50-247

DETAILED STATEMENT ON THE ENVIRONMENTAL CONSIDERATIONS

BY THE

DIVISION OF REACTOR LICENSING

U. S. ATOMIC ENERGY COMMISSION

RELATED TO THE PROPOSED OPERATION OF

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

BY THE CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

Issued: November 20, 1970

FOREWORD

This detailed statement of environmental considerations associated with the proposed operation of the Indian Point Nuclear Generating Unit No. 2 by the Consolidated Edison Company of New York, Inc. (hereinafter referred to as the applicant) has been prepared by the U. S. Atomic Energy Commission's regulatory staff pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA) which was enacted on January 1, 1970. It follows procedures for implementing NEPA published by the Atomic Energy Commission in the Federal Register on June 3, 1970 (35 FR 8594), as proposed amendments to its regulations in 10 CFR Part 50, Appendix D, and reflects the guidance of the Council on Environmental Quality, as contained in the Interim Guidelines which were published by the Council in the Federal Register on May 12, 1970 (35 FR 7390).

The detailed statement is based upon the applicant's environmental report dated August 6, 1970 (Appendix A); the comments received from Federal and State agencies regarding the applicant's report (Appendices B, C, D, E, F, G, H, I, and J); additional information furnished to the AEC by the applicant (Appendix K); information contained in the Final Safety Analysis Report furnished with the applicant's application for an operating license, and the AEC regulatory staff's Safety Evaluation.

As stated in paragraph 9 of the Commission's proposed Appendix D to 10 CFR Part 50, "Statement of General Policy and Procedure: Implementation of the National Environmental Policy Act of 1969 (Public Law 91-190)" (published in the Federal Register on June 3, 1970), the filing of the applicant's environmental report and of the detailed statement shall not be construed as extending the licensing or regulatory jurisdiction of the Commission to making independent determinations on matters other than those specified in Part 50 for construction permit or operating license applications.

TABLE OF CONTENTS

Subject		Page
1.0	INTRODUCTION	1
2.0	THE INDIAN POINT NUCLEAR GENERATING UNIT NO. 2	5
	2.1 Site Location	5
	2.2 Description of Reactor	6
3.0	THE NEED FOR POWER	8
4.0	REQUIREMENTS OF THE NATIONAL ENVIRONMENTAL POLICY ACT	10
5.0	ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION	11
	5.1 Radiological Effects	11
	5.1.1 Radwaste Treatment System	12
	5.1.2 Radiological Monitoring in the Environment	14
	5.1.3 Federal Agency Comments	15
	5.2 Water Quality Aspects	19
	5.2.1 Legislation	19
	5.2.2 Thermal Effects	20
	5.2.3 Chemical Effluents	23
	5.3 Other Environmental Effects	24
	5.3.1 Intake Structure Design	24
	5.3.2 National and Historic Landmarks	30
	5.3.3 Sewage Disposal	31
	5.3.4 Regional Impact of the Plant	31

Subject	Page
5.4 Enhancement of Environmental Amenities	34
6.0 ALTERNATIVES TO THE PROPOSED ACTION	35
7.0 ADVERSE ENVIRONMENTAL EFFECTS	37
8.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	38
9.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES .	39

Appendices

APPENDIX A - Applicant's Environmental Report - Operating License Stage, Indian Point Unit No. 2, Docket No. 50-247 . 40

APPENDIX B - Comments from the Department of Housing and Urban Development, September 14, 1970 100

APPENDIX C - Comments from the Department of Defense, September 17, 1970 103

APPENDIX D - Comments from the Department of Agriculture, September 21, 1970 104

APPENDIX E - Comments from the Federal Power Commission, September 24, 1970 105

APPENDIX F - Comments from the Department of Health, Education, and Welfare, October 5, 1970 110

Subject	Page
APPENDIX G - Comments from the Department of the Interior, October 9, 1970	120
APPENDIX H - Comments from the State of New York Atomic Energy Council, October 24, 1970	124
APPENDIX I - Statement of the New York State Department of Environmental Conservation, October 24, 1970 . .	181
APPENDIX J - Comments from the Westchester County Department of Planning, November 9, 1970	185
APPENDIX K - Comments from the Applicant, November 12, 1970 .	186
APPENDIX L - Chronology - Environmental Data, Indian Point Nuclear Generating Unit No. 2	210
APPENDIX M - Section 3.9 Effluent Release, from the Technical Specifications for Indian Point Unit 2	212

1.0 INTRODUCTION

By application dated October 15, 1968, and amendments thereto (the application), the Consolidated Edison Company of New York, Incorporated applied for necessary licenses to operate a nuclear power reactor at the applicants' site located at Indian Point, Village of Buchanan, New York. The application is available for public inspection at the AEC's Public Document Room at 1717 H Street, N.W., Washington, D. C. The application has been forwarded to appropriate New York State and local officials.

The application has been evaluated by the AEC regulatory staff and the Commission's independent Advisory Committee on Reactor Safeguards, both of which concluded that there is reasonable assurance that the facility could be operated at the proposed site without undue risk to the health and safety of the public.

The AEC regulatory staff's evaluation of the application is set forth in a document entitled "Safety Evaluation by the Division of Reactor Licensing," dated November, 16, 1970 (hereinafter referred to as Safety Evaluation). The report of the Advisory Committee on Reactor Safeguards is set forth in a letter to Chairman Seaborg, dated September 23, 1970, and attached to the Safety Evaluation as Appendix B.

Pursuant to existing inter-agency arrangements, the Atomic Energy Commission's regulatory staff sent copies of the application, shortly after it was received, to the U. S. Fish and Wildlife Service, the U. S. Geological Survey, the Environmental Science Services Administration, and the U. S. Coastal Engineering Research Center. Expert advice and comments from each of these Federal departments or agencies are attached to the Safety Evaluation as Appendices C, D, E, and G.

The Safety Evaluation is available for inspection at the Commission's Public Document Room and at the Hendrik Hudson High School, Albany Post Road, Montrose, New York.

A copy of the application also was sent to the Department of Health, Education, and Welfare's Public Health Service.

In accordance with the National Environmental Policy Act of 1969 and the Council on Environmental Quality's Interim Guidelines, the Commission published in the Federal Register proposed amendments to its regulations, 10 CFR Part 50, Appendix D. The proposed revised Statement of General Policy provides, among other things, that applicants for construction permits for nuclear power reactors will be required to submit a report on specified environmental considerations, and that copies of such reports would then be transmitted by the Commission to appropriate Federal agencies for comment. A summary notice of availability of the report will be published in

the Federal Register, with a request for comments on the proposed action and on the report from State and local agencies of any affected State (with respect to matters within their jurisdiction) which are authorized to develop and enforce environmental standards. After receipt of the comments of the Federal, State, and local agencies, the Commission's Director of Regulation or his designee will prepare a detailed statement on environmental considerations.

The policy statement also provides that each construction permit would contain a condition to the effect that:

> The applicants 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 covered by this construction permit. This condition does not apply to (a) radiological effects, since such effects are dealt with in other provisions of this construction permit or (b) matters of water quality covered by Section 21(b) of the Federal Water Pollution Control Act.

On August 6, 1970, the applicant submitted an environmental report on Indian Point Unit 2. A copy of the report was transmitted to the Governor of New York on August 17, 1970. A notice of availability of the document along with a request for comments from appropriate State and local agencies was published in the Federal Register on August 25, 1970 (35 FR 13548). In addition, copies of the report were transmitted, with a request for comments within 30 days, to those applicable Federal agencies listed in the Interim Guidelines; namely, the Department of Agriculture, the Department of Commerce, the Department of Defense, the Department of Health, Education, and Welfare, the Department of Housing and Urban Development, the Department of the Interior, and the Department of Transportation, and to the Federal Power Commission.

Copies of all the comments received from Federal and State agencies are attached to this Statement as Appendices B through J. The applicant's response to the agencies' comments is attached as Appendix K.

A complete chronology of the correspondence related to the applicant's environmental report is attached as Appendix L.

2.0 THE INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

2.1 Site Location

The Indian Point site is located on the east bank of the Hudson River about 24 miles north of the New York City boundary line. The site contains approximately 227 acres and is owned by the applicant. Indian Point Unit 2 is one of three reactors located at or under construction at the Indian Point site. Indian Point Unit 2 is adjacent to Indian Point Unit 1, a 615 thermal megawatt pressurized water reactor plant that has been in operation since August 1962. Indian Point Unit 3, a plant similar to Indian Point Unit 2, received a provisional construction permit in August 1969, and is presently under construction at the Indian Point site. The applicant has filed an application for a construction permit for two additional reactors designated Nuclear Units 4 and 5 to be located at an adjacent site about one mile south of Indian Point Unit 2.

The area immediately around and including the site is zoned for heavy industry. The surrounding area is generally residential but includes some large parks and a military reservation. The communities of Verplanck, Buchanan, and Peekskill lie within two miles of the site.

The nearest site boundary on land is 0.323 miles from the Indian Point Unit 2 reactor. The total 1960 population within five miles of the site is 53,040 and within ten miles of the site it is 155,510.

2.2 Description of Reactor

Indian Point Unit 2 is the first of the four-loop pressurized water reactors designed by the Westinghouse Electric Company (Westinghouse). It will be owned and operated by the Consolidated Edison Company of New York, Inc. Westinghouse is the principal contractor and has turnkey responsibility for the design, construction, testing, and initial startup of the facility. Westinghouse contracted with United Engineers and Constructors as architect engineer. Construction of the plant was performed by United Engineers until December 1969 when this function was assumed by WEDCO, a wholly-owned subsidiary of Westinghouse.

The Indian Point Unit 2 pressurized water reactor is fueled with slightly enriched uranium dioxide in the form of ceramic pellets contained in zircalloy fuel tubes. Water serves as both the moderator and the coolant. Heat is removed from the reactor core by four separate coolant loops, each provided with a separate pump and steam generator. The heated water flows through the steam generators where heat is transferred to the secondary (steam) system. The water then flows back to the pumps to repeat the cycle. The system pressure is controlled by the use of a pressurizer in which steam and water are maintained in thermal equilibrium.

The secondary steam produced in the steam generators is used to drive the turbine generator. The heat removed from the condensing steam is transferred to the circulating water system and this water is discharged to the Hudson River. The condensate is recharged to the steam generators to repeat the secondary cycle.

The primary coolant system includes the reactor, steam generators, primary coolant pumps, primary coolant piping, and the pressurizer. This system is housed inside the containment building which is a steel-lined, leak-tight reinforced concrete structure. The containment provides a barrier to the release to the environment of radioactive fission products that might be released inside the containment in the event of an accident. Auxiliary systems, including the chemical and volume control systems, the waste handling system, and additional auxiliary cooling systems, are housed separately, principally in the adjacent primary auxiliary building. The primary auxiliary building also houses components of the engineered safety features. A separate fuel handling building is provided for storage of spent fuel. A separate turbine building houses the turbine generator.

3.0 THE NEED FOR POWER

The shortage of installed generating capacity in the Northeast and in New York City specifically is well known as a result of the extensive publicity in the news media given to voltage reductions and voluntary and selective load shedding practices during periods of high power demand. Statistical data on electric power demand, generating capacity and reserve margin for the peak demand periods actually experienced during the summer of 1970 and as projected for the summer of 1971 have been provided by the Federal Power Commission in their comments on the environmental impact of Indian Point Unit 2. These data are summarized below.

The 1970 summer peak load of 7,041 megawatts was accommodated with a total available supply of 7,415 megawatts, including 1253 megawatts of capacity available through firm power purchases. At the time of the peak load during a single summer day, a considerable amount of capacity was unavailable because of unscheduled outages of generating equipment. The reserve margin at this time was only 374 megawatts, equivalent to 5.3 percent of the peak load. This peak load probably would have been exceeded on other summer days if the Company had not operated its facilities at reduced voltage and requested voluntary load curtailments.

Projections for the summer of 1971 indicate that a capacity of 11,131 megawatts (including Indian Point Unit 2) should be available to handle a peak load of 8,125 megawatts. This would provide a reserve margin of 3,006 megawatts or 36.9 percent of peak load. When consideration is given to the fact that major portions of the Consolidated Edison generating capacity is provided by over-age thermal plants (30 were placed in service during 1925 or earlier) and that an additional large block results from recently installed or to be installed gas turbine peaking units, this projected reserve margin, when viewed from the perspective of past performance does not appear excessive.

4.0 REQUIREMENTS OF THE NATIONAL ENVIRONMENTAL POLICY ACT

The following sections discuss, within the context of the applicant's environmental report and the comments made by the various Federal agencies, the following environmental factors specified in section 102(2)(C) of the National Environmental Policy Act of 1969:

a. the environmental impact of the proposed action,

b. any adverse environmental effects which cannot be avoided should the proposal be implemented,

c. alternatives to the proposed action,

d. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

e. any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Additional details on each of these items are contained in the applicant's environmental report.

5.0 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

The environmental impact associated with the construction and operation of Indian Point Unit 2 include those actions which may have a potentially detrimental effect on the present state of the environment and those actions which may potentially enhance environmental amenities. In the former group are such actions as the release of low levels of radioactivity to the environment and the discharge of effluents to the Hudson River after withdrawal, treatment, and use in the various plant systems. In the latter group are the educational, recreational, and scenic value of the site for the visiting public. These and other effects are discussed below.

5.1 Radiological Effects

The operation of any nuclear power reactor results in the production of radioactive materials that for the most part are contained within the fuel elements in the reactor vessel. The radioactive materials are produced as a direct result of the fission process or are activated materials resulting from nuclear reactions. Small quantities of gaseous and liquid radioactive wastes are released to the environment by controlled processes following appropriate procedures for sampling, treatment, and dilution, as

appropriate. The maximum allowable amount of radioactivity that may be released is established in accordance with the Commission's regulations, as set forth in 10 CFR Part 20. The applicant has indicated that releases of radioactivity in liquid and gaseous effluents will be a small percentage of these limits. Experience with operating nuclear plants of design similar to that of Indian Point Unit 2 supports the applicant's contention that releases will in fact be a small percentage of 10 CFR Part 20 limits.

5.1.1 Radwaste Treatment System

Radioactive waste treatment systems that are incorporated into the facility are described in Section 9.0 of the Safety Evaluation. Processes for separation or concentration of radioactive liquid wastes include holdup, filtration, demineralization, and evaporation. After suitable sampling, treatment, and monitoring to assure that releases are within the limits established in the Commission's regulations, small quantities of radioactive liquid waste are released on a batch basis to the condenser circulating water discharge canal where the effluent is diluted and discharged to the Hudson River. A minimum dilution of 1000-to-1 is provided in the discharge canal. The limits on routine radwaste releases from the three units at the Indian Point site requires that the combined releases from the three units when added together be within

the limits specified in 10 CFR Part 20. This requirement is stated in Section 3.9 of the Technical Specifications of the operating license for Indian Point Unit 2 (see Appendix M).

