50-247

State of New York
ATOMIC ENERGY COUNCIL
Department of Commerce
112 State Street
Albany, N. Y. 12207

Regulatory File Cy.

October 29, 1970

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

Dear Mr. Price:

Members of the New York State Atomic Energy Council have reviewed the Environmental Report submitted by Consolidated Edison Company of New York, Inc. concerning Indian Point Station Unit No. 2. This review has identified no immediate area of environmental concern which would indicate that the Commission should not proceed with its plans relating to licensing this Unit.

The specific comments of the Council in regard to the environmental factors pertinent to the operation of this facility are enclosed. In addition, a list of background documents considered by the Council in its review is attached for your information.

A separate statement by the New York State Department of Environmental Conservation is also attached.

We in New York are pleased to participate in the Commission's licensing process in order to insure maximum protection of the public health and safety, as well as minimal impact upon the environment.

Cordially,

Neal L. Moylan

Neal L. Moylan
Chairman

Enc

cc: Members of the New York State Atomic Energy Council

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
INDIAN POINT STATION, UNIT NO. 2

Comments by the New York State Atomic Energy Council on the "Environmental Report, Indian Point Station, Unit No. 2" filed by the Consolidated Eidson Company of New York, Inc., U. S. AEC Docket No. 50-247.

The New York State Atomic Energy Council has reviewed the "Environmental Report" (the Report) filed with the U. S. Atomic Energy Commission by Consolidated Edison Company of New York, Inc. (Con Ed), and has had benefit of a meeting with regard to the Report on September 10, 1970 between representatives of Con Ed and staff representatives of Council members.

The Report filed by Con Ed is a brief and general discussion of several aspects of the potential impact of Indian Point Station Unit No. 2 on the environment rather than a single source of all available information on the environmental impact of Unit No. 2. For this reason, the information considered by the Council in its review of the Report has not been limited to that contained in the Report itself, but has also been based on the background and knowledge of New York State agencies concerning the Indian Point site, both for existing facilities and those under construction. This background includes a familiarity with the documentary materials relating to radiological safety considerations involved in the U. S. Atomic Energy Commission's licensing activities concerning the facilities at Indian Point over the past decade. Appendix A lists many of the pertinent background documents relating to the Indian Point site in light of which the Council has reviewed the Report. In addition, at the request of the Council's staff, Con Ed submitted supplemental information contained in a letter dated September 24, 1970 and a report entitled "Effect of Indian Point Facility on Water Quality of the Hudson River," copies of which are attached as Appendices B and C, respectively.

The State is familiar with the Indian Point site since it has been actively involved in environmental evaluations in relation to preoperational and operational activities of Indian Point Station Unit No. 1. A number of these studies have been underway for at least ten years. This type of first-hand evaluation has brought about a familiarity with the site which provides an effective base line for evaluating the expected environmental impact from the operation of Indian Point Station Unit No. 2.

The Atomic Energy Council of the State of New York feels that the U. S. Atomic Energy Commission should proceed with its plans relating to licensing Consolidated Edison Company of New York, Inc. to operate Indian Point Station Unit No. 2.

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The following are the specific comments the Council has on the environmental factors referred to in the Report. They are grouped into two main categories: (1) Radiological Considerations, and (2) Non-radiological Considerations. A third section addresses itself to the format and content of Environmental Reports in general.

RADIOLOGICAL CONSIDERATIONS

The Report states that equipment for processing radioactive waste and administrative procedures to control the release of radioactive effluents will keep such releases as far below regulatory limits as "practicable." As a specific example of the Company's program to reduce its activity discharged to the enviornment to levels as low as practicable, Con Ed indicated in the meeting that to reduce the liquid radioactive effluent from Unit No. 1, it plans to install ion exchange equipment for the secondary loop boiler blowdown and to make more extensive use of the liquid radioactive waste evaporator.

We understand from the meeting with Con Ed that Unit No. 2 will be provided with equipment and Con Ed will implement procedures to eliminate essentially all halogens and particulate material from the gaseous effluent.

To insure that operating procedures are consistent with minimizing any radiological impact on the environment, the State is reviewing and will make recommendations to the U. S. AEC on the Technical Specifications to be included in the proposed operating license.

The Report indicates that the releases of radioactive materials to both the atmosphere and to the Hudson River are expected to be small percentages of the regulatory limits. The published reports of the State concerning findings in connection with the operation of Indian Point Station Unit No. 1 for the period 1965 through 1968 indicate that the levels of activity in air near the Indian Point site show no detectable off-site releases from Indian Point. Analysis by the State of water samples collected from the lower Hudson River for the same period have detected no radioactivity from Indian Point Unit No. 1.

Analyses of aquatic vegetation and fish have revealed a detectable increase in manganese-54. The State's analysis has been confirmed by studies made by New York University Center's Institute for Environmental Medicine. Apparently certain species of algae and aquatic vegetation tend to reconcentrate manganese. Evaluations are continuing even though there is no public health significance associated with the present levels that have been observed.

Although transportation of irradiated fuel and emergency planning were not discussed in the Report, we are aware that much material has been presented in these areas through the Preliminary and Final Safety Analysis Reports and discussions with State representatives, and that transportation is subject to separate licenses. In addition, these matters have, of course, been satisfactorily dealt with as to Unit No. 1 and irradiated fuel has been routinely transported from the site. Nevertheless, a limited discussion of these subjects with specific cross references to the available information would be of major assistance in the consideration of the environmental impact of the Facility.

NON-RADIOLOGICAL CONSIDERATIONS

We wish to reflect the very active role played by the State of New York to assure that the discharge of condenser cooling water from the Indian Point nuclear generating units does not impair the environment of the Hudson estuary. A permit authorizing the discharge of cooling water from Indian Point Station Unit No. 1 was first issued by the State on August 1, 1961. This permit was superseded by a permit dated August 22, 1966 which was based in part on operating experience during the first five years. After additional careful and close review, on May 19, 1970 the State issued a construction permit for improved and expanded thermal discharge facilities which are intended to satisfy State requirements with respect to three units at Indian Point. The Department of Environmental Conservation will carefully review the construction of these facilities to make certain the fulfillment of the requirements of the construction permit and review and analyze post operation performances for these facilities to assure that they are and remain within State requirements. Additionally, under an agreement between the State Atomic and Space Development Authority and Consolidated Edison Company, the Authority is providing for the design and construction of the discharge facilities, including the performance of very substantial research and engineering.

Over half a million dollars have been spent on mathematical and physical hydrological models, and numerous on-site temperature studies and infrared surveys have been conducted which have led to the design of these outfall structures. State permits have been written so that steps can be taken to restrict the use of facilities until operational results clearly establish that these facilities will perform in accordance with their designed objectives.

Permits issued to date authorize the construction of an effluent channel and diffusers designed to handle the cooling water requirements of three units; however, these authorizations clearly indicate that construction approval may not be construed as allowing the operation of such structures at their rated capacity. It is recognized that modifications may be necessary as additional operating data is developed.

In evaluating various areas of environmental impact, one related area of concern has been identified. While vertical traveling screens and a water intake velocity modulating system will be installed at the site in an effort to eliminate extensive fish loss, it is not clear from data presented by the applicant that the cooling water intake structure design will completely protect fish and other aquatic organisms.

In an effort to resolve this particular area of environmental concern, Consolidated Eidson Company has established a special technical task force headed by the Company's Chief Civil Engineer. This task force will concentrate and coordinate the Company's efforts to implement plans and studies relating to fish protection. In addition, an Indian Point Fish Advisory Board of expert biologists and engineers has been convened to provide advice to the Company about how to protect fish in the vicinity of the Indian Point site. A list of the members on the task force and the advisory board has been attached for your information as Appendix D.

Special ecological studies under the direction of the Hudson River Policy Committee and Technical Committee have been undertaken in the Indian Point area. These committees are made up of representatives from State and Federal conservation agencies. A list of present committee members is attached for your information as Appendix E. The actual study being guided by the committees is being carried out by Raytheon Company, and it covers a period of 19 months and is funded at $595,000.

The amount of attention and level of effort being given to this area of environmental concern is expected to identify possible mechanisms for minimizing the impact of plant operation on fish and aquatic life.

The environmental report of Consolidated Edison indicates the nearest historical landmarks are St. Peter's Church and Cemetery in Verplanck, and St. Mary's Cemetery. Our effort to identify areas of historical significance revealed that there were at least 17 historical locations included in a preliminary inventory undertaken by the Hudson River Valley Commission and entitled "Historic Resources of the Hudson." They varied from historic houses in the

Town of Peekskill to Lent's Cove, which is right adjacent to Indian Point and is where the British landed for their raid on Peekskill in 1777. We were unable to determine that the historic significance of any of these landmarks would be diminished in any way by the operation of Indian Point Unit No. 2.

Landscape and architectural design efforts have helped to minimize the intrusion of this plant. In accordance with the suggestions of the Hudson River Valley Commission, Con Ed has restricted the use of the northern part of the Indian Point site in order to avoid profiling the facilities. By siting these facilities on the lower lying portion of the site, the intrusion into the area has been minimized. The upper portion of the site continues to support an 80-acre forest with a fresh water lake. It appears that the nuclear power development at this particular site may have resulted in an improved land use.

ENVIRONMENTAL REPORTS IN GENERAL

As the number of multi-unit sites increase (for example, Indian Point and Nine Mile Point), the environmental report for a particular facility should include a summary for all facilities planned or operational at the site and their combined environmental impact. We also suggest that future environmental reports include specific cross reference to materials and data supportive of statements made in the environmental report. (This information is generally presented in greater detail in other publicly accessible documents, particularly the Preliminary and/or Final Safety Analysis Reports filed with the U. S. Atomic Energy Commission.) Nonetheless, we would urge the U. S. AEC to provide clearer additional guidance to applicants for the preparation of the environmental report so that applicants may have a more definite understanding of the specific environmental factors that should be discussed with particularity in these reports. We believe that these should include not only the environmental aspects of proper radiological protection from routine releases and protection against abnormal releases or emergency situations, but also the environmental effects of thermal and other waste discharges to the environment, even though such discharges, for regulatory purposes, may not be within the jurisdiction of the U. S. AEC.

We believe the provision of greater detail in the environmental report itself and clear cross referencing to data available elsewhere will provide greater clarity, will reduce the time and effort needed for comprehensive review by all parties concerned and will help to make evident that there exists, in other readily available documents, a substantial amount of information and data to support the general conclusional statements of the type contained in the environmental report.

As mentioned previously, Appendix A lists background information that has been developed concerning the Indian Point site and environs. This Appendix serves as an indication of the type of documentation that should be specifically cross referenced in future environmental reports.

APPENDIX A

PERTINENT PUBLISHED INFORMATION RELATING TO THE INDIAN POINT SITE

FEDERAL

U.S. AEC staff Safety Evaluations and ACRS Reports for Units 1,2, & 3.

Radioecological Survey of the Hudson River - Progress Report No. 1 - Division of Radiological Health, Bureau of State Services, U. S. Public Health Service, March 1965.

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Report on the Pre-Operational Environmental Survey in the Vicinity of Consolidated Edison Company's Indian Point Nuclear Electric Generating Plant - Bureau of Environmental Sanitation, New York State Department of Health, November 1959.

Report on the Environmental Factors to be considered after an Accidental Release of Radioactivity from the Consolidated Edison Thorium Reactor - Division of Environmental Health Services, New York State Department of Health, April 1962.

Quarterly and Annual Reports of Radioactivity in Air, Milk, and Water - prepared by the Bureau of Radiological Health, Division of General Engineering and Radiological Health, New York State Department of Health, 1961 - present.

Consolidated Edison Indian Point Reactor - Post Operational Survey - Division of Environmental Health Services, New York State Department of Health, August 1965.

Environmental Surveillance - Bureau of Radiological Health Services, New York State Department of Health, December 1964.

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OTHER

Hazards Summary Report for Consolidated Edison Thorium Reactor.

Preliminary and Final Safety Analysis Reports for Indian Point #2 Nuclear Generating Facility.

Preliminary Safety Analysis Report for Indian Point #3 Nuclear Generating Facility.

Preliminary Safety Analysis Report for Indian Point #4 and #5 Nuclear Generating Facilities.

