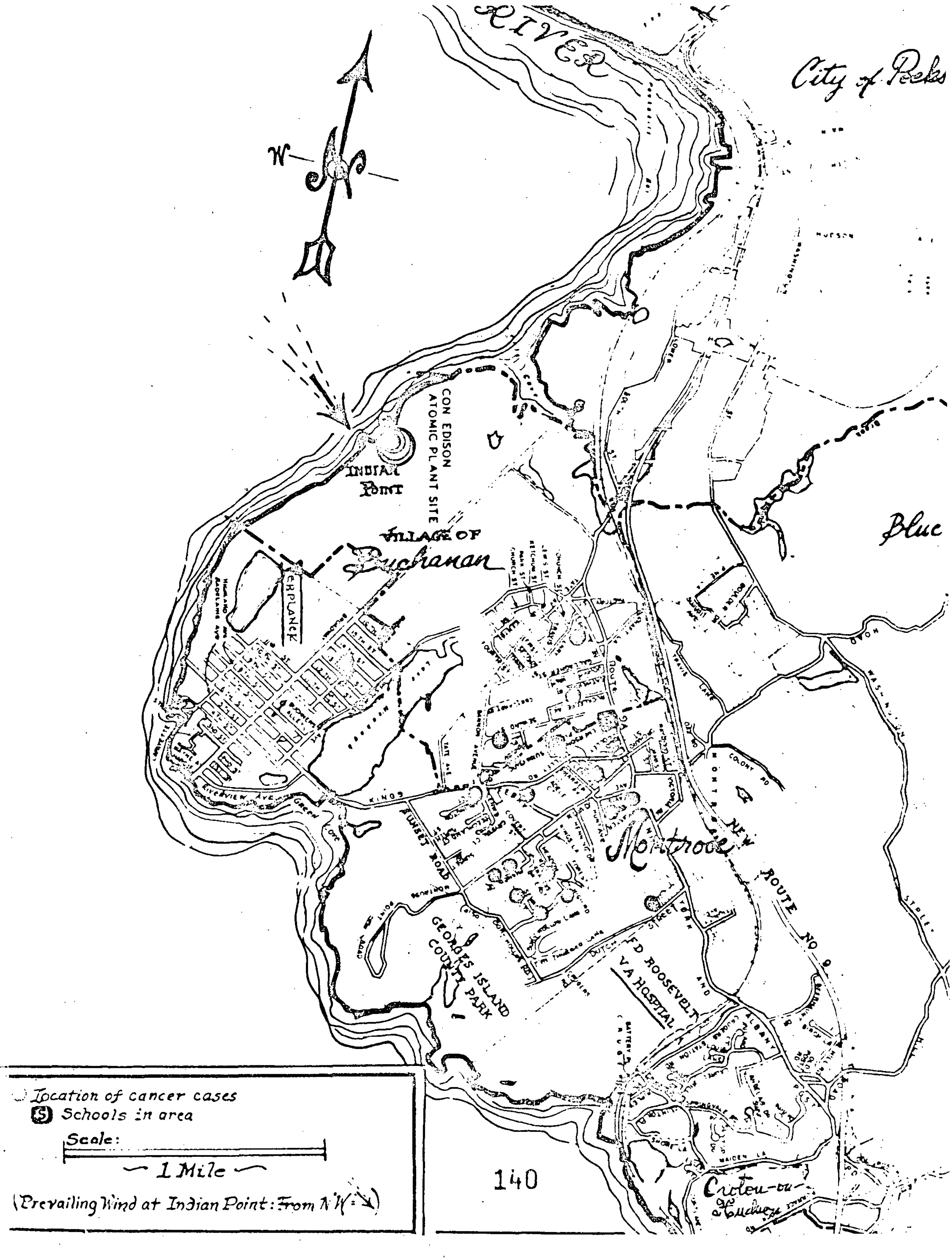
A r e a s	CANCER of BRAIN and Nervous System (193)			BREAST CANCER (WHO International Code 170)			LEUKEMIA (International Code 204)			P o p u l a t i o n		
	'57-'61	'63-'67	% Increase	'57-'61	'63-'67	% Increase	'57-'61	'63-'67	% Increase	1960	1965	Increase
Peekskill	4	4	--	20	25	25 %	4	10	150 %	18,737	18,504	(1% drop)
Croton-on-Hudson	-	6	600 %	7	10	43 %	3	6	100 %	6,812	6,941	Inc: 2%
Buchanan	-	1	100 %	-	2	200 %	-	1	100 %	2,019	2,168	" 7%
Rest of Cortlandt Town (including MONTROSE)	-	4 *	400 %	4	12	200 %	2	5	150 %	17,505	** 22,231	" 27%
TOTAL Cortlandt Town	4	15	275 %	31	49	58 %	9	22	144 %	45,073	49,844	" 11%

* Three of these 4 deaths were recorded for a small section (c. 500 population) of MONTROSE directly downwind to the Indian Point atomic plant.

139

** MONTROSE total population was only 2200 in 1970 (Rand McNally 1971 Commercial Atlas & Marketing Guide).

*** Conclusions issued by State and County Health Boards are in curious contradiction to their own records: In spite of the increases shown in the N.Y. State Health Dept. figures reported above, State Health Commissioner HOLLIS S. INGRAHAM, in his presentation letter to the U.S. Atomic Energy Commission of March 23, 1970 accompanying the above report, said: "We find no evidence of an increase in . . cancer mortality in the vicinity of Indian Point;" and Dr. DONALD R. REED, President of the Westchester County Board of Health, in a March 18, 1970 letter answering a local citizen's inquiry, in which Dr. REED himself cited a rise in All Cancer Death figures in the 4 years after Indian Point's start (1963-1966) which, compared to the 4 years preceding its start (1958-1961), amounted to an increase of 22% in MONTROSE and an increase of 150% in BUCHANAN, wrote: "These figures would indicate to me that the cancer deaths have not increased in the villages of Buchanan or Montrose (!)."



RIVER
City of Peeks
W
CON EDISON
ATOMIC PLANT SITE
INDIAN POINT
VILLAGE OF
Buchanan
VERPLANCK
Blue
RIVERVIEW AVE
KINGS
SUNSET ROAD
Montrose
NEW
ROUTE NO 9
GEORGES ISLAND
COUNTY PARK
FD ROOSEVELT
VA HOSPITAL
Croton-on-Hudson
Location of cancer cases
5 Schools in area
Scale:
1 Mile
(Prevailing Wind at Indian Point: From NW)

B I L I N G U A L

Q U O T E S

FROM: Committee To End Radiological Hazards
166 Second Avenue, New York, NY 10003, USA
Mary Hays Weik, Secretary (GR 7-5935)

ATOMIC PLANT RELEASES CANNOT BE FAIRLY COMPARED TO NATURAL BACKGROUND RADIATION

(English translation):

"A nuclear power plant releases radioactivity to its environment through its chimney and cooling-water. Even in undisturbed normal operation, the chimney emits radioactive gases and particulate matter which are distributed through the surroundings.

"Company 'experts' claim that the amount released is minimal. They calculate high plant releases by comparing them with natural background radiation. Actually, the effect of radioactive material taken into the body, as is that from the plant's chimney and cooling-water, through inhalation, or by way of the food chain and drinking-water, is significantly higher (than company figures show), and impossible to measure exactly.

"If a (radioactive) particle merely lies on the ground, then its effect is minimal although its radiation may be dangerously high. If the particle, however, is deposited on a mucous membrane by inhalation or ingestion, or if it settles in an organ due to its chemical nature, then as a result of contact radiation, its effect will be increased to the square of its ownvalue and give an extraordinarily strong dose of radiation to its direct surroundings, leading to death of the cells contacted or severe damage to those it touches.

"Especially effective in this connection are Alpha and Beta rays, whose effect would otherwise be screened out by the atmosphere. These inner effects cannot be controlled from without. Thus numbers of Cancers and other damages can arise; above all, genetic damage and disease if the reproductive organs are affected. Moreover, this radioactive matter stored up in the body increases with time, and the damages build up . . ."

(From Der Skandal Atomkraftwerk by Ing. KARL NOWAK, Vienna physicist and editor of „Neue Physik", in an article in „Oberösterreich. Wochenpost," Austria)

(Original German):

„Ein Kernkraftwerk gibt über Schornstein und Kühlwasser Radioaktivität an die Umgebung ab. Der Schornstein auch im ungestörten Normalbetrieb laufend radioaktive Gase und Schwebstoffe ausstöszt und in der Umgebung verteilt.

„Von den bezahlten 'Experten' wird es so dargestellt, als sei das minimal. Man rechnet mit der erhöhten Umgebungsstrahlung und vergleicht sie mit der natürlichen Strahlenbelastung. Tatsächlich ist die Wirkung inkorporierter radioaktiver Stoffe, wie solche aus Schornstein und Kühlwasser über Atomluft, Nahrungskette und Trinkwasser in den Körper gelangen, ganz bedeutend höher und nicht exakt messbar.

„Liegt ein Staubkörnchen am Boden, so ist seine Wirkung minimal, mag es auch ein gefährlicher starker Strahler sein. Gelangt das Teilchen aber mit Atomluft oder Nahrung auf eine Schleimhaut oder wird es gar infolge seiner chemischen Beschaffenheit in ein Organ eingelagert so kann es infolge Kontaktbestrahlung, da die Wirkung mit dem abnehmenden Abstand quadratisch zunimmt, an seine unmittelbare Umgebung auszerordentlich starke Strahlungsdosen abgeben und so sogar zu Nekrose (Zelltod) oder schweren Zellschäden Anlasz geben.

„Besonders wirksam sind dabei Alpha- und Betastrahler, deren Wirkung sonst durch die Luft abgeschirmt wird. Diese inneren Vorgänge sind von auszen überhaupt nicht kontrollierbar. So können Krebsherde und andere Schädigungen entstehen, vor allem auch Erbschäden und Erbkrankheiten, soweit die Fortpflanzungsorgane beeinfluszt werden. Auch speichern sich radioaktive Stoffe im Körper und die Schädigungen summieren sich . . "

JONATHAN B. BINGHAM
23D DISTRICT, NEW YORK

WASHINGTON OFFICE:
133 CANNON HOUSE OFFICE BUILDING
TELEPHONE: (202) 225-4411

R. ROGER MAJAK
ADMINISTRATIVE ASSISTANT

Congress of the United States
House of Representatives
Washington, D.C. 20515

COMMITTEES:
FOREIGN AFFAIRS
HOUSE ADMINISTRATION

DISTRICT OFFICE:
ONE EAST FORDHAM ROAD
BRONX, NEW YORK 10468
TELEPHONE: (212) WE 3-2310

May 30, 1972

U.S. Atomic Energy Commission
1717 H Street, N. W.
Washington, D. C.

In re: Consolidated Edison Company of
New York, Inc. (Indian Point Unit No. 2)
Docket No. 50-247

Gentlemen:

As a Congressman representing a district which lies within the Consolidated Edison service area as well as being adjacent to the Hudson River, I am writing to comment on the Commission's draft NEPA statement on Indian Point 2 as it relates to an important environmental issue - the protection and enhancement of the natural aquatic life of the Hudson.

The state of New York has sought to protect its fisheries by legislation, imposing a $10 civil penalty for the taking of fish by the drawing off of water. Recently the Attorney General of New York filed suit against Con Edison for $1.6-million for fish killed at Indian Point 2. This is the second major legal action which the Attorney General has launched in the effort to protect fish at the Indian Point site. These are important actions, but the answer to fish protection does not lie in fines and damage actions. They do nothing to improve the Hudson fishery and if the sums are in any way passed on to the consumers they will increase electrical bills with little direct gain to the River or the people of New York.

A very important part of the real work of protecting the great and productive fishery of the Hudson lies with the AEC. In these circumstances I was shocked to read in the draft statement that the annual loss of striped bass "may be as high as 15% to 20% from the direct effects of Plant operation." Similar figures would hold true for other fish species as well. Fish destruction of this magnitude - or anything close to it - is an unacceptable assault on both the fishery and the general environment of the Hudson. If these kills are accompanied by fines levied by the State, the situation will also be intolerable for the citizens of New York City whose electrical bills are decided by the fate of Con Edison.

Rec'd Off. Dir. of Reg.
Date 6/2/72
Time 9:08

DR-566

Environmentally, the situation will also be made worse when the Bowline Point and Roseton plants go on line in the course of the next two years. The draft statement does not address itself to these plants. I consider this a major flaw in the statement. Those plants will have an effect on the Hudson similar to that of the Indian Point plant. It is impossible to judge fully the damage on the River unless we see Indian Point 2 as part of the total array of plants which will be operating on the Hudson in the course of the next few years. It was precisely to produce analyses of this sort that the Congress passed the National Environmental Policy Act. As part of its duty under the Act, the Commission should consider the full impact of the power plants now under construction on the Hudson.

From the draft statement, it appears that the only solution to the fish kill problem will be an alternate cooling system. This may be expensive, but it has the clear advantage that money spent would actually go toward the protection of the Hudson fishery and would not be drained away in law suits with their consequent fines and damages.

Yours sincerely,

Jonathan B. Bingham

JBB:AJD

Congress of the United States
House of Representatives
Washington, D.C. 20515
June 1, 1972

U. S. Atomic Energy Commission
1717 H Street, N. W.
Washington, D. C. 20545

Re: Consolidated Edison Company of New York Inc. (Indian Point Unit No. 2) Docket No. 50-247

Gentlemen:

As a Congressman representing a District which lies along the Hudson River, I am writing to comment on the AEC's draft environmental impact statement on Indian Point No. 2. I was shocked to see that the annual loss of striped bass "may be as high as 15% to 20% from direct effects of plant operation." These figures become more startling when the draft points out that they will apply to other fish as well as the striped bass.

Losses of fish from the Hudson of this magnitude are simply unacceptable. The Hudson is a great estuarine fishery. It is invaluable for the recreational pleasure which it gives to the millions who live along its banks. It has great commercial value as the spawning and nursery ground for fish, most particularly the striped bass, which populate Long Island Sound, and the Atlantic waters from Montauk to Cape May. All government agencies must make every effort to maintain and enhance that fishery.

I am also perturbed that the draft statement gives only a partial picture of the situation in the Hudson. The AEC when writing impact statements must take into account the entire environment on which the proposed plant will have an effect. This was clearly the intent of Congress in passing the National Environmental Policy Act: each project is to be analyzed in terms of the particular environment on which it will have an impact.

In the case of Indian Point No. 2, this requires an analysis of the other plants which will be operating on the River in the next two years -- Bowline Point and Roseton. These plants will also withdraw large quantities of water from the Hudson -- hundreds of thousands of gallons a minute -- and heat it substantially before discharging it again into the River. This will add to the devastating effect on the Hudson fishery which the draft environmental statement foresees at Indian Point. If the AEC fails to consider these effects it will be doing a disservice to the public as well as failing to address a major threat to the Hudson River in coherent and common sense terms. How can we talk about Indian Point No. 2 as if the other plants did not exist?

It seems to me inevitable that Con Edison will be required to build cooling towers at Indian Point. We must accept that as the price for saving the Hudson and its fishery. The alternative is to treat one of the great rivers of America as a cooling sluice for a utility and in the process sacrifice the vast natural resource of the Hudson's aquatic life. That is not an acceptable solution. I urge the AEC to require that Con Edison install cooling towers on the fastest practicable scheduled. Moreover, it is important that such towers be constructed with silhouette as low as possible so that we do not have more towers in the environs of the Hudson Highlands that break the horizon line.

Everyone is concerned to see that we protect the environment as well as provide power. It is imperative that the AEC pursue its environmental mandate with the same vigor with which it has promoted nuclear power.

Sincerely,

John G. Dow

JOHN G. DOW
Member of Congress

JGD:kjs

WILLIAM F. RYAN
20TH DISTRICT, NEW YORK

COMMITTEES:
JUDICIARY
INTERIOR AND INSULAR AFFAIRS

DOCKET NUMBER
PROD. & UTIL. FAC. 50-247

Congress of the United States
House of Representatives
Washington, D.C. 20515

303 CANNON BUILDING
WASHINGTON, D.C. 20515
225-6616

DISTRICT OFFICE:
3765 BROADWAY
(AT 157TH STREET)
NEW YORK, NEW YORK 10032
234-6900

May 31, 1972

The Honorable W. B. McCool
Secretary of the Commission
Atomic Energy Commission
1717 H Street, NW
Washington, D.C. 20545

Re: Consolidated Edison Company of New York
Indian Point Unit No. 2
Nuclear Generating Plant
Docket No. 50-247

Dear Mr. McCool:

I wish to submit this statement as a protest to the Atomic Energy Commission's "Draft Detailed Statement on the Environmental Considerations Related to the Proposed Issuance of an Operating License to the Consolidated Edison Company of New York for the Indian Point Unit. No. 2 Nuclear Generating Plant, Docket No. 50-247." I request that this study be reevaluated on the basis of the following points:

1. that the possibility of a substantially harmful impact on the fish in the area needs further study;

2. that such a study should not be conducted by Consolidated Edison on the basis of a conflict of interest;

3. that guidelines be drawn upon which to base such a study;

4. that the potential for Closed Cycle Natural Draft Cooling Towers at Indian Point No. 2 should not be dismissed without a more complete study as to its long run cost-benefit relationship as compared to the present plans.

146

I feel that without reconsideration of these points the Commission will have failed to provide adequate, effective protection to the Hudson River environment and could result in higher costs, physically and financially, than alternate designs proposed.

With kindest regards.

Sincerely,

William F. Ryan
Member of Congress

WFR/jgsp

63 WALL STREET
NEW YORK

June 1, 1972

Atomic Energy Commission
1717 H Street, N.W.
Washington, D. C. 20545

Re: Petition of Consolidated Edison Company of New York to allow operation of its Indian Point Number 2 facility.
Docket No. 50-247

Dear Sirs:

This letter of comment respecting the above facility is submitted in response to your request for comments and in my capacity as the Democratic nominee for Representative in Congress from the new 25th Congressional District of New York in which the above facility is situated.

The above application should be denied subject to the condition that it be reconsidered upon Consolidated Edison's undertaking to install and operate appropriate facilities to cool its cooling waters prior to returning them to the Hudson River and to minimize the quantity of these waters to be returned to the Hudson. This action should be taken because:

(1) The immediate licensing of this facility will not solve any imperative power needs;

(2) The proposed thermal discharges pose a serious threat to the quality of the Hudson and to its water life;

(3) Inadequate consideration has been given to the impact upon the quality of the Hudson and upon its water life of the proposed discharge and other existing thermal discharges into the Hudson; and

(4) Appropriate cooling facilities can be installed without violating reasonable esthetic standards and without undue expense.

(1) The immediate licensing of this facility will not solve any imperative power needs. Consolidated Edison's proposed testing schedule indicates that it does not intend to use this facility to provide power during the summer of 1972. Since Consolidated Edison now has a 35% reserve capacity over anticipated winter peak load, there is no urgent need to operate this facility before adequate consideration has been given to the threats posed to the Hudson by its proposed operation.

(2) The proposed thermal discharges pose a serious threat to the quality of the Hudson and to its water life. The proposed facility will withdraw from the Hudson between one-half million and one million gallons of water per minute, heat it approximately 15°F, and discharge it into the Hudson.

The discharge of this heated water will remove substantial dissolved oxygen and may cause increased evaporation leading to sedimentation. This thermal discharge will diminish the capacity of the Hudson to assimilate other wastes presently discharged in undue quantities into the Hudson and increase the toxic effects of pollutants presently in these waters.

The thermal discharge will have the effect of altering diet, reproductive activities, disease resistance, migration patterns and other considerations affecting the life cycle of the various species of fish now found in abundance in the Hudson. The effect may be to wipe out entire species of fish.

Even fish species which adjust to the new temperatures of the Hudson to be created by the intended thermal discharge can be destroyed in the event that a failure of operation of this facility results in a sudden decrease in water temperature.

Moreover, it is to be anticipated that substantial numbers of fish will be entrained and killed upon screening equipment during the intake of water from the Hudson by this facility. During one test day last February, approximately 150,000 fish were killed when just two of the six proposed pumps of this facility were put through a test run. Qualified scientists estimate that the operation of this facility may destroy 25% of the fish in the Hudson per year. If such destruction continues over a number of years at this annual rate, it is obvious that the number of fish in the Hudson would quickly approach zero.

(3) <u>Inadequate consideration has been given to the impact upon the quality of the Hudson and upon its water life of the proposed discharge and other existing thermal discharges into the Hudson.</u> The proposed facility and the nearby Indian Point Unit Number 1 will together withdraw [illegible],000 gallons of water per minute from the Hudson. Commencing in 1974, the proposed Bowline Point facilities will withdraw 768,000 gallons of water per minute from the Hudson, heat it to 13.5°F and discharge the heated water into the Hudson. These facilities are only 5 miles from the subject facility. Commencing in 1973, the proposed Roseton facilities will withdraw 650,000 gallons of water per minute from the Hudson, heat it to 15.4°F and discharge the heated water into the Hudson. These facilities are only 2[illegible] miles from the subject facility. There appears to have been no adequate investigation of the combined effect upon the Hudson of these numerous thermal discharges. Nor has there been any consideration of the numerous thermal discharges presently being made in this area of the Hudson.

(4) Appropriate cooling facilities can be installed without violating reasonable esthetic standards and without undue expense. I am advised that the Scenic Hudson Preservation Conference does not object on esthetic grounds to the installation of appropriate cooling towers. Compared to the costs of losing the present life in the Hudson, the cost of installing adequate cooling towers is minimal.

* * *

The obvious conclusion is that no permission should be granted to Consolidated Edison to operate the proposed facility until appropriate closed looped cooling towers have been installed and are in operation. Consolidated Edison should not be permitted to monitor the impact of its discharges upon the Hudson. The preservation of existing life in the Hudson and the future rehabilitation of the Hudson depend upon immediate steps to limit further intrusions into the Hudson of the type proposed in the present petition.

Very truly yours,

John M. Burns

JOHN M. BURNS, III

DOCKET NUMBER
PROD. & UTIL. FAC. 50-247

RICHARD L. OTTINGER
235 BEAR RIDGE ROAD
PLEASANTVILLE, N.Y.

May 26, 1972

United States Atomic Energy Commission
1717 H Street NW
Washington, D.C. 20545

Re: Docket No. 50-247

Dear Sirs:

I am writing today to urge that the Atomic Energy Commission require that Consolidated Edison begin immediate construction of cooling towers at its Indian Point 2 nuclear plant. The alternative to construction of these towers is the possible destruction of the fish population of the Hudson River.

Although your staff has determined that there will be only a 15 to 20 per-cent destruction of the fish population caused by the operation of Indian Point 2, we must consider that this station is only of several which are proposed for construction along the river.

While Con Edison continues to experiment with elaborate, yet ineffectual fish protection devices, all evidence indicates that cooling towers will reduce the withdrawal of water, and therefore also fish life, from the river by 95 to 98 per-cent.

We cannot afford to waste time on further research, especially since it will take considerable time to put any protection plan into operation.

The solution is available; cooling towers will work, and their effect on the environmet will be small.

Sincerely,

Richard L. Ottinger

RLO/jm

152

Harry G. Woodbury
Executive Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-6001

May 30, 1972

U. S. Atomic Energy Commission
Washington, D. C. 20545

RECEIVED
JUN 8 1972
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Attention: Director, Division of Radiological and Environmental Protection

Re: Indian Point Unit No. 2
Docket No. 50-247

Dear Sirs:

Consolidated Edison Company of New York, Inc. (Con Edison) respectfully submits its comments on the Draft Detailed Statement (the Statement) on the environmental considerations related to the proposed issuance of an operating license to Con Edison for the Indian Point Unit No. 2 nuclear generating plant, dated April 13, 1972, prepared by the Atomic Energy Commission's Regulatory Staff. These comments are submitted pursuant to notices in the Federal Register on April 20, 1972 and May 2, 1972.

This letter contains comments on the major features of the Statement. Enclosed are nine appendices. Appendix A consists of suggested detailed corrections to the Statement. Appendices B-1 to H are detailed analyses in support of the positions indicated in this letter.

1. Conclusions

Con Edison agrees with the conclusions contained in the Statement that Indian Point should be allowed to operate subject to an operational monitoring program. Con Edison believes that this conclusion represents the best approach to satisfy the public interest in light of all relevant factors.

It is difficult to predict with accuracy the quantitative environmental impacts of a major facility such as Indian Point 2 on the complex aquatic ecosystem of the Hudson River. The Statement notes that, "Existing information is insufficient to accurately predict the degree to which the potential damage will eventually take place during operation." Con Edison agrees with the basic point that additional data and analyses are desirable to provide a better basis for professional opinions. The only way all such data can be obtained is to commence operations and study the actual impacts. Con Edison will cooperate with the Commission's Staff, the Hudson River Policy Committee and the Hudson River Fishermen's Association in monitoring and study programs sufficient to obtain the information required by the Commission. A general description of these programs was set forth in Supplement 1 to our Environmental Report. More detailed information was furnished to the Staff on March 8, 1972. A further description is enclosed as Exhibit G.

Some of the desired data have already been obtained but were not available to the Commission in written form when the Statement was prepared. Most of this material was introduced into evidence at the hearing conducted by the Atomic Safety and Licensing Board (ASLB) on April 5, 1972. The Commission should utilize these new data in the preparation of the Final Detailed Statement. Many of the comments contained herein are based on these data. Enclosed as Exhibit H is this testimony which is referenced in this letter.

The body of the Statement appears to be written on the basis that the Statement should maximize estimates of environmental damage and minimize estimates of lack of such damage. Con Edison believes that this approach is contrary to law. The National Environmental Policy Act of 1969 calls for a detailed statement on the environmental impact of the proposed Federal action, i.e., the issuance of an operating license for Indian Point 2. The derivative requirement is thus an impartial objective analysis of environmental impacts. The Statement, however, describes the conceivable potentials for harm - in effect a speculative maximum damage rather than an impartial objective assessment. The Statement does not indicate either a minimum or likely damage level.

The basis which apparently guided the preparation of the Statement leads to biased estimates of environmental damage and renders it impossible to perform an objective analysis of benefits and costs. The undue emphasis on potential environmental damage without a corresponding analysis of potential lack of damage weights the scales unevenly so that a balance of benefits and costs is not practicable. The most fundamental decision which must be made in this case is whether the economic and environmental costs of major changes to the plant are worth the benefits to be derived in environmental improvements. If the potential for environmental damage has been overstated, a correct evaluation is impossible, and the public interest is not served.

The most significant example of this is that an admittedly rudimentary mathematical model has been used to compute, on the basis of limited information on but a few of the natural influences on fish populations, an entrainment of 25% of the young-of-the-year fish each year. This might have been described as a small percent of the natural mortality to put the number in perspective. And, although the number neglects diurnal movements, natural migrations, transport and avoidance mechanisms, it is mentioned time and again throughout the Statement implying that the 25% loss due to entrainment will be a fact.

Other examples of the lack of objective analysis include omission from the Statement of several important facts. As noted in the Statement, Indian Point 1 has experienced over several years a problem of the collection of fish on the intake screens. Con Edison has successfully eliminated collections of large fish, and collections are now limited to fish approximately two inches in length which are generally immature, young-of-the-year fish. The only reference to size is a sentence that the fish are generally larger than 45-50 millimeters in length (V-33). The actual size is not given nor is there any statement as to the biological significance and natural mortality of the small size of these fish. Nor is there any mention of the findings of the AEC in their "Report of Inquiry Into Allegations Concerning Operation of Indian Point 1 Plant of Consolidated Edison Company" dated October 1971.

Another error concerns the temperature rise of circulating water passing through the plant. Con Edison intends to reduce the rate of flow during cold weather in order to reduce the problem of fish collections. The reduced rate of flow will produce a higher temperature rise, a ΔT of about 24°F. This does not present any problem with respect to thermal criteria because this mode of operation will occur only when river temperatures are low. The Statement does not clearly state that reduced flow will only occur during cold weather. Accordingly, the higher temperature rise during reduced flow might erroneously be added to summer temperatures and lead to the erroneous conclusion that a problem of excessive thermal discharges exists. The Statement implies that this problem could exist (III-37).

2. <u>Thermal Criteria</u>

The Statement concludes that Con Edison has not adequately demonstrated compliance with New York State criteria for thermal discharges. Con Edison refers the Commission to the testimony of Dr. John P. Lawler on The Effect of Indian Point Units 1 and 2 Cooling Water Discharge on Hudson River Temperature Distribution which was submitted to the ASLB on April 5, 1972 (see Appendix H). Enclosed as Appendix B-1 is an analysis of Con Edison's differences with the Statement and an explanation of why Con Edison believes its analysis is correct. The Commission was also furnished with additional information on this subject in a report of Quirk, Lawler & Matusky Engineers entitled "Supplemental Study of Effect of Submerged Discharge of Indian Point Cooling Water on Hudson River Temperature Discharge" dated May 1972. This report is enclosed as Appendix B-2.

If the Commission should nevertheless conclude that thermal discharges may not meet State criteria at all times, the Statement should then include an analysis of the extent the criteria will be exceeded and the ecological significance of that fact. The Statement indicates that the Commission is primarily concerned with the standard of a 90°F maximum surface temperature at any point. This statement may result from a misunderstanding of our planned use of the circulating pump bypass or from the misleading temperature data in the Raytheon Report. Peak temperatures fluctuate from year to year. The Commission's analysis is based on peak temperatures which, if seen at all, would be seen rarely -- certainly not every year. The Statement should indicate the expected frequency and the extent of the surface area heated in excess of 90°F and the environmental impact of such an occurrence. The post-operational data that Con Edison proposes to collect will provide hard data with which to verify predictions.

The concern expressed by the Staff appears to be associated with the use of uncontrolled data collected for other purposes. See Appendix B-1. The Staff uses a maximum river temperature at the plant intake of 81°F (III-35). The temperature at the Indian Point 1 intake is monitored continuously.

In view of the voluminous data available on this subject, Con Edison considers 79°F (without recirculation) to be the highest water ambient temperature that can be experienced by the Indian Point intake at any time.

The Statement references data contained in the Report of Inquiry on Indian Point Unit No. 1 submitted by the Commission's Division of Compliance in October 1971. These data show three readings at 81°F and the balance of the readings are consistent with Con Edison's analysis. These three readings were not at the plant intake but were out in the river where they were influenced by the thermal plumes from Indian Point and Lovett. The same Report of Inquiry had data on intake temperatures which is not referred to by the Statement. (See Appendix B-1 for further details.)