The gaseous radwaste system includes a capability for a minimum of 20 days holdup prior to release from the Indian Point Unit 2 vent. Thus, advantage is taken of both decay time in holdup tanks and a controlled elevated release. The routine gaseous radioactivity releases from the three plants planned for operation at Indian Point will be from three different vents. The combined release of gaseous waste containing radioactivity from these three sources is limited by the Technical Specifications so that the annual average concentrations at the minimum exclusion distance will not exceed the limits of 10 CFR Part 20. For gaseous halogens and particulates with half-lives greater than eight days, the applicable limits of the Technical Specification are less than 1% of the limits given in 10 CFR Part 20. The Technical Specifications also require that the maximum release rate of gaseous waste not exceed the annual average limit.

Solid wastes are placed in Federally approved containers for shipment to an offsite licensed burial ground.

5.1.2 Radiological Monitoring in the Environment

The radioactivity levels in the vicinity of the Indian Point site have been measured by the applicant since 1958 to ascertain the impact of operation of Indian Point Unit 1 on the background levels of radioactivity. The environs of the Indian Point site have been studied intensively for many years by the Institute of Environmental Medicine of New York University Medical Center. These studies considered both the exposure to man and to the flora and fauna indigenous to the vicinity of the plant. All the results compiled to date indicate that radioactive effluents from Indian Point Unit 1 operation have produced barely distinguishable radiation exposure to the public and have had no detectable effect on the ecology of the area.

The environmental radiation monitoring program for Indian Point Unit 2 will be a continuation of the present program. The program includes direct measurements of gamma radiation and analyses to monitor fallout, air particulates, airborne iodines, water from various surface drinking water supplies, Hudson River water, water from lakes near the site, well water, lake aquatic vegetation, Hudson River vegetation, river bottom sediments, river aquatic biota, terrestrial vegetation, and soil.

The detailed requirements of the environmental program are stated in the proposed operating license as Section 4.10 of the Technical Specifications. Section 4.10 is included as a part of the applicant's response to a question from the Department of Defense attached as Appendix K to this statement.

On the basis of the type and size of equipment provided to control effluent releases, and general experience with currently licensed and operating power reactors, there is reasonable assurance that the radioactive waste treatment system will perform as designed and that the radioactivity levels in liquid or gaseous releases from Indian Point Unit 2 will be well below the levels specified in the Commission's regulation, 10 CFR Part 20, "Standards for Protection Against Radiation." The extensive environmental monitoring program to be carried out by the licensee will assure that information and environmental levels of radioactivity are developed on a continuing basis. There is reasonable assurance that there will be no adverse effects on the human environment from the release of radioactivity from Indian Point Unit 2.

5.1.3 Federal Agency Comments

As noted earlier, the Department of Health, Education, and Welfare's Public Health Service was sent a copy of the FSAR with subsequent amendments. A copy of the applicant's environmental report also was sent to the Department for comment, and in their

response the Department concluded, "...with the qualifications stated in this report, we are of the opinion that Indian Point Nuclear Generating Unit 2 can be operated along with Unit 1 without any significant impact on the environment and with minimal risk to the public health."

In its comments the Department of Health, Education, and Welfare questioned the estimates of liquid radioactive effluents presented by the applicant in the FSAR. The applicant has responded that the estimates were based on design criteria and determination of the actual variance from these estimates will require operating experience. However, the estimate is so low that adequate margin exists to provide confidence that the discharges will be well within the allowable limits and current PWR experience confirms that liquid discharges are small percentages of 10 CFR Part 20 limits.

The Department of Health, Education and Welfare also stated that the environmental statement does not, but should, contain a commitment by the applicant to use his waste treatment systems to their fullest capacity in order to keep discharges as low as practicable. Section 3.9 of the operating license Technical Specifications (see Appendix M) contains such a requirement reading as follows:

> Plant equipment shall be used in conjunction with developed operating procedures to maintain surveillance of radioactive gaseous and liquid effluents produced during normal reactor operations and expected operational occurrences in an effort to maintain radioactive releases to unrestricted areas as low as practicable.

The Department of Health, Education, and Welfare also stated their belief that the gaseous waste holdup capacity should be expanded to 60 days minimum. Section 3.9 of the Technical Specifications (see Appendix M) requires a minimum decay holdup time of 20 days for gaseous wastes except for low radioactivity gaseous waste resulting from operations associated with refueling and startup. The applicant has stated that design capacity of the tanks at design flow rates would permit 40 day holdup.

The Department of Health, Education, and Welfare stated that the proposed Technical Specifications for the site gaseous waste limit would be excessive if calculated by the method

proposed by the applicant and that discharge limits for the Indian Point facility should also be applied to the proposed Nuclear Units 4 and 5. The Technical Specification (see Appendix M) for the site gaseous waste discharge limit has been changed by correcting a typographical error appearing in the equations presented in the FSAR. The Technical Specifications provide that effluents for all three plants planned for operation at the Indian Point site be considered as one unit with respect to meeting requirements of 10 CFR Part 20. Nuclear units 4 and 5 have not been considered as yet, since they have not received a construction permit.

With respect to other comments of the Department of Health, Education, and Welfare the environmental surveillance program for Indian Point Unit 2 does provide for TLD's (thermo-luminescent-dosimeters) with minimum sensitivity for 10 millirems per month at 11 points on the site boundary and does include both gamma spectroscopy of drinking water, Hudson River water, and lake water all of which is in consonance with their recommendations.

The Department of the Interior and the Department of Defense commented on the insufficiency of information presented in the Environmental Report on the environmental monitoring program. This material was covered in detail in the FSAR and is now incorporated into the operating license Technical Specifications as previously discussed above (see Appendix K). The Department of Defense also requested a more definitive statement regarding the air pollution potential of two packaged boilers to be used at the site. In their response the applicant has provided estimates of pollutants to be released in the operation of these two 50,000 pounds/hour boilers and has stated that a permit for their operation has been obtained from the New York State Department of Environmental Conservation.

5.2 Water Quality Aspects

5.2.1 Legislation

Section 21(b) of the Federal Water Pollution Control Act, as amended by the Water Quality Improvement Act of 1970, requires applicants for Federal licenses or permits to conduct any activity, including the construction of a facility such as a nuclear power plant, which may result in any discharge into the navigable waters of the United States, to provide the Federal licensing agency with certification from the State, or interstate water pollution control agency, or the Secretary of the Interior, as appropriate, that there is reasonable assurance, as determined by such certifying

authority, that the activity will be conducted in a manner which will not violate applicable water quality standards. Since construction of Indian Point Unit 2 was commenced before April 3, 1970 (the date of enactment of the Water Quality Improvement Act of 1970), section 21(b)(7) of the Federal Water Pollution Control Act, as amended, provides that such certification is not required prior to issuance by the AEC of an operating license, but the applicant will be required to submit a certification to the AEC by April 2, 1973.

The applicant has made application dated July 15, 1970, to the New York State Department of Environmental Conservation for certification pursuant to section 21(b)(1) of the Federal Water Pollution Control Act. Supporting technical information for this application is included in Appendix H of this statement.

5.2.2 Thermal Effects

All steam-electric generating plants release heat to the environment as an inevitable consequence of producing useful electricity. Heat from the fission of nuclear fuel in a reactor or combustion from fossil fuel in a boiler is used to produce high temperature, high pressure steam, which in turn drives a turbine connected to a generator. When a portion of the thermal energy

in the steam has been converted to mechanical energy in the turbine, the remaining steam is converted back into water in a condenser.

Condensation is accomplished by passing large amounts of cooling water through the cooling coils in the condenser. In the least costly and most widely used method, the condenser cooling water is taken directly from nearby rivers, lakes, estuaries, or the ocean. The cooling water is heated 10 to 30 degrees F. -- depending on plant design and operation -- and then usually returned to the same source.

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."

The applicant initiated extensive studies of the potential effects of thermal discharges to the Hudson River estuary at the Indian Point site in 1964. 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, a new outfall structure was designed, and it was determined that, with the new outfall structure, the criteria would be 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. The results of these studies have been used as a basis for the applicant's request for water quality certification and are included in Appendix H of this statement.

5.2.3 Chemical Effluents

As in the case of other power plants, various chemicals will be utilized for maintenance of plant water quality, corrosion inhibition in certain closed loop systems, regeneration of demineralizers, and the prevention of marine fouling of condenser and other tubing. Additionally, in Indian Point Unit 2, part of the nuclear reactivity control is accomplished by the addition or deletion of boron compounds to the reactor cooling water; thus the chemicals used can include boric acid, sulfuric acid, potassium dichromate, various laboratory chemicals, and chlorine. In the course of normal plant operation, small amounts of these chemicals will be discharged to the river. The applicant has stated that discharge concentrations of these chemicals during normal cooling water flow are not expected to exceed those listed in the table below.

CHEMICALS USED FOR ROUTINE TREATMENT DISCHARGED FROM INDIAN POINT UNIT NUMBER 2

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	1×10^{-5} ppm hydrazine
Morpholine	0.0001 ppm morpholine
Sodium Hypochlorite	0.1 ppm residual chlorine
Trisodium Phosphate	0.0004 ppm Na_3PO_4

Permits for discharge of these effluents are being requested by the applicant from the New York State Department of Environmental Conservation in connection with the request for certification under the Federal Water Pollution Control Act.

5.3 Other Environmental Effects

5.3.1 Intake Structure Design

An intake structure is designed to remove cooling water from the river and provide it to Indian Point Unit 2. Intake screens serve the necessary function of "screening" the cooling water of anything large enough to plug the water passages in the plant equipment and thus decrease the plant performance. At the intake structure entrance is a trash rack - heavy bar members on wide spacing - designed to restrain logs and other large debris as well as floating ice in wintertime. Behind this is a traveling screen of relatively fine mesh to prevent entry of smaller material. This is made up of a number of screen sections, fastened top to bottom, to form an endless belt of screens. The addition of top and bottom rotating wheels results in a screen which continuously moves vertically upward through the cooling water, over the top and then, before it enters the water on its downward pass, is sprayed with high pressure water to wash off any material picked up on the up pass. Provisions are also made for placing fine mesh stationary screens in front of the traveling screens.

Despite these precautions the cooling water intake of Indian Point Unit 1 has experienced problems with fish impingement on the screens at various times since full operation was initiated in 1963. The applicant has expended considerable effort to determine why the problem exists and to solve it by design modifications. Despite numerous modifications and corrective actions difficulty was experienced as recently as the winter of 1969-1970 when considerable numbers of dead fish had to be removed from the screens. The applicant has stated that their investigations indicate that chemical and radioactive discharges from the plant are not contributing factors in harming fish nor are thermal discharges, except to the extent that the warm water might serve to attract fish to the area of the intake.

The location of the Unit No. 2 intake, unlike that of the Unit No. 1 intake, is not behind the existing loading wharf, a possible attraction for fish. Therefore, there is reason for belief that the problem will not exist to the same degree for Unit No. 2. Nevertheless, because of experience with Unit No. 1, the applicant recognizes that there may be a problem with the current design of the Unit No. 2 intake to provide adequate protection against fish kills.

Because of this, tests will be run prior to plant startup with the Unit No. 2 circulating water pumps to determine whether fish will be attracted to the intake and how they will react to the operation of the screens and pumps. As an interim measure, fish protective screens will be installed prior to the commercial operation of Unit No. 2. The protective screens will be installed at the outer face of the intake structure in guides already provided in the walls. Based on Unit No. 1 operating experience, a throttling capability will be incorporated to reduce substantially the intake velocities during the colder parts of the year.

During the throttling operation, the average approach velocity to the protective screens will be lowered from about 0.85 feet per second to about 0.6 feet per second. This will result in a reduction of flow through the plant condensers from 840,000 gallons per minute to 600,000 gallons per minute. The cooling water temperature will be increased approximately 23°F during its passage through the condenser, which is a rise of 7°F over that expected with 100% flow. Since it is expected that the throttling procedure will be needed only in the colder part of the year (river temperatures less than 50°F), plant discharges are expected to be well within the allowable limits set forth in the Thermal Discharge Criteria of the New York State Water Quality Standards.

Because recent efforts have not resulted in assurance of complete effectiveness of a fish protection system the applicant is continuing ecological and engineering studies in the area of fish protection. As a long term solution for fish protection for Unit No. 2 as well as for the other units at Indian Point, the applicant's engineers are developing a new concept for the water intake structure that appears promising. This concept includes a new screen structure built farther out from the shore (75' - 100') and more into the main longitudinal flow of the river. This structure would screen water for all three units at Indian Point and would be designed to permit intake velocities below 0.5 feet per second during the colder parts of the year. The main objectives of the proposed structures are:

1. To minimize recirculation effects to the intake point from the discharge outfall, which is an attraction mechanism.
2. To deny access under the unloading wharf to fish, thereby eliminating the possibility of the wharf acting as an attraction.

3. To place the traveling screens where the river's stronger currents can longitudinally wash the face of the screens.
4. To achieve low intake velocities.
5. To provide other operational benefits not directly related to fish protection, such as greater unit efficiency with reduced recirculation, and removal of the existing eddying conditions which lead to greater accumulation of river debris in front of the individual units.

Engineering design and associated research and development have already begun on this project and it is planned that the work will be completed and in operation by the spring of 1973.

A technical task force has been formed by the applicant, headed by the applicant's Chief Civil Engineer and including its Environmental Engineer and the General Superintendent of the Indian Point Station. The purpose of the task force is to concentrate and coordinate the applicant's efforts in implementing the plans and studies on fish protection. To assist the Task Force, an Indian Point Fish Advisory Board consisting of expert biologists and engineers from the United States and Great Britain has been brought together by the applicant. The

Board has been requested to provide advice to the applicant on how to protect fish from damage from the operation of Indian Point power plant cooling systems. The Board has held a number of meetings with the Task Force and with other individuals and organizations.

The applicant has reviewed with the Indian Point Fish Advisory Board the overall program described above for fish protection in connection with operation of the Indian Point plants. The Board is of the opinion that, in light of present knowledge, the program provides the best approach to the fish protection problems for Indian Point Unit 2.

Aquatic life of low mobility which is small enough to pass through screens will be passed through the condensers of the plant. These organisms will be exposed to a rapid temperature increase followed by a gradual return to ambient temperature. The effects of this passage on these various organisms is presently under active investigation by the applicant's consultants and other investigators. These effects also will be considered in connection with the continuing ecological studies of the site and the Hudson River.

The Department of Interior has requested further information on possible alternative measures and supplementary facilities to alleviate potential fish problems similar to those encountered with Unit 1. Additional consideration is currently being given this problem by the applicant's Indian Point Fish Advisory Board. The applicant has stated in his reply to the Department's comments that it believes it is doing everything possible to alleviate this problem and feels that the interim and long range measures presented in its environmental report as outlined above, embody the best approach to resolution of this problem.

5.3.2 National and Historic Landmarks

The site for the facility has been considered in accordance with the requirements of the National Historic Preservation Act to determine whether any historic landmarks will be affected by the location of the nuclear plant at the Indian Point site. In this regard the AEC requested the Advisory Council on Historic Preservation to comment on the proposed plant site. The Stony Point Battlefield Reservation in Rockland County which is listed in the National Historic Register is located across the Hudson River from the Indian Point site. The

Advisory Council stated that "The impact of the operation of the Indian Point plant on the Stony Point Battlefield Reservation cannot be judged sufficiently adverse to warrent Council comment."

5.3.3 Sewage Disposal

The applicant has stated that an appropriate sewage disposal system has been provided with the approval of the appropriate State authorities. This system now serves Unit 1 and is sized to take into account future expansion of the Indian Point facility. No modifications are required for the system to provide service for Unit 2.