Ecological Survey of the Hudson River - Progress Report No. 3 - New York University Institute of Environmental Medicine, September 1968.

Semi-annual Operating Reports on Indian Point #1 Nuclear Generating Facility. Consolidated Edison Company, Inc., New York.

Semi-annual Survey of Environmental Radioactivity in the vicinity of the Indian Point Station, Consolidated Edison Company, Inc., New York.

Protecting the Environment Around a Nuclear Power Reactor - a State Health Department Acts. Sherwood Davies, P.E., M.P.H., and Meredith Thompson, D. Engr., American Journal of Public Health and the Nation's Health. 52:12, 1993-2000, December 1962.

"Hudson River Ecology," proceeding of a Symposium sponsored by the Hudson River Valley Commission, October 4-5, 1966 at Onchiota Conference Center at Sterling Forest, Tuxedo, New York

William J. Cahill, Jr.
Vice President

APPENDIX B

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-3819

September 24, 1970

Dr. William E. Seymour
Staff Coordinator
Atomic Energy Council
112 State Street
Albany, New York

Re: Environmental Report for Indian Point Unit No. 2

Dear Dr. Seymour:

Your office has requested certain information in connection with the preparation of comments by New York State on the Environmental Report on Indian Point Unit No. 2. This letter is in response to that request.

Accident Analyses

Enclosed as attachment A to this letter is a list of accidents considered in the AEC licensing review of Indian Point Unit No. 2. The list contains a brief description of each accident and a reference to the section in the Final Safety Analysis Report (FSAR) which describes the accident in detail.

Section 14 of the FSAR considers the possibility of the accidental release of radioactivity to the environment in great detail. This section analyzes the potential for environmental effects under various accident conditions. This safety analysis demonstrates that the plant can be operated safely and that exposures from credible accidents do not exceed the guidelines of 10 CFR 100. You will note that most of the accidents do not produce any release of radioactivity, and others, under various assumptions, produce releases well below those guidelines.

It must be kept clearly in mind that Section 14 of the FSAR employs various assumptions on malfunctions, which we do not think will occur. For example, many of the loss of coolant accidents are analyzed on the basis of the arbitrary guidelines of TID-14844, which assumes (1) a fission product release from the core associated with core melting, and (2) leakage of these fission products to the environment assuming a standard one-tenth of a percent per day containment leakage. Neither of these assumptions is applicable to the design of Indian Point Unit No. 2, since post-accident core cooling systems are provided to prevent core melting and sealing systems are provided to prevent containment leakage.

Transportation accidents are not analyzed in the FSAR because transportation is the subject of separate licenses. A contract for the reprocessing of spent fuel from Indian Point Unit No. 2 has not yet been signed. Details of shipping are, therefore, not yet available. However, the spent fuel shipping cask for Indian Point No. 2 must be designed to meet all the criteria under normal and hypothetical conditions set forth in 10 CFR 71 and 49 CFR 173. The hypothetical accident conditions which must be considered in obtaining approval of a cask are set forth in Appendix B of 10 CFR 71. A copy of Appendix B is enclosed as attachment B. The standards for the hypothetical accident conditions are set forth in 10 CFR §71.36. This section in effect prescribes the limit on the environmental effects.

<u>Geology</u>

You also referred to a geologic report of Sidney Paige, Consulting Geologist, dated October 12, 1955, which is included in Section 2.7 of the FSAR. That report states that it is desirable to seal off from the ground water, that part of the plant from which contamination might arise. Mr. Paige suggested, as one method of accomplishing this, pressure grouting the ground beneath and surrounding the plant. You have inquired if this procedure has been followed.

We believe that the part of the plant from which contamination might arise has been effectively sealed off from the ground water, but we have not used pressure grouting. Characteristics of the rock revealed by the excavation were such that pressure grouting was not deemed necessary. In areas of the plant containing nuclear facilities, all rock surfaces were sealed with a covering of lean concrete prior to the placement of foundation concrete. Undercutting of the rock was performed in areas where significant loose rock was encountered. In the area of the containment structure, after placement of this concrete fill, a 9-foot thick base mat was placed upon which was set a 1/4-inch steel containment liner. In addition, above the containment liner plating, a top concrete mat of 3-foot thickness was placed. These materials collectively form an effective barrier against any leakage of contaminated liquids into the ground water. Similarly, beneath the primary auxiliary building and fuel storage building, loose rock, when encountered, was removed, and these areas were sealed with a covering of lean concrete prior to foundation placement.

Furthermore, we call your attention to the memorandum on geological features of Thomas W. Fluhr, Engineering Geologist, also contained in Section 2.7 of the FSAR. On page W-6 of his report, Mr. Fluhr notes that ground water will flow from the plant into the river and there is no possibility of an outflow from the plant working against the flow toward the river. He concludes:

> "All these factors make it an impossibility for any drainage from the plant to go anywhere except into the Hudson River. No problem of contamination of water supplies exists."

Very truly yours,

William J. Cahill, Jr.
Vice President

Enc.

LIST OF ACCIDENTS ANALYZED FOR INDIAN POINT UNIT NO. 2

Accidents	FFD & SAR Section	Description
Uncontrolled Rod Withdrawal	14.1.1, 14.1.2 and 14.1.3	Defined as an uncontrolled addition of reactivity to the core by withdrawal of rod cluster control assemblies.
RCCA Drop	14.1.4	Dropping of control rod into the core if a drive mechanism malfunctions or de-energizes.
Chemical and Volume Control System	14.1.5	Chemical volume control system can accidentally add unborated water to the primary system.
Loss-of-Coolant Flow	14.1.6	May occur from a mechanical or electrical failure in one or more reactor coolant pumps, or a fault in the power supply to these pumps. After the reactor is tripped, pumps coastdown.
Startup of an Inactive Loop	14.1.7	Plant may operate on three loops. This transient occurs when the inoperative loop is inadvertently started.
Loss of External Electrical Load	14.1.8	Most likely way for this to occur is as the result of a turbine trip. There is a possibility of a steam release to the environment if the turbine bypass does not function.
Loss of Feedwater	14.1.9	Results in a reduction in the capability of the secondary system to remove heat from the core. Plant is tripped.

Accidents	FFD & SAR Section	Description
Reduction in Feedwater Enthalpy	14.1.10	This may happen if feedwater flow is diverted around the feedwater heaters. This causes reduction of temperature at steam generator inlet, which is fed back to the core.
Excess Load Increase	14.1.11	Rapid increase in steam generator steam flow causing a power mismatch between core and steam demand.
Loss of a.c. Power to Auxiliaries	14.1.12	This will result or can occur in combination with a turbine trip. It is similar in its initial stage to loss of four pump incident. There can be a secondary steam release to the environment.
Fuel-Handling Accident	14.2.1	(1) Fuel assembly stuck in vessel. (2) Fuel assembly dropped in containment. (3) Fuel assembly stuck in penetration valve. (4) Fuel assembly stuck in transfer carriage. (5) Fuel assembly dropped in fuel-handling building. The last case is used for calculating off-site doses while the first four cases are of interest insofar as plant personnel are concerned.

Accidents	FFD & SAR Section	Description
Accidental Release of Waste Liquid	14.2.2	Can occur if pipes or tanks containing radwaste either leak or fail. Hypothetical release was assumed to occur for the purpose of determining concentrations of radioactive species at Chelsea. The hypothetical release consisted of the entire primary coolant system being dumped instantaneously into the Hudson River.
Accidental Release of Waste Gas	14.2.3	Maximum coolant noble gas activity with 1% fuel defects is 110,000 curies equivalent Xe-133.
Steam Generator Tube Rupture	14.2.4	This event consists of a complete tube break adjacent to the tube sheet. If the condenser becomes unavailable, then primary water may find its way to environment via steam generator relief valves.
Rupture of Steam Pipe	14.2.5	Includes any incident which results in an uncontrolled steam release from a steam generator. Can occur when a steam generator is leaking and activity from primary coolant can find its way to the environment.
Rod Cluster Control Assembly (RCCA)	14.2.6	For this accident to occur, a rupture of control rod mechanism housing must be postulated creating full system differential pressure on drive shaft.

Accidents	FFD & SAR Section	Description
Primary System Pipe Rupture	Section 14.3	Consists of a loss-of-coolant when any pipe of the primary system ruptures. The rupture results in an expulsion of primary coolant, core depressurization, ECCS actuation and a possible release of fission products from the core. The release of activity depends on the degree to which the fuel cladding is damaged during the accident. The degree of clad damage is in turn dependent on peak fuel clad temperature which are controlled by the ECCS actuation and operation.
Turbine Missile and Consequences	Section 14	A turbine missile is generated when a turbine disc fails either at operating conditions or at maximum overspeed conditions. The disc can land in the fuel storage pit and damage a number of fuel elements.
TID-14844 Release of Fission Products in Containment	14.3 and Question 14.1	Analysis of radioactivity based on a hypothetical major reactor accident postulated in TID-14844, a document issued by the Division of Licensing and Regulation, AEC.

Attachment B

APPENDIX B—HYPOTHETICAL ACCIDENT CONDITIONS

[¶ 14,835]

The following hypothetical accident conditions are to be applied sequentially, in the order indicated, to determine their cumulative effect on a package or array of packages.

1. *Free Drop*—A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

2. *Puncture*—A free drop through a distance of 40 inches striking, in a position for which maximum damage is expected, the top end of a vertical cylindrical mild steel bar mounted on an essentially unyielding horizontal surface. The bar shall be 6 inches in diameter, with the top horizontal and its edge rounded to a radius of not more than one-quarter inch, and of such a length as to cause maximum damage to the package, but not less than 8 inches long. The long axis of the bar shall be perpendicular to the unyielding horizontal surface.

3. *Thermal*—Exposure to a thermal test in which the heat input to the package is not less than that which would result from exposure of the whole package to a radiation environment of 1,475° F. for 30 minutes with an emissivity coefficient of 0.9, assuming the surfaces of the package have an absorption coefficient of 0.8. The package shall not be cooled artificially until 3 hours after the test period unless it can be shown that the temperature on the inside of the package has begun to fall in less than 3 hours.

4. *Water Immersion* (fissile material packages only)—Immersion in water to the extent that all portions of the package to be tested are under at least 3 feet of water for a period of not less than 8 hours.

[Appendix B as amended November 20, 1968, effective December 31, 1968 (33 F. R. 17621).]

Harry G. Woodbury
Executive Vice President

APPENDIX C

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

17 September 1970

Mr Paul W Eastman
Assistant Commissioner
Division of Pure Waters
Department of Environmental
Conservation
Albany, New York 12201

Dear Mr Eastman:

Enclosed is a report on the "Effect of Indian Point Facility on Water Quality of the Hudson River." This report is submitted to you in connection with Con Edison's application for a certificate under Section 21(b)(1) of the Federal Water Pollution Control Act, as amended. This certificate was originally requested in my letter to you dated 15 July, 1970.

The enclosed report refers to several studies. A complete set of these studies is being delivered to Mr S P Mathur of the Department of Environmental Conservation.

Very truly yours,

Harry G Woodbury

Encl

Effect of Indian Point Facility on Water Quality of the Hudson River

This report is submitted to the New York State Department of Environmental Conservation by Consolidated Edison Company of New York, Inc. (Con Edison) in support of Con Edison's request for a certification, pursuant to Section 21(b)(1) of the Federal Water Pollution Control Act, as amended, that there is reasonable assurance that Indian Point Unit No. 2 will be operated in a manner which will not violate applicable water quality standards of the State of New York. This application was made by letter dated July 15, 1970 from Mr. Harry G. Woodbury of Con Edison to Mr. Paul W. Eastman of the Department of Health (now Department of Environmental Conservation).

This report discusses (A) thermal discharges, and (B) chemical discharges. Plant sewage is treated on site and is not discharged to the river.

The discussion of thermal discharges is based on the combined discharge of Indian Point Units Nos. 1, 2 and 3. The discharges from these three units will be combined and released through a single discharge canal and outfall structure. An application to construct and operate this discharge structure is now pending before the Department of Environmental Conservation.

The discussion of chemical discharges deals with the discharges from the operation of Unit No. 1, discharges during the construction of Unit No. 2 and the anticipated discharges from operation of Unit No. 2. Information on Unit No. 3 is not included, since it is not required at this time.