The Statement contains a considerable discussion of the concept of net non-tidal flow (III-22 to 26). The Commission appears to agree with Con Edison that this phenomenon exists but hesitates to make a quantitative determination. Since the phenomenon exists, it is important to provide some quantitative statement of its effects. As is indicated in Appendix B-1, Con Edison has used the most conservative manner of estimating the effect of net non-tidal flow.

3. <u>Dissolved Oxygen</u>

Con Edison disagrees with the Statement concerning dissolved oxygen. Con Edison thought that its testimony before the ASLB and information which had been furnished to the Commission's Staff had removed any concerns about this question. In view of the comments contained in the Statement, Con Edison now submits as Appendix C a report of Quirk, Lawler & Matusky Engineers entitled "Effect of Indian Point Plant on the River Dissolved Oxygen." This report contains data on actual dissolved oxygen measurements taken at the intake and discharge of Indian Point 1 and a detailed analysis of this problem under varying conditions.

The Commission's concern on dissolved oxygen appears to be based on a few data points in a report of Raytheon Company. These data are inconsistent with other data obtained by Con Edison and data gathered at other power plants and is also inconsistent with predictions based on plant engineering design.

Con Edison examined the Raytheon data and found that it was incorrect due to faulty instrumentation. The Staff appears to agree with Con Edison's opinion on the Raytheon data (V-10), but nevertheless says that it is "not yet satisfied." Con Edison proposes to obtain post-operational data additional to that which it already has in order to satisfy the Commission on this point.

4. Chlorination

The Statement contains considerable discussion about the possible damage to aquatic organisms from chlorination. Con Edison has established procedures to minimize harmful effects, and indications are that it has succeeded.

Attached as Appendix D is an analysis of the chlorination program for Indian Point 1 and 2 and an explanation of the basis for Con Edison's disagreement with some of the matters discussed in the Statement. Con Edison also refers the Commission to the testimony of Dr. Gerald J. Lauer on the Effects of Chemical Discharges from Indian Point Units 1 and 2 on Biota and River Chemistry which was submitted to the ASLB on April 5, 1972 (see Appendix H). Dr. Lauer found by sampling at Indian Point 1 that entrained organisms generally are not destroyed by Con Edison's chlorination procedures at Indian Point 1. He states that this is probably due to the fact that the exposure time to high levels of chlorine is very brief as compared to the exposure time of the target organisms on the condenser tubes. He also reports that bioassay studies show survival of organisms at exposures comparable to those experienced by entrained organisms.

Much of the discussion of chlorination problems contained in the Statement appears to relate to an environment and species foreign to the Hudson River. Con Edison believes that observations in the Hudson River with Hudson River species are necessary before a determination can be made that a problem exists. The observations to date have indicated no problem. More data will be obtained as part of the continuing ecological studies when Indian Point 2 commences operation.

The Statement suggests that the discharge concentration of residual chlorine will be 0.5 ppm. Extensive data from operations at Indian Point 1 show a discharge concentration of

0.1 ppm or less. There is no reason for the residual levels at Indian Point 2 to be significantly different (see Appendix D). Under New York State rules 0.5 ppm is a legal maximum.

Furthermore, the discussion of potential toxic effects at low chlorine levels is based on a small portion of the literature and on long periods of exposure and deals principally with fresh water fish. The Statement should note that other portions of the literature show no toxicity at the levels expected from Indian Point operations (see Appendix D).

Con Edison has commenced a program to establish a further reduction in the frequency of chlorination. This program is described in Appendix D.

5. Entrainment

The principal difference between the Staff and Con Edison in regard to the potential adverse impact of Indian Point 2 on marine aquatic organisms is the Staff's estimate of the entrainment of nonscreenable fish eggs, larvae and fingerlings. Con Edison's position is set forth in Appendix E.

In summary, Con Edison agrees that we should seek to quantify the effect of this entrainment, but disagrees with the Staff in the following respects:

A. The crux of the Staff's analysis is its calculation that approximately 25% of the planktonic forms of various fishes using the estuary will be entrained by the plant. The Staff has computed this number by the use of erroneous equations. The Commission's analysis of estuary dilution flow is based on a report of B. H. Ketchum, and the bulk of the literature in the field establishes that this analysis cannot properly be used for this purpose.

B. The Commission understates the significance of the diurnal movement of larvae. The Statement does recognize that this phenomenon exists but states that the effect it maintains is slight. It does so on the basis of an hypothesis which if true suggests a net upstream movement of planktonic larvae which would produce negligible entrainment. Con Edison believes that the diurnal effect may reduce entrainment to one-third to one-half of the Commission's prediction based on the proportion of daylight hours to darkness during the planktonic stage. In conjunction with proper estimates of estuary dilution flows, the entrainment would be further reduced to one-fifth to one-eighth of the Staff's prediction.

C. The Staff also bases its analysis on the conclusion that 75% to 90% of the young juveniles which reach Haverstraw Bay below Indian Point pass Indian Point in an entrainable stage and are uniformly subject to entrainment. Eggs only exist for approximately two days so that only eggs spawned in close proximity to the plant could be susceptible to entrainment. Furthermore, larvae are fully planktonic for only a few days. Juveniles are known to move toward shallows and shoal areas as well as deep waters unlike the area near the Indian Point intake and thus do not randomly reach Indian Point based on total mixing. These same juveniles also have a capability to avoid entrainment.

D. Con Edison shares the view that based upon current data and analytical techniques the impact of entrainment and impingement on the total fish population cannot be satisfactorily quantified. We share the view that a determined attempt to obtain some quantification should be made in the early years of plant operation. In our opinion it will take five years rather than two years to accomplish such a unique task. In the meantime it is the considered opinion of Con Edison that the operation of the plant during the study period will not cause irreversible or irretrievable damage to the fishery. It is to be noted that the intervenor which is raising the question of damage to the fishery is the same one which has been making similar claims for the past eight years concerning the operation of Indian Point 1. And yet the principals of that organization have in the recent past published articles claiming that bass fishing is excellent and improving. Glowka, "17,000,000 Stripers", The Salt Water Fisherman, August 1971.

6. Radiological Impacts

Con Edison believes that the Staff, in computing the possible radiological impact of Indian Point 2, failed to take into account certain systems presently installed or to be installed shortly which it can properly consider. These are described in Appendix F.

Con Edison hopes that these comments and the enclosed appendices will be of use to the Commission in preparing the Final Detailed Statement.

Very truly yours,

Harry G. Woodbury
Executive Vice President

Encs.

Detailed Comments

1. Page i, Item 3c	:First reference to Unit 2 should also include Unit 1.
2. Page ii, Item 3f	:AEC conclusion is not supported by evidence in the Draft Statement. Refer to testimony of John P. Lawler on The Effect of Indian Point Units 1 and 2 Cooling Water Discharge on Hudson River Temperature Distribution submitted at April 5, 1972 hearing session of ASLB and responses to AEC Staff questions dated May 11, 1972.
3. Page ii, Item 3f,	:Change "mean low water" to "U. S. Coast and Geodetic Survey Sea Level Datum." This is the standard reference point for construction in the Hudson River. This was previously described incorrectly as "mean low water." Mean low water is one foot below the standard reference point. The applicable studies which were used to determine the location of the ports were done on the basis of 12 feet below the standard reference point. Accordingly, the ports are correctly located but were incorrectly described.
4. Page ii, Item 3g.	:See Appendix C.
5. Page ii, Item 3i.	: Conclusion contrary to evidence submitted at hearings on January 11, 1972 and April 5, 1972 in testimony by Gerald J. Lauer and Walter Stein which indicated a concentration of less than .1 ppm at the point of injection into the river because of the chlorine demand of the water passing through the half of the condensers not being chlorinated. (See Appendix D).
6. Page ii, Item 3i, line 5.	:The term "may be toxic" should be defined. Bioassays reporting contrary results submitted into evidence in testimony of Gerald J. Lauer on Effects of Chemical Discharges from Indian Point Units 1 and 2 on Biota and River Chemistry. Testimony submitted at hearing session of April 5, 1972.

7. Page ii, Item 3j. :This statement should be clarified to indicate that it constitutes a maximum environmental impact without taking into account unquantifiable phenomena each of which would serve to reduce the 25%.

8. Page iii, Item 3n, line 2: Change "coal" to "oil".

9. Page vi, Item 5f :Two years is an inadequate period for an adequate biological study. Our present study is planned for five years.

10. Page xxi, Last para. :This paragraph should be amended to reflect additional documents on which the Final Environmental Statement will be based. This particularly should be expanded to include all evidence submitted at the hearings of the ASLB, including especially the evidence submitted on April 5, 1972 and the enclosures hereto.

11. Page I-2, Third para., line 6. : "slecting" should be "selecting"

12. Page I-5, Item 2. :Item should be deleted. See tiem 6 on page I-7.

13. Page I-6. :Add permit for new outfall (copy attached).

14. Page II-3, fig. II-2. :See attached figure for new location of Visitors' Center.

15. Page II-4, first para., :No Indian Point buildings can presently be be seen from Peekskill, only IP-1 stack and tip of Unit 2 and Unit 3 containment can be seen.

16. Page II-8, line 3. :Change "St. Peter's Church" to St. <u>Patrick's</u> Church."

17. Page II-11, Third para., line 5. :"29 million cubic feet" should be "29 <u>billion</u> cubic feet."

18. Pages II-11 and 12, last line et seq. :Refer to Appendix B and documents indicated in Comment 1 for discussion of thermal discharges and intake temperatures.

19. Page II-12, Second para. :See Appendix C for discussion of river dissolved oxygen levels.

20. Page II-12, Second para., line 6. :Delete "locations near population centers" and insert "<u>in the vicinity of municipal wastes outfalls</u>."

21. Page III-1, First para.,: Indian Point Unit No. 3 is scheduled for completion by the summer of 1974.

22. Page III-2, Fig. III-1 : Transmission lines not correctly shown (see next comment).

23. Page III-4, Sect. C, First para. : Last sentence should read: "The double circuit structures are designed to carry the Unit No. 2 output of 873 MW(e) at 345 KV to the applicant's system at the Buchanan Substation 2,100 feet away from the Turbine Building, plus the 138 KV input for the Unit No. 2 light and power facilities or the 138 KV output from Indian Point Unit No. 1."

24. Page III-5, fig. III-3. : Should show a double circuit steel pole and not a single circuit steel pole (photograph attached).

25. Page III-6, First para., line 6. : See Comment 21.

26. Page III-6, Second para. line 18. : There is no demineralizer in the feed water path to the steam generator.

27. Page III-7, First para. : Insert between sentences: "fossil plants discharge a significant portion of their waste heat to the atmosphere in the plant and up the stack, while nuclear plants discharge virtually all waste heat to the cooling body."

28. Page III-7, Second para. line 12. : "9.35×10^9" should be "6.38×10^9" based on Table III-1 and Page III-19.

29. Page III-8, Table III-1 : "Tp" in Column 6 and footnote should be " Tp". Total for Column 5 should be "10,294" not "10,295." Total for Column 7 should be "783" not "782".

30. Page III-11, Sixth para. line 6. : Delete from "On November 10, 1971 ... " through end of quote on page III-12 and insert "The disagreements have not as yet been resolved."

31. Page III-12, Second para: April 24 has passed. We have no indication when we can expect action on our sction-13 permit application to the Army Engineers because of current litigation with the Army Engineers in the Federal District Court, District of Columbia.

32. Page III-12, Third para.: Change "300,000" to "319,000".

33. Page III-12, Last para. : Add to last sentence: "and is adding control gates to regulate discharge velocities."

34. Page III-13, First para., line 11. : Add after bar screens: "fixed fine screens."

35. Page III-13, First para., line 12. : Change "inlet" to "outlet."

36. Page III-13, Second para., line 2. : Change "30 feet" to "12 feet, 4 inches."

37. Page III-13, Second para., line 3. : Change "6" to "7".

38. Page III-13, Second para. : Omits reference to recirculation system. See Applicant's Environmental Report, Supplement 1, page 2.3.6-25.

39. Page III-14, fig. III-4
:Fixed fine screens not shown. Should be between curtain wall and de-icing spray.
:Screen cleaning water rate varies from 324 to 358 gpm per section.
:Mean low water is at Elevation -1' -0".
:Change "Tidal Flow to 300,000 cfs" to agree with values on Page III-22, Third paragraph, lines 5 and 6.
:Change "5,000 ft. wide" to "4,000 ft. wide."
:Change "temp 32° F to 80° F " to "temp 32° F to 79° F."

40. Page III-15, fig. III-5
:Change Unit No. 1 Cooling Water from "300,000 gpm" to "280,000 gpm".
:Change Service Water from "60,000 gpm" to "69,000 gpm" .

41. Page III-16, Third para. : Discussion would be more relevant if it described velocities in front of screens which fish experience.

42. Page III-16, footnote*** : Change "1,157,000 gpm" to 1,188,000 gpm."

43. Page III-17, Table III-2, line 1.
:Change Discharge gpm from "300,000" to "319,000".
:Change Daily Heat Loss to River (Btu) from "4.6 x 10^{10}" to "4.7 x 10^{10}".
:Change Daily Average Δt, °F from "13°" to "14°".

44. Page III-17, Table III-2, Line 2.
:Change Daily Heat Loss to River (Btu) from "15.2 x 10^{10}" to "15.3 x 10^{10}".
Change Daily Average Δt, °F from "15°" to "15.1°".

45. Page III-18, Fig. III-6 :Mean low water is at Elevation - 1'-0"
:Head in the canal is 1.5 feet not 5 feet as shown.

46. Page III-19, First para., line 9 :Change "1,157,000 gpm" to "1,188,000 gpm".

47. Page III-19, Second para. :The primary function of the level control weir in the discharge open channel is to provide the required jet velocity for thermal diffusion; it is not intended ~~to use~~ to control the head requirements on the intake pumps. However, a second level control weir, which is installed in the discharge tunnel between Units 1 and 2 is for the purpose of regulating the water level upstream (the section serving Indian Point Unit No. 2) according to daily tidal conditions and thus, stabilize the head requirements on Indian Point Unit No. 2's circulating water pumps.

48. Page III-19, First para., line 9 :Change "1,157,000 gpm" to "1,188,000 gpm".

49. Page III-19, Fourth para., line 5 :Change Reference from "14" to "4".

50. Page III-19, Sixth para., line 8 :Delete " may be helpful in approximating" and insert "is used to determine".

51. Page III-22, First para., lines 1 & 5 :Delete "in excess of 19,000 cfs" and insert "20,800 cfs".

52. Page III-22, Second para., line 3 :Change " 155,000 square feet" to "160,000 square feet".

53. Page III-22, Second para., line 6 :Change Reference from "15" to "9".

54. Page III-27, Third para., line 4 :Delete last sentence and insert "Reference 11 reports a theoretical estimate of 27,000 ft /sec at Indian Point for an assumed salt profile corresponding to a fresh water flow of 3,000 cfs".

55	Page III-27, para., line 4	:Change Mile Point from "85" to "82".
56.	Page III-30, Second para., line 3	:Change "18-foot depth" to "12-foot depth".
57.	Page III-31, Second para., Line 10	:Delete "considered uniform in" and insert "analyzed for its average".
58	Page III-33, Item (3), line 3	:Change "external" to "subsurface".
59	Page III-33, def. "b"	:Change "equals or exceeds" to "equal and exceed".
60	Page III-33, Second para., line 1	:Change "(9) and (10)" to "(5) and (6)".
61	Page III-33, Third para.	:Refer to Chapter V of Reference 4,
62	Page III-33, Item (4) line 3.	:Delete last sentence and insert "The model is used to calculate the cross section averaged temperature excess. The mathematical expression for the cross section area average temperature at the plane of the discharge is
63	Page III-34, Item (5) Third para., line 1	:Change "Model III" to"The Third Model"
64.	Page III-35, Second para., line 3.	:Applicant has never assumed that 5% of the heat generated in the reactor would be "in-plant losses." The in-plant losses for Indian Point Unit No. 2 are more like 3%.
65.	Page III-35, Third para.	:See Appendix B-2 (Thermal Discharge in this submission).
66.	Page III-36, Second para line 1.	:Delete "assumes a uniform: and insert "calculates".
67.	Page III-36, Third para. line 3 and 5.	:Ports are centered 21 feet apart and not 20 feet, and the spacing between the ports is 6 feet and not 5 feet.

68. Page III-37, First para.

:Method of initial port operation was submitted to the AEC in a letter dated April 13, 1972. It is important to note that the ports have been designed with sufficient flexibility so that the method of operating the ports can be adjusted to achieve the 10 fps jet velocity.

69. Page III-37, Second para.

:Reference is made to the testimony of Dr. John P. Lawler submitted to the ASLB on April 5, 1972 and responses to AEC Staff questions dated May 11, 1972 for supporting data concerning the submerged discharge. The discharge ports were changed from -18 feet to -12 feet in order to achieve more rapid decay in surface temperatures with distance from the outfall. This will reduce the surface area covered by elevated temperatures. Hydraulic model studies showed that this did not present any significant problem with respect to maximum surface temperature. Furthermore, operation with reduced flow will only occur when temperatures in the river are low so that this mode of operation can have no effect on the maximum surface temperature limit.

70. Page III-40, Second para.

: The CVCS is not normally considered as part of the liquid waste system. This CVCS is expected to recycle all primary coolant and will thus not be a source of radioactive release. In supplement 15 of the FSAR, there is mention of an expected release from the CVCS of four primary coolant volumes per year. This figure was determined as a means of tritium control based on 30% diffusion of tritium through zircaloy fuel cladding. Recent operating experience at RG&E, Wisconsion and Carolina indicates much less (~1%) diffusion and so there becomes no necessity for tritium control and no monitor tank releases are to be expected under normal operation.

71. Page III-40, Third para. lines 14 and 15. :The effluent from these demineralizers is not directly sent to the monitor tanks. The description is correct if stated "The effluent from both demineralizers will be filtered and returned to the volume control tank for reuse. When necessary, the effluent can be routed to the holdup tanks for processing through the boric acid evaporator. On this path, the concentrate is sent to the monitor tanks for reuse or, under conditions other than normal, can be sent to the discharge canal.?

72. Page III-40, Fourth para. :The first sentence should read, "The second part of the CVCS will process primary water for dilution or borating especially during load follow operation, excess coolant letdown during reactor startup, and liquids that drain from reactor coolant pump seals, accumulators, pressurizer relief tanks and valve and flange leakoffs."

73. Page III-40, Fourth para., last sentence. :The evaporator feed demineralizers are catio demineralizers and reduce the concentration of Cs and Li only, and not all isotopes except H_3 as stated.

74. Page III-41, Fig. III-13. :See attached Figure (Figure 2) for more accurate description.

75. Page III-42, First para., line 2. :Two demineralizers are provided. Normally neither is used until toward the end-of-core life, then one or both may be used.

76. Page III-42, line 9. :See comment 70.

77. Page III-42, Fourth para. :Laundry and shower wastes are processed in the Indian Point Unit No. 1 system.

78. Page III-43, Fig. III-14. :There is no Laundry and Shower Tank in Unit No. 2.

79. Page III-45, First para., line 1. :The Unit No. 2 evaporator is equipped with alkaline treatment and hence should be credited with a DF greater than the DF of 100 shown.

80. Page III-45, First para., line 3 :should read: "6 curies per year".

81. Page III-45, Second para., line 3 :Waste is collected in 75,000 gallon tank until it is full, regardless of the period it takes to fill the tank.

82. Page III-46, Table III-5 :Credit for the Indian Point Unit No. 1 waste evaporator should be given. This will substantially reduce these releases.

83. Page III-47, Table III-6 :Activity releases for 100% Plant Factor are inappropriate. A 100% Plant Factor is unrealistic; thus, column so headed should be omitted.

84. Page III-49, Third para. :Applicant has committed to installing charcoal absorbers in the exhaust of the containment and PAB by the end of the first refueling outage (See Appendix F).

85. Page III-49, Fourth para. :There is provision for diverting air ejectors to the containment in the event of high activity. Upon completion of the blowdown intertie, steam from blowdown will be routed to the Indian Point Unit No. 1 condenser. Essentially all the iodine would be retained in the condenser. Any releases would be through the Indian Point Unit No. 1 condenser air ejector which exhausts to the Indian Point Unit No. 1 stack. When the Unit No. 1 condenser is not operating, the gases from the flash tank divert to an already-existing vent and go directly to atmosphere via a vent on the roof.

86.	Page III-49, Fifth para., line 6	:Since our Tech. Specs. set firm limits, there is no basis for calculating a higher release.
87.	Page III-51, Table III-8	:See comment 83 .
88.	Page III-52, First para.	:Estimates shown should incorporate effects of new design changes which applicant has committed to install (See Appendix F).
89.	Page III-52, Second para., line 3	:"mixed with a solidifying agent such as vermiculite and cement."
90.	Page III-52, Fourth para., line 4	:Effluents will not be monitored for chemicals other than chlorine.
91.	Page III-54, Table III-9	:Should be revised as per attached table.
92.	Page III-55, First para., line 6	:The expected concentration is less than 0.0001 ppm Li.
93.	Page III-55, Second para., line 1	:A maximum of 2000 ppm boron as boron not boric acid.
94.	Page III-55, Second para., line 5	:50 ppm of boric acid is the proposed concentratic Concentration with 100,000 gpm is 0.3 ppm boron from each unit.
95.	Page III-55, Fourth para., line 11	:Waste not wasted.
96.	Page III-55, Fourth para., line 15	:The 10 ppm is not the expected concentration, it is the proposed maximum concentration. The expected concentration is 1.2 ppm.
97.	Page III-55, Fifth para., line 1	:We use 3 pounds detergent per day not the 6 pounds per day stated.
98.	Page III-56, Second para., line 4	:0.1 ppm is the proposed maximum concentration. The expected concentration is 0.006 ppm.

99.	Page III-56, Third para., line 8	:0.1 ppm is the proposed maximum concentration. The expected concentration is 0.0007 ppm.
100.	Page III-57, First para., line 3	:10 ppm is the maximum proposed concentration. The expected concentration is 3 ppm. Sulfuric acid from cation regenerations will not be neutralized by sodium hydroxide before release.
101.	Page III-57, Second para., line 2	:5 ppm is the maximum concentration. A 2% solution is used for 12 hours and is discharged continuously at a concentration of 1% during this period at a rate of 17 gpm.
102.	Page III-59, Third para.	:In a report on Unit No. 2 it seems inappropriate to comment on air emissions from Unit No. 1 fossil boiler. Further it is stated in essence that our NO_x emission factor of 0.36 lbs/10^6BTU is 20% in excess of that specified in 42 CFR 466. It should be noted: (1) 42 CFR 466 contained proposed and not adopted "Standards for New Stationary Sources". (2) The adopted standards for new stationary sources are cited in 40 CFR 60 and (3) 40 CFR 60 is not applicable to Indian Point because it is not a new plant, and also because the superheaters do not fall under the definition of a fossil-fuel fired steam generator. A fossil-fuel generating unit is described as a "furnace or boiler used in the process of burning fossil fuel for the primary purpose of producing steam by heat transfer." Further, the New York City air pollution code has no relevance to a discussion of effluent systems at Indian Point. As applied to Con Edison, this code requires a reduction of sulfur content in residual fuel oil from 1% to an annual average of 0.55% from October 1, 1971 to October 1, 1972, and to 0.30% thereafter.

103.	Page IV-2, Fourth para., line 8	:Mean low water is -1'-0". (See comment 3).
104.	Page V-1, Third para., line 15.	:should be page 2.3.1-2 not 2.2.1-2.
105.	Page V-2, First para., line 7.	:Trap Rock not Trapp.
106.	Page V-6, Third para.	:This paragraph is highly speculative and seems less than objective as required by NEPA and Calvert Cliffs.
107.	Page V-9, Table V-1.	:Concentration factors are for fresh water and therefore do not apply.
108.	Page V-10, Fifth para.	:See Appendix C regarding minimum DO.
109.	Page V-11, Second para.	:See Appendix D. The discussion of rainbow trout is irrelevant and should be deleted as not referring to the Hudson River at Indian Point.
110.	Page V-12, Second para.	:Penultimate sentence is without basis. See Applicant's bioassay results report in testimony of Dr. Gerald J. Lauer submitted to ASLB on April 5, 1972.
111.	Page V-21	:See testimony of Dr. Gerald J. Lauer on Effects of Elevated Temperature and Entrainment on Hudson River Biota submitted to ASLB on April 5, 1972 for discussion of Applicant's temperature tolerance studies.
112.	Page V-23, Third para.	:The discussion of fish in the discharge canal is irrelevant since the 10 foot/sec. discharge velocity is sufficient to keep fish from entering the canal. This discussion should be deleted, or it should be noted that Indian Point does not have a canal of the type discussed in the referenced literature.
113.	Page V-28, Second para., line 9	:"No" survivals of larval or juvenile fish is not correct. Report says "most" were dead, not all. Statement should indicate that most data involved canal temperatures greater than 95°F, which are not expected at Indian Point.

114.	Page V-29, Fourth para.	:See document referred to in Comment 111.
115.	Page V-31, First para.	:fish are not ordinarily netted in front of fixed screens. This paragraph indicates a misunderstanding of the function of the fixed screens. These screens, installed in front of the intake openings at Units 1 and 2, serve the purpose of barring the entry of relatively large fish into the intake forebays where they could be come trapped. During a brief period of testing at Unit 1 in April 1970, the fixed screens were removed from two of the four bays for a period of six days. During this period, the mean length of fish collected from the open bays was greater than the mean length of fish from the screened bays. The increase in mean length was due to the collection of relatively large fish which are rarely caught on the fixed screens.
116.	Page V-31, Fourth para., lines 1 and 2	:The intake velocity is not high but is a customary design.
117.	Page V-33, First para.	:The statement is correct but over 90% would be more accurate.
118.	Page V-33, First para.	:The size of the collected fish is not indicated. The vast majority of fish collected at the intakes at Indian Point are approximately 50 mm. in length. Occasionally, larger specimens of tomcod, catfish, white perch and eel are caught.
119.	Page V-33, Second para.	:Staff has failed to take into account changes made in Units 1 and 2 regarding intake velocity. See Section 2.3.6.4 of Unit 2 Environmental Report, Supplement 1.
120	Pages V-36 & 37, Table V-3	:The total for Invertebrates Dose is incorrect.

121. Page V-38, First para., line 1 :See comment 107.

122. Page V-39, Third para. :First sentence needs to be qualified by substituting "maybe" for "are".

123. Page V-40, Table V-4 :The table is not supported by evidence and is inconsistent in part with the text. For example, Table V-4 lists the equilibrium concentration of boron as 4.85 ppm while paragraph C(1) on page V-39 gives 0.055 ppm as concentration in the river due to maximum sustained releases. Further, the minimum toxic level of 0.0034 ppm for chlorine is based on a chronic exposure for 15 weeks (Page V-11). See Appendix D.

124. Page V-42, Second and Third para. :See document referred to in Comment 103. If the staff nevertheless anticipates some thermal effects, those effects should be quantified.

125. Page V-45, Table V-6 :See corrections to Staff's 50% draft statement as submitted to ASLB on January 11, 1972 (Tr. 4363).

126. Page V-47, First para., line 6 :The intake velocity is not dependent on the number of pumps operating. The statement does not refer to the recirculation loops which will be used to reduce intake velocities.

127. Page V-47, Second para. lines 1-3 :This statement is incorrect. Two pumps were operated at full flow for one day and one pump at full flow for the remaining four days.

128. Page V-49, Fourth para. :See document referred to in comment 103 for discussion of entrainment and entrainment mortality.

129. Page V-51, Section (b) :<u>Neomysis'</u> presence in the vicinity of Indian Point appears to be dependent upon intrusion of salt water upstream to that area. Studies have shown that increases in fresh water flow which push the salt "front" downstream have made <u>Neomysis</u> virtually unavailable at Indian Point. For further discussion see document referred to in comment 111.

130. Page V-52 Section (c) :See Appendix E.

131. Page V-53, First para. :The conclusion is based upon a great many more assumptions than stated. See Appendix 5 and April 5 testimony of Dr. Lawler on entrainment.

132. Page V-56, Fifth para., :Applicant is seeking to identify by the 5-year ecological study if there is any adverse effect due to thermal discharges. New York State established its thermal standards, after extensive hearings, at levels which will assure no significant adverse effects. Further evidenc on this subject was submitted to the ASLB on April 5, 1972. See document referred to in Comment 111.

133. Page V-60, Section (e) :It is recommended that Applicant and Staff discuss the Staff's recommendations as soon as possible. A copy of the contract scopes for the studies is attached as Appendix G.

134. Page V-61, Section 8 :It is not possible to count fish on the fixed screens. When the fixed screens are washed, impinged fish fall into the water and are carried by the intake flow onto the traveling screens. The traveling screens pick up the fish and transfer them to a sluice where they can be collected and counted.

135. Page V-64, Fourth para. :Present height of stack is 113m above local ground elevation. After truncation, the stack will be 88m above this elevation.

136. Page V-65, Table V-8 :Doses given are for 0.5 miles south of the site. This is not the site boundary nor is it located in the worst meteorological sector (SSW of the site). The site boundary is 520 meters. The dose for the closest resident is twice that indicated in the table.

137. Page V-71, Fourth para., line 2 :and will contain about 30 to 50 percent of the original -235 (which is recoverable).

138. Page V-71, Fourth para., line 6 :Change "varies" to "decreases".

139. Page V-71, Fifth para., line 6 :Change "3 fuel elements per cask" to "2 fuel elements per cask".

140. Page V-72, Second para., line 5 :Delete "Specification 17-H drums," and insert "containers".

141. Page V-72, Third para., line 7 :Change "other non-radioactive cargo" to "other non-radioactive hazardous cargo".

142. Page V-73, First para., :Change last sentence as follows: "For fresh and irradiated fuel, the shipper must also provide under both normal and design basis damage conditions a specified margin of criticality safety.

143. Page VI-7, Second para, :Change first sentence as follows: "The packaging is design with specific safety margin to prevent..."

144. Page VI-7, Third para., line 2 :The phrase "extremely remote" does not adequately convey the probability in question. Criticality of new fuel under these conditions has always been regarded as impossible for all meaningful purposes.