5.3.4 Regional Impact of the Plant

In its comments on the applicant's environmental report, the Department of Housing and Urban Development commented upon the relationship of the facility to regional economic development plans, and stated that local, regional, or state planning agencies should be consulted early in the development of the project. The applicant has been and will continue to coordinate its planning with the Village of Buchanan which has favored the construction of the plant and the Westchester County Planning Board, the appropriate County agency, has been consulted and kept advised of developments at the site (see Appendix J).

The Hudson River Valley Commission which was not in existence at the time of commencement of construction of Indian Point Unit 2 has been kept advised of developments with respect to Indian Point Unit 3.

The Department of Housing and Urban Development has expressed concern about the proximity of populated areas to Indian Point Unit 2. The proximity of populated areas was an important part of the Atomic Energy Commission's review at the construction permit stage and had a significant effect on plant design and provisions for engineered safety features. On the basis of this review, the Atomic Energy Commission and its Advisory Committee on Reactor Safeguards concluded that Indian Point Unit 2 could be built at the Indian Point site without undue risk to the health and safety of the public.

The Department of Interior has stated that it may be premature for the applicant to conclude that on the basis of investigations and studies conducted to date that Indian Point Unit 2 will have no significant adverse impact on the ecology of the Hudson River. The Department of Housing and Urban Development stated that relevant findings of ecological studies should be included in the applicant's environmental report.

The applicant is sponsoring a detailed study of the ecology of the Hudson River in the vicinity of the Indian Point site which is now being performed by the Raytheon Company. This study is being carried out under the sole direction of the Hudson River Policy Committee, an independent body consisting of representatives of appropriate State and Federal agencies. This study is a continuation and expansion of a previous ecology study of the river conducted by the New York University Institute of Environmental Medicine initiated in 1968. The content of these studies is outlined in the environmental report and the applicant is keeping the cognizant Federal and State agencies advised as to progress on the preparation of final reports.

The applicant has stated in his reply to the Department of Interior comment as follows: "Con Edison agrees that it cannot be known with absolute, 100% accuracy, that the plant will have no significant adverse impact on the Hudson River until after the plant has operated and post-operational ecological studies have been completed. However, we believe that Con Edison has approached this problem with due regard for the protection of the environment, has conducted extensive investigations and studies and is justified in its belief, on the basis of the best evidence now available, that Unit No. 2 will have no significant adverse impact on the ecology of the Hudson River."

5.4 Enhancement of Environmental Amenities

The area immediately around and including the Indian Point Station is industrially zoned. The site is bounded on the west by the Hudson River. The applicant has consulted environmental designers in an effort to preserve, as much as possible, the natural beauty of the site following the construction of the facility.

The northern part of the site includes an 80 acre forest with a freshwater lake. This area is being maintained for general public use and includes a picnic area and a 2000 foot nature trail from the lake to the Hudson River.

A new visitors center will be constructed, the plans for which include indoor and outdoor exhibit areas. Extensive landscaping of the areas previously cleared will be done.

6.0 ALTERNATIVES TO THE PROPOSED ACTION

Indian Point Unit 2 is located on an existing nuclear generating site. The site characteristics as noted in the regulatory staff's Safety Evaluation, have been thoroughly studied and evaluated by the regulatory staff and certain expert consultants, including other Federal agencies, and are considered adequate to support the activities associated with the construction and operation of the Indian Point Unit 2. The need for the additional generating capacity which will be derived from Indian Point Unit 2 has been discussed with the applicant and with the Federal Power Commission, and the applicant indicated that the plant is necessary to provide additional base load generating capacity to meet regional load conditions and reserve requirements projected for the summer of 1971. Alternatives to the proposed operation of Indian Point Unit 2 have been discussed by the applicant in his environmental report and by the Federal Power Commission in its comments.

The applicant has discussed the alternatives in terms of feasibility to provide additional capacity no later than the summer of 1972. Neither fossil fueled unit or a nuclear unit at a different site could possibly be designed and constructed

to meet that schedule. Both the applicant and the Federal Power Commission state that the import of additional firm power from other utilities beyond that already committed is not a feasible alternative. The applicant concludes that:

> "The only possible alternative would be gas turbines, and from the standpoint of environmental values and conservation of resources, the balance favors the nuclear unit.... Gas turbines have not yet been developed (and could not be developed for use in 1972) to the point that they can be operated in sizes which can provide a base load source of power, although they now appear to be desirable for use for peaking power. They, therefore, cannot be considered equivalent to a base load unit such as Indian Point Unit 2."

7.0 ADVERSE ENVIRONMENTAL EFFECTS

As discussed in the previous section on the environmental impact of Indian Point Unit 2, there are certain potentially detrimental environmental effects associated with the operation of the facility. In view of the AEC's evaluation of the radiological impact of the plant on the environs, the AEC does not expect radiological effects to be significant. Further the applicant states that other effects such as thermal effects, effects on fish, chemical waste releases, and sewage disposal will not produce a significant effect on the environment.

The applicant has stated that he is legally required to comply with all applicable Federal and state laws and regulations concerning radioactive, thermal, and chemical wastes and will have to take whatever measures may be required to correct unforeseen problems which may, if not connected, result in a violation of applicable laws and regulations.

8.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The local short-term effects on the environment are those associated with the construction of any large industrial facility, and during facility operation, those associated with the radioactive, thermal, and chemical discharges of Indian Point Unit 2. The discharge of condenser cooling water will be kept within the applicable water quality standards and the plant's liquid and gaseous radioactive effluents are expected to be less than ten percent of the 10 CFR Part 20 limits.

The applicant has conducted an environmental monitoring program in connection with the operation of Unit 1 and will enlarge in this existing program in conformance with the Technical Specifications as previously discussed in this statement in Section 5.1.2 Radiological Monitoring in the Environment. This program will be used to provide a basis for detecting and evaluating any radiological impact which might lead to long-term effects in order that timely corrective action can be taken if required.

9.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The Indian Point site was committed to nuclear power generation with the beginning of construction of Indian Point Unit 1 in 1958, and no additional commitment was involved with the subsequent construction of Indian Point Unit 2. The applicant has stated that the location of a second unit adjacent to Indian Point Unit 1 represents an efficient use of land compared with the development of a separate site. As the area immediately around including the site is industrially zoned it would probably have been developed as an industrial site eventually. Curtailment of the use of the area as a result of operation of Indian Point Unit 2 should not be as severe as that incident to many other heavy industrial facilities. The recreational and other beneficial uses of the surrounding area should not be impaired. In fact, as previously noted, new recreational facilities will be created.

Executive Harry G. Woodbury

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-6031

August 6, 1970

Dr. Peter A. Morris
Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

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

Dear Dr. Morris:

By your letter dated May 7, 1970, you requested the Consolidated Edison Company to supply certain information on environmental aspects of Indian Point Unit No. 2. In response to your request we have prepared a document entitled "Applicant's Environmental Report - Operating License Stage", one hundred (100) copies of which are enclosed.

In preparing this report we have been guided by the proposed Appendix D to 10 CFR Part 50, entitled "Statement of General Policy and Procedure: Implementation of the National Environmental Policy Act of 1969" (35 Fed. Reg. 8594, June 3, 1970).

Very truly yours,

Harry G. Woodbury
Executive Vice President

enc.
gs

BEFORE THE UNITED STATES

ATOMIC ENERGY COMMISSION

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

Applicant's Environmental Report -

Operating License Stage

August 6, 1970

TABLE OF CONTENTS

		Page
I.	General	1
II.	Characteristics of site and surrounding area	5
III.	Environmental impact and effects	10
	A. Construction of Unit No. 2	10
	B. Physical presence of Unit No. 2	11
	1. Land use	11
	2. Landscape and appearance	12
	3. Recreation and education	13
	4. Historical preservation	16
	5. Population and congestion	16
	6. Wildlife	17
	C. Operation of Unit No. 2	17
	1. Radiological effects of operation	17
	2. Water quality	22
	3. Air quality	22
	4. Water use; aquatic life	25
	5. Noise	34
	D. Utilization of Unit No. 2	34
IV.	Alternatives to the proposed action	36
V.	Environmental perspective; commitments of resources; long-term productivity	40

		Page
VI.	Supplemental information	41
	A. Environmental studies	41
	1. Ecological studies	41
	2. Radiological studies	44
	3. Fish protection studies	48
	B. Pollution control measures	49
	1. Radioactive waste disposal facilities	49
	2. Sanitary waste facilities	52
	C. State and local licensing agencies	53
	D. Maps	
	1. Scale plot plan of site	54
	2. General location of plant site	55
	E. Artist's rendition of Indian Point site with Unit No. 2 on the left	56

Applicant's Environmental Report
Operating License Stage

I. General

The Atomic Energy Commission ("AEC"), in a letter of May 7, 1970, requested Consolidated Edison Company of New York, Inc. ("Con Edison") to supply certain information on environmental aspects of Indian Point Unit No. 2 ("Unit No. 2"), a nuclear-powered electric generating unit being constructed by Con Edison and now nearing completion. On June 3, 1970 the AEC published for comment in the Federal Register (35 Fed. Reg. 8594) a proposed Appendix D to 10 CFR Part 50, specifying in greater detail the information on environmental matters to be provided by license applicants to assist the AEC in preparing the detailed statements required by the National Environmental Policy Act of 1969. * This report is intended to be responsive both to the AEC's letter and to the proposed Appendix D.

Con Edison filed its Application for Licenses for Unit No. 2 with the AEC in December, 1965, and received a construction permit in October, 1966. The unit is designed to provide 873,000 net kilowatts of electric power for the Con Edison system. It is located on Con Edison's Indian Point site on the Hudson River, and is adjacent to and to the north of Unit No. 1, a nuclear generating unit of 285 megawatts net electrical capacity, which has been in operation since 1962. A third nuclear unit, also under construction at this site,

*The Notice of Proposed Rule Making states that the proposed Appendix D is to be used as interim guidance pending further action on the appendix.

is scheduled for completion in 1973. All three units utilize reactors of the pressurized water type.

Con Edison's request for an operating license for the second unit is now under review by the AEC, and it is in connection with that review that this report is submitted.

Some of the interpretations chosen in preparing this document (which it is believed are supported by the legislative history of the National Environmental Policy Act as well as the Interim Guidelines issued on April 30, 1970 by the Council on Environmental Quality) are summarized below:

1. The human environment includes that created by man for his subsistence, safety, and comfort as well as that provided by nature. For example, air-conditioners, artificial light and elevators in modern buildings are a part of the human environment as well as parks.

2. The geographical area considered is roughly the same as the "metropolitan area" of New York City which (as in the case of other large American cities) carries with it a connotation of close economic and social interdependence and ease of communication. In consequence, discussion of benefits to the inner-city dweller or worker through use of power (elevators, heating and rapid transit etc.) have been considered appropriate for this report.

3. "Long-term productivity" is presumed to mean productivity over an extended period toward an economic or other purpose generally accepted as a constructive use of some part of the natural environment.

In reviewing this report the reader should bear in mind that Unit No. 2 was licensed for construction by the AEC over three years before the National Environmental Policy Act of 1969 became law. The unit is approaching completion and is scheduled to go into commercial operation in June, 1971. As a result, unlike many later projects, the current AEC operating license review represents the first opportunity to submit such a report. Inevitably the character of the report differs in certain ways from one that would be typically filed at the construction permit stage. Particularly, (1) discussions of the environmental effects of construction must take into account the fact that most of the construction and its effects have already occurred, and (2) some alternatives are now precluded as a practical matter by the passage of time, the stage of completion, and the financial commitment now represented by Unit No. 2.

Consistent with the AEC's proposed Appendix D to 10 CFR Part 50, information is not included on water quality aspects of construction

or operation of the unit, except for a statement concerning the applicability of the certification requirement of the Federal Water Pollution Control Act as amended.

II. Characteristics of site and surrounding area

The 235-acre Indian Point site is located in Westchester County, New York on the east bank of the Hudson River, about 24 miles north of the New York City boundary line. Section VI.D. of this report contains a scale plot plan of the site and a map showing the general location of the site.

The site is surrounded on most sides by high ground ranging from 600 to 1,000 feet above sea level. The river at this point runs northeast to southwest but turns sharply northwest approximately two miles upstream of the plant. The west bank of the Hudson is flanked by the steep, heavily wooded slopes of the Dunderberg and West Mountains to the northwest (elevations 1,086 feet and 1,257 feet respectively) and Buckberg Mountain to the west-southwest (elevation 793 feet). To the east of the site, peaks are generally lower than those to the north and west. The river south of the site makes a sharp bend to the east and then widens.

The area immediately around and including Indian Point is zoned for heavy industry.* The surrounding area is generally residential with some large parks and military reservations. The

*Industries in the vicinity include Georgia Pacific Complex, New York Trap Rock Corporation, Fleishmann's Distillery, and Sanitas Company.

communities of Verplanck, Buchanan, and Peekskill lie within two miles of the site. West of the river the Palisades Interstate Park, and residential areas are the dominant land usage. Orange and Rockland Utilities' Lovett Generating Station is located on the west shore of the river across from Indian Point.

Based upon the 1960 census, approximately 53,000 people live within a 5-mile radius of the site, and this number is expected to increase to about 108,000 by 1980. The 1960 population within a 15-mile radius of the site was 326,930, whereas the estimated 1980 population is about 670,000. Within a 5-mile radius most of the population is located northeast of the site. Within the larger radius the majority of the people are located south of the site.

The site itself is hilly, rising from the Hudson River to elevations of about 150 feet. The dominant elevation is approximately 100 feet.

The northern part of the site includes an 80-acre forest and a fresh water lake. The south-central portion of the site contains Unit No. 1 and related structures, as well as Units 2 and 3 now under construction. The dominant features of Unit No. 1 are its containment dome and a stack (which serves primarily its oil-fired superheater). A considerable portion of this area has been cleared for construction, storage, parking, roads, or temporary

structures. This portion of the site is presently affected in a manner typical of large construction projects in progress. Access roads and electrical transmission lines run from Units No. 1 and 2 to the eastern site boundary. A major gas transmission line also traverses the property. A temporary visitors' center is located on a hill overlooking the generating station.

Adjoining the Indian Point site to the south is another tract owned by Con Edison, known as the Trap Rock site, which was purchased as a site for future nuclear generating units. The water-front portion of that site is separated from the Indian Point waterfront by the Georgia Pacific Complex. It contains a grassy area contained to the west by a curving ridge and to the north and east by a series of large earth mounds. The area is traversed by several electric transmission lines. An abandoned quarry, now a lake of about 30 acres, dominates this area. As discussed more fully below, plans are being developed for landscaping and enhancing the recreational value of both sites as a unified whole.

The plant life at the Indian Point site may best be described as an oak-maple-hemlock forest. These primary species occur throughout the site. However, a great variety of other species not part of the normal ecological succession has been introduced to previously cleared areas. These include wild cherry, dogwood, hickory, sumac, cottonwood and linden. The large block of natural maturing

untouched forest does not have these additional species.

The wildlife includes a typical group of North American species associated with a hardwood forest, such as porcupines, woodchucks, squirrels, opossums, insects, reptiles and a variety of bird life such as robins, thrushes, and occasional waterfowl.