A. Thermal Discharges

New York State has adopted detailed criteria covering thermal discharges into the Hudson River at Indian Point, which has been classified as "an estuary." The criteria are as follows [6 NYCRR 704.1(b)(4)]:

> "The water temperature at the surface of an estuary shall not be raised to more than 90°F at any point provided further, at least 50 percent of the cross sectional area and/or volume of the flow of the estuary including a minimum of one third of the surface as measured from water edge to water edge at any stage of tide, shall not be raised to more than 4°F over the temperature that existed before the addition of heat of artificial origin or a maximum of 83°F, whichever is less. However, during July through September if the water temperature at the surface of an estuary before the addition of heat of artificial origin is more than 83°F, an increase in temperature not to exceed 1.5°F, at any point of the estuarine passageway as delineated above, may be permitted."

Con Edison started to study the Hudson River characteristics for the purpose of determining the effects of its thermal discharges in 1964, prior to the adoption of the above criteria. This was one of the Company's extensive programs to study the effect of its existing and proposed generating plants on the environment of the Hudson River. When the above criteria were adopted, these studies were reoriented to determine whether the discharges would meet the criteria. As a result of these studies, an outfall structure was designed, and it was determined that, with the outfall structure, the criteria would be easily met.

The principal studies leading to these conclusions were conducted by Quirk, Lawler and Matusky, Environmental Science & Engineering Consultants, and by the Alden Research Laboratory of Worcester Polytechnic Institute at Holden, Massachusetts.

Copies of these studies have been furnished to the Department of Health from time to time as the studies were completed. This report will describe these studies and reference should be made to the studies themselves for complete details and data. A list of these studies together with the amount authorized and the amount spent to date is attached as Exhibit A to indicate the degree of effort involved in these activities.

Section I - Quirk, Lawler, and Matusky Engineers Studies

1. Heat Dissipation Model

The firm of Quirk, Lawler and Matusky (QLM), which had conducted Hudson River salinity dispersion studies for Con Edison in 1965, was asked to construct a mathematical model to predict temperature distributions at various tidal and salinity conditions.

Northeastern Biologists, Inc. obtained data to compare with the predicted results. They performed temperature distribution measurements of the Hudson River in July 1966 and April 1967. Measurements were taken at different tidal cycles while the Indian Point Unit No. 1 was in operation.

This resulted in a QLM report "Effect of Indian Point Cooling Water Discharge on Hudson River Temperature Distribution," dated January 1968. In this report, QLM calculated that the expected capacity operation of all three units at Indian Point would result in a temperature rise of 16.4°F in a total of 2,040,000 gpm cooling water flow. This yielded a total heat load of 430 x 10^9 BTU/day.

Mathematical analyses were developed to estimate the expected cross-sectional area-average temperature rise along the longitudinal axis of the river and the departure from this average at any point with the cross section.

The temperature distribution across a river cross-section was represented by two different mathematical expressions. These are "the exponential decay model" and "the reciprocal decay model". The "exponential decay model" represents temperature as an exponentially decreasing function of river cross sectional area. The "reciprocal decay model" represents temperature as being approximately inversely proportional to river area.

These analyses yielded computed temperatures which were higher than field temperature measurements made while Indian Point Unit No. 1 was operating.

At the time these models were constructed, the New York State criteria then proposed divided the river's cross-section at any point along its length into a mixing zone and a passage zone. The mixing zone allowed dilution of the heated effluent with cooler water. No specific constraints were affixed to this zone except for its size; it should not exceed 50% of the total cross-sectional area. The remaining portion of the cross section is called the "passage zone," which provides a passage way for migratory fish and other aquatic life. The criteria for this zone included a maximum temperature of 86°F.

The results computed by the two models are summarized below:

	Exponential Decay	Reciprocal Decay	Proposed Standard
Non Summer Conditions			
Maximum Area, T = 4°F	30%	25%	50%
Maximum ΔT, at 50% Area	1.5°F	2.3°F	4°F
Summer Conditions			
Maximum Area, T = 1.5°F	44%	64%	50%
Maximum ΔT, at 50% Area	1.1°F	1.9°F	1.5°F

Analysis shows that the non-summer criterion will not be exceeded. The summer rise standard of 1.5 will not be exceeded, provided the decay followed the exponential behavior. However, since the computed rises are conservative in nature, the reciprocal decay becomes a border line case.

The effect of the expected river temperature rise on river dissolved oxygen concentration was evaluated, and it was not expected to cause any significant changes in the dissolved oxygen content of the water as it passes through the plant.

In August 1969, the criteria governing thermal discharges were adopted effective immediately. The new regulations were as quoted on page 2.

The changes in the thermal discharge criteria of the New York State Health Department necessitate a revision of the original QLM report on the "Effect of Indian Point Cooling Water Discharge on Hudson River Temperature Distribution." In particular, the criteria on water surface temperatures required replacement of the planned surface discharge by a submerged outfall. The revised QLM report is dated February 1969.

The revised report incorporated the work of Texas Instruments, Inc. which conducted airborne infrared data surveys of the Hudson River in the Indian Point vicinity in October 1967 and April 1968. The surveys were undertaken to collect data for compilation of isothermal maps of the river surface.

The revised QLM report adjusted the mathematical model by reducing the heat load to 79% of the value used in prior calculations. Previously, the heat load used was 6% higher than that associated with the maximum possible three unit electrical output of 2351 MW. Planned operation and the initial AEC licensed power levels, however, are 90% of this value or 2114 MW. This value is slightly less than the manufacturer's guaranteed rating of 2123 MW. These corrections lead to a design heat load of 340×10^9 BTU/day which is 79% of the previous value of 430×10^9 BTU/day. The circulating water flow is 2,040,000 gpm. The three unit effluent channel temperature rise for initial power levels becomes 14°F, rather than the 17°F previously used.

Comparison of the values predicted by the unadjusted mathematical model for Unit No. 1 behavior with the field measurements are presented below:

Location	Area - Average Temperature Rise, °F July 1966 Measured	July 1966 Predicted	April 1967 Measured	April 1967 Predicted
Across Plane of Discharge	0.2	0.25	0.093	0.172
Across plane 800 Ft Below Discharge	0.145	0.245	0.0825	0.17

The mathematical model was adjusted to yield the observed values when operating at the Unit No. 1 heat load. The adjusted model showed that the area average temperature rise across the plane of discharge is between 50% to 75% of the values previously predicted. Also, temperature decay above and below the plane of discharge becomes much more rapid, resulting in a substantial reduction of the extent of temperature rises greater than 1°F.

This improved dilution and dispersion was attributed to salinity-induced circulation in the estuary. Results obtained from operation of the Indian Point Hydraulic Model II, at the Alden Research Laboratories (discussed in Section A-II of this report) were employed to check and confirm the rapid heat dispersion as predicted by the adjusted mathematical model. Summer conditions are reported by many to constitute the critical biological condition, which consisted of a sustained drought flow of 4000 cfs and a heat transfer coefficient of 135 BTU/sq. ft./day/°F. The predicted results are presented below as well as those for conditions of maximum severity (4000 cfs flow and heat transfer coefficient of 90 BTU/sq.ft./day/°F):

Condition	% Area Bounded by 4°F Isotherm		% Surface width Bounded by 4°F Isotherm	
	Criterion	Prediction	Criterion	Predicted
Maximum Severity	50	26	67	52
Critical Summer	50	21	67	53

The percentages of the surface width bounded by other isotherms at various distances above and below Indian Point were also computed using the adjusted model. The results show that temperature rises greater than 1°F are limited to the vicinity of Indian Point.

2. Submerged Discharge Model

The studies indicated that the criterion of a maximum surface temperature of 90°F at any point could not be met with a surface discharge. Hydraulic model studies conducted by Alden Research Laboratories showed that the 14°F effluent channel temperature rise can be reduced markedly, before reaching the river's surface, by discharging the cooling water through a submerged discharge. Model studies showed that rectangular ports located along the bottom of the West wall of the discharge canal would yield maximum surface temperatures substantially lower than the 90°F criterion.

In October 1969, QLM prepared for Con Edison a report on "Effect of Submerged Discharge of Indian Point Cooling Water on Hudson River Temperature Distribution." This study consisted of the development of a mathematical model which is based on a consideration of the fluid mechanics of submerged jets, a comparison of the theoretical model to observations of actual submerged jet behavior made in the Alden model and in the Hudson River, and a prediction of behavior at Indian Point under a different and more severe set of conditions than those studied in the hydraulic model.

The mathematical model consists of a set of twelve simultaneous equations. It incorporates the effect of plant intake temperature, density and salinity, plant outfall temperature, density, salinity and flow, outfall geometry, including port size, shape, edging, orientation, and submergence, and linear velocity (both runoff and tidal), tidal phase, and ambient temperature, density, and salinity.

The assumptions made in the development of this model are that initial jet momentum, induced buoyancy, and entrained river flow and momentum are the controlling mechanisms and that drag force and river boundaries, such as bank, surface and bottom can be neglected.

The computed results agree in general with measurements made in the undistorted hydraulic model, and with measurements taken in the river in the vicinity of the submerged outfall of Orange and Rockland Utilities' Lovett Unit #4.

Computed results for a condition of maximum river ambient temperature of 79°F, and a maximum condenser rise of 17°F, showed that the maximum surface temperature can be expected to rise 9°F. The surface area bounded by the 4°F isotherms, and the lateral distance from the shore, bounded by this isotherm, compare very well with values given for these parameters in QLM's report of February 1969, and previously presented in this report.

These results show that the submerged discharge will meet the thermal discharge criteria of the New York State Water Resources Commission. The proposed outfall structure for the combined discharges from Indian Point Units Nos. 1, 2 and 3 will consist of twelve 4' x 15' ports, spaced on 20 ft centers, submerged 18 feet below the water's surface, and discharging at 10 ft/sec normal to the river's longitudinal axis.

3. Net Non-Tidal Effect Study

QLM prepared an additional study entitled "Influence of Hudson River Net Non-Tidal Flow on Temperature Distribution" dated October 1969, in order to provide additional support for the mathematical model, concerning the salinity induced circulation in the estuary. On October 1 and 7, 1969 field surveys were carried out by Alden Research Laboratories to collect information about water velocities during ebb and flood conditions in various parts of the river. At the same time, the Raytheon Co. took temperature and salinity measurements.

that forces other than those due to inertia and pressure gradients governed the water motion during this phenomena. Salinity measurements revealed a pronounced density stratification. The average water temperature was 68°F with insignificant variation.

Analysis of these salinity and current measurements showed that over a tidal cycle there is a net upstream movement of sea water in the lower layers and a net downstream movement of fresher water in the upper layers of the Lower Hudson River. The surface of no net motion which separates the two layers usually occurs approximately above mid-depth. These net movements are induced by density differences which exist on account of the vertical and longitudinal distribution of salinity. Such movements exist mainly in the saline portion of the estuary. This effect is called the net non-tidal flow.

At Indian Point, the net non-tidal flow is present when the fresh water runoff in the Lower Hudson is less than 20,000 cfs. The effect is weakest where salt is not present.

Field measurements showed that when the Lower Hudson fresh water runoff is about 7,300 cfs, there is a seaward flow of about 22,000 cfs at Indian Point in the upper layer, and an upstream flow of some 14,700 cfs in the lower layer. Under those conditions, a total flow of 36,700 cfs is available for dilution purposes at Indian Point.

The net non-tidal flow concept explained the measured area-average temperature rise at Indian Point. The predicted area-average temperature rise at the Indian Point plane of discharge taking into account the net non-tidal flow concept was only 9% less than the area-average temperature rise measured in July 1966.

Quirk, Lawler and Matusky Engineers predicted, through their use of the mathematical heat dissipation model written for Con Edison, that the expected heat load would cause an area-average temperature rise of 1.7°F when the fresh water runoff is 7,300 cfs. A maximum value of 3.2°F may occur when the net non-tidal flow effect is weak, and the area-average temperature rise is expected to range between 1.7° and 3.2°F.

The establishment of the existence of the net non-tidal flow in the Hudson River and the conclusions outlined above gave additional justification and support to the theoretical findings of February 1969.