145.	Page VI-8, Second para., lines 2 and 3	:Change first sentence as follows: "In such an accident, the amount of radioactive material released could be limited to the number of fuel rods which were ruptured or became perforated. This material consists of noble gases in the void spaces in the fuel pins and some fraction of the low level contamination in the coolant".
146.	Page VII-1, Section B, line 6	:add "simulator", delete marina.
147.	Page VII-4, Third para., line 6	:See comment 69. 32.5 is incorrect for a 40% reduction in flow. Should read 23.9. See attached table.
148.	Page VII-5, First para.	:The Staff appears to have disregarded physical model studies performed for the Applicant by Alden Research Laboratories and appended to Applicant's Environmental Report. See documents referred to in comment 2.
149.	Page VII-5, Second para.	:Staff appears to have passed judgment on what they characterize as insufficient data. See testimony of Dr. Gerald J. Lauer on Effects of Chemical Discharges and Effects of Elevated Temperature and Entrainment submitted to ASLB on April 5, 1972.
150.	Page VII-5, Fourth para.	:See Appendix C.
151.	Page VII-6, Fourth para.	:See document referred to in comment 103 and Appendix E. The staff again appears to have passed judgment on insufficient data.
152.	Chapter X	:Reference is made throughout Chapter X to the 40 year expected life of Indian Point No. 2. In Applicant's economic evaluations, a 30 year service life has been used.
153.	Page X-1, First para.	:"Save-a-watt" campaign was introduced in 1971.

154. Page X-1, Second para., line 14 : Reference is made to the high ratio of maximum to minimum loads during any 24 hour period which requires that much of the capacity needed to meet the daytime peak will be idle or unloaded a good part of the time. It should be made clear that while this will be true of gas turbine peaking plants and some base load fossil plants, it does not accurately reflect the use of our nuclear plants. For the foreseeable future, these will be base-loaded when available.

155. Page X-4, Second para. : Con Edison does not use a fixed 20% reserve criteria to establish levels of installed capacity. Rather, installed capacity requirements, and consequently levels of planned reserve, vary from year to year as a function of the size and age of units installed, the past experience and projections of forced outages and daily deratings and the characteristics of the load distribution. At the present time, Con Edison has a relatively high percentage of older and less reliable generating units and is dependent on the timely completion of new generating resources for much of its planned reserve. Consequently, a planned installed reserve of 20% is not adequate. This has been demonstrated in the recent past when planned reserves varied from 21% to 27%, and we experienced numerous days of voltage reduction.

156. Page X-6, Third para., line 8 : Change 1584 megawatts to 1833 megawatts.

157 Page X-11, First para. : In view of the passage of time since the preparation of the environmental report, new information is available concerning the details of power supply during the summer of 1972 and the winter of 1972-73, and Con Edison has made a new calculation of costs of delay taking into account current cost information. This

data is contained in the testimony of Mr. Bertram Schwartz submitted to the ASLB on May 18, 1972. It does not alter the basic conclusions contained in the Statement.

158. Page XI-11, Second para., line 9 : See Appendix D. See Comment 5.

159. Page XI-11, Second para., line 14 : See comment 110. Reference refers to species of fish not found in Hudson River and is therefore irrelevant.

160. Page XI-16, Fourth para., lines 5 and 6 : New Visitor's Center will be started before and not after completion of Indian Point Unit No. 3.

161. Page XI-22 & 23, Item 21 Staff conclusions are not supported and contrary to evidence submitted on April 5, 1972. See comment 108.

162. Page XI-35, Item 7.2 : See Appendix D.

163. Page XI-8, Second para., line 7 : See comment 40.

164. Page XI-9, First para., lines 12-14 : Brackish water cooling towers are commercially available but there has, as yet, been little operating experience with them.

165. Page XI-16, para. F : Include simulator which will be located in the area just east of Unit No. 2. This facility will be used for training reactor operators.

166. Pages XI-46 and 47, Item 13.1, Subalt. 2B 7 2E : This appears to present an inconsistent discussion of the noise problems from cooling towers. It estimates that noise from natural draft cooling towers "will be in the unacceptable region for a distance of 2,500 feet from the center of the tower complex". The Staff then concludes "that the noise in this case is probably negligible."

167.	Page XI-54, Last para.	:Add the poor visual impact of cooling towers on environs, particularly hyperbolics which would be visible for miles.
168.	Page A-4, definition for "Vs"	:Change "32 ppt" to "35 ppt".
169.	Page A-42	:The width of the intake openings increase from 13'-4" to 14'-10" at the fixed fine screens. Therefore, the velocity is 0.81 fps instead of 0.9 fps. :Mean low water = 26' depth, therefore velocity through trash racks becomes 1.05 fps instead of 1.01 fps.
170.	Page A-43	:Fixed fine screens are at forward side of intake where bay is 14'-10" wide and is 26' at mean low water. Therefore, velocity is 1.34 fps instead of 1.44 fps.
171.	Page A-44, Item 1b	:Only 1/3 of the liquid in the flash tank would flash to steam in the absence of any cooling. It should be noted that the blowdown flash tank is equipped with a spray system from the city water supply header. Cool water will be sprayed into the tank to condense flashing blowdown. This will result in a significant reduction in the quantity of steam released and hence in the amount of iodine released. In addition, after completion of the blowdown intertie, flashing steam would be routed to the Indian Point Unit No. 1 condenser. Since the partition factor for iodine in the condenser is very high, this would essentially eliminate this source of activity whenever the Unit No. 1 condenser is in operation.
172.	Page A-45	:See Comment 68.
173.	Page A-45, Item 2a	:Reference should be to Supplement 15, Page Q11.1-19, not Supplement 5.
174.	Page A-49	:References not listed.
175.	A-77, Altern. 2c, line 3	:Drift for mechanical draft tower should be 0.1%.

176. All reference lists should be modified to reflect the added references used as a result of this report

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1971

COWHERD

New York State Department of Environmental Conservation
Albany, N. Y. 12201

DIVISION OF PURE WATERS

Henry L. Diamond
Commissioner

November 4, 1971

Mr. Harry G. Woodbury
Executive Vice President
Consolidated Edison Company of New York, Inc.
4 Irving Place
New York, New York 10003

Dear Sir:

Re: Outfall Construction
Indian Point Nuclear Station
Buchanan (V), Westchester Co.

Transmittal

The construction permit for this project, dated November 4, 1971, is attached. This permit shall supersede all previous permits and the instructions below for operating permit issuance provide the basis for future discharge control.

One approved copy of the plans is enclosed.

Permit to Construct

This permit carries qualifying conditions:

1. Permit filing
2. Revocability and modification
3. Construction conformance
4. Start of operation
5. Construction supervision
6. Construction certification
7. Construction time limitations

The attached construction permit does not constitute authority to operate the approved facilities. Please note instructions below regarding operation permit.

Permit to Operate

Pursuant to provisions of Part 73 of Title 10 of the official compilation of Codes, Rules and Regulations of the State of New York, a permit to operate the construction facilities is required.

Upon completion of the facilities, application for the permit to operate should be submitted to the Bureau of Industrial Wastes of the New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12201, accompanied by a certificate of construction compliance, executed by the New York State licensed professional engineer supervising construction.

The Bureau of Industrial Wastes has previously contacted you to provide application forms and instructions for the operating permit.

The attached permit authorizes construction of an effluent channel and diffuser whose hydraulic capacity is rated at 3,020,000,000 gallons per day. It shall not be inferred that this authority to construct commits the Department to allow operation at the rated capacity. Serious questions concerning the acceptability of discharges of heated waters from the operation of all three units at Indian Point remain unanswered.

Destruction of the previously approved outfalls for units one and two to facilitate construction of the intake and outfall for unit three is noted. The Department will, upon completion of these facilities, and receipt of your application, issue an operating permit for units one and two.

To obtain an operating permit for unit three, it must be conclusively demonstrated by Consolidated Edison Company that the thermal criteria relating to limits and distribution of temperature and the thermal standard relating to conditions non-injurious to fish life will be satisfied. It is also necessary to define and verify predictions made from mathematical and hydraulic models to correlate actual operations of units one and two to conditions postulated for unit three. The conclusions drawn by your consultants from studies done to date cannot be accepted as representative of conditions that will prevail after operation is established.

Field work to assess actual conditions and effects of units one and two, to supplement theoretical projections is essential. To this end, it is required that extensive temperature and ecological studies, on a program to be agreed to by the company and the various agencies involved, be conducted and reported to establish the basis for the unit three operating permit. The Department of Environmental Conservation's Bureau of Water Quality Management in the Division of Pure Waters, and the Division of Fish and Wildlife, will provide details of surveillance to satisfy the Department on physical/chemical and ecological parameters respectively.

An analysis of existing and projected thermal loadings on the Hudson River estuary portion, which includes your existing Indian Point site and the proposed Verplanck site, have indicated a future heat load which would be unacceptable. Therefore, you are formally advised that any further units proposed for Indian Point or for Verplanck will require cooling facilities to reduce cooling water temperature to essentially intake ambient temperature.

The basis of approval at this time is the committment by Consolidated Edison to:

1. Provide installation of adjustable gates, prior to unit two operation, which will be controlled to maintain, under all sequences of unit one and/or two operation an average discharge velocity of not less than ten feet per second, and

2. Investigate, design and construct a new intake structure for all units, with intake screens upstream of all units, as proposed in the environmental report, as expeditiously as possible.

Number one is incorporated in plans approved herewith, and the construction completion date considers that commercial operations will not take place for unit two before completion of approved facilities. The intake completion and a demonstration of its efficiency must precede commercial operation of unit three. The instream verification studies required above to support a unit three operating permit application must include data on the new intake structure.

The requirements for followup, testing, and measurement programs are consistant with those which have been and will be imposed on other utilities to determine compliance with criteria and standards and verification and refinement of mathematical and hydraulic model studies. Consolidated Edison has not been singled for any special restrictions nor is any more expected from the company than of any other discharger, which is, compliance with all applicable laws, standards, criteria and rules and regulations officially adopted by New York State.

The above portions contain that material from the May 19, 1970 and December 10, 1970 approval letters which are considered pertinent and applicable, adjusted as necessary to reflect accommodation of unit two in the approval and the basis of operating permit therefore.

Acceptance of the enclosed permit and initiation of construction will constitute agreement by Consolidated Edison Company to the conditions of approval, including the restrictions intended to be imposed on its future operations.

Very truly yours,

Thomas E. Quinn, P.E., Chief
Industrial Facility Section

TEQ:lt

Attachment

cc: New Paltz Region #3
Bureau of Water Quality Management
Division of Fish and Wildlife

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PERMIT TO CONSTRUCT A WASTE DISPOSAL SYSTEM

This permit is issued under the provisions of Article 12 of the Public Health Law and 10 NYCRR 73.

1. Name of Permittee:	2. Location of Works (C,V,T):	3. County:	4. Entity or Area Served:
Consolidated Edison Company of New York, Inc.	Buchanan (V)	Westchester	Indian Point Nuclear Power Plant

By initiating construction of the approved works, the permittee accepts and agrees to abide by and conform with the following:

1. THAT the construction permit shall be maintained on file by the permittee.
2. THAT the permit is revocable or subject to modification or change pursuant to Article 12 of the Public Health Law.
3. THAT the facilities shall be fully constructed and completed in compliance with the engineering report, plans and specifications as approved.
4. THAT the facilities shall not be placed in operation until construction has been completed and an operation permit has been issued, or unless ordered to be operated by the Commissioner or by a Court.
5. THAT the construction of the facilities shall be under the supervision of a person or firm qualified to practice professional engineering in the State of New York under the Education Law of the State of New York, whenever engineering services are required by such law for such purposes.
6. THAT where such facilities are under the supervision of a professional engineer, he shall certify to the Department and to the permittee that the constructed facilities have been under his supervision and that the works have been fully completed in accordance with the approved engineering reports, plans, specifications and permit.
7. THAT the construction of the facilities shall commence by December 1, 1971 and be fully completed by May 31, 1972, but in any case shall be complete prior to commercial operation of Indian Point Unit Number Two.

186

ISSUED FOR THE STATE COMMISSIONER OF Environmental Conservation

[signature]

Designated Representative

DATE 11/4/71

Distribution: White – Applicant; Pink – Central Office (BED); Yellow – File (LHO or DHO); Green – Other

Sen. 2 (rev. 11/67)

Type of Ownership:

- [ ] Municipal
- [ ] Industrial 4911
- [ ] Commercial
- [ ] 6 Sewage Works Corp.
- [ ] 67 Private-Home
- [ ] 68 Private-Other
- [ ] Private-Institutional
- [ ] 26 Board of Education
- [ ] 1 Authority
- [ ] 19 Federal
- [ ] 20 State
- [ ] 30 Interstate
- [ ] 40 International
- [ ] 18 Indian Reservation

6. Type & Nature of Construction:

Collection: [ ] 1 New [ ] 2 Additions or Alterations

Treatment and/or Disposal: [X] 1 New [ ] 2 Additions or Alterations

7. Estimated Cost of Construction:

Collection System ______ Treatment and/or Disposal ______

5. Type of Waste: [ ] 1 Sewage [ ] Industrial Specify ______ [X] Other Specify Cooling Water

9. Degree of Treatment:

- [ ] 1 None
- [ ] 2 Septic Tank
- [ ] 3 Primary
- [ ] 4 Intermediate
- [ ] 5 Secondary
- [ ] 6 Tertiary
- [ ] . Complete
- [X] 8 Not Applicable

10. Point of Discharge:

Location (C,V,T) Buchanan (V) Major Drainage Basin Lower Hudson

Surface Water: Name of Watercourse Hudson River Surface Water Class SB

Ground Water: Name of Watercourse to which ground water is tributary ______ Ground Water Class ______

11. Name of Receiving Treatment Works:	12. Grade of Plant Operator Required:	13. Disinfection Required:
N/A	N/A	[ ] 1 Continuous [ ] 2 Seasonal [X] 3 None
14. Design Flow (Gals./day):	**15. Design Equivalent Population (BOD Basis):**	**16. Design Plant Efficiency (% BOD Removal):**
3,020,000,000	N/A	N/A

Description of works, such as number, name and capacity of units:

one - effluent channel with submerged diffuser:

252' side open channel with twelve (12) submerged openings, six (6) by fifteen (15) feet each, with thirteen (13) foot centerline depth submergence, including eleven (11) adjustable ports, as detailed on drawings #A1080436-4, A183340-1 and A183339-1 of Consolidated Edison Company, with control gates adjustable to any intermediate stop position in such ports.

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-6001

October 15, 1971

Mr. Thomas E. Quinn
Chief, Industrial Facility Section
New York State Department of
Environmental Conservation
50 Wolf Road, Room 308
Albany, New York 12201

Dear Mr. Quinn,

In reply to your request (October 8, 1971) for justification of the proposed Indian Point outfall modification this description and these model results are provided for your review.

In early 1971 review of the previous undistorted model tests, and recent theoretical results indicated that the earlier tests should be rerun to verify that the design was optimized. This was done in an expanded undistorted Outfall Model simulating half the River's width and nearly a mile of its length. A number of variations on the present design concept were tested. The changes included raising the ports above the discharge canal floor, increasing the port spacing, increasing the exit velocity, and dredging below the river side of the discharge canal bulkhead.

The test series clearly showed that raising the ports resulted in more rapid decay in surface temperatures with distance from the outfall. Dye observations in the model showed that this effect results from the entrainment of cool deeper water into the jets from below. Model isotherms for both the original scheme and that for raised ports at two different tidal velocities are attached.

The outfall design now proposed would consist of twelve raised ports (centerline submergence - 12 feet) each measuring about 4' x 15' when opened (see "Gate Assembly" on Dwg. A183339-1). Closable gates are provided for the 10 openings along the northern portion of the discharge canal. The southern-most two openings have removable gates allowing each opening to be either 4' x 15' or 9' x 15' (see "Removable Gate" on Dwg. A180436-4). This combination of adjustable openings allows complete flexibility in the discharge operation.

For two unit operation the circulating plus service water flow will be approximately 2600 cfs. This effluent will initially be discharged at 10 fps. "contracta" exit velocity through seven 4' x 15' ports. The seven ports will be numbers 1, 3, 5, 7, 9, 11, 12 listed north to south.

Field measurements of the thermal plume resulting from such operations will be made in the summer of 1972 and compared to the model results. The various port openings will then be adjusted by trial so as to minimize the surface plume extent.

On the basis of the model tests described above my letter of September 29, 1971 requests issuance of an amended construction permit. We believe that this description of model tests and planned operation justifies our decision but should any questions arise please call on us for a prompt reply.

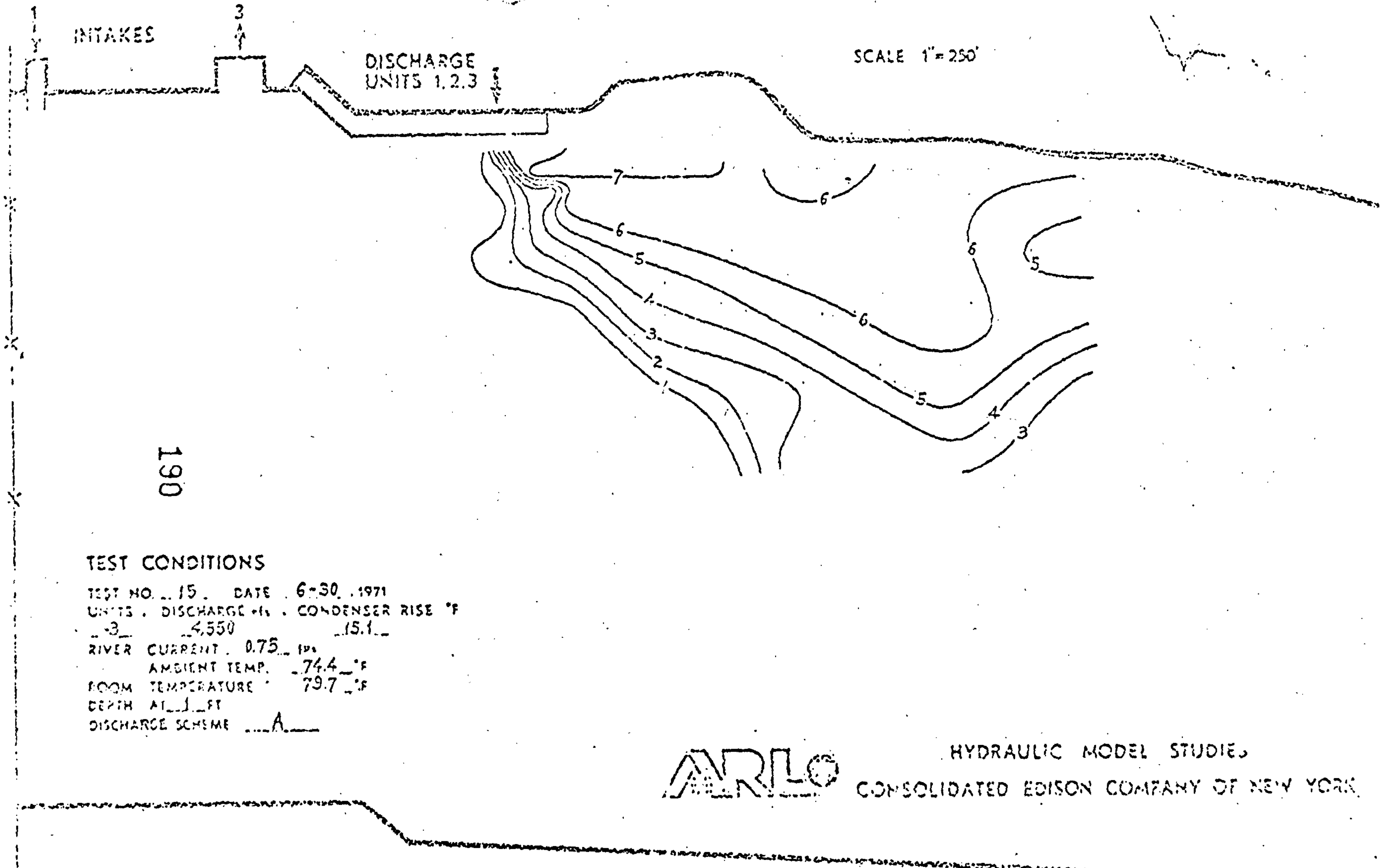
We request a technical meeting with the Department of Environmental Conservation in the near future to discuss the following points: (1) How the initial field measurements will be made. (2) What numerical parameters will be used to compare the field measurements with the model results. (3) What procedure will be used to "fine tune" the gate openings, and (4) What mode of discharge will be used in winter. We appreciate your prompt action on behalf of this request.

Very truly yours,

189 William Talbott
for Harry G. Woodbury

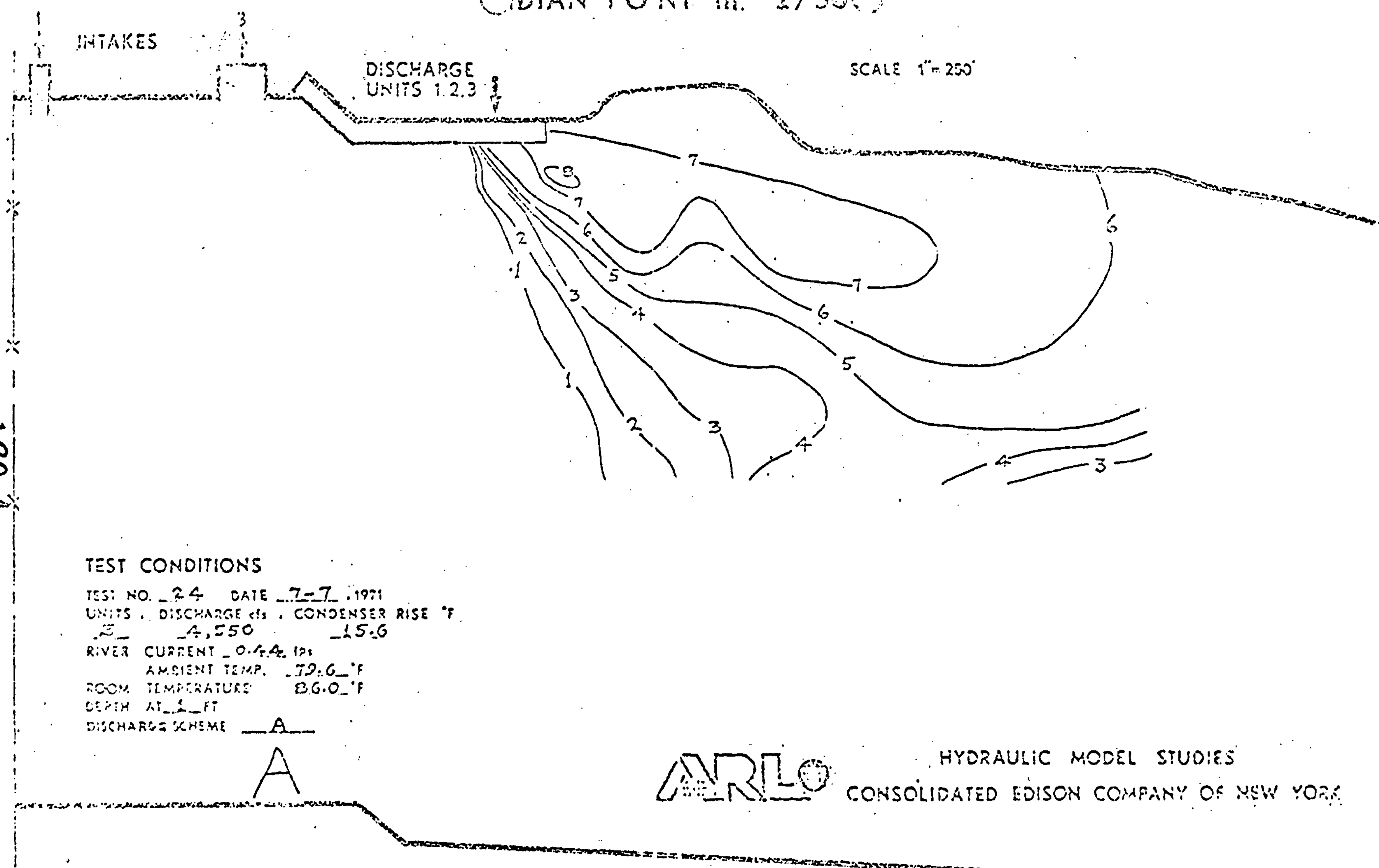
TEP/lo
bc: Carl L Newman
William J Talbott
J.A. Harold L.

INDIAN POINT III. 1/50



190-A

INDIAN POINT III. 1/50



TEST CONDITIONS

TEST NO. 24 DATE 7-7, 1971

UNITS, DISCHARGE cfs, CONDENSER RISE °F

3 4,550 15.6

RIVER CURRENT 0.44 fps

AMBIENT TEMP. 79.6 °F

ROOM TEMPERATURE 86.0 °F

DEPTH AT 1 FT

DISCHARGE SCHEME A

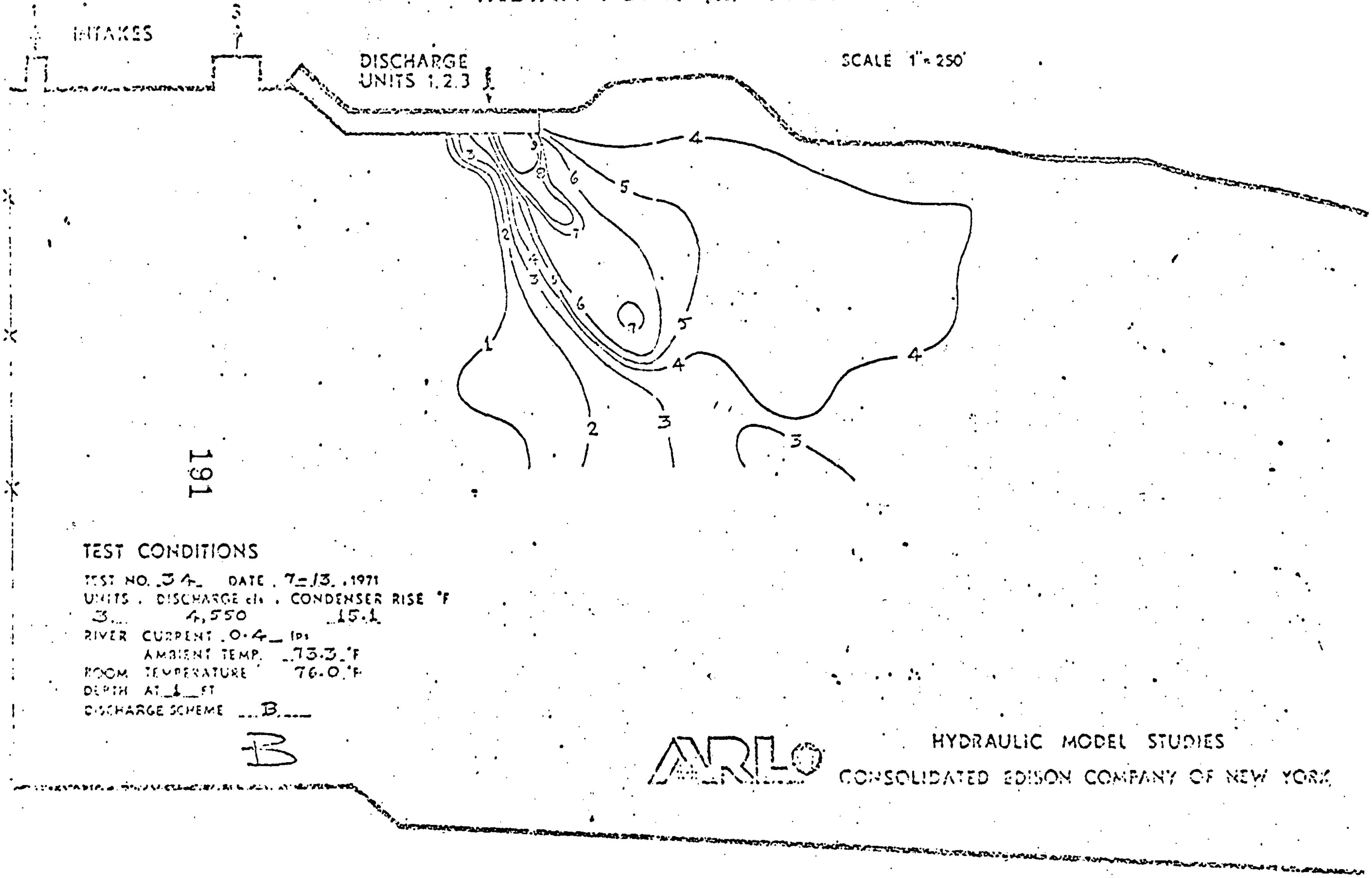
A

ARL

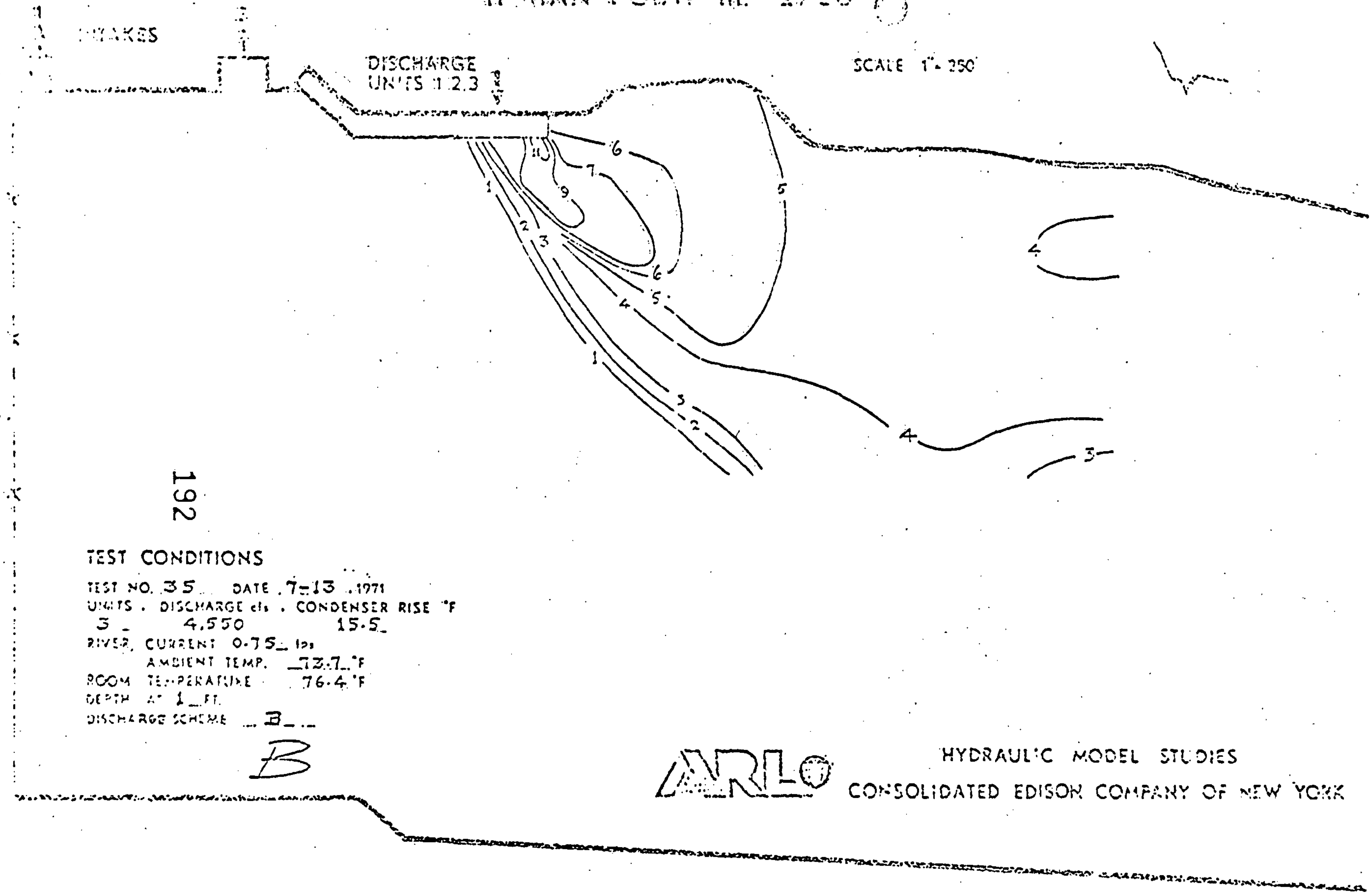
HYDRAULIC MODEL STUDIES

CONSOLIDATED EDISON COMPANY OF NEW YORK

INDIAN POINT III. 1/50



INDIAN POINT III 1/50



192

TEST CONDITIONS

TEST NO. 35 DATE 7-13 .1971
UNITS . DISCHARGE cfs . CONDENSER RISE °F
3 4,550 15.5
RIVER, CURRENT 0.75 fps
AMBIENT TEMP. 73.7 °F
ROOM TEMPERATURE 76.4 °F
DEPTH AT 1 FT.
DISCHARGE SCHEME B