The meterorology of the site is characterized by a prevalent north-south wind direction resulting from the orientation of the ridges in the Hudson Valley. The geological characteristics of the site have been evaluated and have been found suitable for location of the unit. The site is located in what may be described as a seismically inactive region and one in which severe natural phenomena such as tornados and flooding are uncommon.*

Flow in the Hudson River at Indian Point is affected more by the tides than by the runoff of the tributary watershed. Tide changes in this area of the Hudson are normally about three feet but run to seven feet in extreme storm conditions. The width of the river opposite the plant is approximately 5,000 feet with a depth of 55 to 75 feet within 1,000 feet of the shoreline. About 80 million gallons of water per minute flow past the plant during the peak tidal flow.

*Nevertheless, Unit No. 2 is well protected from tornados by virtue of its design and by intervening existing structures and topographical features. The potential of the site for earthquakes and flooding has been analyzed in detail, and the Unit No. 2 design reflects the results of these studies with appropriate margins. The Final Safety Analysis Report for Unit No. 2 contains detailed information on these subjects.

The Hudson River at Indian Point may be described as a partially mixed estuary, with the salinity varying considerably depending upon tidal changes and fresh water runoff. The river is subjected to pollutants from municipal, industrial and agricultural sources, both upstream and downstream. By comparison with pollution occurring near population centers such as Albany, Poughkeepsie, and New York City, the quality of water reaching Indian Point, as well as the dissolved oxygen content, is fairly good and the river at that point supports a considerable variety and abundance of aquatic life.

Migratory fish in the area include striped bass, shad, alewife, blueback herring, smelt, and sturgeon. The principal resident fish are eels, catfish, white perch, minnows, tomcod, and sunfish. Both commercial and sport fishing are carried on in the area, although the amount of commercial fishing is declining. The shad and striped bass are the two most important for commercial fishing, while the striped bass is the most important for sport fishing. There is no commercial shellfish industry in the area, and there are no commercially harvested crustaceans. The river also contains various underwater plant life, small aquatic insects and small crustaceans in sufficient amount to support the fish life.

III. Environmental impact and effects

A. Construction of Unit No. 2

As described earlier some of the ground around Unit No. 2 has been disturbed as a result of construction. However, this will be restored and landscaped as described in Section III.B.2. below.

A limited amount of traffic congestion has occurred from time to time during construction, since there may be as many as a thousand persons working on site at a given time. However, this congestion is temporary and will not occur after completion of construction.

Construction of Unit No. 2 is creating no noise problem for off-site residents because of the size of the site. Construction noise and other disruption have resulted in the temporary relocation of wildlife which for the most part will be naturally reestablished after completion of construction.

Some combustion products are released to the atmosphere during construction as a result of operation of diesel-powered machinery. This has no significant effect upon the environment and does not differ from any other large construction job.

There have been discharges to the river of small amounts of chemicals used for cleaning during the construction

of the facility, and there will be further chemical discharges prior to completion of the facility. These discharges are made subject to prior approval by the New York State Department of Health. No adverse effect has been or is expected to be experienced with these discharges. As with other water quality matters, these discharges are covered by the Federal Water Pollution Control Act, as amended, and the considerations set forth in Section III.C.2. of this report also apply here.

Dredging and filling generally results in the destruction of benthic organisms in the area involved. Relatively little dredging and filling was required for the construction of Unit No. 2 intake and discharge structures, so that these effects have been minimal. Authorization has been obtained from the U.S. Army Corps of Engineers for this work as necessary.

B. Physical presence of Unit No. 2

1. Land use

As previously mentioned, the area immediately around and including Indian Point is industrially zoned. Also, the location of a second unit adjacent to one already in existence represents an efficient use of land compared with the selection of an undeveloped site.

A study of the population and land use, both existing and projected, within a 55-mile radius of Indian Point, has been compiled for Con Edison by the Regional Economic Development Institute, Inc., under the direction of Dr. Edward M. Hoover. It is Con Edison's opinion that Unit No. 2 represents a reasonable land use consistent with both the short and long-term development of the surrounding area.

2. Landscape and appearance

The structures of Unit No. 2 were architectually designed to present an attractive appearance and one that is cohesive with the existing facilities. An artist's rendition of the completed facility is found in Section VI.E. of this report.

Effort was exercised wherever possible to eliminate from view unsightly operating equipment. The screen well machinery at the shore front is located behind a masonry curtain with a planting box at its base to screen it from river traffic and the opposite shore. Attention has been given to the form, color and texture of the buildings so that the setting is enhanced and the feeling of intrusion is held to a minimum.

The area around the plant will be landscaped in an attractive manner. The landscaping is being developed

as a part of an overall plan to improve the aesthetic and recreational value of the complete site for the visiting public and others.

Transmission of electricity from Unit No. 2 to the load center will not require the use of new rights of way for overhead transmission lines. From Indian Point east to a north-south Con Edison right of way, a new 345 kV overhead circuit has been strung on existing towers. From the intersection with the north-south right of way south to a station just north of New York City, a double circuit 138 kV overhead transmission line has been rebuilt for operation at 345 kV.

Steel pole construction will be used to transmit Unit No. 2 power from the site to the Buchanan substation. Steel pole construction for transmission lines is a rather recent concept that is gaining acceptance in the utility industry for use in areas where aesthetic values are of prime concern. The tapered steel pole with upswept crossarms is more graceful than conventional latticed towers and the configuration coupled with the latest engineering knowledge as to insulator requirements and spacing of the conductors permits a narrower structure than a latticed tower.

3. Recreation and education

As previously mentioned, the northern part of Con Edison's Indian Point site includes an 80-acre forest with a

freshwater lake. This woodland is being maintained for use of the visiting public. Picnic tables and benches are located in shaded areas around the lake, which is available for fishing. A marked trail of approximately 2,000 feet starts at the lake and terminates at the Hudson River shoreline. Parking and toilet facilities are available to visitors in these areas.

A parcel of approximately 18 acres at the northwest corner of the site has been transferred by Con Edison to the Village of Buchanan, to be developed as a public marina.

The visitors' center now in use has been operating since September, 1959 and has served some 381,000 visitors. A tour of the Indian Point facilities begins at the information center where films, exhibits, and binoculars for viewing the site are available. Visitors then proceed by bus to the station, where they may tour the turbine hall and other portions of the station.

Con Edison is now in the process of developing a master plan for enhancing the educational, recreational and scenic value of the site for the visiting public, as well as providing facilities to accommodate a considerably larger number of visitors. To accomplish this Con Edison has engaged M. Paul Friedberg and Associates, a firm accomplished in the

fields of landscape architecture and urban planning, as a consultant in these matters. While the details have not as yet been determined, the following is an outline of what will be done:

1. A new visitors' center will be constructed to the south and east of the plant. This center will be considerably larger than the existing one and will include more sophisticated exhibits. Outdoor exhibit areas may also be provided. The exhibits themselves, which will be designed by Atkins and Merrill, will focus upon the peaceful uses of nuclear energy. Outdoor overlooks and expanded parking facilities will be provided. Vincent G. Kling and Associates has been retained to design the actual structure.

2. Picnic facilities, trails and other facilities will be improved and expanded. Facilities for nature study will be provided.

3. As mentioned previously, there will be extensive landscaping of areas of the site which have previously been cleared. This will be done in a manner that is attractive and consistent with the natural surroundings.

4. The plan includes the development of the Trap Rock site in a manner consistent with that of the Indian Point site.

These new facilities will improve the attractiveness and usefulness of the site to the general public.

The major recreational uses of the area surrounding the site are fishing, boating, and use of the various parks in the general vicinity. Neither these or any other recreational uses of the area will be foreclosed or impaired by Unit No. 2 (or the other units).

4. Historical preservation

There are some picturesque buildings and streets in neighboring communities. The nearest landmarks of consequence are St. Peter's Church and Cemetery in Verplanck, and St. Mary's Cemetery along the Broadway Road. Unit No. 2 will not infringe upon these or any other historical landmarks or areas.

5. Population and congestion

Unit No. 2 when completed will have no significant direct effect upon traffic or other congestion. An increase in the station staff of only about 25 persons will be required. The increase in visitor traffic due to the attraction offered by the new visitors' facilities will be accommodated by improvements in the site road network and parking

areas. Finally, the location of a second nuclear generating unit at Indian Point is not expected to affect the overall development or the population patterns of the surrounding area so as to aggravate traffic or other congestion.

6. Wildlife

While some relocation of wildlife has occurred as a result of construction, large areas of the site remain untouched and as such provide immediate refuge for wildlife movement. This has held to a minimum the actual distance of wildlife relocation. The areas disturbed during construction will be rehabilitated and resettlement of wildlife can be expected.

C. Operation of Unit No. 2

1. Radiological effects of operation

Under normal operating conditions small amounts of radioactive wastes will be released from Unit No. 2 into the atmosphere and into the cooling water discharge to the Hudson River. These releases will be in compliance with Part 20 of the regulations of the AEC. For the purpose of determining compliance with these regulations Indian Point Units 1, 2 and 3 will be treated as a single facility. The combined releases from all three units are expected to be far below the regulatory limits.

The following tables contain the quantities of liquid and gaseous effluents which are expected as a result of facility operation. It must be emphasized, however, that these estimates are based upon predicted performance of fuel and certain plant components and systems; actual releases may be higher or lower than those predicted.

ESTIMATED LIQUID EFFLUENTS

	Indian Point Unit No. 2		Units 1, 2 and 3 Combined (a)	
	All Others	Tritium	All Others	Tritium
Curies Per Year	.0252	4238	36.95	9228
Concentration Curies/cc	$.2 \times 10^{-14}$	283×10^{-14}	6.5×10^{-14}	691×10^{-14}
Fraction of Maximum Permissible Concentrations at Point of Discharge	0.00002	0.00090	0.039	0.0022

(a) With Indian Point Unit No. 1 Average 1967-1969

The numbers above for Units 2 and 3 are for 1% failed fuel. With no failed fuel, the numbers are approximately equivalent to those for tritium alone.

ESTIMATED GASEOUS EFFLUENTS

	Indian Point Unit No. 2	Units 1, 2 and 3 Combined (b)
Curies Per Year	9850	19876
Concentration Curies/cc	0.9×10^{-14}	2.1×10^{-14}
Fraction of Maximum Permissible Concentrations at Site Boundary	0.015	0.035

(b) With Indian Point No. 1 Average 1967-1969

The numbers above for Units No. 2 and 3 are for 1% failed fuel.

The above estimates do not take into account a reduction in the height of the Unit No. 1 stack from elevation 470 feet above sea level to the elevation 390 feet above sea level.* This modification, which is subject to AEC approval, will be accomplished as a result of seismic considerations in the Unit No. 2 design. The effect of this change upon the concentration figures listed above has not yet been calculated in detail but is certain to be insubstantial.

Based on the estimates presented above, the radiation levels to which a person on the site boundary would be exposed as a result of plant operation are only a fraction compared to that which he normally receives from background radiation.

*The general terrain around the plant varies from approximately elevation 15 feet to elevation 70 feet above sea level.

Equipment is provided for processing of radioactive wastes in order to reduce to a minimum the amount required to be released to the environment. This equipment is described in Section VI.B.1. below, as is the instrumentation provided to insure compliance with regulatory requirements and to protect against and warn of inadvertent or accidental releases.

Administrative procedures will control the manner in which gaseous and liquid effluents are released. As provided by current AEC regulations Con Edison will keep such releases as far below regulatory limits as practicable.

A comprehensive environmental monitoring program has been conducted in connection with the operation of Unit No. 1. Results of this program to date have shown that operation of Unit No. 1 has had no adverse radiological effect on the environment.

This program will continue as Units No. 2 and 3 become operational and throughout their operating lifetime. Operation of Unit No. 2 (as well as Unit No. 3) is likewise expected to have no adverse radiological effect upon the environment. The environmental monitoring program and other programs and studies are described in Section VI.A.2. below.

Solid radioactive wastes will be packaged and transported to an authorized disposal area in accordance with applicable governmental regulations.

Great attention has been devoted in the design and construction of Unit No. 2, by Con Edison and its contractors and by the Atomic Energy Commission, to the prevention of accidental releases of radioactive materials to the environment. Much of the cost and design effort of the unit is devoted to structures and equipment for the prevention of accidents and the limiting of the consequences of an accident should one occur. Numerous postulated equipment failures, abnormal operating conditions, and operator errors have been analyzed to assure that the health and safety of the public will be protected. A comprehensive quality assurance program is carried out during design and construction to assure that the unit as constructed will meet its design objectives. Operator training, detailed operating and emergency procedures, and periodic tests and inspections over the lifetime of the unit will assure the safe operation of the facility. The Final Safety Analysis Report for Unit No. 2 filed by Con Edison with the Atomic Energy Commission covers these subjects in detail.

The construction permit which Con Edison now holds for Unit No. 2 was issued after intensive review by the AEC Regulatory Staff and the Advisory Committee on Reactor Safeguards, of Con Edison's preliminary design, site studies and safety analysis, and after a public hearing conducted by an Atomic Safety and

Licensing Board appointed by the Commission. An operating license will be issued for Unit No. 2 only after the AEC has conducted another comprehensive safety review and has found that public health and safety have been assured.

2. Water quality

Unit No. 2 will discharge considerable quantities of warm water to the Hudson River. Also, small amounts of certain chemicals used for cleaning and water purification will be released to the river during operation. These discharges will be made in accordance with applicable water quality standards, and are subject to the certification requirement of Section 21(b) of the Federal Water Pollution Control Act as amended. In the case of Unit No. 2 certification is required to be submitted to the Atomic Energy Commission by April 1973. As provided by § 21(b)(7) of that Act, such certification is not required prior to issuance by the Atomic Energy Commission of an operating license, since construction of Unit No. 2 was lawfully commenced long before April 3, 1970 (the date of enactment of the Water Quality Improvement Act of 1970). Nevertheless, Con Edison has already made application to the New York State Department of Environmental Conservation for such certification and will take all necessary steps to obtain certification on a timely basis.

3. Air quality

Unit No. 2, like other nuclear power plants, will release no combustion products to the atmosphere as a result of

reactor operation. It will, however, have two "package boilers," fueled by #6 fuel oil (.37% sulphur), to produce auxiliary service steam for plant startup and service heating. The exhaust from these boilers will be discharged through the Unit No. 1 superheater stack. The amount of combustion products released per year resulting from the addition of these boilers will be insignificant. The contribution to air pollution of the reduction in Unit No. 1 stack height previously mentioned will not lead to a significant increase in air pollution.

However, if the Indian Point No. 2 nuclear station had been planned and constructed as a fossil-fuel plant, the contribution to the air pollution would not be negligible. For an 873 MWE fossil unit operated for 6500 hours per year, the following pollutants would be released to the atmosphere each year, using different types of fuel.

Estimated Millions of Pounds of Pollutants Per Year Based on 6500 Hour Operation/Year/Fuel.