SECTION II - ALDEN RESEARCH LABORATORIES STUDIES

Alden Research Laboratories has been studying thermal discharges at Indian Point since 1964 by the use of hydraulic models. These models attempt to reproduce in a physical structure all relevant characteristics of the river, such as topography, tidal conditions, flows and introduced conditions (including the "mothball" fleet). Calibrated flow meters are installed in each of the supply pipelines for flow measurement, and valves are installed for flow regulation. Point gauges and staff gauges are used to determine water surface elevations. The temperature measurements are made with either thermister type or thermocouple temperature sensors. These sensors are located at the critical locations such as the inlet and outlet sections of the model and the inlet and outlet of the model plant. In addition, the sensors are placed in various sections of the model to provide data which will allow a development of temperature distribution and flow patterns of the warm water.

The first model (Model I) was concerned with recirculation problems of Indian Point Unit No. 1. This led to a discharge canal design which minimized the recirculation of heated discharge water.

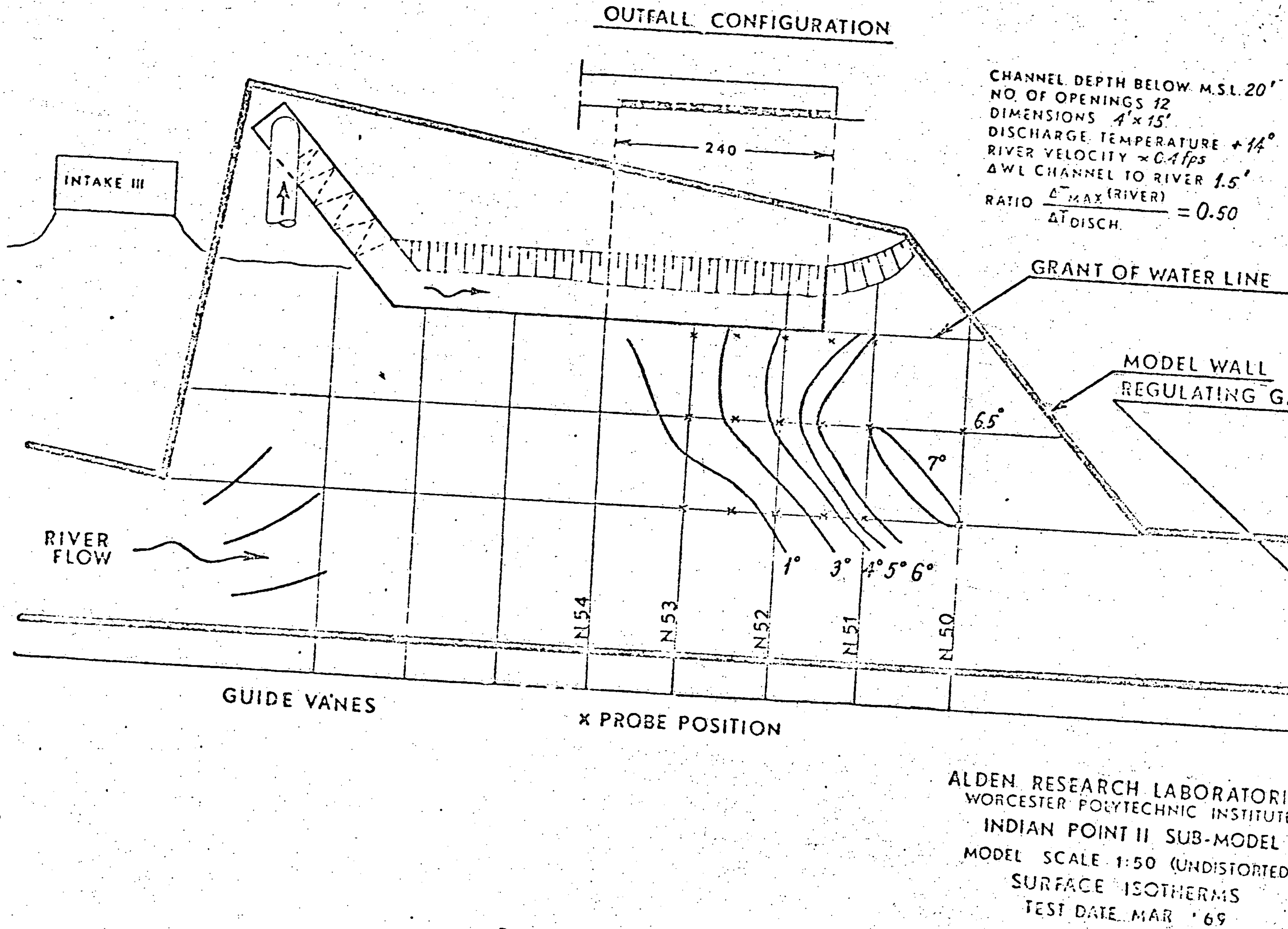
In early 1968 a model of the Hudson River simulating 9000 feet above and below Indian Point was constructed (May 1969 Alden Report). The model (Model II) was scaled 1:250 in horizontal dimensions and 1:60 in the vertical. It was designed to simulate the large-scale effects of the heated discharge of two and three nuclear units on the Hudson River temperature.

During model construction the State of New York formulated thermal criteria including maximum temperatures and temperature rise for discharges into State waters. Another model for the area near the plant was necessary to optimize the outfall design in light of the criteria.

1. Outfall Model

The outfall model was undistorted and scaled 1:50 so that velocities and temperatures could be accurately simulated for the immediate vicinity (within 500 feet) of the outfall. The engineering limitations within which Alden was to test outfalls were: (1) the plant flow and temperature rise for three units (Units No. 2 and No. 3 operating at initial licensed power levels) at full capacity (2.04 million gpm, 14°F temperature rise), (2) the maximum head available from circulating pumps, and (3) the property line and bulkhead line of Con Edison. During tests on the outfall model the thermal criteria were modified as indicated in Section I of this report. The modification required new tests of outfall designs.

The current criteria led to the outfall now under construction (May 1969 Alden report). The temperature distribution created by plant discharge through the accepted outfall is presented in Figure 1. The outfall consists of 12 submerged ports. The resulting dilution at the point where the plume reaches the surface is 1:2.



OUTFALL CONFIGURATION
CHANNEL DEPTH BELOW M.S.L. 20'
NO. OF OPENINGS 12
DIMENSIONS 4'x 15'
DISCHARGE TEMPERATURE +14°
RIVER VELOCITY ≈ 0.4 fps
ΔWL CHANNEL TO RIVER 1.5'
RATIO ΔT MAX (RIVER) / ΔT DISCH. = 0.50
INTAKE III
240
GRANT OF WATER LINE
MODEL WALL
REGULATING GATE
6.5°
7°
1° 3° 4° 5° 6°
RIVER FLOW
N 54
N 53
N 52
N 51
N 50
GUIDE VANES
x PROBE POSITION
ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE
INDIAN POINT II SUB-MODEL
MODEL SCALE 1:50 (UNDISTORTED)
SURFACE ISOTHERMS
TEST DATE MAR '69

FIGURE 17

Tests with Model II were conducted with an outfall similar to that now under construction. Model II simulated two unit and three unit plant operation. The model's results, however, indicated that a larger part of the river should be simulated.

2. Model III Design

Mod l III represents an investment of over a year and a half for construction and pre-operational testing. (Figure 2) The model simulates over 13 miles of river in topographic detail. Thermal discharges of all power plants in existence and proposed may be included. Tidal flow and net river flow are reproduced. Several assumptions are necessary to design a model and interpret the results. The basic hypothesis is that the forces interacting in thermal discharges are basically those of inertia and buoyancy. If the model is to simulate these two forces, then the ratio of forces must be the same in the model as they are in the prototype. The densimetric Froude number, F, as a dimensionless ratio of characteristic parameters which represents the ratio of inertial to buoyant forces:

$$F = \frac{V\Delta p}{g \, p \, D_o}$$

Where g is gravity, V is a characteristic velocity (exit velocity at discharge), $\frac{\Delta p}{p}$ is the ratio of density variations to ambient density, and D_o is a dimension of the discharge port. The assumption inherent in scaling velocities and densities by Froude number is that other forces are much less important (May 1969 Alden

INDIAN POINT III MODEL

GENERAL ARRANGEMENT

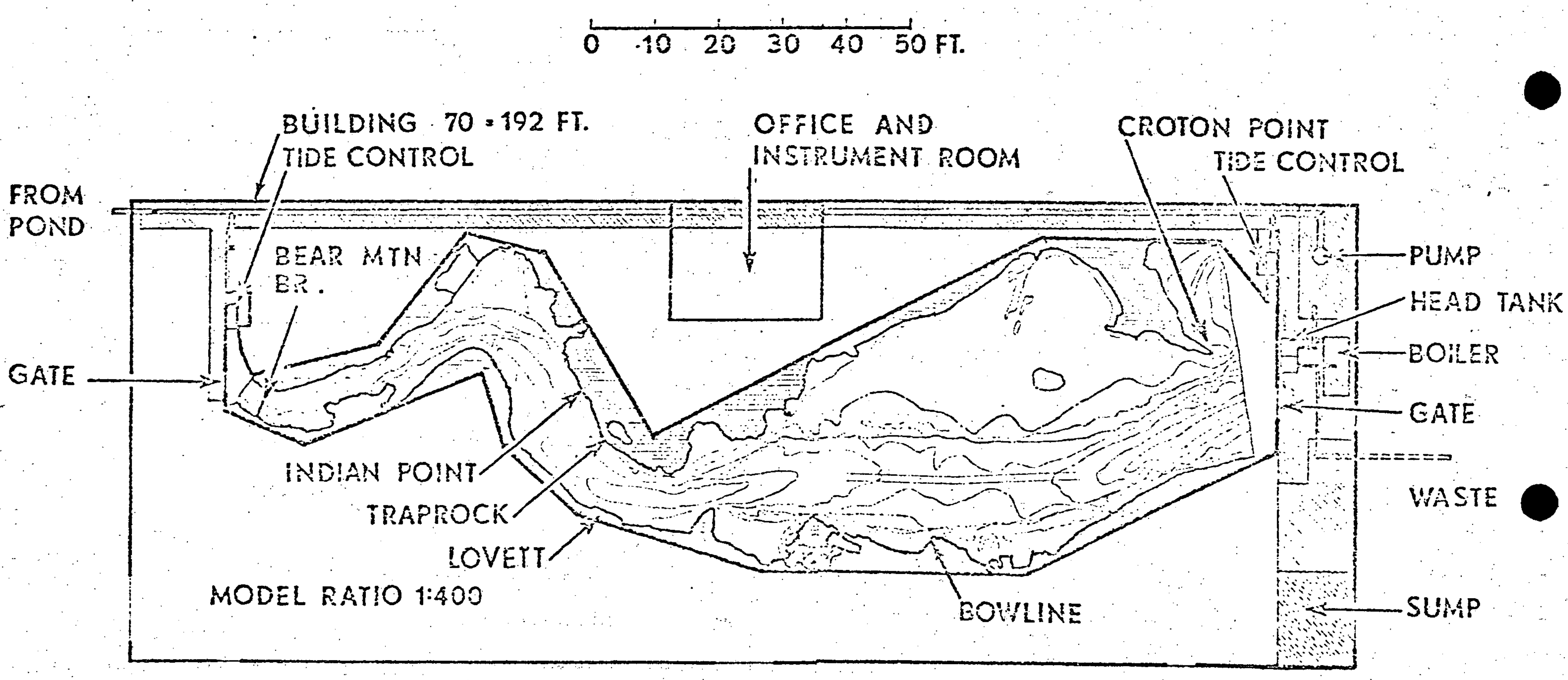


FIGURE 2.