B

ARL

HYDRAULIC MODEL STUDIES
CONSOLIDATED EDISON COMPANY OF NEW YORK

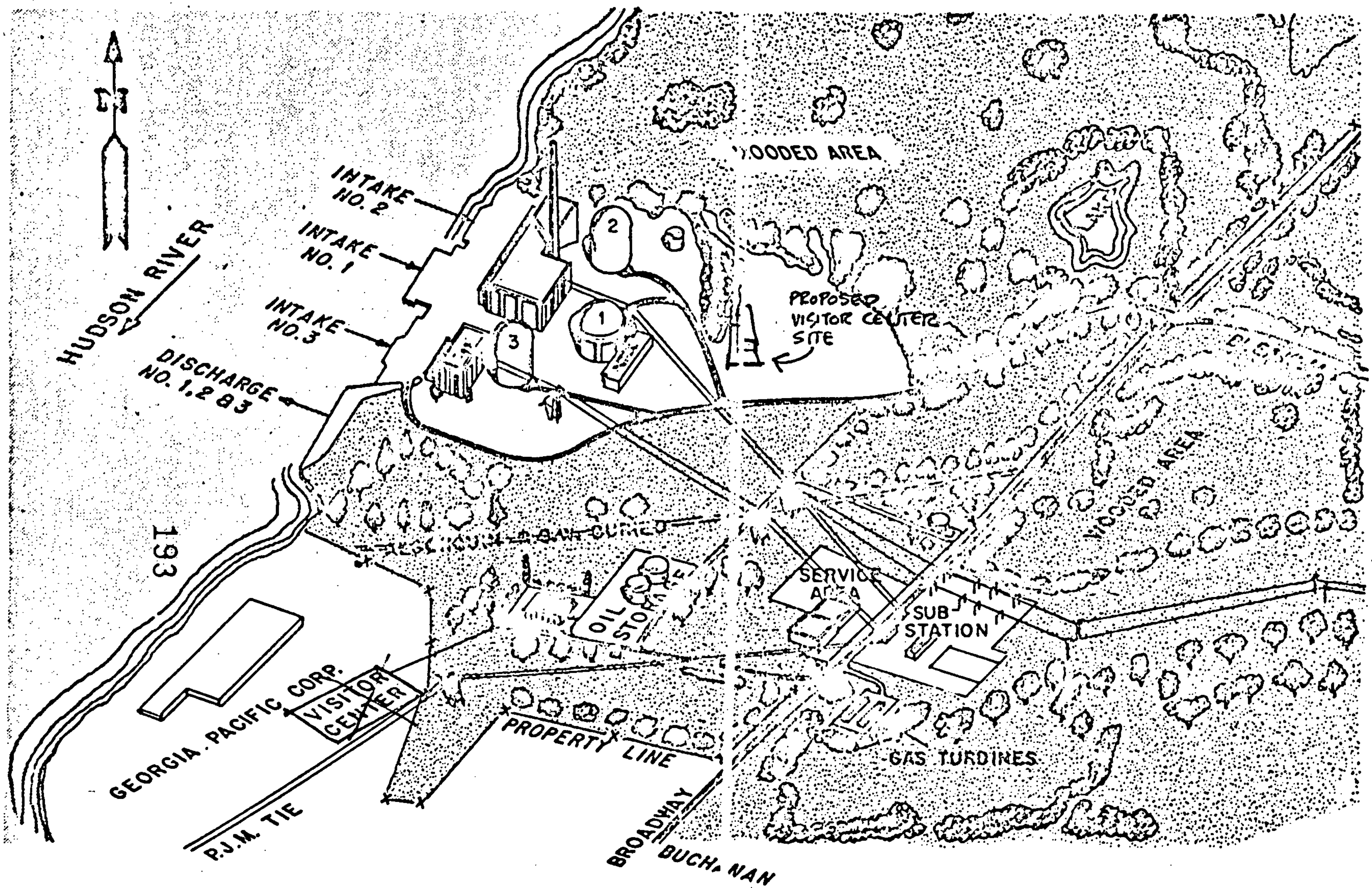
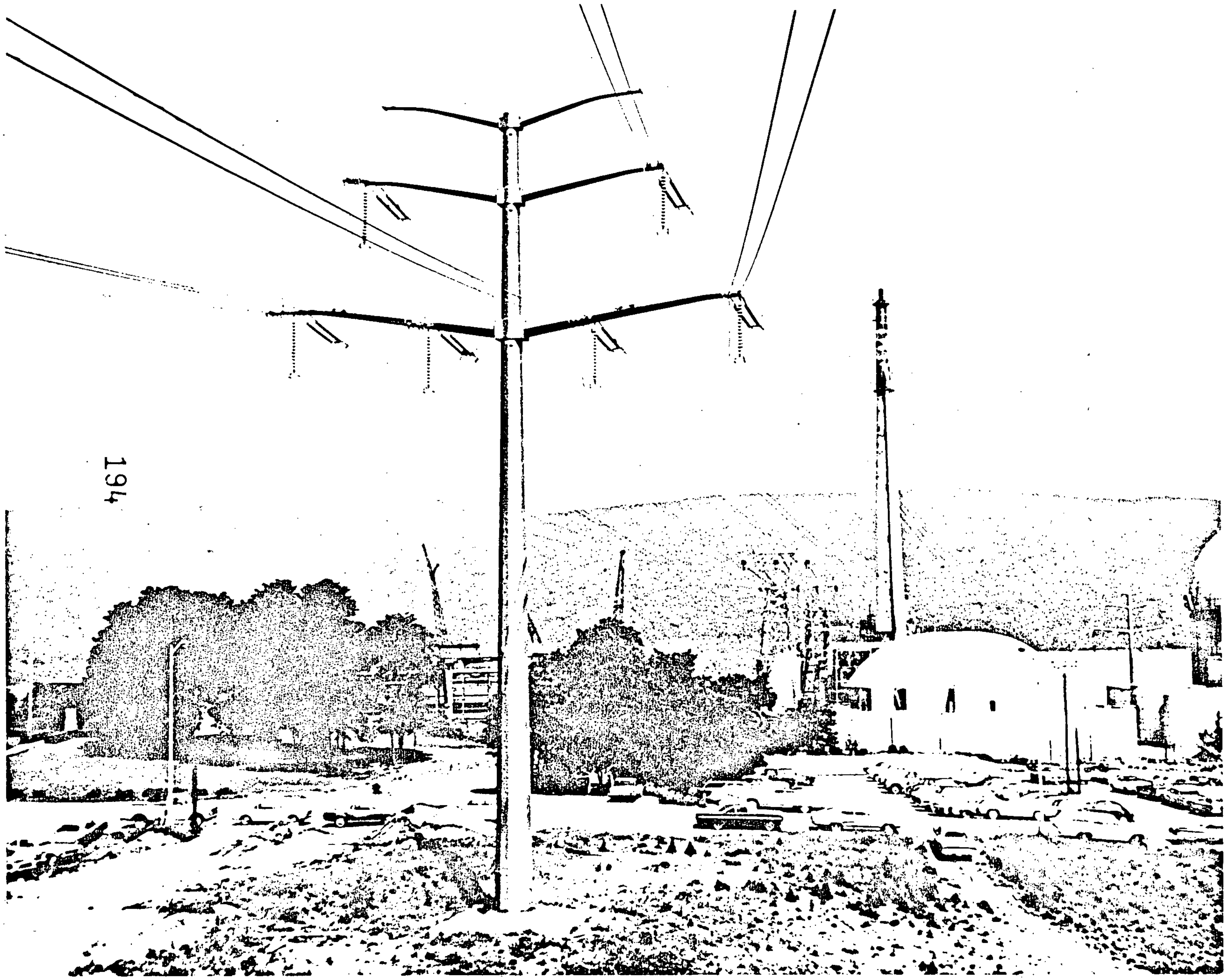


Fig. II-2
Indian Point Site



AVERAGE TEMPERATURE RISE UNDER VARIOUS FLOW CONDITIONS

Units Operating			% of Total Flow Through Condenser			% of Total Flow Recirculated			Total Discharged Flow	Average Temperature Rise, °F
1	2	3	1	2	3	1	2	3	gpm	
X	-	-	100	-	-	0	-	-	280,000	12.6
X	-	-	60	-	-	0	-	-	168,000	21.0
X	-	-	60	-	-	10	-	-	140,000	25.2
-	X	-	-	100	-	-	0	-	840,000	14.9
-	X	-	-	60	-	-	0	-	504,000	24.8
-	X	-	-	60	-	-	10	-	420,000	29.8
-	X	-	-	60	-	-	20	-	336,000	37.2
X	X	-	100	100	-	0	0	-	1,120,000	14.3
X	X	-	60	60	-	0	0	-	672,000	23.9
X	X	-	60	60	-	10	10	-	560,000	28.7
X	X	-	60	60	-	10	20	-	476,000	33.7

Detailed Comments on Thermal Discharge

Aspects of AEC Draft Statement, April 13, 1972

The Draft Statement addresses the environmental aspects of the combined thermal discharge from Indian Point Units Nos. 1 and 2. This appendix clarifies several misconceptions in the Statement, apparently engendered by earlier, less comprehensive analyses which had been submitte to the AEC Staff.

These comments are supplied in support of the applicant's contentions that the Statement is erroneous in its evaluation of the following four topics:

1. Net nontidal flow

   a. The Staff states on page III-35 "The magnitude of the net nontidal flow for different freshwater flows needs to be determined." Similar and sometimes contradictory remarks are made in sections III E 1 d(3), III E 1 f(4), III E 1 g(5), and Appendix II-1.

   b. The Applicant has demonstrated through extensive analyses using several independent methods (see Chapter V, reference 9), how the nontidal flow depends on freshwater flow. The final two unit predictions (reference 11) use the minimum (most conservative) estimates of the nontidal flow that can be obtained. The efforts of the applicant's consultants represent a significant advancement in methods of modeling such estuaries.

2. Maximum river ambient temperature

   a. Staff concludes on page III-35 "the maximum river temperature can be above 81° F in August." This conclusion is subsequently used to imply probable noncompliance with 90° F maximum surface temperature criterion.

   b. Applicant has demonstrated and will outline in these comments:

      (1) The source of error in the Staff analysis.

      (2) The applicant's consultant statistical analyses of ambient temperature.

3. Far-field heat dissipation

   a. Staff maintains on page III-37 "The adjustments made to the original model by arbitrarily using correction factors so that the results will agree with only one set of observed data from operation of Indian Point Unit 1 and extrapolating the model to predict the effects of Units Nos. 1, 2, and 3 together is unjustified."

b. Applicant used all available data to calibrate the models presented. The models have now been tested in numerous applications and have been verified. The model development and verification has at all time been beyond the "state-of-the-art". The summary analyses in reference 11 employ no empirical adjustments; they are theoretical predictive models which show remarkable agreement with the independent physical models.

4. Physical model results

a. Staff makes reference to the extensive physical modeling program only in twelve lines on page III-34, apparently disregarding those results.

b. Applicant maintains, as in the original 1969 report, that the mathematical and physical models are independent, illustrate remarkable agreement and should be reviewed and interpreted as complimentary predictions.

1. Net Nontidal Flow

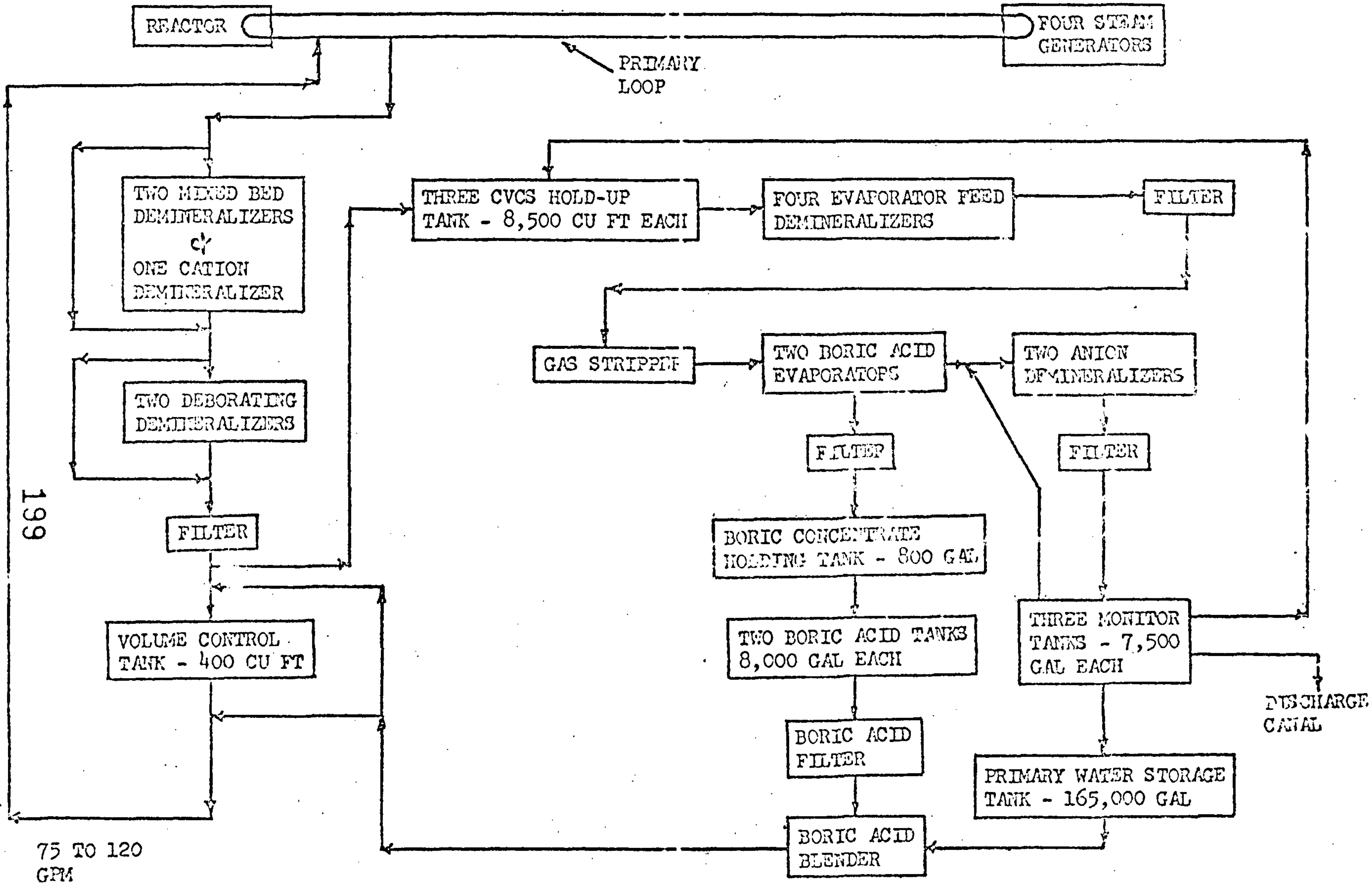
The Draft Statement, in its discussion of Net Nontidal Flow, attempts to summarize and evaluate the application of this concept to the Hudson River at Indian Point. The Statement does not convey a consistent evaluation as to how the concept should be applied.

Table 1 summarizes results of the density induced circulation studies detailed in references 8 and 9. The table compares the velocity and salinity approaches. In general, the salt approach exhibits several favorable characteristics such as relatively more stable and predictable distribution, more independence of temporary meteorological and local eddy conditions, simplicity and availability of more precise detection instruments. The end result of these advantages is, of course, a more reliable measurement which makes the use of salt more attractive from a practical standpoint.

The salt approach results were also used to introduce some degree of perspective to the problem and to determine seasonal variation of upper layer flows since most of the available current observations were made during the summer months.

When the freshwater flow exceeds 20,800 cfs at Indian Point, the river changes from a two-layer to one-layer system having a net flow in the downstream direction from top to bottom. This flow value represents the incipient salt flow at Indian Point and may occur during May during certain years. This critical value of freshwater flow may be obtained from Figure 1. The long term monthly average upper layer flows are shown in Figure 2.

In conclusion several methods of estimating the net nontidal flow have been evaluated. The Staff recommends use of salinity data on page III-27 of the Draft Statement and the applicant concurs. Statistical analyses using different methods of interpreting salinity data lead to estimates of upper layer flow from 35,000 to 92,000 cfs. Since the less accurate velocity method resulted in lower values of upper layer flow, the applicant has used this most conservative value obtained, approximately 21,000 cfs in their evaluation. The applicant's methods of analyses have employed established principles to advance the scientific state of estuarine prediction techniques.



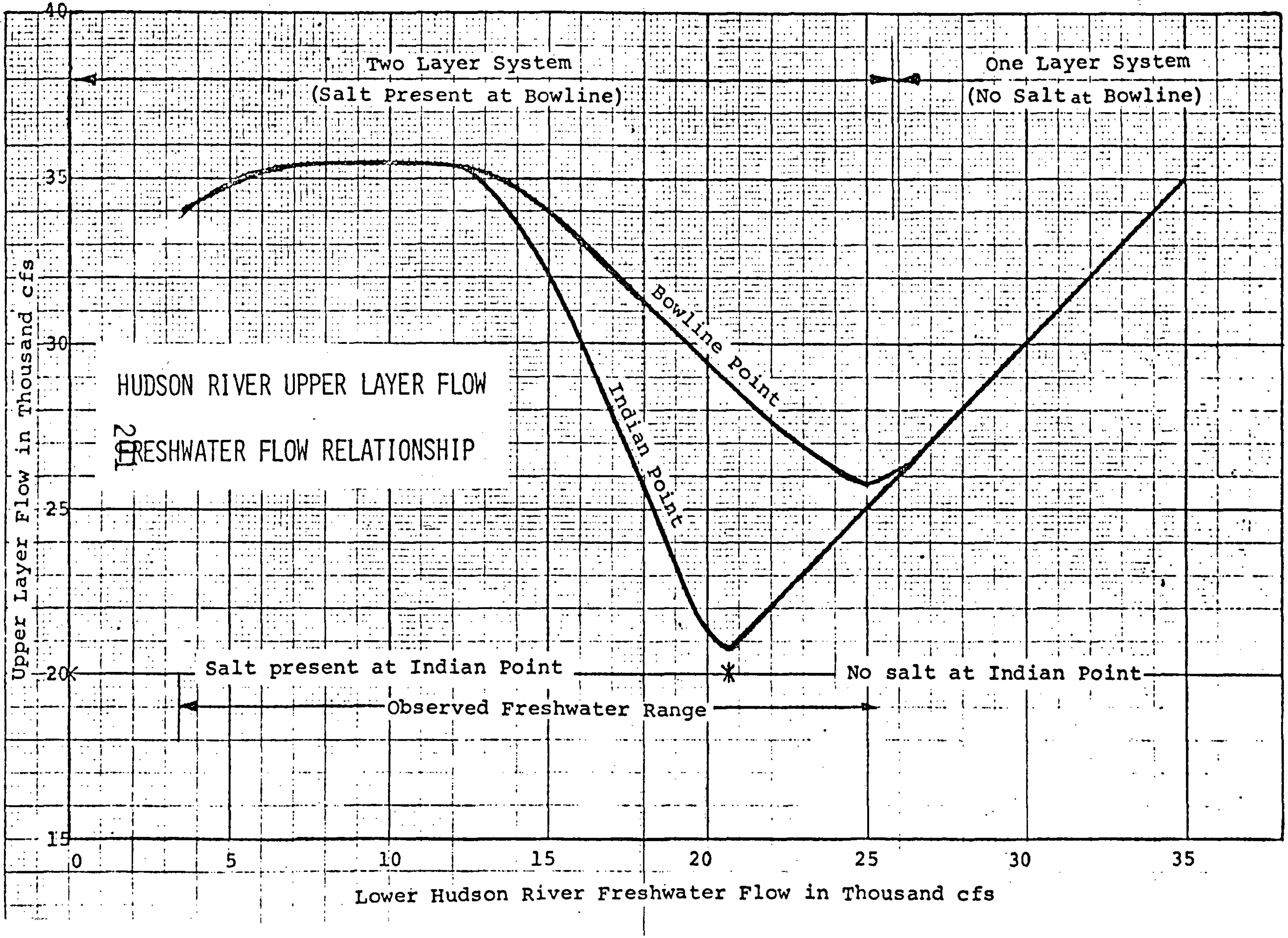
PRIMARY COOLANT PURIFICATION
IN CHEMICAL AND VOLUME CONTROL
SYSTEM - INDIAN POINT UNIT NO. 2

FIGURE 2

TABLE 1

COMPARISON OF LOWER HUDSON UPPER LAYER FLOW USING SALINITY AND CURRENT OBSERVATIONS

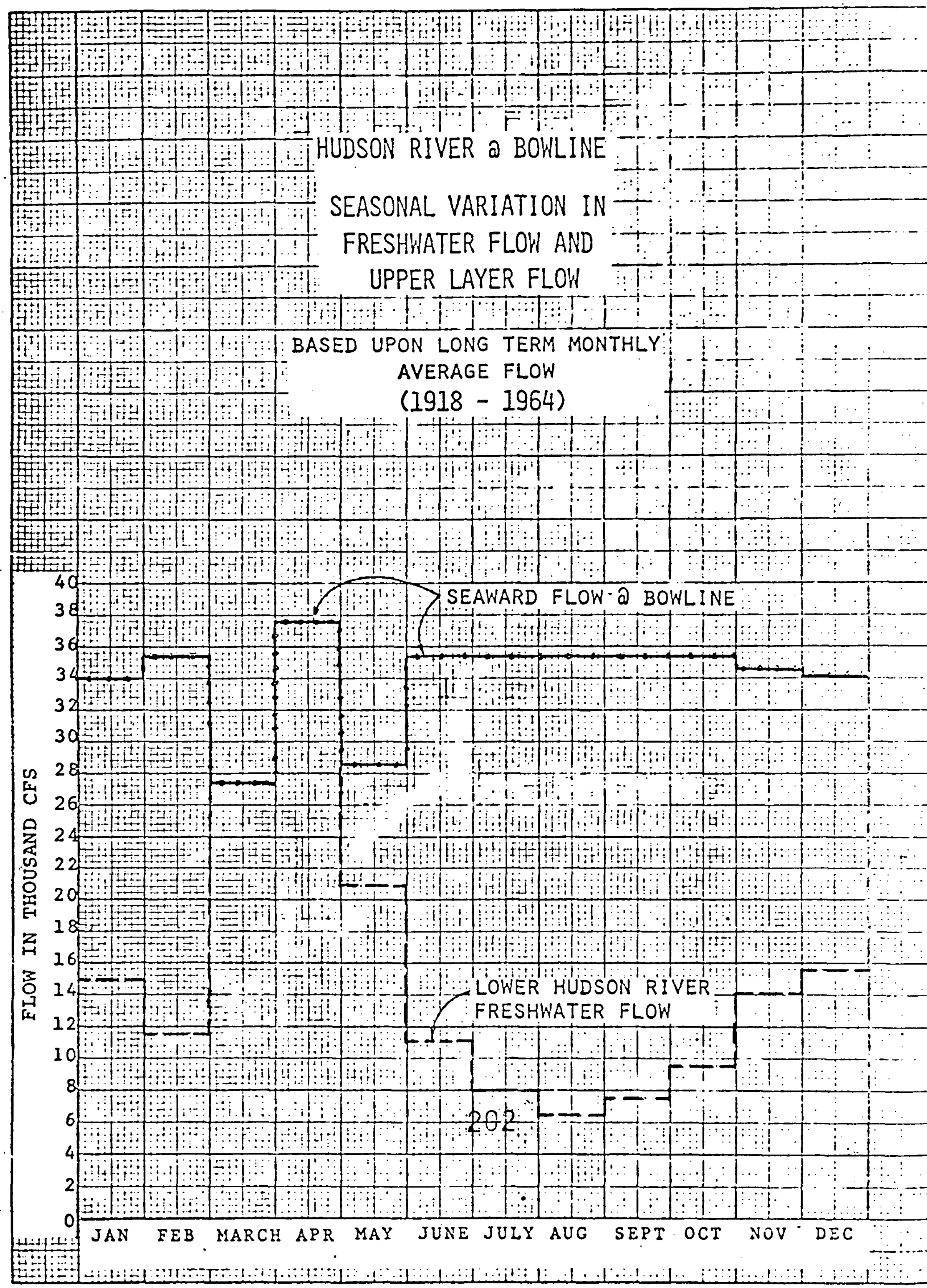
Method	Reference 8 Figure No.	Upper Layer Flow, Thousand cfs -- Summer Conditions -- Indian Point
1. Current Observations	7	21.5
2. Salinity Surveys		
a) Salt Budget Method		
1964	22	90.0
1967	23	92.0
b) Two Layer Flow Method		
All Salinity Surveys	24	35.0
Generalized Salinity	26	35.4



Two Layer System
(Salt Present at Bowline)
One Layer System
(No Salt at Bowline)
HUDSON RIVER UPPER LAYER FLOW
FRESHWATER FLOW RELATIONSHIP
Bowline Point
Indian Point
Salt present at Indian Point
No salt at Indian Point
Observed Freshwater Range
Upper Layer Flow in Thousand cfs
Lower Hudson River Freshwater Flow in Thousand cfs
40
35
30
25
20
15
0
5
10
15
20
25
30
35

FIGURE 1

FIGURE 2



HUDSON RIVER @ BOWLINE
SEASONAL VARIATION IN FRESHWATER FLOW AND UPPER LAYER FLOW
BASED UPON LONG TERM MONTHLY AVERAGE FLOW (1918 - 1964)
SEAWARD FLOW @ BOWLINE
LOWER HUDSON RIVER FRESHWATER FLOW
FLOW IN THOUSAND CFS
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
JAN
FEB
MARCH
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC

2. Maximum River Ambient Temperature

The Draft Statement maintains that "Report of Inquiry into Allegation Concerning Operation of Indian Point 1 Plant of Consolidated Edison Company" shows river ambient temperatures of 81° F. Certainly it is clear that an extensive body of temperature data exists beyond this simple source. Our consultants have analyzed all existing data and these analyses have been described in Dr. Lawler's Supplemental Study dated May 1972 (reference 12, pages I-3 through I-5). The comments below are, in part, based on that report.

The New York State regulations define ambient temperature implicitly in NYCRR 704.1 where estuarine thermal criteria are specified. With regard to the 4° F heating limitation that section reads in part: "...shall not be raised to more than 4° F over the temperature that existed before the addition of heat of artifical origin..." The data presented in the Staff reference indicating a temperature of 81° F were obtained while Lovett and Indian Point were operating and were not measured at the Indian Point site. Thus, these temperatures measure thermal plume effects, not ambient intake temperature. Furthermore, the data were accumulated with uncalibrated thermometers normally accurate to only ±1° F at best. By contrast the applicants' consultants' data analysis in reference 12 was based on measurements using Bureau of Standards calibrated thermometers and employed statistical methods in documenting the use of the 79° F maximum ambient river temperature at the site.

The Draft Statement references Attachment B-3 of the Report of Inquiry referred to above for its finding of the 81° F intake temperature. The same report contains an exhibit designated Attachment B-2 which shows temperatures specifically at the intake of Indian Point 1 for the summer periods of 1967 and 1968. The highest temperature indicated is 80° F which occurred on six days in 1967 and no days in 1968. Since the present outfall structure had not been constructed, recirculation effects would be greater at that time than would be expected from the present configuration. The Draft Statement makes no mention of Attachment B-2.

The Draft Statement uses the 81° F hypothetical ambient temperature to criticize the applicant's conclusions that the 90° F maximum surface temperature criterion will not be exceeded. The applicant's submerged discharge model is fully explained and documented in the Supplemental Study of May 1972 (reference 12). We understand that this document was not available to the Staff when it prepared the Draft Statement. The model is conservative, uses published parameters where needed, and agrees with physical model results, from the undistorted model of the outfall. The physical model tests are more fully described in the comments below. (See #4). The models predict a maximum surface temperature of 88° F.

In summary, the applicant maintains (1) that the maximum ambient river temperature is 79° F, based on statistical analyses of available data; and (2) that the effluent will be diluted to ~~easily~~ meet the 90° F maximum surface temperature limit.

3. Far-Field Heat Dissipation

The Staff Draft Statement critically reviews one of the applicant's first generation models used to predict the expected temperature distribution associated with three unit operation. The Lawler Testimony submitted to the ASLB on April 5 (reference 11) is a much more concise and complete description of the essence of these models. We understand that this document was not available to the Staff when it prepared the Draft Statement. In fact, the April testimony employs no empirical corrections to arrive at predictions that two units will meet the 4° F New York State Thermal Criteria.