Item	Coal (1% Sulphur)	Oil (1% Sulphur)	Gas
Particulate	2.56	0.86	-
SO_2	75.97	54.57	-
NO_2	32.34	19.07	11.24
CO	1.99	-	-

	(Fly Ash Removal)	(Fly Ash Removal)
	99%	0%
R_a-226	6 m Ci	5.2 m Ci
R_a-228	3.8 m Ci	12.2 m Ci

In terms of air pollution, the advantages of a nuclear unit such as Unit No. 2 over a fossil-fired unit of equivalent size are considerable. It should be noted that the use of a nuclear generating unit such as Unit No. 2 may result in reduction of air pollution considerably greater than the percentage of the system generating capacity which the unit represents, for two reasons. First, the use of such units will permit the retirement of old and inefficient fossil-fired units located in heavily populated areas. Second, it is generally desirable to use the nuclear units for base load and fossil-fired units (with their higher unit fueled costs) for peaking where possible, thus concentrating idle time and operation at less than capacity in the fossil-fired units.

4. Water use; aquatic life

(a) Fish Protection

Unit No. 1 at Indian Point went into full operation in 1963. Unit No. 2 is adjacent and to the north and will go into service in 1971. Cooling water from the river passes through intake screen structures directly in front of each unit, and after condensing the stream returns to the river, via a discharge canal, at a point approximately 950 feet downstream from the centerline of Unit No. 1.

Intake screens serve the necessary function of "screening" the cooling water of anything large enough to plug the water passages in the plant equipment and thus render the plant inoperative. At the entrance is a trash rack - heavy bar members on wide spacing - designed to restrain logs and other large debris as well as floating ice in wintertime. Behind this is a traveling screen of relatively fine mesh to prevent entry of smaller material. This is made up of a number of screen sections, fastened top to bottom, to form an endless belt of screens. The addition of top and bottom rotating wheels results in a screen which continuously moves vertically upward through the cooling water, over the top and then, before it enters the water on its downward pass, is sprayed with high pressure water to wash off any material picked up on the up pass. Provisions are also made for placing fine

mesh stationary screens in front of the traveling screens, generally to permit the removal of the traveling screen for repairs or inspection.

The cooling water intake of Unit No. 1 has experienced problems with fish being impinged on the screens from time to time since it went into full operation in 1963. Much effort has been expended both to determine why the problem exists and to solve it by design modifications. The intake structure and screening of Unit No. 1 were modified a number of times to improve the protective devices and to enable fish to avoid the intake more easily. Because it was felt that warm water from the Unit No. 1 discharge might be attracting the fish, the outflow has been moved downstream on two occasions and is now more than 950 feet from the centerline of the Unit No. 1 intake and more than 1200 feet from the centerline of the Unit No. 2 intake. Other methods such as air bubble, accoustical, electrical and lighting devices have been investigated without success.

Nevertheless, operating experience during the winter months of 1970 indicated that the problem was not completely solved. Considerable numbers of fish were removed from the screens on occasions during December 1969 through March of this year. An analysis of the species removed from the screens on one of these occasions showed that 92% were white perch, 4% were striped bass,

and the remainder were divided among five other species. The average weight of the fish collected was less than 1/2 ounce and the average length was under three inches. Evidence indicates that the swimming performance of the fish, particularly white perch, is impaired in cold water temperatures, preventing them from escaping impingement even by relatively low intake flow velocities.

Because of Con Edison's recent problems this past season, several changes will be made to the Unit No. 1 fish protective system before this coming winter season. The major change consists of introducing a throttling procedure during the operation which will reduce the intake velocity substantially. This will be done by partially closing the condenser outlet valves or by other means. Tests run in April, 1970 on Unit No. 1 (when the intake water temperature was 40°F) indicate that this throttling procedure was highly effective in lowering the amount of fish brought up on the traveling screens.

Investigations indicate that chemical and radioactive discharges from the plant are not contributing factors in harming fish, nor are thermal discharges (except to the extent that the warm water might attract fish to the area of the intake).

Unit No. 2 will draw about 900,000 gallons of water per minute from the Hudson River for cooling purposes. This

water will be drawn in through a concrete intake structure on the river edge. There are eight inlets flush with the river edge, six for the main circulating pumps and the other two for the auxiliary service pumps. Eight channels, separated by concrete walls, lead inland from the openings. Each channel includes a trash rack, a vertical traveling screen (except for one of the auxiliary service pumps which serves as backup and has only a fixed screen), provision for outer fish protective screens, and associated equipment for cleaning of the screens. The pumps are directly behind the traveling screens. The structure is designed to provide an intake water flow velocity approaching all of the screens of less than one foot per second. Construction of the intake is now substantially complete.

The location of the Unit No. 2 intake, unlike that of the Unit No. 1 intake, is not behind the existing loading wharf, a possible attraction for fish. Therefore, there is reason for belief that the problem will not exist to the same degree for Unit No. 2. Nevertheless, because of experience with Unit No. 1, Con Edison recognizes that there may be a fish protective problem with the current design of the Unit No. 2 intake.

Because of this, tests will be run prior to plant startup with the Unit No. 2 circulating water pumps to determine whether fish will be attracted to the intake and how they

will react to the operation of the screens and pumps. Fish density tests will also be run up and down the shoreline at Indian Point to establish if fish are attracted any more (or less) to the Unit No. 2 intake area than to any other location, particularly to the Unit No. 1 intake area.

As an interim measure, fish protective screens will be installed prior to the commercial operation of Unit No. 2. The protective screens will be installed at the outer face of the intake structure in guides already provided in the walls. Based on Unit No. 1 operating experience, a throttling capability will be incorporated to substantially reduce the intake velocities during the colder parts of the year.

During the throttling operation, the average approach velocity to the protective screens will be lowered from about 0.85 feet per second to about 0.6 feet per second. This will result in a reduction of flow through the plant condensers from 840,000 gallons per minute to 600,000 gallons per minute. The cooling water temperature will be increased approximately 23°F during its passage through the condenser, which is a rise of 7°F over that expected with 100% flow. Since it is expected that the throttling procedure will be needed only in the colder part of the year (river temperatures less than 50°F), plant discharges will be well within the allowable limits set forth in the Thermal

Discharge Criteria of the New York State Water Quality Standards. Tests will be run on the above throttling procedure for Unit No. 2 during the winter of 1970-71 to confirm its effectiveness prior to commercial operation.

As an additional measure, Con Edison has decided to change the motors of the circulating water pumps to include a two-speed capability. This will allow the intake velocity to be lowered below 0.5 feet per second when needed. This change, however, cannot possibly be made prior to the startup of Unit No. 2 (late spring, 1971) but every effort will be made to have the new motors installed for the winter season of 1971-72.

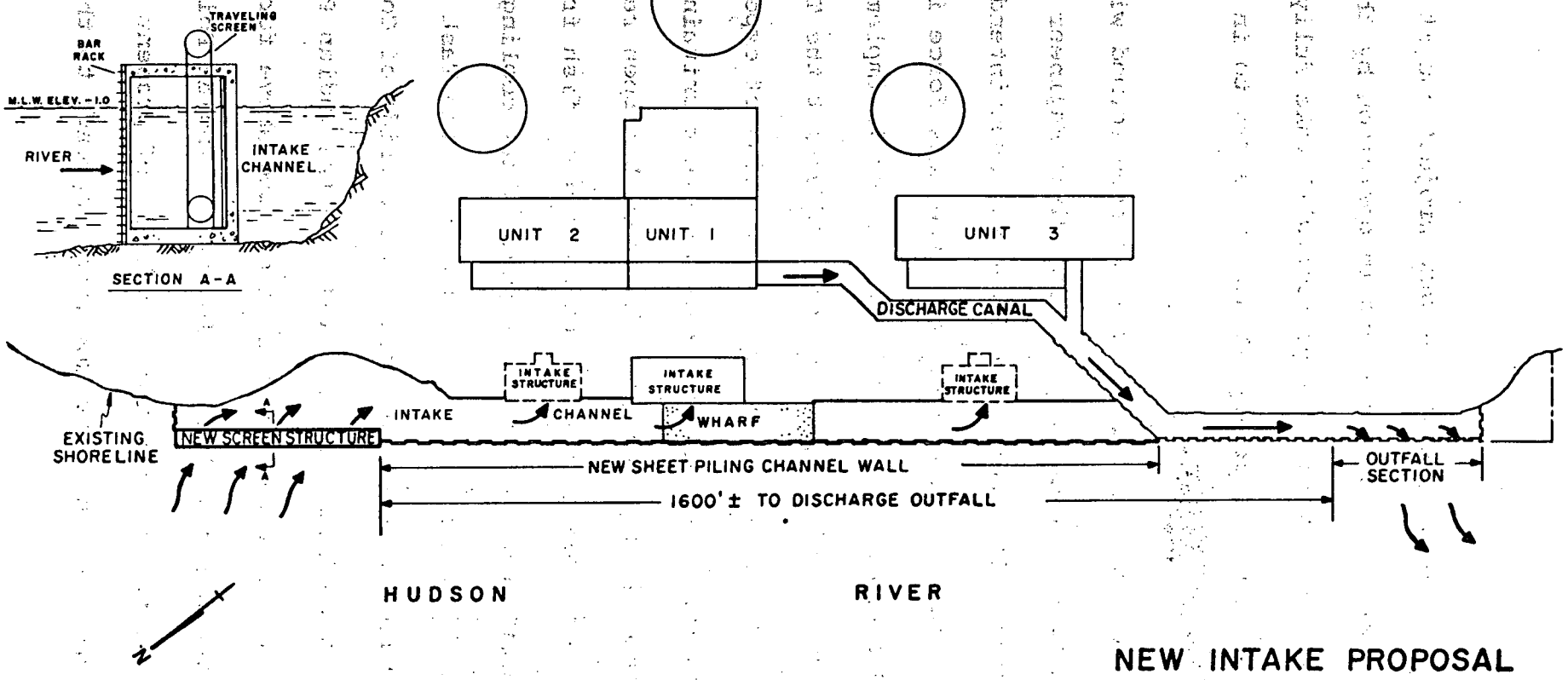
From recent experience, Con Edison knows that regardless of the anticipated effectiveness of a fish protection system, the possibility exists that it will require further improvement. As a result, in addition to implementing the design modification mentioned above, Con Edison is engaged in a program of ecological and engineering studies in the area of fish protection. This program is described in Section VI.A. 3 below.

As a long term solution in the area of fish protection for Unit No. 2 as well as for the other units at Indian Point, Con Edison engineers are developing a new intake water concept which appears very promising. This scheme will include a new screen structure built farther out from the shore (75' - 100')

and more into the main longitudinal flow of the river. This structure would screen water for all three Units at Indian Point and would be designed to permit intake velocities below 0.5 feet per second during the colder parts of the year. The attached sketch (Figure 1) shows a plan of the proposed scheme. The main advantages of the proposed structures are:

1. To minimize recirculation effects to the intake point from the discharge outfall which is an attraction mechanism.
2. To deny access under the unloading wharf to fish, thereby eliminating the probability that the wharf is acting as an attraction.
3. To place the traveling screens out where the river's stronger currents can longitudinally wash the face of the screens.
4. To achieve low intake velocities.
5. To provide other operational benefits not directly related to fish protection such as greater unit efficiency with reduced recirculation, and removal of the existing eddying conditions which lead to greater accumulation of river debris in front of the individual units.

Engineering design and associated research and



NEW INTAKE PROPOSAL
INDIAN POINT STATION
FIGURE 1

development have already begun on this project and it is hoped that the work will be completed and in operation by the spring of 1973. Further work on this project will take fully into account the ecological and engineering studies referred to in Section VI.A. 3.

A technical task force has been formed within the Company, headed by the Company's Chief Civil Engineer and including its Environmental Engineer and the General Superintendent of the Indian Point Station. The purpose of the task force is to concentrate and coordinate Con Edison's efforts in implementing the plans and studies on fish protection. To assist the Task Force, an Indian Point Fish Advisory Board consisting of expert biologists and engineers from the United States and Great Britain has been brought together by Con Edison. The Board has been requested to provide advice to Con Edison on how to protect fish from damage from the operation of Indian Point power plant cooling systems. The Board has held a number of meetings with the Task Force and with other individuals and organizations outside of Con Edison.

Con Edison has reviewed with the Indian Point Fish Advisory Board the overall program described above for fish protection in connection with operation of the Indian Point plants. The Board is of the opinion that, in light of present knowledge, the program provides the best immediate approach to the fish

protection problems at Unit No. 2 and the most promising longer range solution to these problems for all units at Indian Point. The Board further believes that additional studies are needed to expand present knowledge in this area and that the planned program of studies is adequate to provide the design parameters for future plant modifications.

In view of the studies undertaken and design modifications planned, Con Edison does not expect that the Hudson River fishery will be adversely affected by the operation of Unit No. 2.

(b) Other aquatic life

Aquatic life which is small enough to pass through debris screens and which does not possess sufficient mobility to avoid the intake flow will be carried through the cooling water condensers of Unit No. 2. Phytoplankton, zooplankton, eggs and larvae of various organisms will be the types most commonly withdrawn. In passing through the condenser these organisms will be exposed to a rapid temperature increase followed by a gradual return to ambient temperature. The effects of this passage on these various organisms is presently under active investigation by Con Edison consultants and other investigators. As a part of the Raytheon and the New York University studies described in Section VI.A. below, the variety and abundance of these organisms and ecological effects are being determined. Thermal shock

bioassays will be conducted on various organisms. The effects of the operation of the plant on benthic organisms in the vicinity are also included in the studies mentioned above.

On the basis of the investigations and studies conducted to date, it is considered that the effect of the operation of Unit No. 2 on small aquatic life is not likely to have a significant adverse impact on the ecology of the Hudson River.

5. Noise

No noise problem will be created by the operation of Unit No. 2.

D. Utilization of Unit No. 2

In reviewing the environmental effects of a facility such as Unit No. 2, certain beneficial effects on the human environment should not be overlooked. The unit will supply a substantial part of the energy needs of hundreds of thousands of people. Many of the uses of electric energy take the form of improving, by means of heating, lighting, and cooling of homes and places of work, a part of the environment where people spend a large portion of their time. In a broader sense, other uses of electricity such as cooking, street lighting, elevators, and refrigeration are essential if life in urban areas is to be socially productive or even tolerable. A feature of electric

energy particularly important in urban areas is that it is pollution-free at the point of use.

IV. Alternatives to the proposed action

Alternatives to the completion and operation of Unit No. 2 will be discussed both in the context of 1965, when the decision to construct the unit was made, and in the context of the present.

Prior to the 1965 decision Con Edison, in determining how best to provide base load capacity to meet the projected demand for electricity in its service area, considered both alternative power sources and alternative sites. Urban sites in Brooklyn, Queens and Staten Island were considered for fossil units, and other suburban sites for a nuclear unit were considered.

The decision to build a second nuclear unit at Indian Point rested primarily on the following factors:

1. The difficulties relating to air pollution of a new, close-in, fossil-fueled unit.

2. The unacceptability of a new, close-in nuclear unit because of uncertainties in obtaining various regulatory approvals for such a unit within a schedule when the unit would be needed.

3. The fact that the Indian Point site had already been approved for a nuclear unit by the U. S. Atomic Energy Commission and the apparent unavailability of other sites within the Con Edison service area which might be approved by the AEC and also win public acceptance.

energy particularly important in urban areas is that it is pollution-free at the point of use.

IV. Alternatives to the proposed action

Alternatives to the completion and operation of Unit No. 2 will be discussed both in the context of 1965, when the decision to construct the unit was made, and in the context of the present.