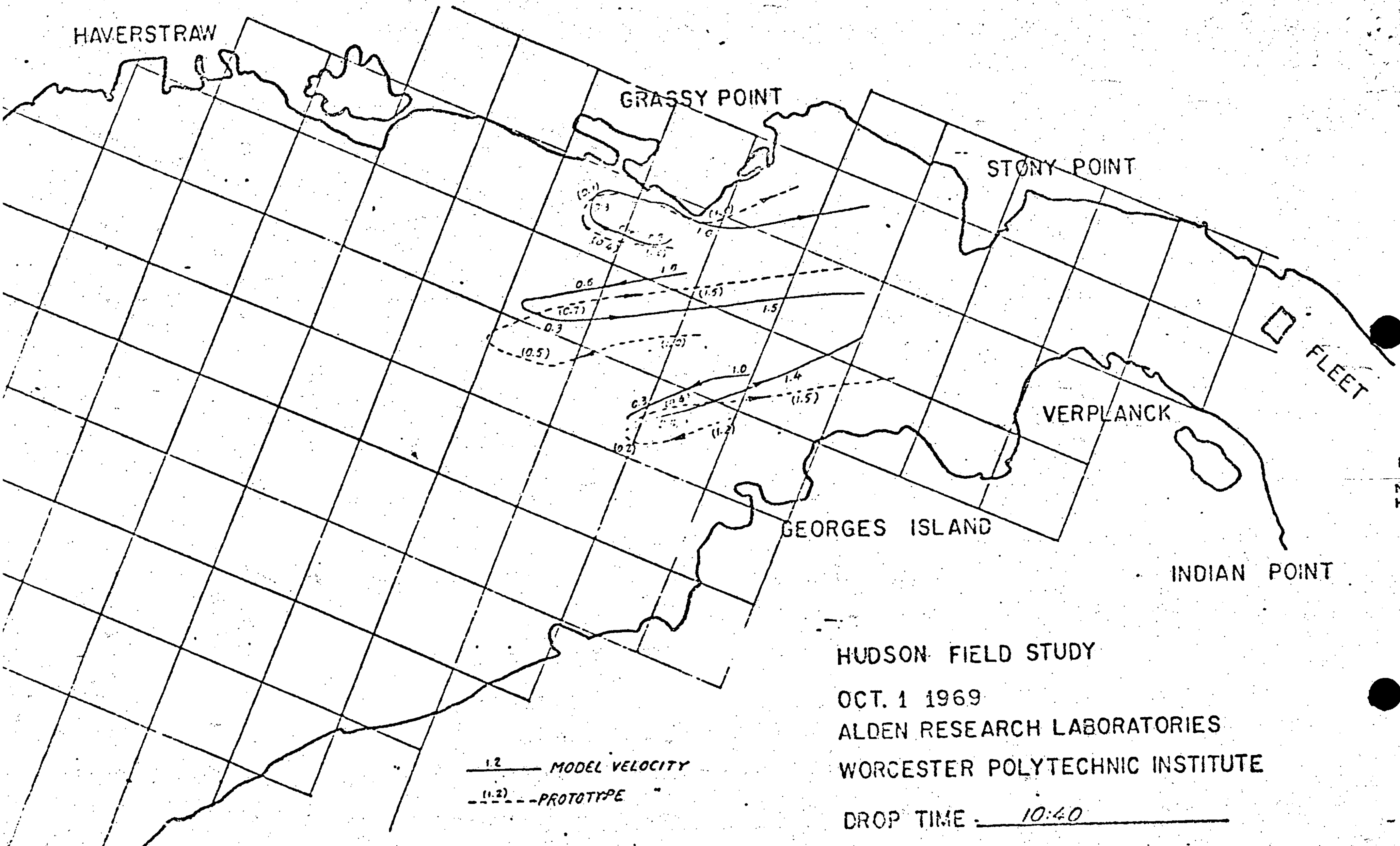
Report). The only way to validate such a model is to compare it with the prototype conditions. Extensive field measurements of velocity and temperature in the modeled section of the prototype river have been made (see February, 1970 Alden Report).

Primary concern is for reproduction of velocities and shears throughout the model. Field measurements of velocities at numerous points across the river and at several depths were made in October 1969, and reported in Alden's February 1970 report.

The parameters representative of the velocity distribution are the tidal phase lag and the net tidal excursion at various points. Drogues were tracked in both model and prototype. The velocities are reproduced remarkably well, as shown by typical results in Figures 3, 4 and 5.

Model III cannot simulate temperatures near the outfall because this model is vertically distorted. The distortion is necessary to achieve vertical resolution while modeling an extensive distance along the river. Since the model was constructed to simulate the large-scale thermal effects, the surface temperature near the outfall is determined in the undistorted outfall model. This temperature is then reproduced in Model III by adjustment of a horizontal submerged slot at the modeled Indian point outfall.

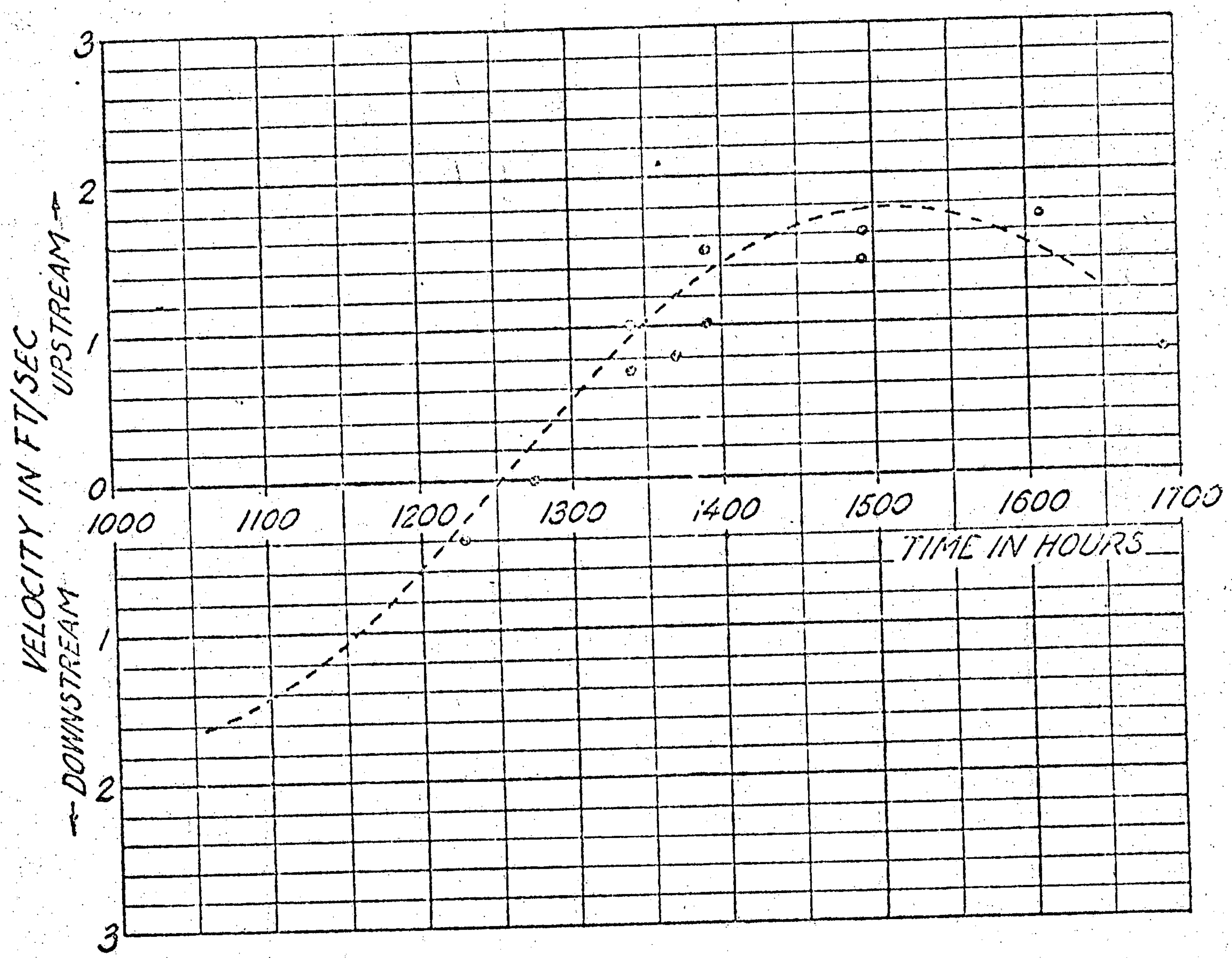
Conditions of net river flow and relative buoyancy vary through the year. Dilution depends most strongly on the densimetric Froude number as discussed above and net river flow.



COMPARISON BETWEEN PROTOTYPE AND MODEL PATHLINES

FIGURE 3.

FIGURE 4.



- - - - - MIDSTREAM FIELD VELOCITIES MEASURED AT GRASSY PT , OCT. 1, 1969.

° ° ° ° — " — MODEL DATA TAKEN -"- — " —

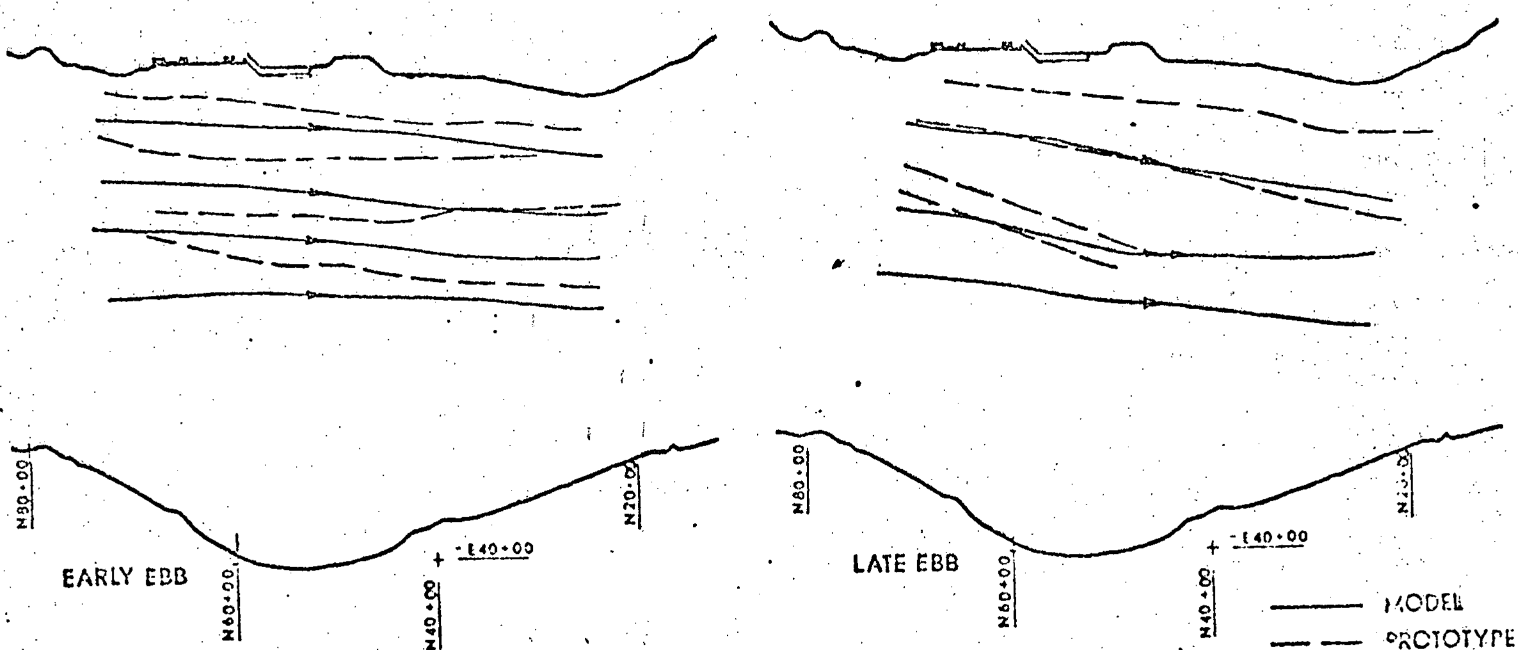
HUDSON RIVER
FIELD STUDIES OCT 1, 1969.