In point of fact, the applicant has supported the extensive development of the heat dissipation model by the consultant, QLM. Subsequent to the 1969 reports, apparently used by the Staff in their preparation, the model has been applied to numerous other outfalls and has been verified using field data as outlined below.

A. Applicability of the Overall Mathematical Models to Thermal Discharges

The heat dissipation mathematical models, and in some cases modified versions of these models, have been used to evaluate a number of existing and planned effluents and waterbodies, including the following:

1. Existing Plants

- Albany Steam Station
- Danskammer Station
- Lovett Unit 1-5
- Indian Point Unit 1
- Arthur Kill Plant
- Astoria Units 1-5
- Ravenswood Plant

2. Proposed Plants

- Roseton
- Indian Point Units 2 and 3
- Standard Brands, Inc.
- Astoria Unit 6
- Bowline Point
- a number of other future generation sites

3. Water Quality Models

- The Hudson River - NYSDEC
- The New York - New Jersey Estuarine Complex - ISC, NYC, NJDH
- The East River - NYC
- several waterbodies outside New York State

In addition, subsequent analysis, summarized in Table 2, of available temperature measurements in the vicinity of other Hudson River existing plants indicated existence of upper layer flows close to those computed using the above described tidal current and salinity approaches. These results support the capability of the density induced circulation concept to explain temperature observations.

TABLE 2

Plant	Survey	Observed $\Delta \overline{T}_O$, °F	Heat Load, BBTU/Day	Upper Layer* flow, cfs
Danskammer	1969 QL&M	0.146	47.3	32,000
Lovett	1969 QL&M	0.152	57.0	37,800
Lovett	1970 QL&M	0.175	41.7	26,200
Indian Pt. 1	1966 NBI	0.200	37.4	20,900

* Computed using temperature observations

B. Presentation of Study Results

In order to select the most severe set of hydrology and meteorology that can occur in the vicinity of Indian Point and to compare results of the various models used in this study, a plane of discharge counterpart of the mathematical model may be used. For a given location outfall design and known fluid characteristics, this model reduces to:

$$\Delta \bar{T}_o = \frac{\alpha H}{\sqrt{Q^2 + \beta \bar{K} E}} = \frac{\alpha H}{Q_d}$$

in which:

$\Delta \bar{T}_o$ = Area-average temperature rise at the plane of discharge, ^oF. It is used here as a measure of the response of the Hudson River to thermal discharges.

H = Thermal discharge, BBTU/Day

$\bar{K}$ = Heat transfer coefficient, BTU/sq. ft. day ^oF. It is used in this model to define the influence of meteorological conditions on the distribution of temperature.

Q = River freshwater flow, thousand cu. ft./sec.

E = Longitudinal dispersion coefficient, sq. miles/day

Q_d = A heat dissipation parameter reflecting the influence of flow available for dilution of thermal discharges and of heat transfer to the atmosphere. In the case of the convection-dispersion mathematical models, Q_d combines the influence of Q, K and E. In dealing with a tidal smoothed temperature rise averaged over the entire cross-section within a salt-intruded reach of an estuary, Q_d reflects the influence of the seaward directed upper layer flow, Q_u, and landward directed lower layer flow, Q_L. This definition of Q_d has been selected to insure consistent comparison of the convection-dispersion and density induced circulation model results. However, since an inherently stratifying discharge, such as is a thermal effluent, rises to the surface and tends to stay in the upper layer, only the upper layer flow may be used to predict the distribution of temperature in the seaward directed layer.

α & β = Constants defining the influence of river geometry (A,B), outfall design (TSF), and water quality (ρ,C_p). At indian Point, use of A, B, TSF, ρ, C_p of 160,000 sq. ft. , 4,000 ft., 1.5, 62.4 lb/cu. ft. and 1 BTU/#^oF respectively, yields α= 0.185 and β= 0.23.

A comparison between the various hydrological and meteorological conditions and models presented using this equation is given in Table 3. The study results of Table 3 indicate that an incipient salt flow condition occurring during certain winter months represents the most severe set of hydrology and meteorology that can be expected at Indian Point. The thermal effect is less critical during the other months due to availability of high freshwater flow and heat transfer rate and/or density induced circulation associated with ocean-derived salt intrusion. In order to predict the maximum expected effect, the incipient salt flow condi-

TABLE 3

COMPARISON BETWEEN VARIOUS HYDROLOGICAL & METEOROLOGICAL

CONDITIONS AT INDIAN POINT & STUDY MODELS

Condition	Model[1]	Q tcfs	Q_u tcfs	E smd	$\overline{K}$ BTU/ft^2°Fday	$\Delta\overline{T}_o$ °F/100BBTU/day
A. Indian Point within Salt-Intruded Reach						
Drought-Fall Conditions	C-D[2]	4.0	-	12	90	0.84
	DICC	-	21.5	0	-	0.48
	DICS	-	35.4	0	-	0.28
	Average.....					...0.53
Summer Conditions	C-D[3]	4.0	-	12	135	0.69
	DICC	-	21.5	0	-	0.48
	DICS	-	35.4	0	-	0.28
	HYD	4.0	-	0.2	130	0.58
	Average.....					...0.51
B. Indian Point outside Salt-Intruded Reach						
Incipient salt flow	C-D	20.8	-	6	120	0.76
	C-D	20.8	-	6	90	0.78
Winter or Spring flow	C-D	28.0	-	6	90	0.62

1 C-D = Convection-Dispersion model
DICC = Density induced circulation model - upper
DICS layer flow computed using tidal current and salinity measurements, respectively.
HYD = Indian Point hydraulic model

2 Based upon Table 10 of Reference 3
3 Based upon Table 12 of Reference 3

tions were used in this study.

The combined effect of rated capacity operation of Lovett Units 1 through 5 and of Indian Point Unit 1 and 2 is expressed in terms of and compared with the New York State thermal discharge criteria in Table 4.

These values have been computed using an overall convection-dispersion model capable of handling variable system parameters, including heat loads, within a number of consecutive river segments. To convert the overall response to near field behavior and to permit evaluation in terms of the NYSDEC thermal discharge criteria, the exponential decay model (from reference 3) has been employed.

The surface width criterion, that no more than 67% of the river's surface width may experience temperature rises in excess of 4^{o} F, is the most difficult of the criteria to meet. This conclusion has been found to be valid in numerous cases including Albany, Danskammer, Roseton, Lovett, Bowline, Arthur Kill, Ravenwood and Astoria Plants.

The results of Table 4 indicate that in all cases, the predictions are substantially less than the New York State thermal discharge criteria. Table 4 results correspond to rated capacity operation of Indian Point Units 1 and 2 as well as the existing Lovett Units 1 through 5.

TABLE 4

PREDICTION OF 4°F AREA AND SURFACE

BOUNDARIES AT INDIAN POINT

FOR THE MAXIMUM SEVERE CONDITIONS

A. Conditions

Incipient Salt Flow	... 20,800	cfs
Heat Transfer coefficient	... 90	BTU/ft^2 day °F
Dispersion coefficient	... 6	sq. miles/day
Thermal Stratification factor	... 1.5	
Critical tidal phase to tidal average location ratio	... 1.35	
Heat Load (Rated Capacity)		
Indian Point Unit 1	... 265 MWE or 47 BBTU/Day	
Indian Point Unit 2	... 873 MWE or 153 BBTU/Day	
Lovett Units 1 - 5	... 503 MWE or 57 BBTU/Day	

B. Study Results

Parameter	Tidal Phase	Percentage at Lovett	Percentage at Indian Point	NYSDEC Criterion
% Width bounded by 4°F	Tidal Average	24	23	67
	Critical Tidal Phase	32*	31	
% Area bounded by 4°F	Tidal Average	16	15	50
	Critical Tidal Phase	22	21	
Maximum surface Temperature, °F	Critical Tidal Phase	87		90
Area average Temp. rise, °F	Tidal Average	1.79	1.75	-
Surface average Temp. rise, °F	Tidal Average	2.69	2.62	-

* This value is based upon a maximum surface temperature rise (ΔT_{sm}) of 8°F. To generalize the results, other rises have been investigated. Use of ΔT_{sm} of 6, 7, 9 & 10°F would yield a maximum critical tidal phase % width bounded by 4°F of 28, 30, 33 and 33.5%, respectively.

4. Physical Model Results

The Draft Statement refers to the existence of a physical model (on page III - 34), but does not interpret the results or critically review the data. Significant aspects of the physical model program are outlined below.

In the winter of 1967-68 a model (Model II) of the Hudson River simulating 9000 feet above and below Indian Point was constructed at Alden Research Laboratories, Worchester, Massachusetts. The layout of Model II which was scaled 1:250 in horizontal dimension and 1:60 in the vertical, is shown in Figure 3. In order to optimize the outfall design, an Outfall Model was constructed at Alden. The Model was undistorted, scaled 1:50 and simulated 900 feet along the east shore and 400 feet of the river's 4,000 foot width. Tests of various outfall designs were conducted using the model through the Fall of 1968 and Spring of 1969.

The current thermal criteria led to selection of the outfall with 18 feet submergence. The predicted temperature distribution created by the plant discharge through the outfall is presented in Figure 4. The expected near-field dilution at the point where the plume reaches the surface was shown by this model to be approximately 1:2.

Tests in the distorted Model II were conducted with this submerged outfall. These tests simulated two unit and three unit plant operation and indicated that the transient thermal plume would comply with the thermal criteria. The model results are presented in the Alden Report: "Indian Point Cooling Water Studies, Model No. 2" (May 1969), reference 10.

A subsequent critical review of the results, however, suggested a need to confirm the near-field results in that they appeared to indicate less than theorectically predicted mixing from the submerged discharge, and hence distortion in the results observed in Model II. The undistorted model was expanded in 1971 to simulate 1800 feet of the river's width including 2500 feet downstream from the Indian Point outfall and 1400 feet upstream at a scale of 1:50 including the features of bottom topography.

Recent re-testing in the expanded model of the outfall with 18 feet submergence confirmed the 1:2 dilution which had been measured in the smaller Outfall Model. In an effort to further improve the efficiency of the outfall, tests were run simulating a wide variety of new outfall configurations. As a result of these tests the decision was made to raise the ports to a submergence of 12 feet, to improve effluent dilution. The near-field temperature distribution for the raised port scheme, according to the Outfall Model tests, is shown in Figures 5.

The mechanism by which this increased jet efficiency occurs is entrainment of cool water from beneath the ports. Whereas previously entrainment was limited by the presence of the bottom, the outfall design with raised ports indicates substantially increased dilution, especially at points several hundred feet from the outfall.

Figure 5 shows that the dilution affected by the raised port outfall scheme will result in a maximum surface temperature approximately 8^{o} F above the intake temperature. With recirculation amounting to 1^{o} F average, and a maximum river ambient temperature of 79^{o} F, the maximum surface temperature is not expected to exceed 88^{o} F. It should also be noted that the surface area of maximum water temperature is exceedingly small, approximately 0.1 acres.

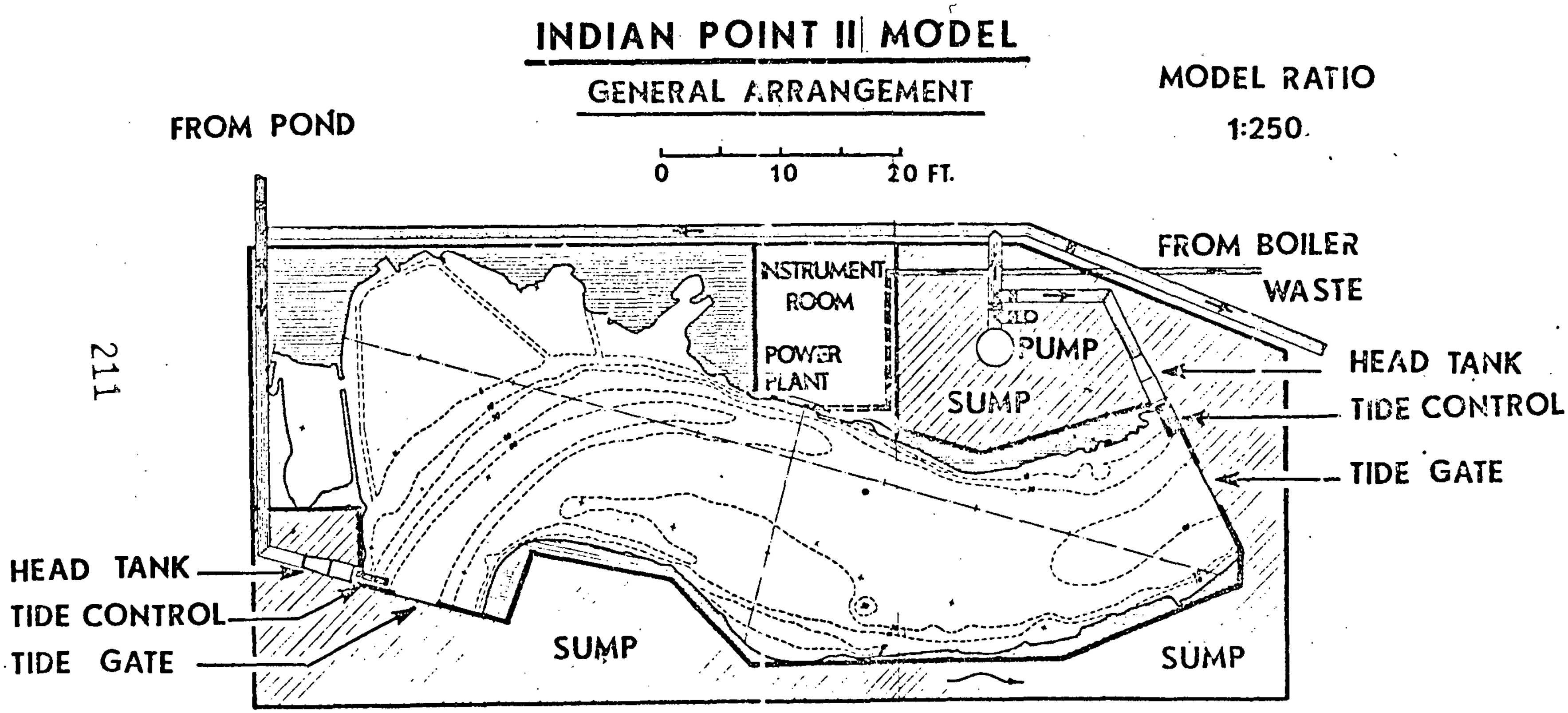


Figure - 3 Indian Point II Model - general arrangement.

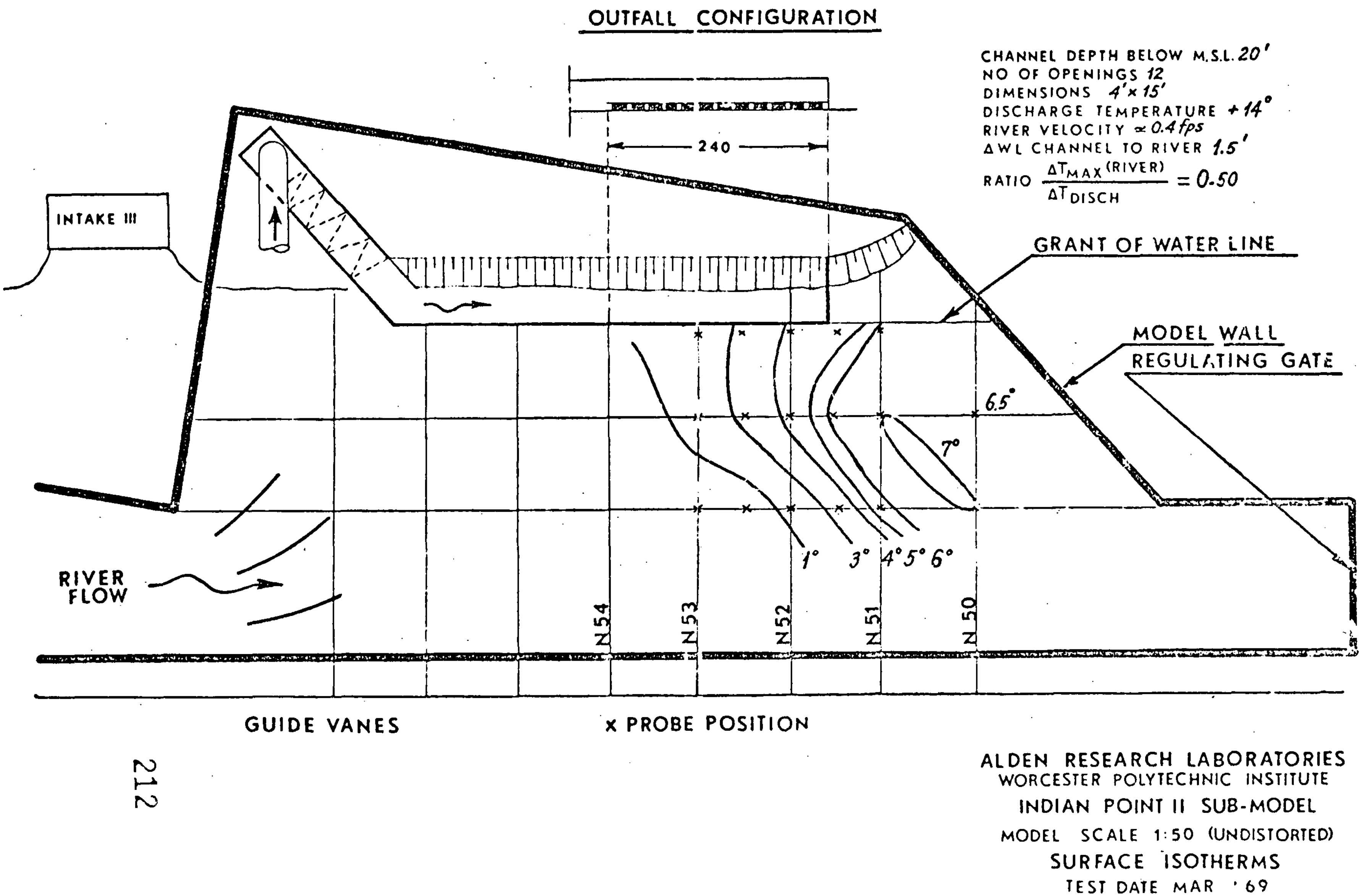


Figure 4 - Outfall Model - surface isotherms with ports at 18' submergence

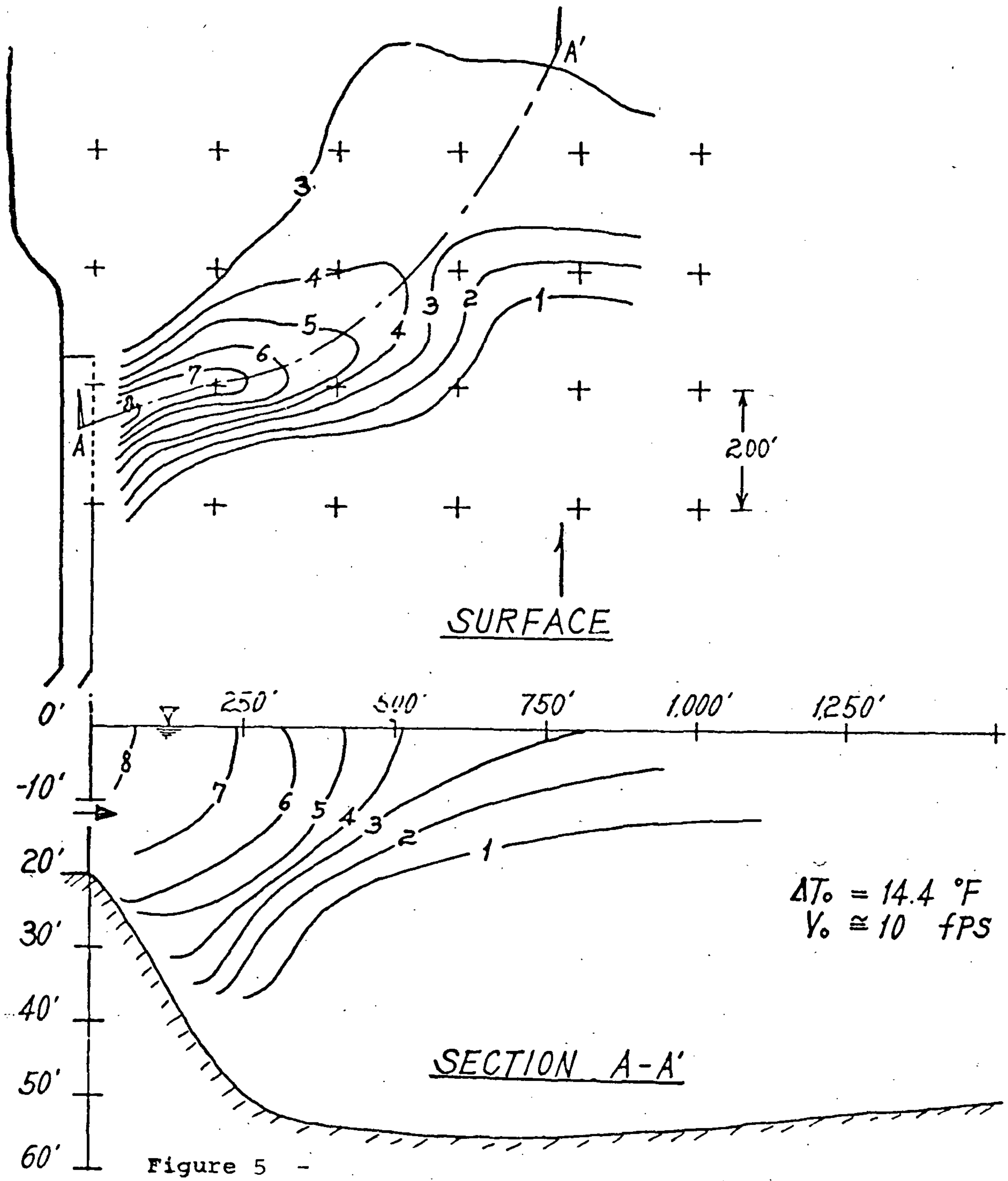


Figure 5 - TEMPERATURE PATTERN — REVISED DESIGN AT 0.4 FT/SEC CURRENT, 1/50 SCALE MODEL

TABLE III-9

THE DISCHARGE OF CHEMICALS TO THE HUDSON RIVER FROM INDIAN POINT UNITS NOS. 1 AND 2[(a)]

Chemical Discharged	Max. Sustained Releases, lbs/day		Max. Conc. at Discharge Point to Hudson River[b] (ppm)		Max Releases from Both Units[c] (ppm)	NYS Allowable Conc. o Chemical Discharges (
	Unit No. 1	Unit No. 2	Unit No. 1	Unit No. 2		
Lithium hydroxide[d]	2.5	2.5	~~0.01~~ 0.0001	~~0.001~~ 0.00005	~~0.1~~ 0.001	-
Boric acid (Boron)[d]	600	600	~~75~~ 0.2	~~0.7~~ 0.06	~~50~~ 0.6	-
Sodium hydroxide	156	12	1.2	~~1~~ 0.01	~~10~~ 4	e
Sulfuric acid (SO_4)	450	-	~~6~~ 3	—	~~10~~ 9	e
Sodium Phosphate (PO_4)	~~24~~ 15	~~15~~ 24	~~0.0013~~ 0.004	~~0.07~~ 0.003	~~1.54~~ 0.03	-
Hydrazine	24	5	0.006	~~0.007~~ 0.0005	~~0.1~~ 0.02	-
Cyclohexylamine	2.5	12	~~0.0004~~ 0.0007	~~0.003~~ 0.001	~~0.1~~ 0.01	-
Morpholine	2.5	12	~~0.0004~~ 0.0007	~~0.003~~ 0.001	~~0.1~~ 0.01	-
Sodium sulfate	Neutralization product of NaOH and H_2SO_4		~~6.6~~ 2.5	~~0.7~~ —	~~10~~ 7.5	~~d~~
Sodium carbonate	1000 ~~2%~~	~~20~~ —	~~1.2~~[f] 8.5	-	~~7~~[f] 1.7	~~d~~
Chlorine	~~15%~~ —	~~15%~~ —	0 to 0.5[h]	0 to 0.5[i]	0.5	0.5
Potassium chromate (Cr VI)	~~Intermittent use~~ —	30	~~0.35~~ —	~~0.05~~ 0.008	~~0.05~~ 0.025	0.05.
Detergent[g]	~~1.5~~ 3.0	~~1.5~~ —	~~0.12~~ 0.01	~~0.01~~ —	~~1.0~~ 0.03	-

[a]Sulfate, caustic soda, and soda ash together represent 5 to 10% of the permissible concentrations of the total dissolved solid (TDS) that can be discharged into receiving waters.

[b]Discharge during full power operation with 300,000 gpm for Unit No. 1 and 870,000 gpm flow for Unit No. 2 of condenser coolant in the discharge canal.

[c]Values normalized to a nominal flow of condenser coolant in the discharge canal of 100,000 gpm.

[d]These releases would occur only in the event of evaporator breakdown.

[e]These represent the concentration of dissolved solids that can be discharged into the river.

[f]Soda ash used in a 2% solution for 8 hours to wash the Unit No. 1 flue gas passages of the superheaters, economizers and preheaters, 4 times per year and discharged continuously during the cleaning period at ~~7 gpm~~ 17 gpm into a flow of 20,000 gpm of service cooling water during Unit No. 1 shutdown.

[g]Alkyl benzene sulfonate.

[h]Chlorination treatment for 30 minutes of each inlet water box 3 times per week.

[i]Intermittent discharge - 1 hour, 3 times per week for a 30 minute treatment of each water box of 3 condensers.

In summary, the physical model results cannot be ignored in any realistic evaluation of the thermal discharge from units 1 and 2. The far field data presented in the Alden Report (reference 10) constitute an accepted engineering prediction of the plume. It is a tribute to the veracity of both the physical and the mathematical heat dissipation models that their agreement is excellent. With respect to the accuracy of the near-field temperatures associated with the raised port design, the expanded Outfall Model is the most accepted method in the field of hydraulic engineering for evaluation of such schemes. The Staff is correctly aware of the assumptions required in the mathematical model, yet does not recognize the significance, accuracy and simplicity of the physical model results for both near and far field temperature distributions.

APPENDIX A

LIST OF REFERENCES *

1. Quirk, Lawler & Matusky Engineers. "Effect of Contaminant Discharge at Indian Point on Hudson River Water Intake at Chelsea, New York," Report to Consolidated Edison of New York, Inc., May 1966.

2. Quirk, Lawler & Matusky Engineers. "Effect of Indian Point Cooling Water Discharge on Hudson River Temperature Distribution," Report to Consolidated Edison Company of New York, Inc., January 1968.

3. Quirk, Lawler & Matusky Engineers. "Effect of Indian Point Cooling Water Dishcarge on Hudson River Temperature Distribution," Report to Consolidated Edison Company of New York, Inc., February 1969.

4. Quirk, Lawler & Matusky Engineers. "Effect of Submerged Discharge of Indian Point Cooling Water Discharge on Hudson River Temperature Distribution," Report to Consolidated Edison Company of New York, Inc., October 1969.

5. Quirk, Lawler & Matusky Engineers. "Influence of Hudson River Net Non-Tidal Flow on Temperature Distribution," Report to Consolidated Edison Company of New York, Inc., October 1969.

6. Quirk, Lawler & Matusky Engineers. "Hudson River Water Quality and Waste Assimilative Capacity Study," Report to the State of New York Department of Environmental Conservation, Division of Pure Waters, December 1970.

7. Quirk, Lawler & Matusky Engineers. "Hudson River Assimilation Capacity Study," Report to the New York State Department of Health, March 1970.

8. Quirk, Lawler & Matusky Engineers. "Circulation in the Hudson Estuary," a technical bulletin prepared by QL&M in 1971.

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* References 1, 2, 3, 4, 5, and 10 appear in Con Ed's Environmental Report as Appendices A, I, J, L, M and N respectively.

9. Quirk, Lawler and Matusky, Engineers, "Environmental Effects of Bowline Generating Station on the Hudson River," Volume I-IV, QL&M Project No. 169-1, March 1971.

10. Alden Research Laboratories. "Indian Point Cooling Water Studies: Model No. 2," May 1969.

11. Quirk, Lawler and Matusky, Engineers, "Testimony of John P. Lawler, The Effect of Indian Point Units 1 and 2 Cooling Water Discharge on the Hudson River Temperature Distribution," April 5, 1972.

12. Quirk, Lawler and Matusky, Engineers, "Supplemental Study of Effect of Submerged Discharge of Indian Point Cooling Water on Hudson River Temperature Distribution," May 1972.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

Appendix B-2

SUPPLEMENTAL STUDY
OF
EFFECT OF SUBMERGED DISCHARGE
OF INDIAN POINT COOLING WATER ON
HUDSON RIVER TEMPERATURE DISTRIBUTION

MAY, 1972

QL&M Project No. : 115-17

(Report Submitted to the ASL Board for the Licensing Hearings)

Appendix C

General Comments on Dissolved Oxygen

QLM's measurements of dissolved oxygen in the vicinity of the Lovett Power Plant during summer in 1969 and 1970 and in the vicinity of Bowline Point during summer 1970 indicate that the majority of observed dissolved oxygen concentrations are above 5.0 mg/l (see attached table).

QLM analyzed the data and procedures of dissolved oxygen (D. O.) measurement by the Automatic Environmental System at Indian Point. This analysis indicated that the D. O. measurement systems from the intake and discharge were not calibrated at the same time, and the calibration was made approximately once a month. This is probably the reason for large differences between the intake and discharge readings of D. O. concentrations.

QLM made careful simultaneous measurements of the intake and discharge dissolved oxygen concentrations at Indian Point Unit #1 in December 1971. The tests and analytical determinations of D. O. were made in accordance with the most recent edition of Standard Methods for the Examination of Water and Waste Water. Water temperatures were measured using precision thermometers certified by the National Bureau of Standards.