Prior to the 1965 decision Con Edison, in determining how best to provide base load capacity to meet the projected demand for electricity in its service area, considered both alternative power sources and alternative sites. Urban sites in Brooklyn, Queens and Staten Island were considered for fossil units, and other suburban sites for a nuclear unit were considered.

The decision to build a second nuclear unit at Indian Point rested primarily on the following factors:

1. The difficulties relating to air pollution of a new, close-in, fossil-fueled unit.

2. The unacceptability of a new, close-in nuclear unit because of uncertainties in obtaining various regulatory approvals for such a unit within a schedule when the unit would be needed.

3. The fact that the Indian Point site had already been approved for a nuclear unit by the U. S. Atomic Energy Commission and the apparent unavailability of other sites within the Con Edison service area which might be approved by the AEC and also win public acceptance.

4. The relative overall economic advantage of a nuclear unit at the 1965 price at Indian Point in comparison with a close-in fossil-fueled unit, even after taking into account the cost of transmitting power from Indian Point to the City.

At the time of the 1965 decision, gas turbines had not been developed to the point of being seriously considered as an alternative base load source of power. (In the judgment of Con Edison they are still not suitable for such load.)

Indian Point No. 2 is now almost completed and subject to obtaining necessary regulatory approvals is expected to go into commercial operation in 1971. Thus, the only question which can be realistically asked at this time is whether there are now reasonable alternatives to the completion and operation of that unit in 1971 or 1972.

The shortage of generating facilities in the Northeast, in New York State and specifically in New York City are so well known that it would seem unnecessary to give detailed statistics on system capacity and expected reserves for the period through 1972. Even if it were conceded that because of the use of gas turbines and an unusually high availability of old fossil-fueled units a serious situation would not arise in 1971, the adequacy of system reserves would certainly be a major problem by 1972. Therefore, it seems reasonable to discuss the present alternatives in relation to that

year, ignoring for such purpose the very large investment already made in Unit No. 2 which is non-recoverable and most of it not useable at some other site, and the related problem of financing the very large cost of any alternative.

Fossil-fueled units require an estimated 4 1/2 years to complete, even on an existing site, and so they are not a reasonable alternative for 1971 or 1972.

A nuclear unit could not possibly be designed and constructed for operation at another site in 1971 or 1972, even if, which is improbable in the extreme, another site could be found which would be more appealing from the standpoint of preservation of environmental values.

It is not anticipated that Con Edison will be able to contract for the purchase of additional capacity from other utility systems beyond that which is already included in its planned capacity schedule. A review of the installed reserves of neighboring utilities indicates that they cannot be expected to have additional capacity available for sale.

The only possible alternative would be gas turbines, and from the standpoint of environmental values and conservation of resources, the balance favors the nuclear unit. Gas turbines are fueled either by high grade oil (the supply of which is uncertain since most has to be imported) or gas (in the case of natural gas, a regular use

of a large quantity in the winter would be hard to obtain due to the large demand by Con Edison's gas customers) and these are resources which will be more exhausted over 40 years, the anticipated operating life of Unit No. 2, than will be the supply of nuclear fuel.

Also, gas turbines have not yet been developed (and could not be developed for use in 1972) to the point that they can be operated in sizes which can provide a base load source of power, although they now appear to be desirable for use for peaking power. They therefore cannot be considered equivalent to a base load unit, such as Unit No. 2.

V. Environmental perspective; commitments of resources; long-term productivity

Unit No. 2 will consume a certain amount of nuclear fuel in the form of uranium 235 in the process of generating electricity. The amount so consumed does not represent a threat to the supply of uranium in this country and will not foreclose military or other uses of nuclear materials. Unit No. 2 will also utilize a certain amount of land and water during its lifetime.

An adequate and reliable supply of electric power is essential to the welfare, health and safety of persons residing in the New York area. The electric power generated by Unit No. 2 will be beneficial to the long-term productivity of the area. The commitments of resources referred to above are reasonable, both in the absolute sense and in comparison with the commitments of resources which would be involved in the generation of an equivalent amount of electrical power by other means. They do not represent an expedient use of resources at the expense of some more important long-range benefit which could be otherwise obtained.

VI. Supplemental information

A. Environmental studies

1. Ecological studies

A detailed study of the ecology of the Hudson River in the general vicinity of Indian Point is now being performed by the Raytheon Company. This study is being financed by Con Edison but is being carried out under the sole direction of the Hudson River Policy Committee, an independent body made up of representatives of the New York State Department of Environmental Conservation, the New Jersey Department of Conservation and Economic Development, the Connecticut Department of Conservation, the U. S. Bureau of Sport Fisheries and Wildlife and the U. S. Bureau of Commercial Fisheries.

The study is oriented toward determining the effect of plant operation generally on the biota of the Hudson River, whether thermal, chemical or mechanical. Under this study:

(a) The seasonal distribution of fish and key organisms which might be affected by environmental changes attributable to plant operation at Indian Point is being studied, both within and outside of areas subject to withdrawal of cooling water for all three units. Extensive sampling of small organisms in the river is being taken at intervals along a 13-mile stretch of the river, including Indian Point. Their presence will be determined by employing surface, mid-water and bottom nets of

appropriate mesh size and benthos samplers. Small organisms entering the plant through the intake will also be sampled. The presence of large fish throughout the same area is being determined by employment of anchored and towed nets. Larger striped bass and sturgeon found in Haverstraw Bay in late winter are being marked with sonic tags and their movements traced during spring. Key zooplankters are being separated to genera and species. All other material and plankton samples will be identified at least to family. Fish in net collections are separated by species, enumerated and measured. Specimens of each species are being retained. Data from routine sampling is being entered on coded reports for automatic data processing. This phase of the program will provide much valuable baseline information against which the effect of operation of Units No. 2 and 3 can be measured.

(b) Organism survival studies are being conducted for nonscreenable fish and other key organisms to determine the synergistic effects of temperature rise and chemical additives on their survival and development following their passage through the plant. Equipment is operated in the discharge canal to collect those organisms that have either passed through the plant or entered directly from the river. Key organisms will also be maintained in a laboratory where their survival or tolerance on exposure to temperature and chemical changes equivalent to those of plant operation will be determined.

(c) The physical and chemical characteristics of the river associated with observed change in the biota (i.e. temperature, salinity, conductivity, dissolved solids, suspended solids, dissolved oxygen, additives, and physical alterations) is being studied. Continuous monitoring by instrumentation is being used where practical.

In 1968 New York University Institute of Environmental Medicine began a program of investigation of the ecology of the Hudson River for Con Edison. The present study is a continuation and expansion of a previous ecology study of the river conducted by the University and supported by the U. S. Public Health Service and the New York State Department of Public Health.

The New York University ecological survey encompasses physical, chemical, biological, and radiological investigations of the aquatic habitat at Indian Point. Temperature, salinity, and turbidity are the physical characteristics being investigated. Nutrients and trace elements are chemical features being investigated. Phosphate and nitrate concentrations as well as cadmium, cobalt, chromium, copper, iron, manganese, nickel, lead and zinc were monitored through 1969.

Phytoplankton, zooplankton and fish are being sampled as part of the biological work. The plankton sampling

will identify the species present and the seasonal cycles of abundance for this area. The fish sampling consists of shore seining at a single station on each side of the river at Indian Point. This sampling will provide data on the species composition and relative abundance of fish in the shore areas.

Samples of water, mud, fish, and vegetation are being analyzed for natural and man-made radionuclides. Previous and concurrent studies of Hudson River ecology have provided comparative data for the Indian Point survey.

2. Radiological studies

Numerous studies have been conducted by Con Edison and its consultants to insure the suitability of the Indian Point site for the location of Unit No. 2 and the other two nuclear units. These include studies of the geology, seismology, meterology, hydrology and demography of the site. The Final Safety Analysis Report for Unit No. 2 contains detailed information on these studies.

Con Edison's environmental monitoring program, referred to in Section III.C.1. of this report, includes measurements of radioactivity in fresh water, river water, river sediments, fish, aquatic vegetation, vegetation, soil and air in the vicinity of the Indian Point station. This program began with a survey instituted in 1958 (four years prior to operation of Unit No. 1) to determine the radioactivity in the environment in the vicinity

of the Indian Point station. The purpose of this survey was to determine the natural background radioactivity and to show the variations in the activities that may be expected from natural sources, fallout from bomb tests, and other sources in the vicinity. The program has been continued to the present so that changes in the environment resulting from operation of Unit No. 1 could be accounted for, and will be continued throughout the operating lifetime of all three units.

As a part of this program, rain is collected at the Indian Point station and at a point fifteen miles south of the station. This is a continuous collection which is sampled monthly and analyzed. Air samples are collected at two points on site by means of fixed-membrane filters followed by charcoal filters. Air collections will also be made off site at selected points with similar equipment.

Drinking water is sampled from nearby reservoirs and from the taps supplying water to the Indian Point station. Hudson River water is sampled at the inlet to the Indian Point Plant and at the plant discharge canal. This is a continuous collection which is sampled and measured weekly. The lake on site, the Trap Rock Lake and other lakes in the vicinity are sampled monthly and measured for gross beta and tritium. Two wells, one on site and one in Verplanck, are sampled monthly and analyzed.

Aquatic vegetation from the lake on site and other nearby lakes is sampled periodically and analyzed for gross beta, and a gamma spectrum is also run. Aquatic vegetation is collected from the Hudson River at points at the discharge canal, one-half, one and two miles downstream from the plant. This vegetation is analyzed in the same manner as the lake aquatic vegetation. Bottom sediment is taken from the Hudson River in the vicinity of the plant and at points one-half, one and two miles downstream. This sediment is measured for gross beta activity and is also analyzed for gamma activity and radionuclide content.

River fish caught in the vicinity of the plant are measured for gross beta and a gamma spectrum analysis made. Land vegetation is sampled primarily in the downwind direction from the plant at points one-quarter, one-half, one and two miles south of the plant.

The direct gamma background is monitored along principal roads within a five-mile radius of the plant, at approximately .10 mile intervals. Direct gamma measurement is made continuously at selected locations in Buchanan, Verplanck, Montrose, Peekskill and at a number of points on site. This measurement is made with low-level ionization chambers and film

badges, and thermal luminescent dosimetry may be utilized in the future.

The monitoring program supplies data supplementing the primary control at the source of the effluents, to insure compliance with the requirement of 10 CFR Part 20. The results of the program are reported to the AEC on a semi-annual basis. Reports containing the results of the surveys conducted thus far have been reported to the AEC under Docket No. 50-3. In addition, 10 CFR Part 20 provides for rapid reporting of any unusually high releases. The results of the monitoring program are also reported to the New York State Department of Health if the monthly discharges exceed certain levels.

New York State through its Department of Health has been conducting its own monitoring program in the vicinity of the site since 1958. In 1965 and 1966, the Department reported its findings in the vicinity of the Indian Point Station in two special reports. Since that time, its reporting has been on a statewide basis in quarterly bulletins and in annual reports. Both Con Edison's and New York State's programs are geared to provide greater intensity of surveillance, as the need requires, in the event of significant increase in radioactive discharges.

The New York University Institute of Environmental Medicine study described above includes some radio-ecological studies and the Raytheon studies may yield useful information in the radiological area.

3. Fish protection studies

The following is a summary of current studies underway which are geared toward a better understanding of the behavior of the fish species found in the river at Indian Point and possible ways of improving our protective devices.

(a) The ecological study, already mentioned, conducted by the Institute of Environmental Medicine of New York University will yield important information on the distribution and abundance of fish species, and on the biology of the white perch in the river.

(b) The Raytheon study, also described above, will yield information on fish distribution, population and behavior, particularly as it may be affected by the warm water discharge.

(c) Dr. Edward C. Raney of Ichthyological Associates has been retained by Con Edison to study the swimming performance, temperature avoidance, attraction and preference

of white perch and striped bass at different temperatures and flows, including the very low temperatures found in winter.

(d) Bechtel Corporation has been retained to conduct a complete review of all possible fish protective schemes which could be applied at Indian Point.

(e) Norman Porter Associates has been retained to do velocity studies for the intakes of the Indian Point units, as well as the natural water movements near the intakes.

B. Pollution control measures

1. Radioactive waste disposal facilities

Unit No. 2 contains a number of facilities for disposal of liquid, gaseous, and solid radioactive wastes. These facilities are designed to insure that the discharge of effluents and offsite shipments are in accordance with applicable governmental regulations.

The bulk of the radioactive liquids discharged from the Reactor Coolant System are processed and retained inside the plant by the Chemical and Volume Control System recycle train. This minimizes liquid input to the waste disposal system which processes relatively small quantities of generally low-activity level wastes.

Radioactive fluids from this and other sources entering the waste disposal system are collected in sumps and tanks until determination of subsequent treatment can be made. They are sampled and analyzed to determine the quantity of radioactivity, with an isotopic breakdown if necessary. They are then processed as required before release to the condenser cooling water.

Processing is done on a batch basis, with the liquid being evaporated and the solid residue removed for drumming and shipment offsite. The condensate is held in tanks and is again sampled before it is released under controlled conditions to the cooling water discharge. Provision is made for recirculation of the condensate if further reduction of activity is required. The discharge lines are monitored and activity recorded. If for any reason the effluent exceeds specific levels an automatic cutoff is provided as well as an alarm. From the point where waste processing begins to the point of discharge to the river, activity reduction by a factor of about one million is achieved.

Radioactive gases from various sources are collected and pumped by compressors to decay tanks where they are held until their activity is low enough for release. This

is determined by sampling the tanks. There is also a continuous indication in the control room of the activity in these tanks, as well as an alarm for high activity. Discharge is made through the plant vent. There are three continuous monitors in the discharge line - two for radioactive gases and one for particulates. There is also an automatic cutoff on this system to prevent inadvertent releases, as well as an alarm in the control room. The decontamination factor for this system is also about one million.

The atmosphere in the primary auxiliary building is continuously exhausted through the plant vent by way of the monitors mentioned above. If necessary this exhaust can be rerouted into the containment, which has its own ventilation system. The containment system has filters, demineralizers and recirculating fans which reduce the activity reaching the gas holdup system from the containment.

A drumming area is provided within the auxiliary building, with appropriate equipment for the preparation of solid wastes for disposal offsite. The spent resins from the demineralizers, the filter cartridges, the concentrates from the evaporators and other solid wastes are packaged and stored onsite until

shipped offsite for disposal. Suitable containers are used to package these solids, which is done at the highest practical concentrations to minimize the number of containers shipped for burial.

Area monitors are provided throughout the plant to warn of conditions which might lead to release of radioactivity to the environment and to permit appropriate operator action.

Detailed information on the design of the waste disposal system and associated monitoring equipment is found in the Unit No. 2 Final Safety Analysis Report.