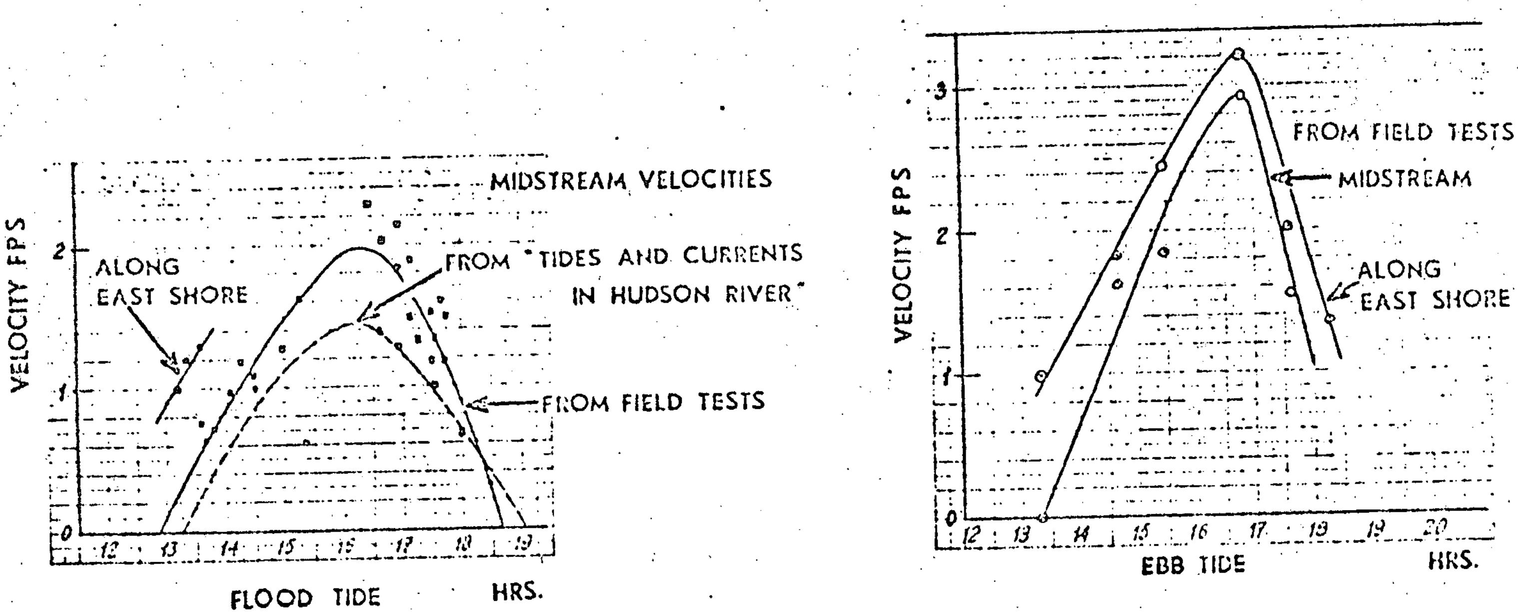
COMPARISON OF FIELD AND
MODEL VELOCITIES

ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE

FIGURE 5.

COMPARISON BETWEEN PATH LINES OFF INDIAN POINT





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HYDRAULIC MODEL STUDIES
FOR
CONSOLIDATED EDISON COMPANY, N. Y.

Since the tidal velocity and the discharge jet are fixed, the relative density variations determine the Froude number change. The relative density change across the condenser in turn depends only on the river temperature, since the condenser temperature rise is taken to be fixed (14°F). Table I shows typical net river flows, ambient temperatures and relative density changes.

TABLE I

Date	Feb.	Apr.	Jun.	Jul.	Aug.	Oct.	Dec.
River Flow (10^3 cfs)	11	38	11	8	6	9	15
Ambient Temperature (°F)	34	53	74	78	75	58	38
Relative Density Change x 10^4	1.2	12.1	21.6	23.2	22.0	14.6	3.8

The maximum relative density change, and thus maximum buoyancy, as well as minimum river flow, indicate minimum dilution in summer. The most severe condition is taken as 4000 cfs river flow and 78°F ambient river temperature.

3. Results

Model III results for severe summer conditions are presented for various depths and tidal phases in the Alden report of May 1970. The tests were run with a thermal discharge from Lovett similar to that expected in prototype. The thermal plumes extend furthest into the river shortly after the tide begins to flood; temperatures at this critical tidal phase for several tests are presented in Figures 6, 7 and 8.

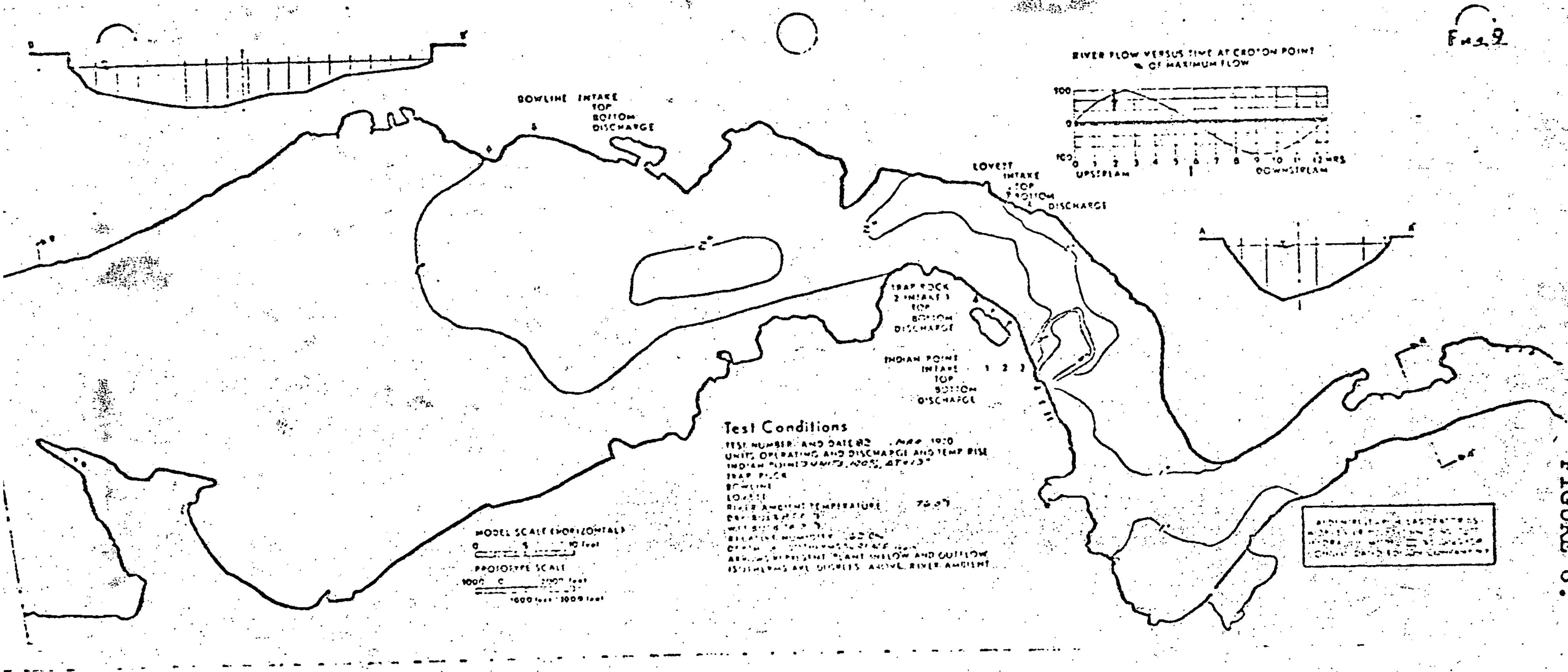

RIVER FLOW VERSUS TIME AT CROTON POINT
% OF MAXIMUM FLOW
UPSTREAM
DOWNSTREAM
BOWLINE INTAKE
TOP
BOTTOM
DISCHARGE
LOVETT
INTAKE
TOP
BOTTOM
DISCHARGE
TRAP ROCK
TOP
BOTTOM
DISCHARGE
INDIAN POINT
INTAKE 1 2 3
TOP
DISCHARGE
Test Conditions
MODEL SCALE (HORIZONTAL)
PROTOTYPE SCALE

FIGURE 6.

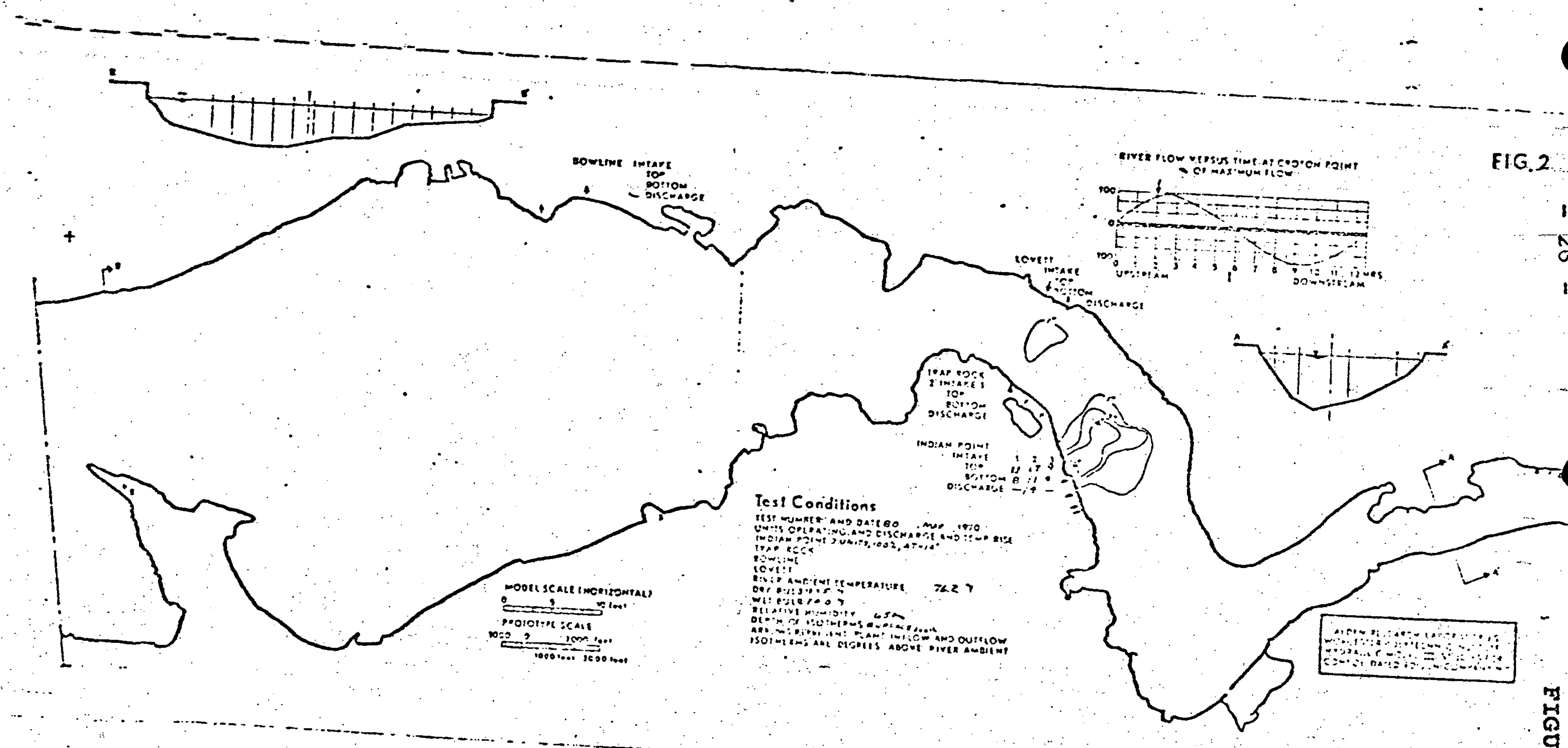
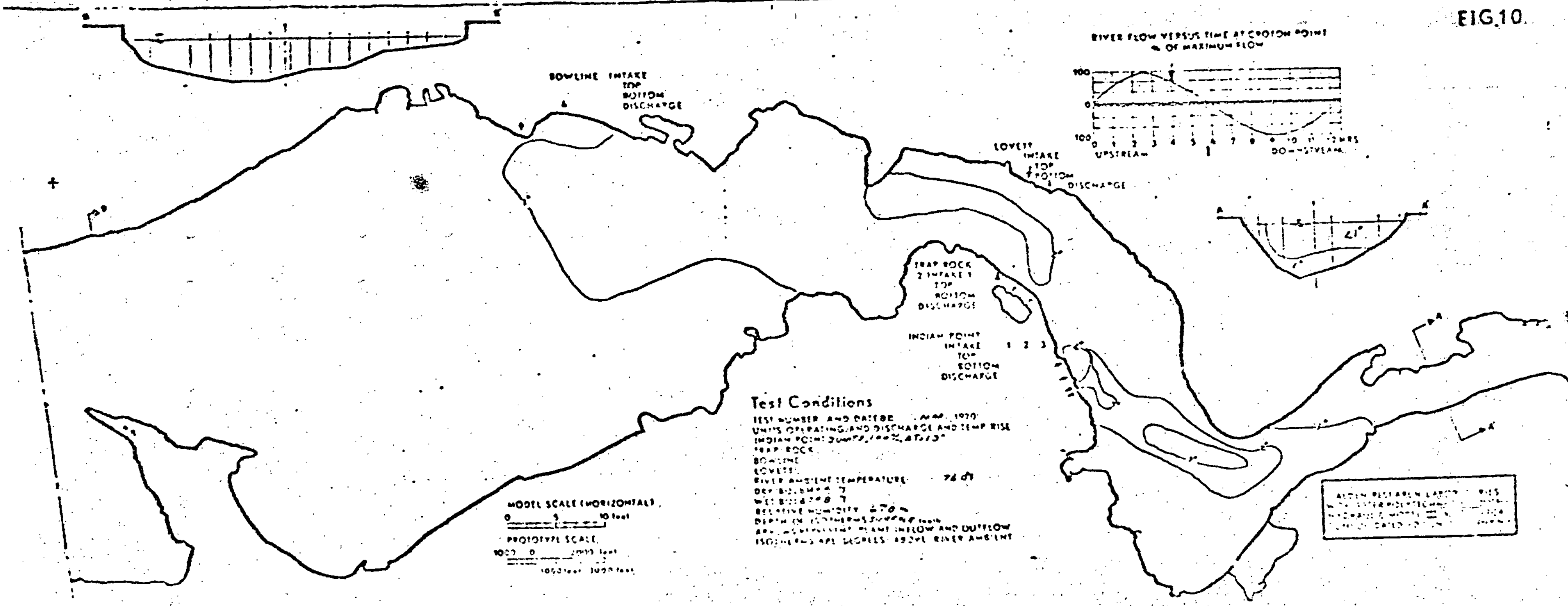