During the survey, Unit No. 1 was operating at rated capacity and the cooling water flow was 204,000 gpm, i.e., throttled to about 85% design flow and average cooling water temperature rise was 16.4°F. The observed average intake concentration of D.O. was 10.48 mg/l and corresponding discharge concentration was 10.3 mg/l. This indicated average loss of D.O. of 0.18 mg/l in the Unit #1 cooling system. These measurements and QLM's mathematical model for D.O. were used for prediction of the dissolved oxygen loss in the Indian Point Unit No. 1 & 2 cooling system. The results of calculations indicate that the loss of oxygen in the system increases with increasing intake concentration of D.O. while the intake temperature is hold constant. For example, during severe summer conditions, when ambient temperature is 79°F, the loss of oxygen in the water cooling system would be as follows:

Intake D.O. mg/l	Loss of D.O. in the system mg/l
5.0	0.05
6.0	0.13
7.0	0.21

The response of the river to such a "sink" of dissolved oxygen was simulated by a mathematical model which included all major mechanisms affecting the river dissolved oxygen concentrations. Results of this model work were reported in a document entitled, "Effect of Indian Point Plant on Hudson River Dissolved Oxygen." A copy of this report is attached. It was determined, for example, that during summer conditions, with the river temperature of 79°F and D.O. concentration of 6.5 mg/l, the loss of dissolved oxygen in the Indian Point Unit #1 & 2 system would be 0.17 mg/l. This loss of oxygen would decrease the river D.O. at Indian Point by about 0.02 mg/l. If the Hudson River concentration is less than 6.5 mg/l, the loss in the system will be less than 0.17 mg/l and decrease of the river D.O. would be lower than 0.02 mg/l. Such an effect of the plant on D.O. is practically undetectable, using accepted procedures for D.O. measurements in flowing streams and can be neglected.

Besides the loss of D.O. in the plant water cooling system, the heat rejected to the river can affect the river concentrations of D.O. The analysis presented in QLM report entitled "Effect of Indian Point Cooling Water Discharge on Hudson River Temperature Distribution, January 1968" indicate that the river D.O. concentration for the heated condition can be expected to be approximately 0.3 mg/l lower than that for the unheated condition.

More detailed discussion of the dissolved oxygen effects of plant operation are included in testimony on this subject presented by Dr. Lawler to the ASLB on January 11, 1972, (Tr. 4428-4430).

HUDSON RIVER DISSOLVED OXYGEN CONCENTRATIONS
OBSERVED BY QUIRK, LAWLER AND MATUSKY ENGINEERS

A) OBSERVATIONS AT LOVETT DURING AUGUST AND SEPTEMBER 1969

INTERVAL OF DISSOLVED OXYGEN CONCENTRATION mg/l	NUMBER OF OBSERVATIONS	PERCENT OF TOTAL OBSERVATIONS %
4.0	0	0
4.0-5.0	0	0
5.0-6.0	11	25.50
6.0-7.0	20	46.50
7.0	12	28.00
TOTAL	43	100.00

Ambient Temperature range: 77.5°F-68.3°F

Observed maximum 9.1 mg/l
Observed minimum 5-1 mg/l

B) OBSERVATIONS AT LOVETT DURING AUGUST THROUGH SEPTEMBER 1970

INTERVAL OF DISSOLVED OXYGEN CONCENTRATION mg/l	NUMBER OF OBSERVATIONS	PERCENT OF TOTAL OBSERVATIONS %
4.0	3	3.65
4.0-5.0	10	12.15
5.0-6.0	39	47.55
6.0-7.0	19	23.20
7.0	11	13.45
TOTAL	82	100.00

Ambient Temperature range: 79.0°F-71.0°F

Observed maximum 7.7 mg/l
Observed minimum 3.3 mg/l

C) OBSERVATIONS AT BOWLINE DURING JULY THROUGH SEPTEMBER 1970

INTERVAL OF DISSOLVED OXYGEN CONCENTRATION mg/l	NUMBER OF OBSERVATIONS	PERCENT OF TOTAL OBSERVATIONS %
4.0	0	0
4.0-5.0	18	17.50
5.0-6.0	71	68.90
6.0-7.0	14	13.60
7.0	0	0
TOTAL	103	100.00

Ambient Temperature range: 80.0°F-69.5°F

Observed maximum 6.6 mg/l
Observed minimum 4.3 mg/l

Consolidated Edison Company of New York, Inc.

EFFECT OF INDIAN POINT PLANT
ON HUDSON RIVER DISSOLVED OXYGEN

QL&M Job No. 115-19

February 1972

(Report Submitted to the ASL Board for the Licensing Hearing)

Appendix D

CHLORINATION AT INDIAN POINT

A sodium hypochlorite system is provided at Indian Point Units 1 and 2 for the specific purpose of preventing the growth of fouling slimes on the inner surfaces of the condenser cooling water system.

When sodium hypochlorite is dissolved in water, it dissociates to form sodium ions and hypochlorite ions. The hypochlorite ions then react to form hypochlorous acid. The ratio of hypochlorous acid to hypochlorite ion depends upon the pH of the solution. Since it is hypochlorous acid that is the principal disinfectant in chlorine solutions, the efficiency of disinfection will be substantially greater at low pH values where the hypochlorous acid content is greater.

If ammonia is present, chloramines will be formed upon the addition of sodium hypochlorite to the water. The disinfecting properties of chloramines are only a few percent of that of hypochlorous acid. Increasing the amount of ammonia decreases the acid concentration, increases the pH and thus decreases the rate of kill. Chloramines are more persistent in the natural environment than hypochlorous acid but are not necessarily more toxic.

Chlorine is dissipated in water by reacting with reducing agents as well as with organic substances and organisms. This loss represents the "chlorine demand" of the water. Hypochlorous acid is also decomposed to exposure to daylight (ultra violet rays from the sun).

The Unit No. 1 condenser at Indian Point has four condenser sections. Chlorine , as sodium hypochlorite, is introduced by manually starting a pump injecting a sodium hypochlorite solution into the cooling water at a point between the travelling screens and the circulating pumps. It is first introduced into two sections of the condenser for one-half hour during the daylight hours. The chlorine is then similarly introduced into the remaining two sections for one-half hour, so that only one-half of the cooling water is chorinated at a given time. Control of the amount of chlorine injected is achieved by adjustment of the hypochlorite pump stroke and observation of the tank level. The water from the chlorinated and unchlorinated sections mix within seconds after leaving the condenser resulting in a 1:1 dilution. The chlorine residual dissipates quickly from exposure to daylight and the chlorine demand so that the discharge concentrations have usually been 0.1 ppm or less. This is based upon actual measurements taken during chlorinations since 1968. The overall time during which chlorine is added to the condenser is one hour. This procedure is repeated as required on alternate days for a maximum of 3 days each week.

The Unit No. 2 condenser has six sections. The chlorination procedure will be similar to Unit No. 1. That is, one-half of the condenser (3 sections) will be chlorinated manually during the daylight hours for one-half hour, followed by chlorination of the other three sections for one-half hour. Since the procedures for chlorination on Unit No. 2 are similar to those used on Unit No. 1, the discharge concentrations during chlorination of Unit No. 2 should also be 0.1 ppm or less. Flow of sodium hypochlorite will be regulated by adjustment of flow control valves and observation of tank level.

Chemical tests are performed on the condenser outlet as a basis of controlling chlorination levels in the condenser sections. Tests are also performed on the discharge canal to insure that compliance with the concentration limit of 0.5 ppm is maintained.

Present plans call for chlorination of Unit No. 1 and Unit No. 2 condensers on alternate days so that chlorine would be introduced into the cooling waters of either Units No. 1 or No. 2 for a maximum of six days of the week for one hour each day. During full capacity operation the volumes of water treated with chlorine at a given time would be 140,000 GPM from Unit No. 1 and 420,000 GPM from Unit No. 2.

The targets of the chlorine are the fouling organisms growing on the inner surfaces of the condenser cooling system. An exposure time of one-half hour, three days per week has effectively controlled such growths at Indian Point Unit No. 1.

In comparison with the target fouling organisms, the organisms passing through the condensers in the cooling water at the time of chlorination are exposed to full application concentration in the condensers for less than 15 seconds, and exposure to the decreasing concentrations in the cooling water discharge for an additional few minutes, the exact concentration and time depending upon the effective dilution and dissipation rates.

While it is expected that some of these non-target organisms in the cooling water are killed during the chlorination period, studies of the phytoplankton and zooplankton populations have ~~no~~ indicated that chlorination had no discernible effect on these populations in the river.

Of the data in McKee and Wolf (1) on toxicity of free chlorine residual compiled from many sources, 13 of 18 concentrations reported to be harmful exceeded 0.2 ppm. The five reports of concentrations less than 0.2 ppm that were harmful involved exposure times of 7 to 23 days. Three of those reports involved trout and salmon.

McKee and Wolf report on thirteen additional observations where concentrations from 0.1 to 5.0 ppm caused no fish mortality. The reported exposure times for these observations ranged from 2 to 100 hours.

Laboratory bioassay tests on fish found in the Hudson River near Indian Point by New York University resulted in 100% survival of small white perch and striped bass for three hours when exposed to 0.75 ppm and 0.60 ppm initial chlorine residuals that dissipated to undetectable limits within one and one-half hours.

Although other references quoted in the USAEC Detailed Statement, dated April 13, 1972 (Merkens (2), Zillich (3), Basch (4), Arthur and Eaton (5)) indicated toxic effects at concentrations below 0.1 ppm, the exposure times encountered were in the order of 96 hours to 15 weeks. Times of exposure in the Hudson River at Indian Point will be much lower. In addition the species quoted by the AEC are not found in the Hudson River near Indian Point and moreover bioassay tests of the species at Indian Point resulted in no mortality.

Since chlorination practices have not and are not expected to cause any measureable damage to the environment, other programs for maintaining condenser cleanliness have not been investigated in detail. Mechanical and thermal cleaning systems have been used at some locations but only with limited success. In addition, the alternate systems will not prevent growth on the cooling water pipes and on the walls of the condenser water boxes.

At the present time however, a program is underway to reduce further the frequency and duration of chlorination. The Indian Point Unit No. 1 condensers have not been chlorinated since January 11, 1972. Inspection of the condensers have been performed regularly to determine the effect of the reduction in chlorination frequencies. Preliminary results show no appreciable growth of fouling slimes during this winter period. Indications are, therefore, that chlorination frequencies can be reduced during the winter months.

This program will continue throughout 1972. After completion of this program, the minimum effective amount of hypochlorite per dose will be determined and new operating instructions will be issued for both Indian Point 1 and 2.

References:

(1) Water Quality Criteria. J.E. McKee and H.W. Wolf, Editors. The Resources Agency of California State Water Quality Control Board Publ. No. 3-A

(2) Merkens, J. C., "Studies on the Toxicity of Chlorine and Chloramines to the Rainbow Trout, " J. Water Waste Treat. 7, 150-151 (1958)

(3) Zillich, J. A., "A Discussion of the Toxicity of Combined Chlorine to Lotic Fish Populations, "Michigan Water Resorces Commission Report, 13pp. (unpublished), 1970.

(4) Basch, R. E., "In-situ Investigations of Toxicity of Chlorinated Municipal Waste Water Treatment Plant Effluents to Rainbow Trout (Salmo gairdneri) and Fathead Minnows (Pimephales promelas), "Completed report Grant 38050G22 Environmental Protection Agency, National Water Quality Office, 50pp. (1971).

(5) Arthur, J. W., and Eaton, J. G., "Chloramine Toxicity to the Amphipod. Gammarus pseudolimneaus, and the Fathead Minnow, Pimephales promelas," Environmental Protection Agency, National Water Quality Laboratory, Duluth, Minn. (1971).

COMMENTS ON STATEMENTS ON ENTRAINMENT AS PRESENTED BY THE AEC STAFF IN DRAFT DETAILED STATEMENT ON THE ENVIRONMENTAL CONSIDERATIONS RELATED TO THE PROPOSED ISSUANCE OF AN OPERATING LICENSE TO THE CONSOLIDATED EDISON COMPANY OF NEW YORK FOR THE INDIAN POINT UNIT NO. 2 NUCLEAR GENERATING PLANT

DOCKET NO. 50-247

MAY 14, 1972

QUIRK, LAWLER & MATUSKY ENGINEERS
ENVIRONMENTAL SCIENCE & ENGINEERING CONSULTANTS
415 ROUTE 303, TAPPAN, NEW YORK 10983

The AEC Staff, in the Draft Detailed Statement of April 13, 1972, has addressed itself to the question of entrainment of fish eggs and larvae at Indian Point. Detailed analysis of the possible effects of such entrainment have been presented. Conclusions to these analyses appear in a number of locations. Pertinent quotations are as follows:

1. <u>In Summary and Conclusions, page ii</u>

   In Unit No. 2, aquatic biota impinged on the intake structure or entrained in the cooling water will be exposed to severe mechanical, chemical (chlorine), and thermal conditions; as a consequence, up to 25% of the average number of eggs and larvae of certain species of fish that annually pass by the Plant may be killed; under the most adverse conditions, up to 100% of some of the entrained planktonic species may be killed; and fish kills of a magnitude two or three times greater than those caused by Unit No. 1 may occur.

2. <u>In the Summary of Conclusions, page iv</u>

   From review and evaluation of the applicant's Environmental Report and Supplements thereto, and from independent observations and analyses discussed in this Statement, the regulatory staff has reached the following conclusions concerning the environmental impact of the Plant's operation:

   a. *The operations of Units Nos. 1 and 2 with the present once-through cooling system has the potential for long-term environmental impact on the aquatic biota inhabiting the Hudson River which could result in permanent damage to the fish population in the Hudson River, Long Island Sound, the adjacent New Jersey coast, and the New York Bight The potential impact is due to possible damage to aquatic biota (including fish eggs, larvae, and plankton) from entrainment in the cooling water system resulting in exposure of the biota to severe mechanical, chemical (chlorine) and thermal conditions and impingement on the intake structure.*

   b. *The estimate of potential environmental impact identified above and discussed in this Statement is based on inconclusive and incomplete data from the applicant. Existing information is insufficient to accurately predict the degree to which the potential damage will eventually take place during operation.*

3. <u>In Chapter V, "Environmental Impacts of Indian Point Unit No. 2 with Unit No. 1 Operation", Section D-2-e, "Biological Impact of Station Operation of Unit Nos. 1 and 2, Sources of Potential Biological Damage, - Entrainment." page V-42</u>

Large numbers of planktonic organisms will pass through the condensers during Plant operation, and, more importantly, a considerably large proportion of the biota will be withdrawn with the addition of Unit No. 2 (Fig. V-5). These organisms will include bacteria, planktonic algae, many invertebrate species, fish eggs and larvae. Table V-6 lists the fish species in the area whose eggs and larvae are known to be vulnerable to entrainment. During their passage through the Plant, these organisms will be exposed to mechanical, thermal and chemical damage. High mortality may result, especially for fragile species or during periods of chlorination. The methods used to determine the fraction of organisms entrained are presented in Appendix V-1. The monthly average probability of randomly distributed plankton moving downstream to be withdrawn varies from a low of about 6% in April to a high of 31% in August, although during drought conditions withdrawal may exceed 45%. Plankton that migrate via density flows to maintain their position in the river will be the most susceptible to entrainment, since they may remain in the area for several weeks.

4. <u>In Chapter V, "Environmental Impact of Indian Point Unit No. 2 with Unit No. 1 Operation," Section D-3-a, "Biological Impact of Station Operation of Units No. 1 and 2, - Probable Biological Effects, - Direct Effects of Plant and Station Operation on Biota." page V-52</u>

The striped bass is the best-studied species in the area that appears to be vulnerable to population changes and will be used to illustrate possible Station impact. Adult striped bass migrate upstream in the spring and spawn upstream from Indian Point. The eggs and larvae drift with the currents in a net downstream direction; large numbers pass the Plant. Several studies have indicated that the principal nursery area for the species is below Indian Point in Haverstraw Bay but that there are some less extensive nursery areas upstream. High entrainment mortality of larvae and eggs as they drift past Indian Point Units Nos. 1 and 2 could result in a loss of 25% or more of the larvae and eggs that pass the Plant en route to their nursery area (see Appendix V-II). Based on the sizes and numbers of the young of the year in the estuary in late July and August, it appears that 75% to 90% of the surviving portion of the total yearly reproduction is below Indian Point. If we assume: (1) that all those fish migrated past the Plant during a life stage which was susceptible to entrainment; (2) that density-independent *factors are responsible for mortality in the populations; and (3) that entrainment mortality is 100%, then the operation of Indian Point Units Nos. 1 and 2 will effectively reduce recruitment resulting from reproduction by about 19% to 22%. This is a maximum estimated loss of recruitment which would result from entrainment of 25% of the striped bass eggs and larvae that pass the Plant and would not likely be reached. However, losses of the young of the year and 1-year age classes from impingement on the intake screens will add to the actual entrainment mortality and could offset the increases in survival during entrainment, so that the total yearly recruitment loss for each subsequent year class in the population may be as high as 15% to 20% from direct effects of Plant operation. Sustained reproductive losses of this magnitude over a long period of time would result in substantial reductions of the striped bass populations that spawn in the Hudson, including those of both the Hudson itself and the area from the south New Jersey coast to Long Island Sound.*

This statement is followed by a discussion of numerous factors that may partially offset the estimates given above. The section is then concluded:

These same arguments apply to other species that spawn in the area and may cause important losses of recruitment to local populations of the alewife, blueback herring, bay anchovy, tomcod, smelt, and Atlantic silversides, as well as striped bass.

5. Chapter VII, "Adverse Environmental Effects which cannot be Avoided," Section A, "Factors Responsible for Adverse Effects, page VII-1.

Several factors associated with the operation of Indian Point Units Nos. 1 and 2 are capable of producing adverse effects. The more important of these factors in the order of their importance include:

1. *Entrainment of large numbers of planktonic organism in the once-through system.....*

6. Chapter VII, "Adverse Environmental Effects which cannot be Avoided,"Section B-4, "Probable Adverse Effects - Biological Impact," page VII-6.

The entrainment of planktonic organisms appear to be the most serious threat to the aquatic community. Entrained organisms will be exposed to mechanical, thermal, and chemical damage. Most species of the aquatic organisms in the area will be subject to entrainment at some life stage. These include phytoplankton, planktonic crustaceans, and larval stages of benthic invertegrates and of many of the estuarine fishes which use the area for spawning. The species of fish which appear most likely to be affected include the striped bass, alewife, blueback herring, tomcod, smelt and white perch.

7. Chapter VIII, "The Relationship Between Local Short Term Usage on Man's Environment and Maintenance and Enhancement of Long Term Productivity," Section B-2, "Uses of Adverse to Productivity - Water Uses," Page VIII-4.

In consideration of the impacts and alternatives discussed in detail in Chapters IV, V, VI, VII, X and XI, the staff has concluded that the only effect of the operation possibly inimical to the objectives of NEPA with respect to productivity is the potential for further degradation of the Hudson River estuary, which is used as the spawning and nursery area in the life cycle of many marine aquatic organisms that spend much of their adult life in the coastal areas of northern New Jersey, New York and Long Island. Such degradation would, indeed, over the long-term diminish the productivity of the area to an extent that cannot be stated in precise terms at present. Only the yearly cost of replacing the estimated number of fish that might be killed has been calculated (see Chapter XI). The ultimate impact on commercial and sport fishing has not been estimated, since the decline of the Hudson River fishery is problematical at this time.

8. Chapter IX, "Irreversible and Irretrievable Commitments of Resources," Section B, "Water and Air Resources," page IX-4

The proposed action when taken has a potential of affecting the aquatic organisms essential to maintaining a fish population of the Hudson River as well as that along the Long Island Sound, *New Jersey coast and the New York Bight so that the population could deteriorate beyond the point of rehabilitation. In this event, operation of the Plant could entail an irreversible commitment of the river as a resource.*

9. Chapter XI, "Alternatives to Proposed Action and Cost Benefit Analysis of Environmental Effects," Section B, "Summary of Alternatives," page XI-12.

The important areas of disagreement between the applicant's analysis and that of the staff are the following:

(2) Environmental effects from operation of the intake-discharge structure have a potential for long-term significant biological damage to aquatic bioto not only in the localized area in the vicinity of Indian Point Unit No. 2, but also in the Hudson River estuary, New Jersey coast and New York Bight. (see Chapter V.D. 3)

There are other areas of difference which are relatively minor. The staff feels that there are insufficient data available to make a reasonably accurate estimate on long-term effects on biota. Of the major differences between the staff and the applicant in the analysis and evaluation of available information, the entrainment of nonscreenable fish eggs, larval, and fingerlings and the impingement of fish on the intake structure appear to be the major impacts on the aquatic ecosystem. Although the staff does not feel that the impacts can be quantified at this time, the staff does not agree with the small impact of about 2-3% damage to eggs larval made by the applicant. Details of the staff's disagreements are given in Chapters V.D., and Appendices II-1, V-2, and XI-1.

10. Appendix V-2, "Entrainment," page A-69

Thus, the probability that a larval striped bass migrating downstream would be entrained is about 25%. Comparison of the freshwater inflows used in these calculations with inflows during the period from 1944 to 1964 indicates that these values were similar to the median conditions.

A discussion of various offsetting factors then follows: The Staff then concludes:

Consequently, the Staff believes that the total average probability of withdrawal of larval striped bass migration downstream past the Station is approximated by the 25% figure, and that this fraction is the best estimate than can be made using available information.

> *In conclusion, based on these considerations, about 25% of the larval striped bass may be entrained as they migrate downstream past the Indian Point site.*

The Staff supposition of damage to the Hudson River fishery and to the population in the offshore waters thus appears to be primarily based on its calculation that some 25% of the planktonic forms of many of the various fishes using the estuary will be entrained and presumably destroyed.

Our approach in these comments is directed first at a critical evaluation of the procedures employed by the Staff to obtain the 25% factor, and then will address the numerous non-quantitative statements made by the Staff regarding possible offsetting mechanisms.

The critique to follow will include the following items:

1. A demonstration that the Staff calculation of available dilution flow at Indian Point, as given by Equations 1 and 2 and Figure A-II-6, in Appendix II-1, entitled "Characteristics of Hudson River Circulation at Indian Point, in Relation to Dilution," employs an inaccurate and theoretically unsupportable methodology, and in the Hudson seriously underestimates available dilution flow at Indian Point.

2. Modification of the probability model given by Equations 1 through 12, Appendix V-2. This probability model was employed by the Staff to compute entrainment loss. The modification includes the quantification of the influence of vertical diurnal movement and estuary density flow on entrainment.

   The Staff's calculation of a 25% entrainment loss is then revised, employing a theoretically and experimentally supportable means of estimating dilution flow in the Hudson River, and the modifications made on the probability model.

1. Criticism of Staff Calculations of Available Dilution Flow at Indian Point

Pages A-4 through A-7 state clearly the Staff's belief that the flow available for dilution in an estuary is given by:

$$Q_T = \frac{Q_F}{1-S/S_0} \qquad \ldots(1)$$

in which:

- Q_T = total dilution flow at point in the estuary
- Q_F = net freshwater discharge
- S = the section average salt concentration at a given point along the estuary's longitudinal axis
- S_0 = the ocean salt concentration

Equation (1) above is identical to Equation (2) (Page A-4), provided that the salinity of the freshwater is zero, and that volume is replaced by volume per unit time, or flow rate (Q). The assumption of zero salinity in the freshwater discharge is quite valid for the Hudson River. The staff replaces volume by flow in constructing Figure A-II-6.

Freshwater flow and salinity data taken from the applicant's Environmental Report Supplement are then reproduced in Figure A-II-5. These data are then employed in conjunction with Staff Equation (2) to obtain the relationship between freshwater flow and dilution flow at Indian Point in Figure A-II-6.

We submit that this procedure is generally invalid in predicting estuary dilution flows. We will show that this method of predicting estuary dilution flow defies analytical development, and has been discounted by most investigators shortly after its appearance in the literature in the early 1950s.

The Staff's reference for their Equations (1) and (2) is a paper by Ketchum, entitled "Eutrophication of Estuaries", which appeared in 1969 in the proceedings of a symposium on eutrophication.[1] Pertinent excerpts from this reference follow:

> *I will mention a few of the essential characteristics of estuarine circulation as they relate to the distribution of pollutants. I will not go into detail because this is covered by Carpenter, Pritchard and Whaley in this volume (page 210). The estuary offers advantages not offered by the river in its ability to dilute and disperse added contaminants.*
>
> *In the river itself, the volume of water available to dilute a pollutant is furnished simply by the river flow, which carries the contaminant downstream at a rate determined solely by the river flow and the geometry of the river bed. In the estuary, the circulation is more complex, although the net seaward flow is also determined by the rate of river flow. If no mixing were involved, this fresh river water would merely flow seaward as a layer on top of undiluted seawater. Mixing is involved, however, and salinity gradually increases down the estuary as river water mixes with more and more seawater. Seawater must flow into the estuary to provide the salt needed to balance the system. In a steady-state condition, the volume of seawater entering the estuary in a given unit of time equals the volume flowing out; there is no augmentation of the net seaward flow. The seawater thus entrained with the freshwater does, however, increase the diluting capacity of the mixed water that is escaping from the estuary. This effect can be evaluated by using the distribution of salt water and freshwater in the estuary.*

[1] Ketchum, B.H. "Eutrophication of Estuaries". Eutrophication: Causes, Consequences, Correctives. National Academy of Sciences, Washington, 1969. p. 197

The amount of freshwater contained in any given sample of brackish water can be calculated from the salinity, since

$$F = 1 - \frac{S}{\sigma}$$

in which F is the fraction of freshwater in the sample, S is the salinity of the sample, and σ is the salinity of the "source" seawater. If the average freshwater content of a complete cross section is known, the volume available for the dilution of the pollutant at that location can be approximated. To obtain the fraction of freshwater in a complete cross section of the estuary, it is necessary to integrate the values from top to bottom and from bank to bank. The volume available for the dilution of the pollutant in a given period is determined approximately by dividing the rate of river flow by the fraction of freshwater in the cross section. If the section is 50 percent freshwater, two volumes must move seaward to move one volume of river water seaward. Closer to the mouth of the estuary, where the amount of freshwater has been reduced to 10 percent, ten volumes must move seaward to remove the river water. A more precise determination of the diluting volume requires detailed knowledge of the circulation. But this simple calculation shows that the total volume available for dilution increases in the seaward direction.*

The underlined statements show clearly that Ketchum's estimate of dilution flow is given by Equation (1) above, or Equation (2) in Appendix A-2 of the AEC Draft Detailed Statement. Note that the last section of the excerpt suggests that Ketchum himself could be viewing this calculation as merely an indication of a trend toward increased dilution as one moves seaward in an estuary, rather than a hard and fast quantitative estimate of dilution flow.

This last statement is made recognizing that Ketchum introduced this method of computation of dilution flow in the early 1950s.[2]

Note: Underlining added for purposes of this reviewer.

*This statement, combined with Ketchum's expression for the fraction of freshwater, is precisely equivalent to Equation (1) above.

[2]Ketchum, B.H. "The Flushing of Tidal Estuaries". Sewage and Industrial Wastes, Vol. 23, No. 2, February 1951. pp. 198-209

Before presenting various comments from the literature on this computation procedure for estimating dilution flow in an estuary, a few statements on the calculation are in order.

The calculation of the fraction of freshwater flow at any point in the estuary, given by Ketchum's definition of "F", above, or by the denominator of Equation (1), above, is generally accepted as correct. This merely states that at any point in the estuary a certain percentage of the water there is of freshwater origin, and the remainder is of ocean origin. This split can be obtained by recognizing that the total volume is the sum of the volume of ocean water origin, containing salt of ocean concentration, and the volume of freshwater origin, containing no salt.

The problem arises when one attempts to show that this percentage split can be employed, along with the freshwater flow, to calculate movement or dilution flow. Ketchum, for example, in the excerpt given above, simply states;

> The volume available for the dilution of the pollutant in a given period is determined approximately be dividing the rate of river flow by the fraction of freshwater in the cross section.

After presentation of the literature comments on Ketchum's work, we shall show the problems which arise when one tries to demonstrate the validity of Ketchum's procedure analytically.

In 1953, Stommel, a coworker of Ketchum's at the Woods Hole Oceanographic Institute, presented a paper[3] in which his intent was to provide a method of estuary pollution analysis that would avoid the difficulties that had been observed in employing Ketchum's methods since its introduction in 1950. It should be noted at this point, that Ketchum's major contribution was not the computational procedure given above, but rather a modification of the "Tidal Prism" concept, a procedure that had been employed to estimate dilution flow, but which was shown by Ketchum to overestimate that flow very grossly. Ketchum merely employed the computational procedure discussed above as a means of verifying his prediction, via the modified tidal prism, of dilution flow. Stommel's introductory remarks are excerpted below:

> *Papers recently published by Ketchum (1) and Arons and Stomel (2) have presumed to give a theoretical account of the distribution of freshwater in an estuary. Pritchard (3), however, justly has pointed out that these treatments are at best applicable only to estuaries so intensely tidally mixed that they exhibit no vertical stratification. In such cases the salt is carried upstream against the main river flow by turbulence. Ketchum proposed a mixing process, which he called "exchange ratio", and was able to compute the salinity distribution in the Raritan. Using the published data (4) on the Severn estuary, the author and Harlow G. Farmer found that the method of the "exchange ratio" gave a grossly incorrect salinity distribution. Inasmuch as the Severn is unstratified, and appear to fit all the requirements of Ketchum's analysis, it is quite clear that the method of the exchange ratio is not nearly so general as was proposed.*

[3]Stommel, Henry. "Computation of Pollution in a Vertically Mixed Estuary". Contribution #640 from the Woods Hole Oceanographic Institution. Sewage and Industrial Wastes, Vol. 25, No. 9, September 1953. pp. 1065-1071.

Pritchard[4,5,6] has discussed, on a number of occasions, the various procedures employed by Ketchum. Reference 4 is a written discussion of a paper by Todd and Lau, in which Pritchard disagrees strongly with the manner in which these authors' propose that estuarine salinity profiles be employed to estimate freshwater flow. The proposed method employs an approach similar to Ketchum's. Excerpts from this discussion follow:

> *The estuary offers many interesting and important problems to the physical hydrographer, and it is encouraging to find that hydrologists are extending their work into this intermediate zone between the river and the ocean. It is unfortunate, however, that this paper by Todd and Lau exhibits a lack of understanding of the mechanisms of circulation and mixing in a tidal estuary.*
>
> *To a casual reader the concepts presented by these authors are disarmingly clear and simple. Unfortunately, they have not used the basic hydrodynamic concept of continuity in its complete form which has led them to misinterpret the equations they develop, particularly their Equ. (1). The error results from the assumption that sea water on the one hand and freshwater on the other can be considered as the two species involved in the mixing processes in an estuary, when in fact, the two separate species which are involved are the salt and the water. The processes of turbulent diffusion, or 'mixing', can lead to a net upstream transport of salt without a net upstream transport of water....*

---

4 Pritchard, D.W. "Discussion of 'On Estimating Stream Flow into Tidal Estuaries," by David K. Todd and Leung-Ku Lau." which appears in Transactions, American Geophysical Union, Vol. 37, 1956, pp. 468-473. Pritchard's discussion appeared in Vol. 38, No. 4, August 1957. pp. 581-584.