2. Sanitary waste facilities

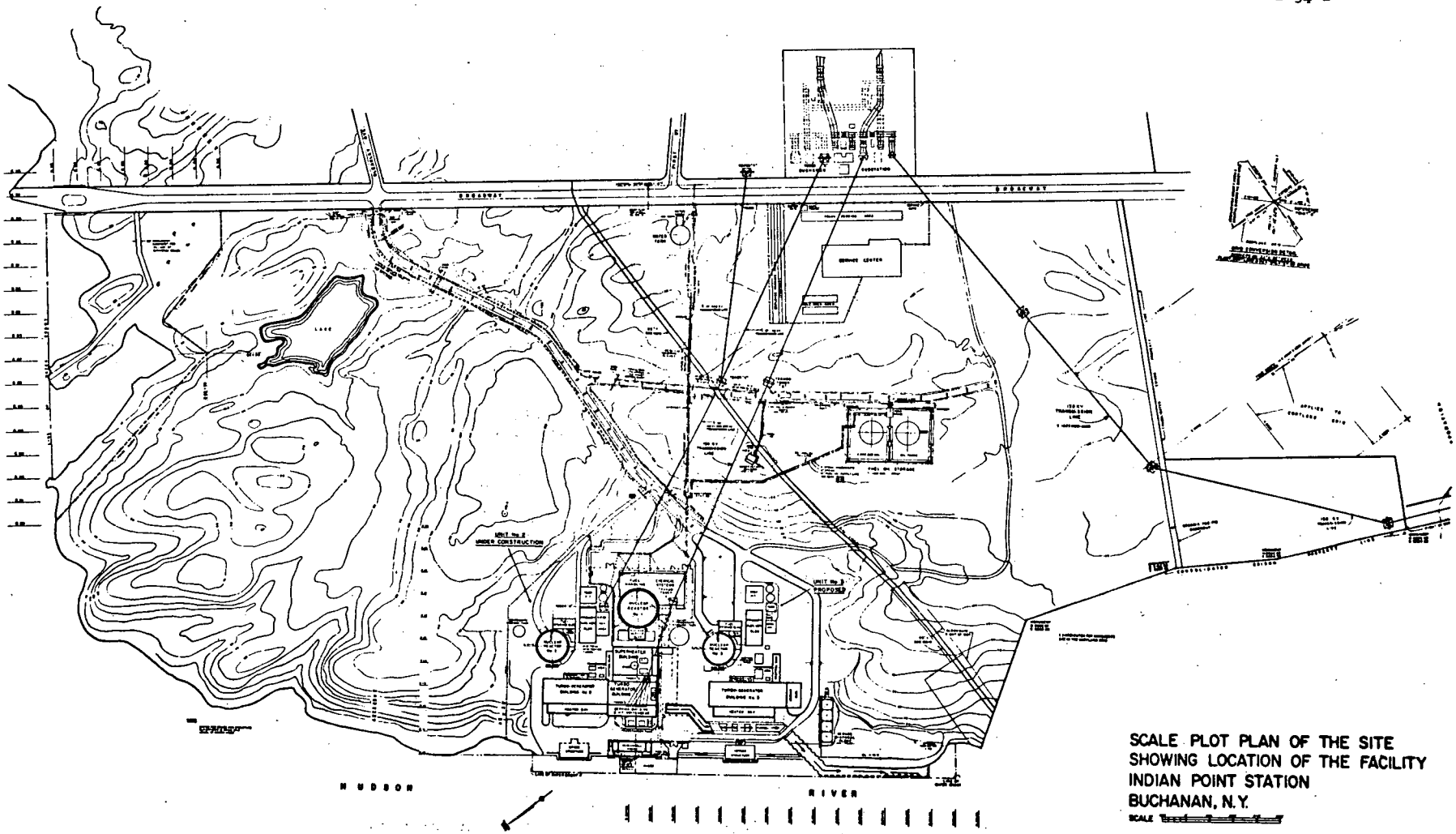
Sanitary wastes from Unit No. 2 will be treated via an existing onsite sewage disposal plant. This plant consists of comminutors, septic tanks, and sand filter beds. This system now serves Unit No. 1 and was originally designed to take into account future expansion of the generating station. The design and operation of this plant has been approved by both the New York State Department of Health and the Westchester County Department of Health. Based on original design parameters and the results of soil percolation tests, the existing disposal

plant will be adequate without modification to serve the Station when Unit No. 2 becomes operational.

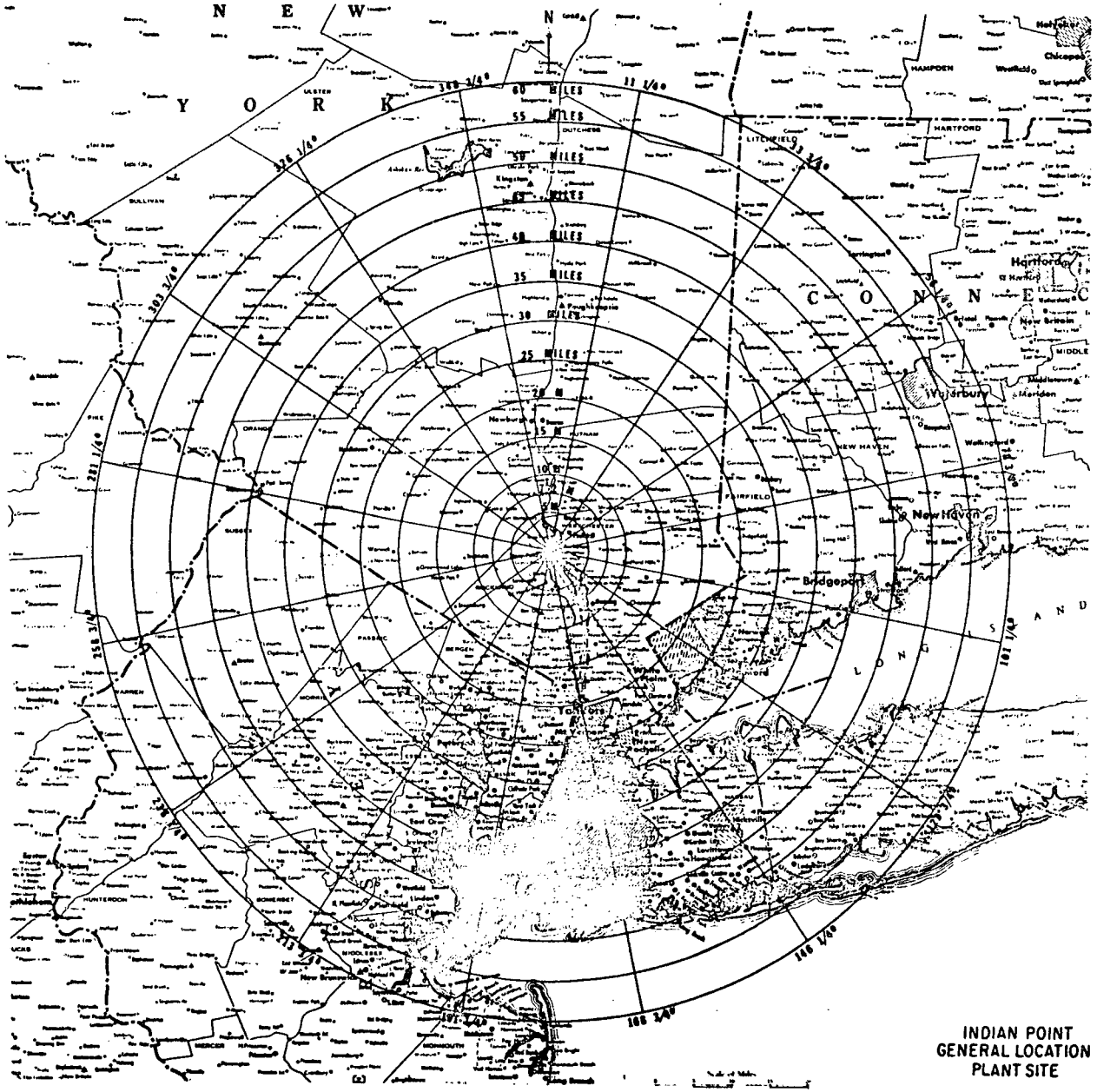
C. State and local licensing agencies

The following is a list of state and local agencies from which licensing permits or other approvals relating to environmental matters must be obtained before operation of the facility may begin.

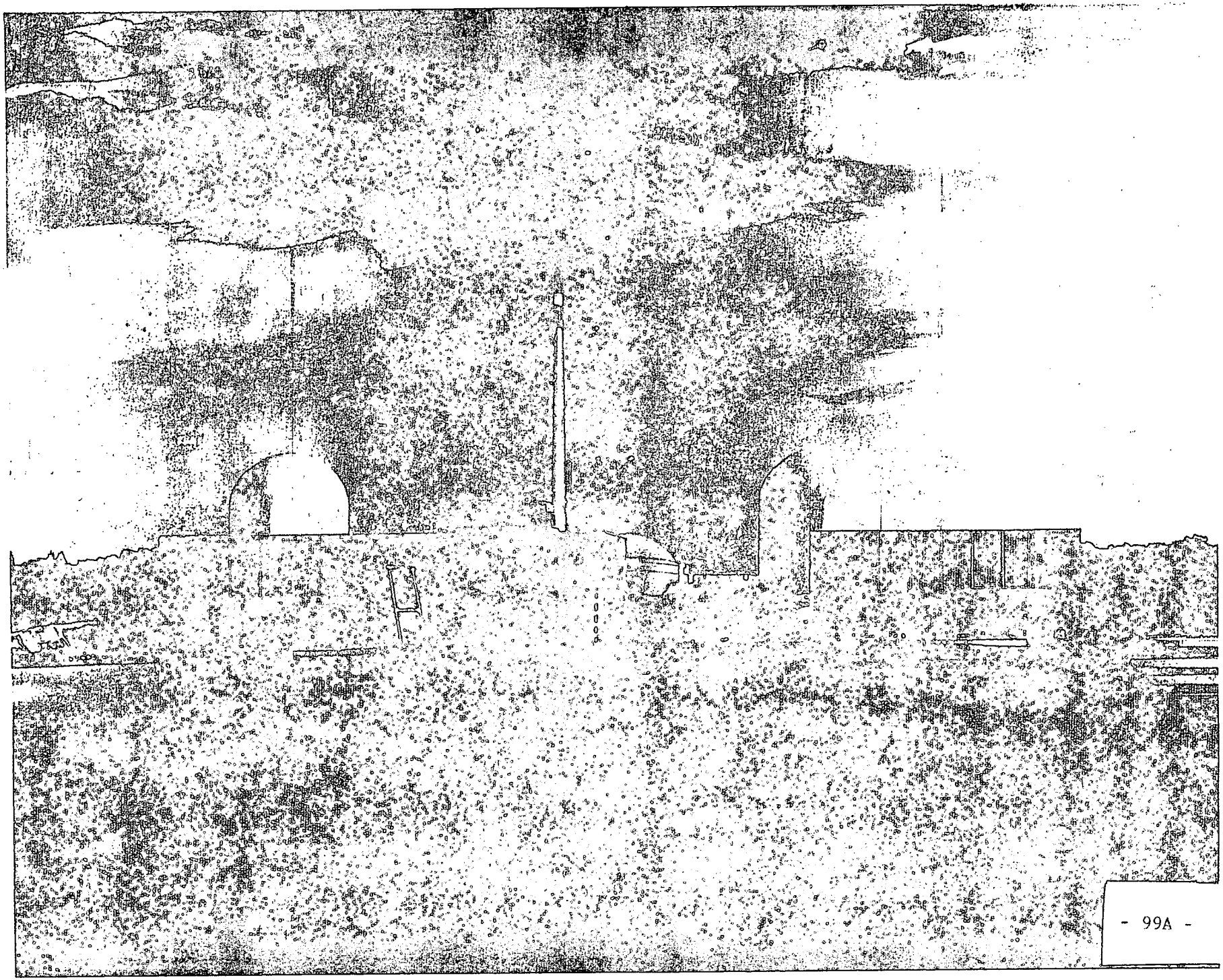
1. New York State Department of Environmental Conservation
2. Westchester County Health Department
3. New York State - Office of General Services
4. Village of Buchanan (Town of Cortlandt) Building Department



SCALE PLOT PLAN OF THE SITE
SHOWING LOCATION OF THE FACILITY
INDIAN POINT STATION
BUCHANAN, N.Y.



INDIAN POINT
GENERAL LOCATION
PLANT SITE



APPENDIX B

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

WASHINGTON, D. C. 20410

OFFICE OF THE UNDER SECRETARY

IN REPLY REFER TO:

SEP 14 1970

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

Re: Indian Point Nuclear Generating Station

Dear Mr. Price:

This is in response to your letter of August 17, 1970, requesting HUD comments on the preliminary environmental statement prepared by Consolidated Edison for its proposed new Indian Point Nuclear Generating Station.

This statement deals with Unit 2 of the Indian Point Station. Unit 1 has been in operation since 1962, Unit 2 is now nearing completion and is expected to begin commercial operation in June 1971, and Unit 3 is currently under construction with an anticipated completion date in 1973. Further, Consolidated Edison plans other facilities adjacent to the existing site. The 235-acre Indian Point site is located in Westchester County, New York on the Hudson River about 24 miles north of New York City. The area immediately around and including the site is zoned for heavy industry. The surrounding area is generally residential with some large and popular parks. The communities of Verplanck, Buchanan and Peekskill are within 2 miles of the station. In 1960, 53,000 people lived within a 5-mile radius of the station, and this number is expected to increase to 108,000 by 1980.

HUD Comment

Except for reservations noted below, the statement prepared by Consolidated Edison appears to be responsive to the National Environmental Policy Act. Based on the experience of Unit 1, the discussion of environmental consequences resulting from the operation of the new unit appears thorough.

We recognize the tremendous electrical need of the New York Metropolitan area, and we concur with Consolidated Edison's belief that it would be a mistake to meet that need with only fossil-fuel generating plants. However, the public interest requires that plant sites be carefully chosen to minimize potential adverse effects of nuclear generators.

We defer to other departments and agencies on safety, radiation and thermal discharge standards. We defer to other State and Federal regulatory agencies for comments on air and water quality standards that will have to be met in the operation of this proposed unit.

HUD Reservations

1. We are quite concerned about the proximity of populated areas to the Indian Point Station, and we believe this matter should be discussed carefully before the license is approved. The estimate that in 1980 108,000 people will live within 5 miles of the plant, the heavy concentration of industry adjacent to the site, and the popularity of nearby recreation facilities warrant giving some attention to isolation factors.

2. We understand that Consolidated Edison is attempting to improve operations of Unit 1 and promoting expected efficiency of Units 2 and 3, and we further understand that there have been many surveys on the ecology of the Hudson River, on land usage along the River, and on ways to better protect fish in the River. Consolidated Edison should include relevant findings from these studies in the draft environmental statements before such environmental statements are circulated for comment.

3. No mention is made of any coordination of planning with a local or regional planning agency. In general, coordination with local planning bodies should be initiated before the draft environmental statement is first circulated, and the clearance process should be used to determine the adequacy of the initiator's treatment of problems. At this stage, we suggest that comments from agencies such as that designated by Bureau of the Budget Circular A-95 be included in the final environmental statement before a license is granted. The appropriate agency is:

Tri-State Transportation Commission
100 Church Street
New York, New York 10007

Another pertinent organization in discussing the Indian Point Station is:

Hudson River Valley Commission
105 White Plains Road
Tarrytown, New York 10591

The Westchester County Planning Agency might also be contacted.