FIG. 2

FIGURE 7.

FIG.10.



- 27 -

FIGURE 8.

In conclusion the modeling at Alden is based on extensive experience of the laboratory as well as experience modeling the Hudson River since 1964 and making field measurements in the river. The model was validated against field data. The results show that the thermal discharge will meet state criteria concerning surface temperature. The 4°F isotherm extends only 50% across the surface width at Indian Point, at the worst tidal phase, river flow, and ambient river temperature.

Further testing is under way to insure that throttled flow will satisfy the criteria and to consider modification of the outfall to maximize dilution of the discharge.

B. CHEMICAL DISCHARGES

SECTION I - DISCHARGE OF CHEMICALS FROM UNIT NO. 1

Normal power plant operations require the discharge of certain chemicals. Permits, where required, will be obtained from the Department of Environmental Conservation with respect to these discharges. All the chemicals described in this section are commonly used in industry, and their discharge to waterways is a common incident of industrial processing. With the exception of boric acid which is unique to nuclear plants, each of the chemicals listed below (and in the concentrations used) is customary to the operation and maintenance of all fossil and nuclear power plants in New York and elsewhere throughout the United States. The list of the chemicals discharged on a routine basis from Indian Point Unit No. 1 is presented in the following table.

CHEMICALS USED FOR ROUTINE TREATMENT DISCHARGED FROM INDIAN POINT UNIT NUMBER 1

CHEMICAL	DISCHARGE CONCENTRATION BASED ON COOLING WATER FLOW OF 300,000 GPM
Boric Acid	0.1 ppm H_3BO_3
Cyclohexylamine	$<1 \times 10^{-6}$ ppm cyclohexylamine
Detergent	0.001 ppm detergent
Soda Ash	7 ppm Na_2CO_3
Sodium Hydroxide	0.4 ppm NaOH
Sodium Hypochlorite	<0.1 ppm residual chlorine
Sulfuric Acid	2.4 ppm H_2SO_4
Trisodium Phosphate	0.0004 ppm Na_3PO_4
Decontamination (Various)	Minor (major decontamination waste would be treated)

The discharge concentrations listed in this table have been calculated based on a cooling water flow of 300,000 gpm under the normal cooling water flow. There are circumstances for which this flow may be less than 300,000 gpm and as low as 20,000 gpm. This would occur only when the plant is not in operation and the resultant concentrations will be increased proportionately. On the other hand, the concentrations listed in this table are extremely conservative because (a) the pre-discharge interactions between chemicals and the river water used for cooling have not been taken into account, and (b) the flow from other units has not been considered. These interactions would undoubtedly decrease many of the concentrations estimated in the table. Measurements in the discharge canal indicate that the pH of this water is near neutral (pH 7), ranging from 6.5 to 7.5. Thus it is apparent that the river water has a strong buffering capacity thereby reducing the anticipated effect of each specific chemical. An example of this buffering effect is the following. The pH of a 2.4 ppm sulfuric acid solution in distilled water with no buffering capacity would be 4.6. Recent observations of discharge canal effluent pH during sulfuric acid discharge have not been less than 6.5.

The parameters used in the determination of the concentrations presented in the above table are as follows:

I. <u>Boric Acid</u> - Boric acid is used in the primary coolant system and in the fuel storage pools at varying concentrations. Considering 1000 ppm H_3BO_3 as an average concentration of the boric acid in the waste, the released concentration calculates to 0.1 ppm H_3BO_3. Waste is processed at approximately 25 GPM, 5 days per month. The boric acid concentration released is undoubtedly much lower, since almost all waste is evaporated, leaving the boric acid behind to be drummed and shipped off site.

II. Cyclohexylamine - Nuclear boiler feedwater is treated with cyclohexylamine to control feedwater and steam pH. Most of the cyclohexylamine remains in the system as it volatilizes in the boilers. A small portion is discharged via boiler blowdown. At a concentration of 0.1 ppm cyclohexylamine in the boiler blowdown, the concentration in the discharge canal would be less than 1×10^{-6} ppm.

III. Detergent - "Colgate Low Foam" detergent is used in the plant laundry at approximately 3 pounds per day. This is equivalent to a continuous discharge of 0.001 ppm in the discharge canal.

IV. Soda Ash - Soda ash is used to wash the flue gas passages of the superheaters, economizers and air preheaters. It is used at a concentration of 2 percent for approximately eight hours, 4 times per year. During discharge its concentration in the canal is approximately 7 ppm.

V. Sodium Hydroxide - During regeneration of the mixed bed exchangers in the make-up water treatment plant, sodium hydroxide is injected for 80 minutes at 0.25 GPM (50 percent solution). During 40 minutes of this injection, sulfuric acid is also injected, neutralizing the effluent.

in the discharge canal is approximately 0.4 ppm NaOH. These exchangers are regenerated about once per week.

VI. Sodium Hypochlorite - Chlorination of our main condensers uses a 15 percent sodium hypochlorite solution at a feed rate of about 2.5 GPM for one hour, 3 times per week. Chemical tests are made at the discharge canal during chlorination to ensure that the discharge limits of 0.5 ppm residual chlorine are met. Actual values are generally less than 0.1 ppm due to the fact that only 1 condenser is chlorinated at a time and the chlorine demand of the other condenser circulating water is approximately 1 ppm.

VII. Sulfuric Acid - Sulfuric acid is used to regenerate the cation and mixed bed ion exchangers in the water treatment room. As previously described in sodium hydroxide, the sulfuric acid used in the mixed bed regeneration is neutralized by the sodium hydroxide prior to discharge. During the cation regeneration 98% sulfuric acid is injected at about 0.6 GPM for one hour. This results in a concentration in the discharge canal of 2.4 ppm of sulfuric acid. Cation exchangers are regenerated approximately once every four days.

VIII. Trisodium Phosphate - Trisodium phosphate is used for internal treatment of the house service boilers. Approximately 1.5 pounds are used daily and discharged to the river via blowdown. The diluted concentration in the discharge canal is approximately 0.0004 ppm Na_3PO_4.

IX. Decontamination Wastes - No major decontamination operations have been performed to date. If any major decontamination should be required, appropriate treatment of the chemical waste would be undertaken.

On occasion, power plant operation requires discharges of a non-routine nature. All such discharges shall be within limits prescribed by applicable New York State regulations. In the event that no such regulation is in existence, an application for a permit will be filed.

SECTION II - DISCHARGE OF CHEMICALS FROM UNIT NO. 2 DURING CONSTRUCTION

The construction of Indian Point Unit No. 2 necessitated the discharge of a cleaning solution in March 1970. At that time an alkaline cleaning (using trisodium phosphate) was performed on the condensate and steam systems of Indian Point Unit No. 2. The concentrated cleaning solution was barged out to sea and only the rinse water was drained to the discharge canal. Bioassays have been performed on alkaline cleaning solutions discharged from Unit No. 2. The bioassays were for trisodium phosphate and demonstrated that the predictions made concerning the lack of toxicity to fish life at the concentrations in question in the discharge canal were correct. All discharges were made with the approval of the N. Y. State Department of Health.

Tests for Indian Point Unit No. 2, which will be conducted this fall, will require the discharge of phosphates, morpholine and hydrazine. An application for a permit was filed with the Department of Environmental Conservation by letter dated September 14, 1970, from Mr. Frank D. McElwee of Con Edison to Mr. Thomas E. Quinn of the Department of Environmental Conservation.

SECTION III - DISCHARGE OF CHEMICALS FROM UNIT NO. 2 DURING OPERATION

A list of chemicals which Con Edison expects to discharge from Indian Point Unit No. 2 is presented in the following table :

Chemical	Discharge Concentration Based on Cooling Water Flow of 850,000 GPM
Boric Acid	0.002 ppm H_3BO_3
Detergent	0.0004 ppm detergent
Hydrazine	$<1 \times 10^{-6}$ ppm hydrazine
Morpholine	0.0001 ppm morpholine
Sodium Hypochlorite	<0.1 ppm residual chlorine
Trisodium Phosphate	0.0007 ppm Na_3PO_4

As discussed above in Section I with respect to Unit No. 1, there will be circumstances when the cooling water flow will be reduced from normal cooling water flow of 850,000 gpm to a flow of as little as 15,000 gpm. Proportionately increased concentrations will result. Practically, of course, the cooling water flow of Unit No. 2 will be augmented by that from Unit No. 1 or, as indicated above in Section I, by 20,000 gpm to 300,000 gpm.

The parameters used in the determination of the concentrations presented in the above table are as follows:

I. Boric Acid - Boric acid will be used in the primary coolant system and in the fuel storage pools at varying concentrations. Considering 1000 ppm H_3BO_3 as an average concentration of the boric acid in the waste, the released concentration calculates to 0.002 ppm H_3BO_3. Waste will be processed at approximately 2 GPM on a continuous basis. The boric acid concentration released will undoubtedly be much lower, since almost all waste will be evaporated, leaving the boric acid behind to be drummed and shipped off site.

II. Detergent - "Colgate Low Foam" detergent will be used in the plant laundry at approximately 3 pounds per day. This is equivalent to a continuous discharge of 0.0004 ppm in the discharge canal.

III. Hydrazine - Hydrazine will be used as an oxygen scavenger in the steam generator. It will be discharged at 58 GPM at a concentration of 0.01 ppm in the blowdown. This will result in a diluted concentration of less than 1×10^{-6} ppm.

IV. Morpholine - Morpholine will be used to control water and steam pH. It will be discharged at 58 GPM via blowdown from the steam generator at a concentration of 2 ppm in the blowdown. This will result in a diluted concentration of 0.0001 ppm.

V. Sodium Hypochlorite - Chlorination of main condensers will use a 15 percent sodium hypochlorite solution at a feed rate of about 2.5 GPM for one hour, 3 times per week. Chemical tests will be made at the discharge canal during chlorination to ensure that the discharge limits of 0.5 ppm residual chlorine are met. Actual values are expected to be generally less than 0.1 ppm due to the fact that only 1 condenser is chlorinated at a time and the chlorine demand of the other condenser circulating water is approximately 1 ppm.