5 Pritchard, D.W. "The Equation of Mass Continuity and Salt Continuity in Estuaries". Journal of Marine Research, Vol. 17, 1958. pp. 412-423

6 Pritchard, D.W.. "Estuarine Hydrography". Recent Advances in Geophysics, Vol. 1, 1952.

> *...The error results from an incomplete use of continuity concepts which presents a continuity argument for fresh water only. Actually there are two species to which the continuity concepts apply in the estuary: the water (actually mass) and the salt. Other investigators have made this same error. An apparent reasonable argument is frequently presented along lines something like the following: A certain amount of fresh water flows into the estuary from the river. In order to maintain continuity an equal amount of fresh water must be carried through each section, and since, as one proceeds down the estuary, the salt content increases, it is evident (?) that only a portion of the volume can be fresh water, and so the seaward directed flow must increase in proportion to the decreasing fraction of fresh water. The correct application of continuity concepts recognizes that it is the mass of water on the one hand, and the salt on the other that is conserved over one or more tidal cycles, not the 'fresh water'....*
>
> *...It might be appropriate to point out that Ketchum (1950) made the same questionable assumption that Todd and Lau did when he defined a non-tidal drift (NTD) as NTD = $R/\overline{F} \times \overline{A}$. Ketchum's arguments parallel the disarmingly simple but erroneous presentation given earlier in this critique.*

We interpret the authors (Todd and Lau) closure to Pritchard's discussion, as a circumlocution of Pritchard's arguments, rather than a direct statement of disagreement, suggesting their recognition of the accuracy of Pritchard's analysis.

The following statement appears in a very extensive analysis of the effect of pollution on the Thames Estuary.[7]

[7] "Effects of Polluting Discharges on the Thames Estuary". Department of Scientific and Industrial Research, Water Pollution Research. Technical Paper No. 11, Chapter 14, 'Tidal Mixing', under Section entitled" 'Theories of Estuarine Mixing', 1964. p. 392

KETCHUM'S THEORY

Ketchum[4-6] divides an estuary into segments such that the length of each is equal to the average excursion of a particle of water on the flood tide. The position of the landward boundary of the first segment is determined by the river flow and the cross-sectional areas at high and low water. In one paper[4] he considers the mixing process may be represented by assuming that, during each tidal cycle, the water is completely mixed within each segment at high water, and that there is an exchange of water between adjacent segments during the ebb—the amount of water removed from a segment being given by the ratio of the difference between the volumes of the segment at high and low water to the volume at high water.

The final equations express the proportion of fresh water in each segment solely in terms of the river flow and the volumes of the segments at high and low water. However, these equations do not follow rigidly from the theoretical model and, although the method has the very considerable merit of simplicity, this concept of tidal mixing is undoubtedly over-simplified, and it is evident that the theory is unlikely to be applicable to all estuaries even though it has been used successfully in particular cases. It is sufficient here to indicate that it cannot be used in the case of the Thames Estuary. Ketchum found that his method did not apply to the Delaware Estuary, and he was not surprised to learn that it did not apply to the Thames[7].

In Fig. 220 the continuous curve shows the approximate observed equilibrium distribution of salinity for a flow at Teddington of 1500 m.g.d. (derived from several years' records of the London County Council), and the broken curve is the distribution calculated (for average tidal conditions) by means of Ketchum's theory. There is a similar disparity between the observed and calculated distributions for flows of 500 and 3000 m.g.d.

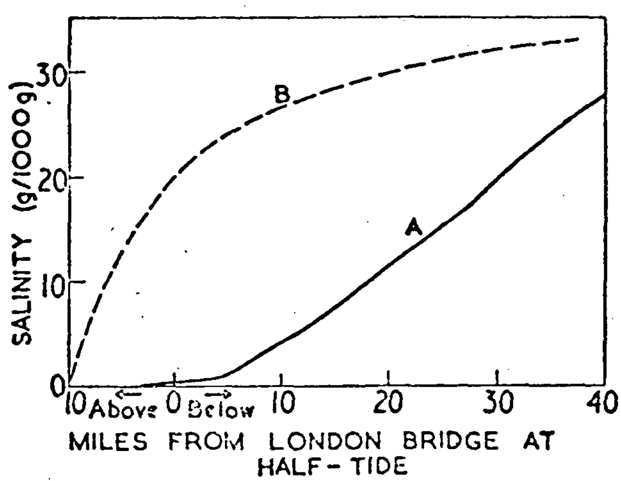

FIG. 220. Equilibrium distribution of salinity in Thames Estuary when flow at Teddington is 1500 m.g.d.
(*A*) *Observed*
(*B*) *Calculated using Ketchum's representation of mixing*

Ketchum references taken from Reference 7

4. KETCHUM, B. H. *J. mar. Res.*, 1951, 10, 18.
5. KETCHUM, B. H. *The Exchanges of Fresh and Salt Waters in Tidal Estuaries*. Woods Hole Oceanographic Institution, Colloquium on Flushing of Estuaries, 1950, p. 1.
6. KETCHUM, B. H. *Sewage industr. Wastes*, 1951, 23, 198.
7. KETCHUM, B. H. Personal communication, 1957.

Thus, it is clear that the methodology employed by the Staff to estimate estuary dilution flow has not met with general acceptance by the field, and, in general, has been discarded in favor of models which recognize more details of observed physical behavior in estuaries, particularly that of salinity-induced circulation.

Before going on to a theoretical presentation as to why the Staff method is unacceptable, and while on this topic of behavior in the Thames River, it should be noted that several investigators including Bowden[8], Preddy & Webber[9] and Inglis & Allen[10] have concluded that the Thames River, like the Hudson, falls into the class of partially stratified estuaries. Similarity between the Thames and Hudson River circulation patterns and mixing characteristics is supported by field observations which established existence of density induced circulation in the Thames[10] and the Hudson[11], relatively high dispersion coefficients (33.8 x 10^5 cm^2/sec or about 10 square miles per day in the salt intruded reaches of both estuaries) and comparable circulation and mixing classification criteria, such as the ratio of tidal amplitude to freshwater used by Bowden[8], the ratio of the flood tide to freshwater volumes used by Pritchard, or the vertical stratification factor (VSF) employed by QL&M[11].

8 Bowden, K.F. "Circulation and Diffusion." Estuaries, Publication #83, American Assoc. for the Advancement of Science, Wash., D.C. 1967. p. 20

9 Preddy, W.S. and B. Weber. "The calculation of Pollution of the Thames Estuary by a Theory of Quantized Mixing," International Conference on Water Pollution, Paper No. 42, September 1962.

10 Inglis, Sir Claude and F.H. Allen. "The Regimen of the Thames Estuary." Porc. Inst. Civil Engineers (London), 7:827-868. 1957

11 Quirk, Lawler & Matusky Engineers. "Environmental Effects of Bowline Generating Station on the Hudson River", Vol. 1-4, QL&M Project No. 169-1, March 1971.

Rejection of the Staff's methodology via theoretical reasoning follows.

Transport phenomenon such as the volume rate of flow available for dilution in an estuary, should always be derivable by application of one or more of the equations of mass, momentum and energy to the system in question. When the system is viewed macroscopically, a conventional means of applying these basic and quantitative laws of physics is control volume analysis. In this method, a finite and typical volume segment of the system is drawn, and rates at which mass momentum or energy flow through, and are produced and or consumed within the segment, are written down. Each entry is then assigned its proper position in an inventory or "balance" equation and a result obtained.

This procedure is applied below to illustrate the development of the two layer estuary model, and then employed to demonstrate the difficulty in deriving the intuitive formulation of estuary dilution flow employed by the Staff.

Consider the typical estuary segment shown below. Freshwater flows into the segment at a rate Q_F. In an attempt to recognize its dilution by salt water, as evidenced by a continually increasing salinity concentration as one moves seaward in the estuary, ocean water is assumed to flow into the estuary, predominantly along the bottom half of the estuary, due to its greater density.

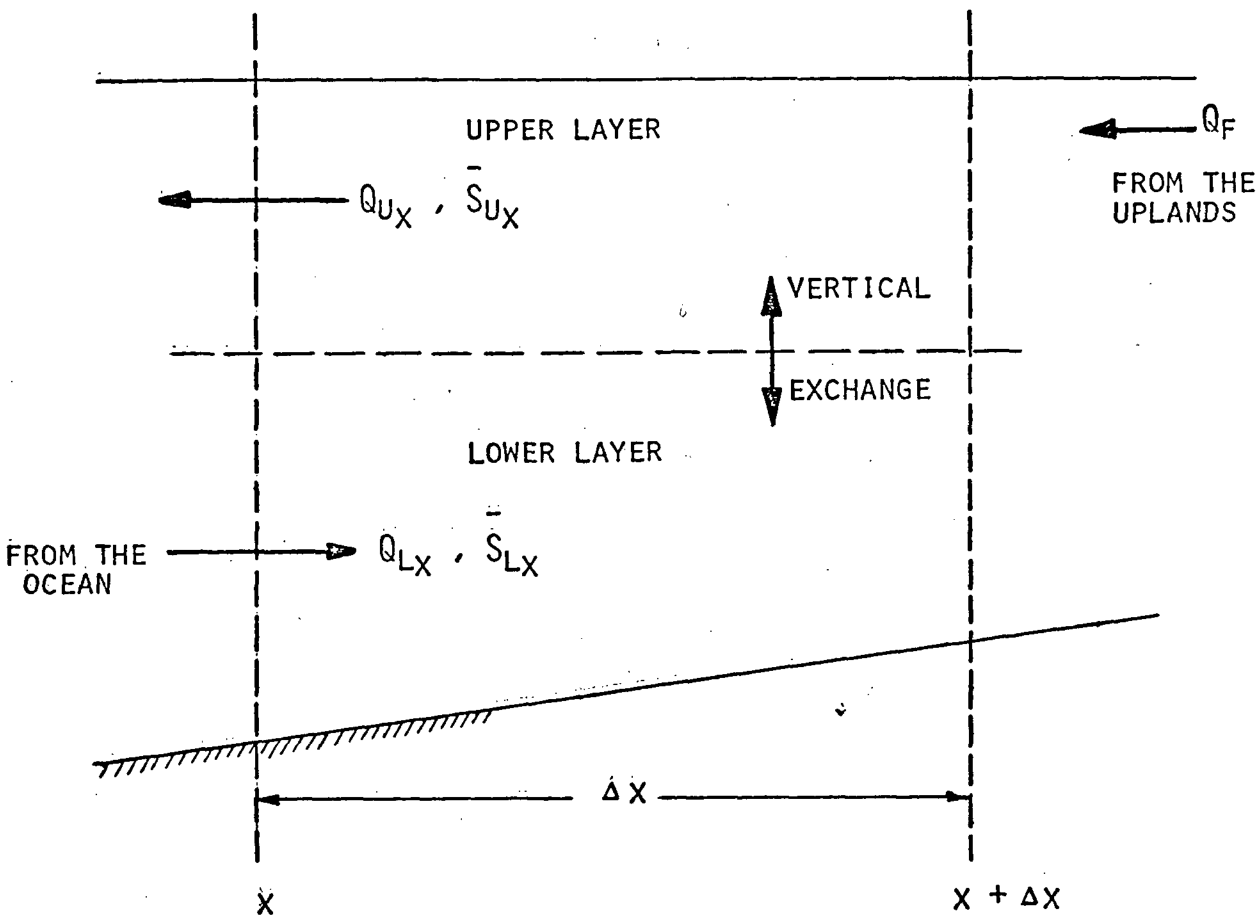

FIGURE 1 - Two Layer Exchange of Water in an Estuary

A steady-state condition is assigned, so that there can be no net transport of salt either into or out of the estuary. In the real world, tidal average behavior approaches this steady condition when external factors controlling movement in the estuary, such as ocean tide, winds, etc., and in particular, river freshwater discharge, remain constant, or nearly so, for extended periods.

Note that the long term condition is a quasi-steady condition. Freshwater discharge undergoes a yearly cycle of high and low water flows, preventing any long term net landward flux of salt. The estuaries salt profile oscillates about some mean position, just as a freshwater discharge oscillates throughout the year about a yearly average runoff value. Since there is no net flux of salt, a mechanism must be provided for returning the salt introduced to the estuary in the landward directed underflow, shown by Q_L in Figure 1. To provide such a return mechanism, water is assumed to be mixed vertically by some means and then returned to the ocean by a seaward movement which takes place predominantly in the upper layer.

Note that a physical rationale is available to explain the postulated movement. This rationale includes the notion of density current development occuring in a system in which waters of different density are brought in contact with each other, and the notion of vertical mixing via tide-induced turbulence.

The notion of vertical mixing is necessary to permit continuous transfer of the heavier seawater up into the layer in which the lighter freshwater is presumed to be moving. Without this, only shear at the salt water-freshwater interface would be available to affect the transfer. This would result in only a fraction of the transfer which can be expected in the presence of tidal turbulence, and in fact describes the stratified, or "salt wedge" type of estuary.

At this point, we have succeeded in developing a conceptual model of estuary water movement. Note that since a macroscopic view is the objective, details of the mixing and transfer process are not required at this point. We are simply attempting to structure an overall view of the estuary, with the objective of writing a statement to describe in a quantitative fashion, the observation that freshwater discharge is diluted by ocean water as it moves down the estuary.

The Law of Conservation of Mass is applied to both the water and the salt in the estuary. This is done by writing a material balance over the volume segments shown in Figure 1.

Since there is no loss or gain of either salt or water within the segment, due to generation or decay processes, and since we are dealing with a steady condition, so that no accumulation of either material can occur over time within the segment, the required balance can be struck across any cross-section of the segment to describe the behavior at that section. This is done first, before striking a balance over the whole volume segment.

Consider Section X in Figure 1. Since there is no net flux of salt, the salt moving into the estuary across the lower portion of the section must balance that moving out of the estuary across the upper half. This is written:

$$Q_U \cdot \overline{S}_U\}_X = Q_L \cdot \overline{S}_L\}_X$$

...(2)

in which:

Q_U, Q_L = the total upper and lower layer flows, respectively

$\overline{S}_U$, $\overline{S}_L$ = the average upper and lower layer salt concentrations, respectively

Since the net overall movement is out of the estuary (seaward), and is given simply by Q_F, the freshwater flow, the upper layer flow, Q_U, must exceed the lower layer flow, Q_L, by this amount. This is written:

$$Q_U - Q_L = Q_F$$

...(3)

Substitution of Equation (3) into Equation (2) yields:

$$Q_U = \frac{Q_F \overline{S}_L}{\overline{S}_L - \overline{S}_U}$$

...(4)

Subscript "X" has been dropped since the section location was arbitrary and Equation(4) is the so-called "salt budget" equation and is described by a number of authors. (see, for example,Reference 8.)

A material balance may now be struck over the whole volume segment. Upper and lower layer flows are entering and leaving the segment at sections X and X + ΔX. The general inventory equation for mass is written:

$$\text{Rate of Mass Input} - \text{Rate of Mass Output} + \text{Rate of Production of Mass} - \text{Rate of Loss of Mass}$$

$$= \text{Rate of Accumulation of Mass} \qquad \text{... (5)}$$

In applying Equation (5) to the system in Figure 1, the last three terms are all zero, for both water and salt. There is no production or loss of either water or salt within the segment, and, since the system is at steady-state, no accumulation of either material occurs.

Application of Equation (5) to salt movement through the segment ΔX yields:

$$\text{Input} \quad - \quad \text{Output} \quad = 0$$

$$Q_U \cdot \bar{S}_U\}_{X+\Delta X} + Q_L \cdot \bar{S}_L\}_X - Q_U \cdot \bar{S}_U\}_X - Q_L \cdot \bar{S}_L\}_{X+\Delta X} = 0 \qquad \text{...(6)}$$

Rearrangement and division by ΔX yields:

$$\left[\frac{Q_U \cdot \bar{S}_U\}_{X+\Delta X} - Q_U \bar{S}_U\}_X}{\Delta X}\right] - \left[\frac{Q_L \cdot \bar{S}_L\}_{X+\Delta X} - Q_L \bar{S}_L\}_X}{\Delta X}\right] = 0$$

The limit of this Equation as $\Delta X \to 0$ yields:

$$\frac{d(Q_u \cdot \overline{S}_u - Q_L \cdot \overline{S}_L)}{dX} = 0 \qquad \ldots(7)$$

Integration yields:

$$Q_u \cdot \overline{S}_u - Q_L \cdot \overline{S}_L = \text{Constant}$$

Consideration of the no net salt flux condition requires that the integration constant be zero. The result is identical to Equation (2).

Application of Equation (5) to water movement through the segment ΔX yields:

$$\text{Input} \quad - \text{Output} \quad = \quad 0$$

$$Q_u\}_{X+\Delta X} + Q_L\}_X - Q_U\}_X - Q_L\}_{X+\Delta X} = 0$$

Rearrangement, division by ΔX and taking the limit as $\Delta X \to 0$ yields:

$$\frac{d[Q_U - Q_L]}{dX} = 0 \qquad \ldots(8)$$

Integration yields:

$$Q_U - Q_L = \text{Constant}$$

Consideration of the fact that the net overall movement across any section in the segment is given by Q_F, the freshwater flow requires that this integration constant be given by Q_F. The result is identical to Equation 3.

Thus, by use of material balances with salt and water across either an arbitrary cross-section or volume segment of the estuary, we have succeeded in establishing an overall quantitative relation between freshwater flow, estuary dilution flow and observed salt concentration. This relationship is given by Equation (4), in which Q_U, the upper layer flow, is the estuary dilution flow.

Equation (4) suggests that the estuary dilution flow can be calculated, provided one knows the location of the interface between the upper and lower layer and has accurate vertical salt profiles. QL&M has shown that, for for the Hudson, vertical salt profiles tend to follow an "S" shaped distribution with the inflection point near the half depth.[11]

This inflection point can be used to estimate the location of the upper layer - lower layer interface as follows. The equation of continuity in two dimensions is written:

$$\frac{\partial U}{\partial X} + \frac{\partial V}{\partial Y} = 0 \qquad ...(9)$$

in which:

U = horizontal water velocity at the point X,Y

V = vertical water velocity at the point X,Y

In the two layer system, the vertical distribution of horizontal velocity moves through zero at the upper layer-lower layer interface. Thus, since the interface is roughly horizontal, at the interface , $\partial U/\partial X = 0$. From Equation 9 the vertical velocity is seen to be a maximum at the interface.

The rate of vertical salt transport by vertical turbulence is proportional to the vertical velocity, and should be a maximum at the interface. This vertical salt flux can also be shown to be essentially proportional to the vertical salinity gradient, so that the point at which this gradient is a maximum can be used to estimate the location in the interface. In an "S"-shaped vertical salt profile, such as those observed on the Hudson, the vertical salinity gradient is a maximum at the inflection point.

This is just one means of estimating the location of the interface in using Equation (4) to estimate estuary dilution flow. Knowledge of the velocity distribution is another. In any event, the whole thrust of the work referred to in Reference 11, is directed at a valid estimate of the dilution flow, in which the role vertical salinity gradients play in this estimating process is discussed in detail. It should be noted that this reference is Reference 4, page III-61, to Chapter III in the AEC Draft Detailed Statement.

The use of Equation 4 and vertical salinity profiles to estimat density flow is recognized by the Staff in Chapter III, pages III-22 to III-27. In this regard, the Staff concludes on III-27:

> *The presence of a net nontidal seaward flow in the salt-intrusion zone of the Hudson is clearly established by means of (1) observed vertical salinity gradients, (2) direct velocity measurements, (3) high computed values for the longitudinal dispersion coefficient. Of these three means of detection, it is thought that only method 1 may be reliably used to obtain a reasonably accurate direct determination.*

The foregoing shows clearly that a model of estuary dilution flow can be developed by application of the Equation of Continuity (Law of Conservation of Mass) to the estuary. To do this, recognition is given to the fact that a vertical density difference exists in any section in the estuary.

No such similar analysis appears to exist which will generate the formulation used by the Staff to estimate estuary dilution flow (Equation (1) above, or Equation (2), page A-4 in the Draft Detailed Statement).

To show this, refer to Figure 1. Since the ultimate formulation (Equation (1)) contains only $\bar{S}$, the area-averaged salt concentration and S_0, the ocean salt concentration, we presume that mixing across the section is assumed for whatever derivation technique one can conceive of. Actually, no such assumption has to be made; the major point is that since the final expression contains only $\overline{S}$ to represent section salinity behavior, the deriver must use this, and only this value in developing his model.

Due to the observed dilution of Q_F, a seaward flow is assumed to exist and to be larger than Q_F. Use the notation Q_u to define the total seaward flow. Define a landward flow Q_L. Q_L is the makeup flow necessary to permit the existence of Q_u and still maintain a net water flux of Q_F.

Application of a material balance on water across the section X shows that Equation (3) still holds; i.e., that:

$$Q_U = Q_L + Q_F$$

Write a salt balance across section X. Since no attempt is made to define vertical variation of salinity and the investigator is apparently working only with $\overline{S}$, the area-averaged salt concentration, this balance yields:

$$Q_U\overline{S} - Q_L\overline{S} = \text{net section salt flux}$$

The net section salt flux must be zero at steady-state. However, substitution of the preceeding equation for Q_U yields:

$$Q_F\overline{S} = \text{net section salt flux}$$

This is clearly a contradiction and arises because the investigator has not distinguished between the concentrations of salt being carried landward by Q_L and seaward by Q_u. The presumption of landward and seaward flows is clearly necessary if one is to explain dilution of Q_L. This fact is acknowledged by many investigators. Care must be taken, however, to recognize that the actual points within the estuary section at which such flows are crossing, must see flow going in one direction or the other. No one point can see two way flow at the same time. Since this must be the case, one must also realize that the concentrations of salt seen by each flow may (and in fact, must) be different. Therefore, application of $\bar{S}_v$ to all flows is incorrect.

Proliferation of this error over the years seems to be associated with the assumption of the sectionally homogemeous estuary. Ketchum, for example, ignored vertical variation, assuming complete and immediate mixing with each of his segments. In using salinity, therefore, to "verify" his model, only section average salinities were used.

In discussing Todd and Lau's paper, Pritchard[4] states:

> *The authors have stated certain limitations on their development. A fundemental requirement is that the estuary be sectionally homogeneous, that is, it shall have no vertical or lateral salinity gradients. This is an unfortunate restriction to place on estuarine studies, since the majority of estuaries do exhibit some degree of vertical or lateral stratification, with accompanying circulation patterns related to the mass distribution.*

The characteristic circulation patterns in the various types of coastal plain estuaries have been discussed by Stommel (1953) and by Pritchard (1952, 1955). However, an adequate study of even this most simple of estuarine types would be welcome so that one should not be unduly critical of this aspect.

Pritchard's point in the discussion, as described previously, is that if the assumption of vertical homogeneity is going to be made, presumably for the purposes of simplifying a complex system, then it should be done with great care, recognizing that the existence of vertical salinity variation is part and parcel of what makes the estuary "go".

Witness, for example, his comment in Reference 5, as he introduces the one-dimensional analysis of an estuary:

The Case of One Spatial Dimension. Because of the complexity of the general three-dimensional equations, and even of the more restricted two-dimensional equations given above, many investigators have attempted to reduce kinematic and dynamic problems in estuaries to a single spatial dimension. It is in these treatments that the most frequent misuse of continuity concepts has occurred.

That the assumption of vertical homogeneity is an idealization is again suggested by Pritchard[12] in a discussion of estuary classification:

It is, in fact, quite possible that the vertically homogeneous estuary does not exist. Our observational methods may not be sufficiently sophisticated to show the slight degree of vertical stratification which might, on the average, exist in such systems. Only a small vertical stratification would be required to remove some of the anomalous factors mentioned above which are associated with this class of estuary.

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12 Contribution No. 64 of Chesapeake Bay Institute and the Department of Oceanography, The John Hopkins University, Reproduced by permission from The Sea, vol. 2, Interscience Publishers, 1963.

Bowden suggests that density-induced circulation must exist, even in cases where vertical mixing is intense and the tendency would be simply to assume vertical homogeneity.[13] A pertinent except from this reference follows:

> *Where the tidal currents are most effective, there is an increase in the intensity of vertical turbulent mixing, which is an exchange process, mixing the fresher water downwards as well as the salter water upwards. In this type of estuary, with moderate mixing, a state of dynamic equilibrium is set up, with a two-layer flow and the salinity along a given vertical increasing with depth. The volume of water involved in the density current flow may be many times the river discharge, e.g., the seaward flow in the upper layer may be 40 times the river flow while the upstream flow below it is 39 times the river flow. With very strong tidal currents, the vertical mixing predominates and a third type of estuary has been described, which is so intensely mixed that there is no vertical variation in salinity and the density current flow is no longer present. It would seem, however, that a tendency to differential flow must persist, even under these extreme conditions, since the primary driving force, the longitudinal density gradient, is still present.*

Comparison of Equations (1) and (4) show that estuary dilution flow calculated by each, will be the same when:

$$\frac{\bar{S}}{S_0} = \frac{\bar{S}_U}{\bar{S}_L}$$

These ratios will approach each other close to the true mouth of the estuary, as all values approach the ocean salt concentration. However, the validity of either equation is questionable at this point. Ketchum recognizes this in

13 Bowden, K.F. "The Mixing Process in a Tidal Estuary." presented at the International Conference on Water Pollution Research, Paper No. 33, of Section 3. September 3-7, 1962. Pergamon Press.

Reference 2 above, and the two-layer model presented previously is an idealization of actual estuary circulation. The simple idealization given tends to be inaccurate as one approaches the estuary mouth.

The foregoing literature review and analysis demonstrate clearly that the staff method of estimating estuary dilution flow, for use in its evaluation of entrainment, is highly questionable, if not categorically in error. We submit that a far more accurate estimate of estuary dilution flow in the Hudson River is that given in Reference 11 (Reference 4, Chapter III, draft detailed Statement.

As noted previously, the staff does recognize the existence of density flow in the Hudson in its Chapter III, Section E-1d entitled "The Hudson River Estuary and its Cooling Capacity." The salt budget equation, identical to Equation 4 above, is presented (Equation 1, page III-22) and the Staff goes on to state:

> *The mixing flow calculated in Equation (1) is the upper layer flow in the downstream direction. This should not be confused with what is called dilution flow in Appendix II-1 and Appendix V-2. (This dilution flow is defined by Equation (1) in Appendix II-1). These two appendices deal with the ecological effects of the Hudson River which are better described by the dilution flow concept mentioned above.*

However, no indication is given at this point or in either Appendix as to why "ecological effects.......are better described" by the Staff concept of dilution flow, as given by Equation 1, page 8 of these comments.

2. COMMENTS ON THE STAFF'S CALCULATION OF ENTRAINMENT LOSS

On pages A-62 through A-64, the Staff presents a model of entrainment loss. On pages A-68 and A-69, this model is used to calculate the percentage of larval striped bass entrained by Units 1 and 2 at Indian Point.

This model presents a very conservative view of entrainment in the river. A number of factors are ignored, the consideration of each one of which will result in reduced estimate of the percentage entrained. These considerations include:

1. The role of density induced circulation.

2. The role of vertical diurnal movement of the organisms.

3. Susceptibility to entrainment

These comments are directed toward showing how the factors of density flow and vertical diurnal movement can be introduced to the Staff's model, and how the notions of planktonic movement and uniform distribution make the entrainment models employed by the staff quite conservative.

The Staff's model is based on the concept of the probability of capture of an organism as it passes Indian Point in the flow. The probability of capture per pass is given as Q_C/Q_T, the ratio of the station cooling water flow to the average tidal flow. The oscillating motion of the tide is recognized so the number of passes, or possible times capture can occur, is greater than once. The number of passes is shown to be given by Q_T/Q_D, the ratio of the average tidal flow to the estuary dilution flow.

Very simply, but approximately stated, the total probability of capture is given by the product of the probability of capture on a single pass times the total number of passes, or

$$P_T = \frac{Q_C}{Q_T} \times \frac{Q_T}{Q_D} = \frac{Q_C}{Q_D} \qquad \text{......(10)}$$

Equation 10 is only close to being accurate when the probability of capture on a single pass is low. Otherwise, recognition must be given to the fact that after each pass, a certain number of organisms has been removed from the system, reducing the number of the original batch, and therefore the number available for capture on the next pass.

The Staff model recognizes this and presents a careful treatment of the probability notion. The probability of withdrawal per pass is shown to be very small and the Staff concludes that an appropriate expression, given by their Equation 12, is:

$$P_T \simeq \frac{Q_C}{Q_D} \left(1-\nu\right)\left[1-1/2 \; (1-\nu) \; \frac{Q_C}{Q_D}\right] \qquad \text{...(11)}$$

in which: $\bar{\nu}$ = the fraction of particles which have passed the condenser and are re-exposed due to recirculation.

The cooling water recirculation ratio, ν, is obtained using model and prototype data as a tracer and is estimated to be on the order of 14%. Q_C/Q_D is also relatively small, and for ease of explanation in this section, we will use the simple Q_C/Q_D as the staff's estimator of entrainment, recognizing that in the actual case, their actual model will give somewhat lower value since the recirculation and higher order probability terms are not dropped.

Note the Staff's statement after presentation of Equation 12.

> *Equation 12 shows that the total probability of being withdrawn is proportional mainly to the ratio of cooling water flow to the river freshwater flow. It is almost independent of the tidal characteristics, although these characteristics are important in that they provide the mixing and dilution which must be met in order for this model to be accurate.*

We disagree with the last sentence of this statement. When higher order terms are neglected, the model the Staff presents can be obtained just as readily by assuming a plug flow non-tidal river moving at the rate Q_E. From this standpoint is virtually "independent of the tidal characteristics." It is true that the tidal characteristics are important and important from the viewpoint of mixing and dilution, but this mixing and dilution is not recognized by the Staff. No attempt has been made to include estuary flushing or exchange characteristics, the real means by which an estuary mixes and dilutes, other than the previously demonstrated erroneous estimate of estuary dilution flow.

Consider first the role of diurnal migration of the organisms. The Staff addresses itself to this on page A-69, saying:

> *These values are based on area-average susceptibility. However, it is known that the larval striped bass make vertical diurnal migrations in the water column and are most concentrated from mid-depth to the surface at night but from mid-depth to the bottom during the day. These distributional patterns are important since the cooling water is taken from mid-depth to the surface. Thus, there would a significant difference in the day vs. nighttime susceptibility of the larvae, i.e., lower during the day and higher at night. Since the length of day and night are not equal at this time of year, these organisms may be slightly less susceptible to entrainment than predicted using this technique, provided that the deeper water is moving seaward.*

We object to the use of the word "slightly" in the last sentence of the above statement, as well as to the statement that the organisms "are most concentrated from mid-depth to the surface at night."

A more accurate description would be to say that the organisms are known to move up from the bottom during the night, and tend to spread out into a relatively uniform distribution throughout the water column during the night, as opposed to being concentrated in the bottom during the day.

An estimate of the reduced impact of entrainment, due to recognizition of this diurnal movement, can be obtained by computing the average probability of capture throughout the day. During the period of the year when this activity occurs, (± 3 weeks about June 21), daylight hours represent roughly two-thirds of the day and darkness roughly one-third of the day.

Assume that the upper layer larval concentration is zero during the daylight hours, and at night that the concentration of larval organisms is uniform throughout the water column. Actually, there will probably be some organisms in the upper layer during the day but this should be offset by only a tendency to approach uniformity from the bottom up. The longer daylight period will allow a greater period of time over which the organisms are "programmed" to seek the deeper layers. This suggests that the description of concentration below mid-depth during daylight hours is the more stable condition, and that the diurnal upward movement, since it has less time in which to equilibrate, is stable for a shorter percentage of its total period

Since the cooling water "is taken from mid-depth to the surface," the probability of withdrawal of organisms during the day is zero, and at night is Q_C/Q_T, as before. Thus, the average probability of capture per pass is 1/3 (Q_C/Q_T).

The total number of passes is still given approximately by Q_T/Q_D, so that the fraction entrained is now given by $1/3(Q_C/Q_D)$, or one-third the original estimate, hardly worthy of the statement "slightly less susceptible to entrainment."

The Staff suggests, however, that this technique is only valid "provided that the deeper water is moving seaward."

In the next paragraph on page A-69, the Staff goes on to say:

However, if the density flow is well developed, then these diurnal migrations will cause them to occupy an inland-moving zone during the day and a seaward moving zone at night. Since their occupancy within the water mass moving inland would be of longer duration than within the watbr mass moving seaward on the surface, the length of time which they are susceptible to entrainment may be much longer than predicted in the above calculations. This is an important consideration in that the probability that they will be withdrawn is related to the number of exposures. A single week of exposure would increase the likelihood of withdrawal to about 34% and 10 days would result in about 45% of the larvae being entrained (assuming random distribution in the water column). These time periods do not seem unrealistic based on the behavior of larval striped bass and the high probability for the occurrence of density flows at Indian Point. As a consequence, the staff believes that the 25% estimate derived by the above calculations is probably somewhat low. However, the increased residence time within the volume of water which passes back and forth in front of Indian Point may be partly offset by a reduction in the average probability of withdrawal per pass, which results from the non-random distribution within the water column. Consequently, the staff believes that the total average probability of withdrawal of larval striped bass migrating downstream past the Station is approximated by the 25% figure, and that this fraction is the best estimate that can be made using avaialble information.

We disagree with the Staff's analysis of the influence of the density flow on entrainment. As presented previously in the two layer flow model, the upper layer flow, Q_U, exceeds the lower layer flow, Q_L, by an amount equal to the freshwater runoff. In Reference (11), QL&M shows that the upper layer flow corresponding to freshwater runoff of 7500 cfs (used by the Staff in their analysis on page A-68) is 35,000 cfs. The corresponding lower layer flow is 28,000 cfs.

More careful analysis of this shows that if the daylight-darkness factor is taken into account, there will be a substantial net transfer in the landward direction rather than seaward. This suggests that if the organisms were subject to the density flows in the manner in which the Staff suggests they are, then the net movement of all organisms will be upstream, and for some (that portion which remains in the lower layer during the night-time hours) this will be the only movement.

Note that, in the model used by the Staff, entrainment only occurs during actual passage past the plant. The influence of density flows as suggested by the Staff would therefore expose only organisms whose origin is below the plant to potential capture by the plant. What we are saying here is that the staff is using a Lagrangian form of reference; i.e., is following the motion of a typical sample of organisms as they move back and forth in the general vicinity of the plant. Simultaneous superposition of the density flow and organism diurnal movement on the Staff's probability model results in a net upstream motion of the organism. Therefore, only those whose origin is below the plant will have an opportunity for capture.*

Simplify the analysis by recognizing that the net effect of the tide is to yield a total probability of capture equal to approximately Q_C/Q_D, when density flow and diurnal movements are not present. By analogy, for a two layer density flow tidal system, in which, for the moment, vertical diurnal movement is neglected, the fraction of entrained organisms is given by Q_C/Q_U, the ratio of the plant flow to the upper layer flow. Recognize also that in this case this capture applies only to those organisms appearing in the upper layer.

* When tidal motion is included, this statement should be modified to include those organisms whose origin is with a tidal excursion above the plant.

Now introduce diurnal movement and recognize that, just as in the tidal analysis, the alternating seaward-landward movement will expose some of the organisms to more than one pass by the plant. Those that will be exposed will be those whose origin is below the plant, and which move up into the upper layer after they have moved landward in the lower layer, past the plant, and then prior to the end of darkness, will move back in the seaward direction past the plant.

The probability of capture per pass, recognizing that roughly half of the organisms reach the upper layer during the darkness hours, will be given by $Q_p/2Q_U$. The number of passes is equal to the number of times the organisms introduced into the seaward directed upper layer pass the plant between the time the particle of water in the lower landward directed layer first reaches the plant from below to the time it finally reaches a point above the plant, at which point the seaward return remains above the plant. This is given as follows:

$$\text{Number of passes past the plant in the upper layer} = \frac{Q_u \cdot T}{Q_L \cdot 2T - Q_u \cdot T}$$

$$= \frac{Q_u}{2Q_L - Q_u}$$

T is the period of darkness and 2T the daylight period. The denominator $[Q_L \cdot 2T - Q_u \cdot T]$ is simply the net upstream movement that takes place each 24 hour day.

To derive the numerator, consider a particle in the lower layer, just $Q_L \cdot 2T$ distance seaward of the plant, at the onset of daylight. On a net, or daily cyclic basis, it must move upstream this distance, less one net translation $(Q_L \cdot 2T - Q_u \cdot T)$ before it can be said to have reached a point such that its organisms, during their sojourn in the return flow, will still be above the plant, and therefore no longer susceptible to entrainment. This net distance is equal to $\{[Q_L \cdot 2T] - [Q_L \cdot 2T - Q_u \cdot T]\}$ or $Q_u \cdot T$, the numerator of the above expression. The ratio of this net upstream movement required to push the particle out of the entrainment zone to the net translation each day, yields the number of passes to which the organisms in the particle are subject.

Following the Staff's probability notation, the formula for entrainment for this case is given:

$$P_T = 1 - (1 - P_e)^n$$

in which: P_T = total fraction entrained

P_e = entrainment per pass, $= \frac{Q_c}{2Q_u}(1 - \nu)$

n = number of passes, $= \frac{Q_u}{2Q_L - Q_u}$

For the case of density flow corresponding to a runoff of 7500 cfs, we have:

Q_c = 2,500 cfs

Q_u = 35,500 cfs

Q_L = 28,000 cfs

ν = 0.14 (page A-64)

P_e = 0.03

P_T = 0.05 or 5% entrainment loss

Summarizing, we believe that three cases may be viewed as possible:

Condition	Percentage Loss by Entrainment
1. Density flow only	3%
2. Diurnal movement only	8%
3. Density flow with diurnal movement	5%

These estimates have been computed employing the Staff model for entrainment loss, modified for either density flow, diurnal movement or both. They show clearly that the Staff opinion that these two mechanisms offset each other is in error, and that the Staff estimate of 25% entrainment loss is not "the best estimate that can be made using available information."

Actually, we believe that all of these models yield conservative estimates of the actual effect. As shown above, the model in which diurnal movement and density flow is introduced, applies essentially to larval organisms originating seaward of the plant. Using the Staff's notion of the interaction between these two mechanisms, it is seen that all organisms originating above a point between $Q_u \cdot T$ and a tidal excursion above the plant, will not be exposed to entrainment during the planktonic stage.

The foregoing has been presented primarily to indicate that relatively simple models, of the type presented by the Staff in the draft detailed statement, must be interpreted extremely carefully. These models are clearly very conservative and note of this fact should be made. Statements such as:

> *"In conclusion, based on these considerations, about 25% of the larval striped bass may be entrained as they migrate downstream past the Indian Point site." (Reference A-69, Draft Detailed Statement)*

are misleading, when care is not taken to demonstrate, in a similar quantitative fashion, how known river and biological behavior can alter these conclusions.

In its discussion of probable biological effects in Chapter V, "Environmental Impact of Indian Point Unit #2 Operation with Unit #1 Operation", the Staff, on pages V-52 through V-55, discusses the probable impact of its conclusion that 25% of the larval striped bass may be entrained by the plant.

The statement is made that:

> *"The eggs and larvae drift with the currents in a net downstream direction; large numbers pass the plant."*

The Staff then states that data show that 75 to 90% of the young juveniles are below Indian Point by late July and August and then go on to state:

> *"If we assume: (1) that all these fish migrated past the plant during the life stage which is susceptible to to entrainment; (2) that density independent factors are responsible for mortality in the population; and (3) that entrainment mortality is 100%, then the operation of Indian Point Units #1 & will effectively reduce recruitment resulting from reproduction by about 19% to 22%,"*

We take strong exception to the thrust of these statements. First of all, it is not at all clear just how the eggs and larvae drift with the currents and for how long. The analysis above shows that if purely planktonic behavior, other than diurnal vertical movement is assumed, then only a small portion of the estuaries larval population is even susceptibel to entrainment (those below or just above the plant).

None of the immature stages are purely planktonic. Even the eggs have a density different than water and tend to settle in the absence of any current. Furthermore, the eggs only exist on the order of two days, before hatching; only those eggs spawned in close proximity to the plant could be susceptible to entrainment by the plant as eggs.

The larvae are sometimes described as planktonic, but by as early as the sixth or seventh day of their existence, are reported to absorb the yolk sac and begin diurnal movement. From this time forward their swimming ability increases, suggesting that the description of drifting with the current is not accurate. Furthermore, the presumption that susceptibility to entrainment is controlled by flow ratio is also highly questionable, since the swimmers may very well avoid the intake.

Studies do show that by September, most of the young striped bass have reached Haverstraw Bay. To assume that this means they are susceptible to entrainment as they pass Indian Point in the manner assumed in the draft detailed statement is misleading. It is true that their passage through the river section bordered on the east by Indian Point probably occurs when they are less than 3 inches long, and in many cases less than 2 inches long, and that fish of 2-inch size or less may be entrained. This does not mean, however, that the entire population passing is planktonic, is subject to tidal and other current drift, is distributed uniformly across the cross-section and, therefore, is subject to 25% entrainment.

These young striped bass are known to seek the bottom as well as shallows and shoal areas, none of which describes the source of the major volume of water passing the Indian Point intake.

In conclusion, we state that the assumptions of uniform distribution across the section, and of downstream drift and planktonic behavior of all entrainable forms are not supportable by the known behavior of the immature fish at many stages of their development. Therefore, the percentage entrainment should be substantially less than the values given above in the modified entrainment model (3 to 8%) and in no way even close to the 25% estimate given by the AEC.

Appendix F

RADIOLOGICAL DISCHARGES

Although Con Edsion concurs with the general conclusions with respect to the radiological discharges and the resulting anticipated doses to man and to biota, there is, however, disagreement with several of the assumptions utilized in arriving at these conclusions. Those areas where major differences exist are discussed below:

I. No credit was given for the blowdown intertie system and the filtration systems which Con Edison has committed to installing prior to the completion of the first refueling outage. Since the release estimates stated should reflect equilibrium operation averaged over the life of the plant, credit should be given for these systems in estimating releases because they will be in-service over the remaining years of the plant life and because the releases prior to their installation should be less than the average because of the time required for (crud) activity to build up and for performance degradation and leakage to occur.

A brief functional description of these new systems follows:

(1) Blowdown Intertie System

The intertie between the Indian Point Unit No. 2 steam generator blowdown lines and the new Indian Point Unit No. 1 secondary purification system is shown in Figure 2.3-14 of the Indian Point Unit No. 2 Environmental Report.

In the event that the leakage from the primary to secondary side of the Indian Point Unit No. 2 steam generators is radioactive, the secondary blowdown which normally would have gone to the steam generator blwodown tank is diverted to the Indian Point Unit No. 1 blowdown flash tank to be treated prior to being discharged to the river. Only 1/3 of the liquid in the flash tank would flash to steam in the absence of any cooling. From the blowdown flash tank, the flashed steam is sent to the Indian Point Unit No. 1 main condenser flash tank and becomes Indian Point Unit No. 1 feedwater. The reduction in the amount of steam vented plus the very high partition factor for iodine in the condenser would essentially eliminate this source of activity whenever the Unit No. 1 condenser is in operation. Any releases would be through the Indian Point Unit No. 1 condenser air ejector which exhausts to the Indian Point Unit No. 1 stack. When the Unit No. 1 condenser is not operating, gases from the flash tank divert to an already-existing vent and go directly to atmosphere via a vent on the roof.

The blowdown flash tank condensate is cooled by river water in a heat exchanger, processed through a filter and demineralizer, and then discharged to the river. In addition, in the event of high activity in the demineralizer effluent, this effluent can be rerouted to the waste collection tanks for recirculation through the filter and demineralizer or for processing through the existing liquid waste disposal system. There are two 66,000 lb/hr in-line booster pumps to overcome the head required to complete the flow path through the filters, demineralizers and overboard piping; two identical 132,000 lb/hr CUNO cartridge-type CG-S filters with pressure differential gauges which will be read periodically to assure changing of cartridges when required and two identical 66,000 lb/hr Illinois Water Treatment 36" x 60" 150 psig ASME code demineralizers, each with 21 cubic feet of IWT NR-6 non-regenerable nuclear grade mixed-bed resin.

Available operating experience to date indicates a minimum decontamination factor of 10 for the demineralizers. (Page III-4, Top).

(2) Filtration System

A simplified diagram of Indian Point Unit No. 2 Air Exhaust Filtration Systems is shown in Figure 1. There are five filtration systems, each of which consists of three filters - roughing, HEPA and charcoal.

The roughing filters remove the large particles from the air stream to preserve the operating life of the HEPA filters. Their construction is fire resistant with the mdeia composed of a glass fiber mat reinforced with stainless steel wire cloth.

The high efficiency particulate air (HEPA) filters are designed and tested for greater than 99% removal efficiency for 0.3 microns or larger particles. The filter media is made of glass fiber with asbestos. Filter frames are made of stainless steel, and asbestos separators resistant to mositure and high temperature are used. The charcoal filters are fabricated with stainless steel frames filled with activated charcoal.

Experiments have demonstrated that the iodine removal efficiencies of at least 99% can be expected. Each charcoal filter plenum is provided with a water dousing system which is designed to drench the absorbers in the extremely unlikely event of a charcoal filter fire.

The HEPA and charcoal filters will be tested in place after installations to insure overall filter design capability is achieved.

There are two Containment Building (CB) purge and/or Primary Auxiliary Building (PAB) exhaust fans in the fan room. Each fan can provide a flow rate of 55,000 cfm. During normal operation (i.e., no CB purging), one fan is operating for PAB exhaust and the other is on standby.

The air streams from the CB purge and the CB pressure relief each pass through their own set of roughing, HEPA and charcoal filters. The other three streams, the PAB exhaust, the Boric Acid Evaporator Building exhaust and the vents from the waste holdup tank pit and the blowdown tank area also each have their own set of roughing, HEPA and charcoal filters. In the case of these three streams, there is a bypass line around the charcoal filter. For these three streams, the roughing and HEPA filter will always be used, but the charcoal may be bypassed if there is no significant iodine in those streams. (Page III-40; Top).

II. Credit should have been given for the Indian Point Unit No. 1 evaporator in estimating the releases from that unit. The evaporator has been operating since March 1, 1972 at about half of its rated 12 gpm capacity with an overall decontamination factor of approximately 100 and an operating factor of about 40 to 50 percent. The capacity of this system is more than sufficient to process all liquids currently going to the liquid waste system at Indian Point Unit No. 1. (Page III-45)

III. Based upon the modifications being made to the Indian Point Unit No. 2 waste disposal system including the addition of a polishing demineralizer, the applicant believes that 10^4 is a conservative estimate of the overall inlet to outlet decontamination factor for all isotipes including radioactivity but excluding tritium.

A brief description of the modifications presently being made to the liquid waste disposal system is presented below:

The main modification to the Indian Point Unit No. 2 liquid waste disposal system is the addition of a distillate cooler, a demineralizer and a filter. The addition of these items will result in a reduction in the activity released from the plant.

The distillate is pumped from the waste evaporator distillate tank, cooled by component cooling water in the heat exchanger (distillate cooler) before being processed through the demineralizer and the filter, and then collected in the waste condensate tanks.

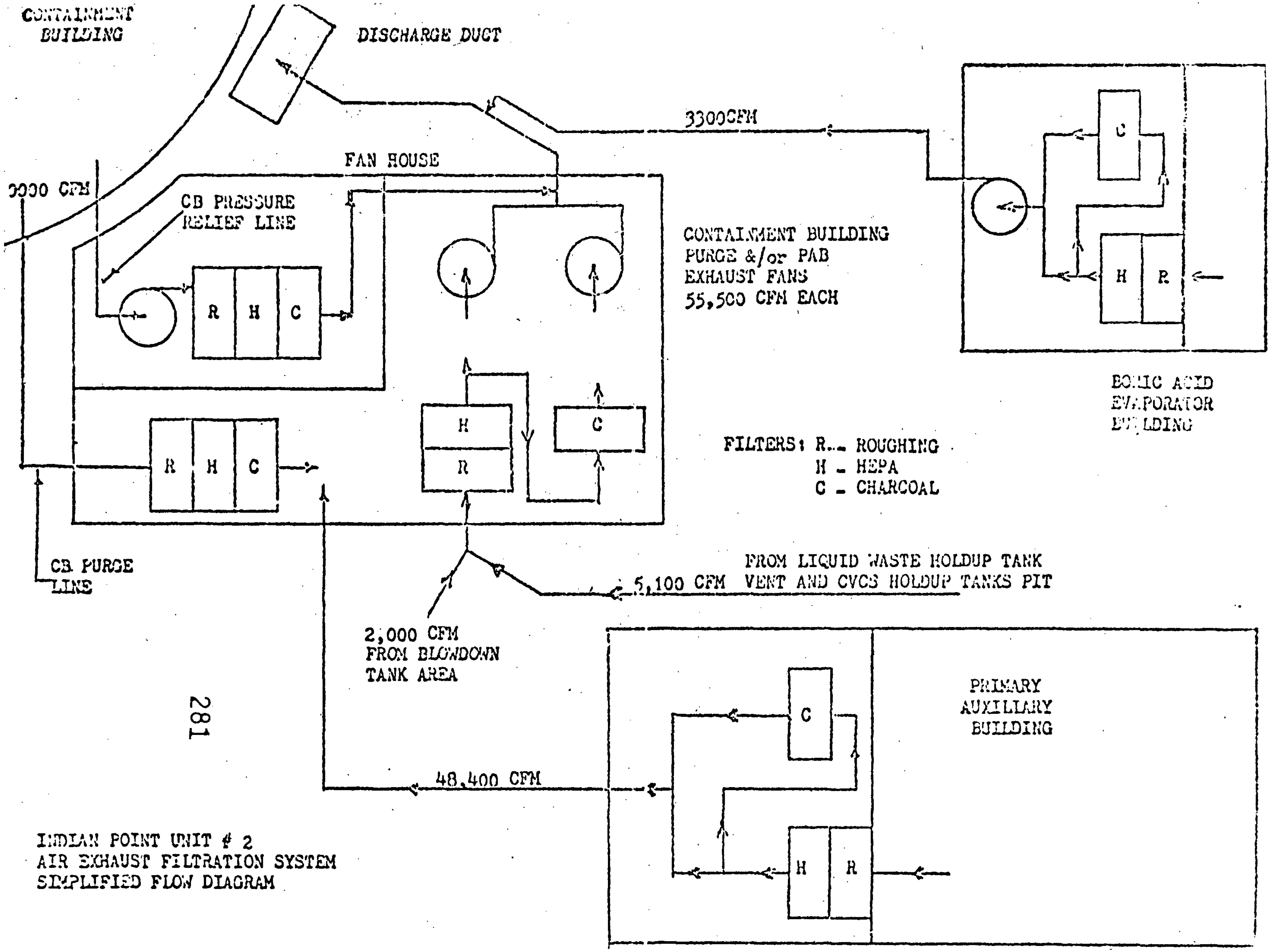
The demineralizer contains 2.5 cubic feet of IRN 150 ROHM-HAAS non-regenerable mixed bed resin.

The filter is CUNO Model No. 51044, and is expected to remove particulate and demineralizer carry-over down to approximately 5.0 micron particles. A pressure gauge at the inlet of the filter will indicate plugging of the filter.

In addition, Ginna-type modifications have been made to the evaporator internals.

Available operating experience demonstrates that a decontamination factor (ratio of inlet to outlet concentration) of ten is the lowest limit to be expected (due solely to the demineralizer) in this kind of a system.

Both the modification of the waste evaporator and the addition of the demineralizer and the filter to the liquid waste disposal system have been completed except for some testing, and both are scheduled for availability by initial criticality. (Page III-42, Bottom; Page III-42, Top; Page A-45, b).



INDIAN POINT UNIT # 2
AIR EXHAUST FILTRATION SYSTEM
SIMPLIFIED FLOW DIAGRAM

APPENDIX G

Scope of Work for Ecological Studies at Indian Point

INDIAN POINT FIVE YEAR ECOLOGICAL STUDY

PROJECT SCOPE

The proposed five year ecological study will begin at full intensity on April 1, 1972.

Thescope of work is proposed to accomplish the following major objectives:

(1) Evaluate the biological significance of impinging fishes at our intakes.

(2) Evaluate the biological significance of passing non-screenable organisms through the plants.

(3) Evaluate the biological changes in the Hudson River ecosystem due to thermal and chemical discharge.

Objective 1 - will be accomplished by estimating population density, natural mortality, age distribution of the population, food habits, movements and migration routes, growth rates, exploitation rate on the screens, etc. These estimates will be made by mark-recapture procedures, aging of the population, etc. from the Haverstraw Bay area to the Beacon Bridge by collecting fish with trawls, seines, fish traps, gill nets, etc.

Objective 2 - will be accomplished by determining the mortality rate of all nonscreenable organisms passing through the plants and predicting the biological significance of such a mortality rate on the Hudson River fishery.

Objective 3 - will be accomplished by a biological survey of all acquatic organisms, physical and chemical measurements at the Indian Point area compared with control regions and determining species diversity and biomass per area in each region.

These studies were recommended to Con Edison by the Lower Hudson River Policy Committee which is composed of members from agencies with regulatory responsibilities for the natural resources of the Hudson River. The studies will yield pertinent data necessary to evaluate the continuing environmental impact of Units No. 1, 2, and 3.

Radiological Investigation of the Aquatic Habitat of Hudson River

Project Scope: To determine radiological effects of Indian Point operation on the ecosystem. This is a continuing study, which originally commenced July 1969, which traces the fate of radionuclides released from the plant through the aquatic environment. This study, which commenced in July 1971 and continues through April 1973, consists of the following major study areas:

1. Routine sampling and analysis of water and sediment, rooted vascular plants and fish for radionuclides.
2. Provide an inventory of major long lived gamma emitting radionuclides.
3. Study the effect of salinity variation on the removal of radionuclides for the sediment.
4. Study of radionuclide content of phytoplankton and zooplankton.

More specifically, the radionuclide studies (1 above) conducted over the past two years have provided important information concerning the fate of radionuclides released to the Hudson River from the operation of the Indian Point facility. This current program will provide a continuing record of radionuclide levels which can be compared with past sampling results and will serve to provide baseline data for evaluating releases from Units 2 and 3 as they go into operation. The remaining three portions of the study are considered exploratory as opposed to monitoring. These three studies are expected to provide answers to the following questions:

1. What is the total inventory of radionuclides in the sediments of the lower Hudson River estuary? What fraction of Indian Point liquid radionuclide discharges deposit in the sediments, and in which location does most of this deposition occur?
2. What is the variation in radionuclide inventory of the bottom sediments along a longitudinal section of the river? Can quantitative differences in sediment radioactivity at points along this longitudinal section be correlated with difference in salinity?
3. To what extent do the phytoplankton and zooplankton of the estuary accumulate radionuclides of natural and artificial origin? How do such accumulated levels in the plankton relate to radionuclide concentrations in higher links in the food chain, and especially in fish which may be consumed by man?

This program has provided considerable information on the fate of radionuclides released to the Hudson River from the operation of the Indian Point facility. In particular, the studies have given perspectives to the relatively small quantities of these operational releases compared to radionuclides from weapons testing fallout and natural sources. A continuation of this program is necessary for two reasons. Foremost, the monitoring phase of this program is necessary to determine compliance with the Atomic Energy Commission radionuclide release limits as put forth in 10 CFR Part 20. Second, far more information is necessary of the pathway of radionuclides to man and the ultimate potential exposure to man from releases at Indian Point.

The information from this program is considered to be essential in preparing for AEC hearings upcoming of Unit 3 and conversion of the provisional Unit 1 license to a permanent license.

The importance of the information to date has already been shown in Unit 2 hearings where, based on information from these studies, the intervenors did not raise the question of radiological releases. It is essential, therefore, that this program be continued.

Fathometer Studies at Indian Point

Project Scope: The proposed study is a continuation of a survey of the density and distribution of fish in the vicinity of Indian Point. The specific objectives of the study are:

1. Describe and quantify the distribution of fish in relation to the termal discharge and intake screens.
2. To compare the density of fish in the vicinity of the plant with the quantity of fish removed from the intake.
3. To attempt to monitor the density of fish in the vicinity of the intakes during specific fish tests.

The echosounder will also be used by Texas Instruments in their five year ecological study so that fish density can be monitored during the sampling of fish with trawls.

Objectives 1 and 2 will be accomplished by surveying a set pattern of transects which include the entire plant site. The fish recorded on the echosounder tape are counted by areas and then a fish density figure is computed based on the area covered by the echosounder. A density of fish by volume will be computed and compared with the number of fish per volume removed to the intake screens.

Objective 3 will be accomplished by mounting the transducer of the echo-sounder to beam across an intake structure and to record fish approaching the intake.

Part 1 - Analysis of Fish Mortality Data at Indian Point

Project Scope: Data has been collected on fish impingement at Indian Point since April 1970 under the direction of the Office of Environmental Affairs. The number of fish caught on the screens has fluctuated over a wide range. The variables that could have affected the number of fish caught are various parameters of plant operation, such as flow, tempearature rise through the condensers, number of pumps and condensers in use, etc., and various environmental factors such as the influence of night versus day, the influence of tidal conditions, fresh water flow and associated salt water intrusion, temperature, etc. It is likely that some or several of these factors may have highly significant bearing on the fish impingement at Indian Point. The fish impingement data will be analyzed in accordance with standard statistical procedures using the facilities of a computer.

Part 2 - Fish Sampling at Indian Point Intakes

Project Scope:

1. Gather data on the seasonal occurrence, species composition, and size composition of the fish collected at the intakes.

2. Conduct tests of various fish protection devices and modes of operation.

3. Monitor fish at the intakes in order to document the rate of withdrawal.

4. Recover marked fish from the intake screens to establish a rate of exploitation by the intakes on selected fish populations.

Monitoring of fishes impinged at our intakes at Indian Point has been requested by the New York Department of Environmental Conservation. Also, to estimate the exploitation rate of fishes on our screens, the number of marked fishes (part of study A) collected on the screens has to be determined. The fish monitoring on the screens is also a pertinent part of the overall testing procedure, which is needed to determine the best intake design and mode of plant operation to reduce the impact of plant operations on fish populations.

Part 3 - Indian Point Flume Study

The proposed flume study at Indian Point is designed to investigate the behavior of white perch and other species in relation to water flows and fish protection devices.

Scope of Work:

1. Evaluate the behavior of white perch in relation to fixed and traveling screens.

2. Study the behavior of white perch at various velocities in order to predict behavior of fish at proposed common intake.

3. Evaluate the fish protection value of various devices proposed for Indian Point:

a) horizontal traveling screen

b) air bubbler

c) sound

Objective (1) will be accomplished by exposing test groups of white perch (and other species) to various screen arrangements and observing (and recording on video tape) their avoidance responses. Factors which may influence the behavior of fish such as water temperature, diurnal activity cycle, salinity and size of fish will be tested. The high percentage of white perch collected at the screens indicates that they may display some unique behavioral problems.

Objective (2) will be accomplished by exposing test fish to a series of approach velocities (velocity immediately in front of screens) to determine if the fish will avoid the screens at the proposed common intake structure.

Objective (3) will be accomplished by exposing test fish to various fish protection devices and recording their avoidance responses.

The study of the fish problem at Indian Point has revealed thus far that a reduction in approach velocity is an effective way of reducing the number of fish impinged on the intake screens. However, velocity reduction has not eliminated the problem and is only available as a method of fish protection during the winter months.

Laboratory tests of the swimming ability of white perch have indicated that the fish, in sizes caught in the intake screens, can swim at a speed in excess of the approach velocity now existing at Unit 1. This indicates that there is a behavioral problem since the fish does not exercise its ability to escape.

Attempts have been made to observe the behavior of fish in front of the screens with a diver and using underwater television. In both cases the turbidity of the water prevented visual observation of the fish. A test device (the flume) is designed to permit observation and recording of fish behavior.

APPENDIX H

Testimony of Gerald J. Lauer, Ph. D., New York University on "Effects of Chemical Discharges from Indian Point Units 1 and 2 on Biota and on River Chemistry," April 5, 1972.

Testimony of Gerald J. Lauer, Ph. D., New York University on "Effects of Elevated Temperature and Entrainment on Hudson River Biota," April 5, 1972.

Testimony of John P. Lawler, Ph. D., Quirk, Lawler, and Matusky Engineers on "The Effect of Indian Point Units 1 and 2 Cooling Water Discharge on Hudson River Temperature Distribution," April 5, 1972.

Testimony of John P. Lawler, Ph. D., Quirk, Lawler, and Matusky Engineers on "The Effect of Entrainment at Indian Point on the Population of the Hudson River Striped Bass," April 5, 1972.

All testimonies presented in the Licensing Hearings before the ASLB Board.

Applicant's Responses to the Comments from Federal, State and Local Agencies and Interested Persons and Groups made on June 9, June 27, July 5, July 6, July 27, and August 1, 1972 are in the Docket File (Docket No. 50-247) in the Public Document Rooms.