VI. Trisodium Phosphate - Trisodium phosphate will be used for internal treatment of the steam generators. It will be discharged at 58 GPM at a concentration of 10 ppm Na_3PO_4 in the blowdown. This will result in a diluted concentration of 0.0007 ppm.

The Indian Point Station, as other power stations, has a wet chemicals laboratory on its premises. In accordance with common industrial practice, the wastes from this laboratory are emptied into drains which, after much dilution, enter the discharge canal. The quantities of chemicals involved are minute and the dilution factor in question is so enormous that the resulting concentrations from these chemicals in the discharge canal are less than trace and are considered inconsequential.

SECTION IV - CONCLUSION

Con Edison is confident that the discharge of the chemicals referred to above will not have any adverse effects on fish life. As noted above, all the chemicals referred to herein have been commonly discharged at the indicated concentrations from power plants throughout the country for many years. Furthermore, in the course of Unit No. 1 operation, adverse effects have not been observed in the discharge canal. These observations combined with the low concentrations of all chemicals in question and the inherent buffering effect of the river water in the vicinity of Indian Point indicate that there will be no undesirable effects on the water quality of the Hudson River.

Dated:
September 17, 1970

EXHIBIT A

INDIAN POINT TEMPERATURE STUDIES	Amount Authorized	Amount Spent
Alden - Hudson River Hydraulic Model No. I (1964-66)	$ 76,963.24	$ 76,963.24
Alden - Hudson River Hydraulic Model No. II (1967-69)	90,000.00	86,323.86
Alden - Hudson River Hydraulic Model No. III (1969-70)	230,000.00	230,033.18
QLM - Hudson River Temperature Study (1967-69)	75,000.00	49,657.70
N.E. Biologists - Temperature Study at I. P. Outfall (1966)	10,000.00	4,802.35
N.E. Biologists - Temperature Study (Boats & Crews) (1968)	1,254.00	1,254.00
N.E. Biologists - Temperature Study at I.P. Outfall (1967)	8,318.16	8,318.16
Texas Instruments - Infrared Temp. Surveys at I.P. (1967-68)	24,300.00	24,300.00
Thomas Air Views - Aerial Surveys at I.P. (1968)	3,842.00	3,842.00
Hollman - Effects on H. River Ambient Temp. from I.P. Discharge (1965-66)	1,296.70	1,296.70
	$ 520,974.10	$ 486,791.19

Consolidated Edison Fish Protection Task Force

Charles Soutar, Chairman
Chief Civil Engineer

George Cowherd, Jr.
Environmental Engineer

Donald McCormick
General Superintendent of Indian Point Station

Indian Point Fish Advisory Board

Merril Eisenbud, Chairman
New York University Medical Center
Institute of Environmental Medicine

Dr. G. J. Lauer, Secretary
New York University Medical Center
Institute of Environmental Medicine

Dr. Edward Raney
Fisheries Biologist
Cornell University

Herbert Reistol
Bechtel Corporation

Dr. Gwenyth Howells
Biologist
Great Britain

APPENDIX E

Hudson River Policy Committee*

Albert G. Hall, Chairman
New York State Department of Environmental Conservation

Lester G. MacNamara**
New Jersey Department of Conservation and Economic Development

Richard E. Griffith, Regional Director
U. S. Bureau of Sport Fisheries & Wildlife
Boston

Ossi Norris
U. S. Bureau of Commercial Fisheries***
Glouster, Mass.

Hudson River Technical Committee

Joseph A. Boccardy, Chairman
U. S. Bureau of Sport Fisheries & Wildlife

Paul E. Hamer
New Jersey Department of Conservation and Economic Development

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* In June 1967 the Connecticut State Board of Fisheries and Game accepted an invitation to participate as an adviser and active discussant. Theodore Bampton is presently serving as the representative from the Connecticut agency.

** Retired in 1970; Acting Director George Alpaugh is participating.

*** October 1970, agency shifted to U. S. Department of Commerce.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
INDIAN POINT STATION, UNIT #2

Statement of the Department of Environmental Conservation on the "Environmental Report, Indian Point Station, Unit No. 2" filed by the Consolidated Edison Company of New York, Inc., U. S. AEC Docket No. 50-247

The Department of Environmental Conservation has reviewed the "Environmental Report" (the Report) filed with the U. S. Atomic Energy Commission by Consolidated Edison Company of New York, Inc. (Con Ed), and has had benefit of a meeting with regard to the Report on September 10, 1970 between representatives of Con Ed and staff representatives of the N.Y. State Atomic Energy Council and subsequent meetings with the staff representatives of the Council.

The Report filed by Con Ed is a brief and general discussion of several aspects of the potential impact of Unit #2 on the environment rather than a single source of all available information on the environmental impact of Unit No. 2.

The following is the specific statement of the Department on the environmental factors referred to in the Report. The statement is divided into two main categories: (1) Radiological Considerations, and (2) Non-radiological Considerations. A third section addresses itself to the format and content of Environmental Reports in general.

RADIOLOGICAL CONSIDERATIONS

The Report indicates (on page 17) that "For the purpose of determining compliance with these regulations* Indian Point Units 1, 2 and 3 will be treated as a single facility." In light of this determination, our comments relate at this time to the environmental impact of the combined radioactive releases from the site of Units 1 and 2.

The Report states (on page 20) that equipment for processing radioactive waste and administrative procedures to control the release of radioactive effluents will keep such releases as far below regulatory limits as "practicable". As a specific example of the Company's program to reduce its activity discharged to the environment to levels as low as practicable, Con Ed indicated in the meeting actions being taken to reduce the liquid radioactive effluent from Unit No. 1. Con Ed is installing an ion exchange system for the secondary loop boiler blowdown and is now making more extensive use of the liquid waste evaporator. These changes should significantly reduce the Report's (table on page 18) estimated 36.95 curies per year of fission and corrosion products other than tritium discharged to the Hudson River. Liquid discharges as reported by Con Ed to the Department for the period September 1969 through February 1970 indicate the release of radioactivity other than tritium to be approximately 10% of the amount released for the previous six months. This lower release rate would give an annual release of three curies per year for Unit No. 1. In the table on page 18 of the Report, Unit No. 2 is estimated to have liquid effluents other than tritium that are less than one curie per year.

*10 CFR 20

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The State radiological surveillance program has detected Manganese-54 in aquatic vegetation in 1968 and 1969 and in fish sampled from the lower Hudson River in the fall of 1968. Cs-134 and CS-137 were detected in fish and mud in 1969. The foregoing actions to be taken by Con Ed to reduce the activity discharged from Unit #1 should reduce the concentration of these isotopes in the aquatic environment.

The Department's Environmental Radiation Surveillance Network has not detected airborne particulate matter attributable to the stack discharges from Indian Point Unit No. 1. Since 1965, radioactive particulate concentrations measured at two locations near the reactor, have been similar to concentrations measured at other sites throughout the state. The particulate activity detected is attributed to worldwide fallout and not to reactor operations.

We understand from the meeting with Con Ed that Unit No. 2 will be provided with equipment and Con Ed will implement procedures to eliminate essentially all halogens and particulate material from the gaseous effluent.

The Department feels that the measures indicated by Con Ed to control the release of radioactive material should minimize the radiological impact on the environment of the two units operating at this site.

This approach to the control of radioactive effluents is consistent with the USAEC's proposed amendments to 10CFR Parts 20 and 50 that emphasize the Federal Radiation Council concept of keeping exposures to radiation as low as practicable. In this regard, to insure that operating procedures are consistent with minimizing any radiological impact on the environment, the proposed Operating License Technical Specifications should include limits on the effluent discharges that reflect this concept and the plant capability.

The following areas of potential environmental impact were not discussed in the Report:

1. Transportation of irradiated fuel; and
2. Emergency planning.

The State is continuing to work with Con Ed in regard to emergency procedures related to the Indian Point site. The State was informed by Con Ed of the details of shipping the spent fuel from Unit No. 1 prior to the initial shipment. Con Ed should identify probable routes, methods, frequency of shipments and ultimate disposition of spent fuel from Unit No. 2 to permit evaluation of the environmental aspects of this factor.

NON-RADIOLOGICAL CONSIDERATIONS

We believe Con Ed's discussion of the urban environment in the Report is a very pertinent consideration. The environmental impact of two alternatives to a nuclear plant, namely, lack of power or additional fossil fueled capacity, have a direct bearing on the acceptability of the Facility.

As in the case of radiological considerations, there are a number of areas of potential non-radiological impact upon the environment which were not discussed or were mentioned only briefly in the Report. These include:

1. Thermal discharges; and
2. Chemical discharges.

A discussion of these subjects with specific cross-reference would be of major assistance in the consideration of the environmental impact of the Facility.

An environmental report should cover thermal discharges to the receiving body. The inclusion of such information in the report should not prejudice the State's authority for regulatory control over industrial waste discharges, including thermal discharges. The Divison of Pure Waters, now in this Department, issued a construction permit on May 19, 1970 for a submerged outfall that could accommodate the discharge from Units 1, 2 and 3. Upon completion of these facilities and receipt of application from Con Ed to use the submerged outfall for Unit No. 1, the request will be granted as evaluation has shown that there is reasonable assurance that the discharge will meet water quality standards. The operating permit will be based on using the submerged outfall. To obtain an operating discharge permit for Unit No. 2, Con Ed must demonstrate by the operation of Unit No. 1 that the estuarine thermal criteria relating to limits and distribution of temperature and the thermal standard relating to conditions non-injurious to fish life will be satisfied. The approval for construction clearly indicates that this approval cannot be construed as allowing operation of the outfall structure at rated capacity. It is recognized that modifications may be necessary as additional operating data is developed.

In evaluating various areas of environmental impact, one related area of concern has been identified. While vertical traveling screens and a water intake velocity modulating system will be installed at the site in an effort to eliminate extensive fish loss, it is not clear from data presented by the applicant that the cooling water intake structure design will adequately protect fish and other aquatic organisms.

The problem of fish mortality at the site must be solved either by the structural and operational modifications proposed by Con Ed in the Report, or by such additional modifications as are found necessary.

Discharges of non-radioactive wastes are mentioned on page 22 of the Report. Con Ed should provide an estimate of the quantity and type of chemicals expected to be released to the Hudson River. This will aid in the determination that all necessary State permits for industrial waste discharges have been obtained.

By siting the plant facilities on the lower lying portion of the site, the aesthetic intrusion into the area has been minimized. The upper portion of the site continues to support an 80-acre forest with a fresh water lake.

ENVIRONMENTAL REPORT

As the number of multi-unit sites increase (for example, Indian Point and Nine Mile Point), the environmental report for a particular facility should include a summary for all facilities planned or operational at the site and their combined environmental impact. We also suggest that future environmental reports include specific cross-reference to materials and data supportive of statements made in the environmental report. (This information is generally presented in greater detail in other publicly accessible documents, particularly the Preliminary and/or Final Safety Analysis Reports filed with the U.S. Atomic Energy Commission.) Nonetheless, we would urge the USAEC to provide clearer additional guidance to applicants for the preparation of the environmental report so that applicants may have a more definite understanding of the specific environmental factors that should be discussed with particularity in these reports. We believe that these should include not only the environmental aspects of proper radiological protection from routine releases and protection against abnormal releases or emergency situations, but also the environmental effects of thermal and other waste discharges to the environment, even though such discharges, for regulatory purposes, may not be within the jurisdiction of the USAEC. For example, detailed information is required in the Environmental Feasibility Report to be filed with this Department in accord with the State law, Rules and Regulations, Part 73, Section 19. Although the EFR is not required for Con Ed Unit No. 2, this type of information would have facilitated the review of the Report and the evaluation of the impact on the environment.

We believe the provision of greater detail in the environmental report itself and clear cross-referencing to data available elsewhere will provide greater clarity and reduce the time and effort needed for comprehensive review by all parties concerned and will help to make evident that there exists, in other readily available documents, a substantial amount of information and data to support the general conclusional statements of the type contained in the environmental report.

October 29, 1970

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