* * * * *

When the final environmental impact statement is publicly distributed, we would appreciate having a copy sent to our Regional Administrator, Mr. S. William Green, 26 Federal Plaza, New York, New York 10007.

Sincerely yours,

Charles J. Orlebeke
Deputy Under Secretary

cc: Mr. Joseph C. Swidler, Chairman
State of New York Public Service Commission

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

HEALTH AND
ENVIRONMENT

17 SEP 1970

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

Dear Mr. Price:

We have reviewed the Environmental Statement from the Consolidated Edison Company of New York, Inc. for the Indian Point Nuclear Generating Station Unit 2 as requested by your letter of August 17, 1970.

The following comments are provided:

1. Insufficient information is presented within the Statement regarding the environmental monitoring program. Sampling frequency should also be included as well as an indication of whether sampling frequency will be increased with the initial operation of Unit No. 2 at the Indian Point Site.

2. Reference is made to page 23 concerning the air pollution potential of two package boilers. The amount of products released is termed "insignificant", but no baseline for this statement is given. Estimated emission due to these boilers would be a valuable addition to the report. Elsewhere in the report, in regard to sanitary waste, it is stated that both the New York State Department of Health and the Westchester County Department of Health had been consulted and that the design and operation had been approved. The same assurance should be provided regarding the subject of air pollution.

Sincerely,

Louis M. Rousselot, M.D., F.A.C.S.

2996
~~2995~~

Docket No. 50-247

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

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

Dear Mr. Price:

This is in response to your letter of August 20, 1970, requesting USDA comments on the environmental statement for Indian Point Nuclear Generating Station, Unit 2, Consolidated Edison Company of New York.

The statement has been reviewed in the relevant agencies of the Department and we have no comments to make.

Sincerely,

T. C. BYERLY
Coordinator of
Environmental Quality Activities

APPENDIX E

FEDERAL POWER COMMISSION
WASHINGTON 20426

SEP 22 1970

Honorable Glenn T. Seaborg
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

C

Dear Dr. Seaborg:

This is in reply to Mr. Price's letter of August 17, 1970, requesting comments of the Federal Power Commission on the environmental impact of the Indian Point No. 2 Nuclear Unit of the Consolidated Edison Company of New York, Inc.

O

Although the Federal Power Commission does not generally have licensing jurisdiction over thermal power plants constructed by electric utilities, the Commission does have a real and continuing interest in the timely construction of generating and transmission facilities to meet growing electric loads and the impact of the facilities upon the environment in matters relating to air pollution, water quality, and other factors.

P

Our comments on pertinent factors related to the proposed environmental statement on the Indian Point Nuclear No. 2 Unit are enclosed.

Y

Sincerely,

(SIGNED) JOHN N. NASSIKAS
CHAIRMAN

John N. Nassikas
Chairman

Enclosure
Comments on the AEC
Environmental Statement

Comments Relative to an Environmental Statement of
Indian Point Nuclear Unit No. 2
Consolidated Edison Company of New York, Inc.

The comments herewith are directed to the relationship of the electrical capacity of this unit to the prospective power supply and demand situation of the system and region involved; to the fuel supply situation related to the type of plant and its environmental effects; and to comment on alternative means of meeting the power supply need for which this unit is proposed. It is understood that other agencies will review and comment on specific aspects relating to effects of the unit on air and water quality and other environmental factors.

The Need for Power

The 873-megawatt Indian Point Nuclear No. 2 Unit is scheduled for service during the summer of 1971. The 1970 summer peak load on the Consolidated Edison Company of New York, Inc.'s system was expected to reach 7,725 megawatts. The actual 1970 summer peak load, however, was only 7,041 megawatts and occurred on August 28. This peak load probably would have been exceeded on other summer days if the Company had not operated its facilities at reduced voltage and requested voluntary load curtailments. At the time of the 1970 peak load, the Company had a total power supply of 7,415 megawatts, including 1,253 megawatts of capacity available through firm power purchases. Most of the purchased capacity was available through short-term arrangements. At the time of the peak load, a considerable amount of capacity was unavailable because of unscheduled outages of generating equipment. The reserve margin was only 374 megawatts, equivalent to 5.3 percent of the peak load.

The peak load in the summer of 1971 is expected to reach 8,125 megawatts. New capacity scheduled to be in service by July 1971 totals 2,963 megawatts. Of this new capacity, the Indian Point Nuclear No. 2 Unit will account for 873 megawatts while the remaining new additions will consist of numerous small gas turbine units. The Company's net dependable capacity for the summer of 1971 peak period will be 11,131 megawatts, indicating a reserve margin of 3,006 megawatts or 36.9 percent of the peak load. Without the capacity of the Indian Point Nuclear No. 2 Unit, the Company's net dependable capacity will be 10,258 megawatts, which is 2,133 megawatts in excess of the expected 1971 peak load, equal to a reserve margin of 26.3 percent.

These reserve margins appear to be appreciable, but when consideration is given to the age of many of the Company's generating units and the disproportionate amount of gas turbine peaking capacity on the Company's system, the reserve margins do not appear to be excessive. Of Consolidated Edison's steam units, 30 were placed in service during 1925 or earlier. The large amount of overage capacity and the disproportionate amount of gas turbine

capacity on the Company's system is a result of the difficulties the Company has been experiencing in recent years in obtaining authority to build modern nuclear or fossil fuel plants or pumped storage peaking plants.

As a member of the New York State Interconnected Systems pool, the Company is required to maintain a reserve margin of at least 18 percent. The New York State pool is estimated to have a reserve margin during the 1971 summer peaking season of 5,406 megawatts or 28.7 percent of a peak load of 18,850 megawatts. Without the capacity of Indian Point Nuclear No. 2 Unit, the pool's reserve would be 4,533 megawatts, equal to 24 percent of the 1971 summer peak load.

While it may appear that the reserve margin of the New York State pool is slightly high, consideration must be given to the fact that there are a large number of overage units, many of which are undermaintained and prone to forced outages and deratings. As one of the consequences of the difficulties experienced by the members of the pool in finding sites for its large baseload units, the pool has acquired a disproportionate amount of gas turbine peaking capacity, which contributes to the pool's reserve margin, but does not provide for supplying firm base loads. Thus, while the reserve margins of the pool, with or without the Indian Point Nuclear No. 2 Unit, may suggest the possibility of delaying construction of some units, under present conditions such a policy does not appear to be appropriate.

The Fuels Situation

In accordance with the practice of electric utility systems in the Northeast Region, major fossil-fuel generating capacity operated by the Consolidated Edison Company was designed to burn coal, oil, and gas. Because of the critical air quality situation in the New York metropolitan area, the Company has been phasing out its coal-burning operations and shifting most of the generation to oil and gas. Of the Company's ten major facilities formerly burning coal, only two, the Arthur Kill and the Astoria Plants generated an appreciable amount of energy from coal during the month of July 1970. If account is taken only of those plants which burned some coal in July, the Company's generating facilities can be classified as 98 percent equipped to burn oil, 85 percent gas, 47 percent coal, and 2 percent nuclear. Of the 2,853 million kilowatt-hours of energy generated last month, 58 percent was from oil, 27 percent from gas, and 15 percent from coal. The Company's nuclear Indian Point No. 1 Unit was not in service.

Developing shortages of domestic coal and foreign fuel oil, as well as public pressure on the Company to contribute its share to air quality in the New York Metropolitan area, have created a difficult fuel supply problem. This has been aggravated by the imposition on October 1, 1969,

of sulfur oxide control regulations which limit sulfur content of fuels burned by utilities in the New York City area to 1.0 percent by weight. The shift from coal to gas as a means of avoiding a difficult utility coal market is not possible because of the unavailability of additional natural gas for power generation. Also, no relief appears to be forthcoming from the foreign fuel oil market because of the present world political situation. The Company has been investigating the economics of importing liquefied natural gas as a solution to the public controversy over the expansion of its Astoria Plant. This alternative to domestic natural gas, however, appears to be economically prohibitive at this time.

Under the prevailing fuels supply situation and the public temper in the City of New York, it is evident that any plan which involved a fossil-fueled plant in lieu of the Indian Point No. 2 Unit would have become enmeshed in public controversy and would have failed to create the generating capacity which is needed on the Company's system for the 1971 summer peaking season.

Any fossil-fuel plant as an alternative to the Indian Point No. 2 Unit would necessarily add to the particulate and gaseous pollutants entering the atmosphere of the Company's service area. The planning of the Indian Point No. 2 Nuclear Unit, therefore, offers important environmental advantages with respect to air quality in the State of New York.

Power Imports

The import of additional firm power from utilities in Canada, New England, the PJM Interconnection, or other members of the New York Pool does not appear feasible. This conclusion is based on a review of the load-supply situation in areas to the south, west, and north of the Company's service area and on the situation as it is expected to develop in these areas.

As a general rule, we feel that a minimum reserve margin for a large operating pool having predominately thermal capacity should be about 20 percent. During the past summer, the New England area, the New York State Pool, and the PJM Pool all were required to reduce voltages a number of times because of the large amount of capacity which was inoperable because of forced outages. The reserve margins are expected to improve during 1971, but not to become high enough to permit export of firm power. Even if firm power were available for export from these areas, the lack of transmission line capacity north, south, and west from Consolidated Edison's service area would prevent the consummation of such support. From the standpoint of reliability and coordination in the planning and operation of system facilities, it is highly desirable to have a strong transmission network interconnecting utility systems in the Northeast. These purposes would not be enhanced, however, by additional interconnections and out-of-the-area

generation to provide for the export of large blocks of firm power. Furthermore, the construction of such facilities would not lessen the overall impact of power facilities on the environment.

Hydro Power Alternatives

A hydroelectric installation as a substitute for the Indian Point Nuclear No. 2 Unit must be ruled out as a practical consideration. The New York and New England area abounds in good pumped storage sites, many within economical transmission distance of the Company's service area, but these sites are suitable for peaking capacity only and, as such, do not offer an alternative to the Indian Point Nuclear Unit, which is intended to service as a baseload generating facility. There are no conventional hydro sites within reasonable transmission distance large enough to serve as a substitute for the Indian Point Unit.

APPENDIX F

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

October 5, 1970

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

Dear Mr. Price:

This is in response to your letter of August 17, 1970 addressed to Mr. Roger Strelow enclosing Consolidated Edison Company's Environmental Report of August 6, 1970 relating to Indian Point Station, Unit Number 2. Your letter requested our comments on the environmental impact involved in the operation of this generating station. We are pleased to provide the enclosed report as our comments. We would appreciate receiving your compilation of comments from other agencies when it is completed.

We would point out that the statement of Consolidated Edison Company which we have reviewed is not a statement by the Atomic Energy Commission, nor, so far as we know, in any way adopted or endorsed by it. Thus, while we are providing you with comments on Indian Point Station, Unit Number 2, as we have in recent months on a number of proposed nuclear power stations, we are taking this opportunity to raise the issue whether it would be more appropriate for the Commission to review and endorse as accurate and complete any such statement before it is submitted to this Department or other Federal agencies for review and comment.

This procedure would have at least two advantages from our point of view. First, it would afford us the benefit of the Commission's considerable expertise and resources in developing our comments. Second, it would preclude the possibility that an applicant, in hearings before the Commission, might use in his behalf conclusions drawn in HEW comments based only upon information supplied by the applicant. We would welcome a discussion of this matter with you. Mr. Strelow (13-28501) of my office would be happy to arrange such a discussion.

Sincerely yours,

WR Strelow, for

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

cc: General Counsel, CEQ

PUBLIC HEALTH REVIEW

INDIAN POINT NUCLEAR GENERATING UNIT 2

Project Officer: Gerald Pliner

Reviewed By: James E. Martin, Ph.D.
Acting Chief
Nuclear Facilities Branch

Approved By: Ernest D. Harward
Deputy Director
Division of Environmental Radiation

September 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service
Bureau of Radiological Health
Division of Environmental Radiation
Nuclear Facilities Branch

PREFACE

This report is one of a series designed to summarize the results of evaluations by the Public Health Service of the environmental effects of nuclear facilities. The evaluation is based on a detailed technical review of design information for the facility as well as the "Environmental Statement" submitted to the Atomic Energy Commission under the conditions of the National Environmental Policy Act of 1969. Reviews of individual facilities are performed by the Nuclear Facilities Branch of the Division of Environmental Radiation, Bureau of Radiological Health. The Branch, as a part of this review process, has developed and referenced several technical documents to support the discussions presented.

The evaluation presented in this report is directly responsive to the requirements placed on Federal agencies by the National Environmental Policy Act and as such is intended to state the position of the Department of Health, Education, and Welfare on the environmental effects of the operation of the facility. The report is also intended, in the traditional role of the Public Health Service, to provide information to the particular State health department involved for use in conducting their radiological health program for the facility.

SUMMARY AND CONCLUSIONS

This report summarizes the conclusions drawn from an updating of two previous evaluations by the Public Health Service of the environmental effects of Indian Point Nuclear Generating Unit 2. The facility is a 2758 Mwt Westinghouse pressurized water reactor (PWR) that will be operated by the Consolidated Edison Company on the east bank of the Hudson River at Indian Point, Village of Buchanan, in Westchester, County, New York. This updating is based primarily on information supplied in the facility's Final Safety Analysis Report (FSAR),[1] including amendments 1-23, and the facility proposed technical specifications.[2] The Applicant's Environmental Report--Operating License Stage[3] has been reviewed, but was used only as a secondary source of information due to its lack of technical data. The conclusions drawn from this review are listed below:

1. The estimate of liquid radioactivity discharges (0.0252 Ci/yr exclusive of ^{3}H) for 1 percent defective fuel and the statement that radioactivity concentrations in the discharge canal will be 0.002 percent of maximum permissible concentrations are, in our judgment, not adequately documented. Current PWR operating experience indicates that both will be considerably higher and the applicant has not presented new design information to support lower estimated discharges.

2. The environmental statement does not, but should, contain a commitment by the company to use all radioactive waste treatment and

holdup systems to their fullest capacity in order to keep discharges as low as practicable. In meeting this objective we believe the gaseous waste holdup capacity should be expanded to 60 days minimum.

3. The proposed technical specification for the site gaseous waste discharge limit would be excessive if calculated by the method indicated by the applicant. Discharge limits for the Indian Point facility should also be applied to Consolidated Edison Nuclear Units 4 and 5 if these additional units are built at the proposed location about 1500 meters south of the Indian Point site.

4. The environmental surveillance program for the facility would be adequate if modified to include TLD's with a minimum sensitivity of 5-10 mr/month and gamma spectroscopy of drinking water and Hudson River and lake water samples.

5. At this stage of the construction of the plant the only alternative action is not to operate it, a choice that is unreasonable in view of the minimal environmental effects expected. Therefore, with the qualifications stated in this report, we are of the opinion that Indian Point Nuclear Generating Unit 2 can be operated along with Unit 1 without any significant impact on the environment and with minimal risk to public health.

RADIOACTIVE WASTE DISPOSAL

Indian Point Units 1, 2, and 3 should be treated as a single facility in establishing discharge limits. Discharge limits set for the Indian

Point plant should also be applied to Consolidated Edison Nuclear Units 4 and 5 if these additional units are built. We consider the location of Units 4 and 5 as being at the same site since the radioactive waste discharges from these two plants will result in radiation exposure to the same population group. The two sites are only 1500 meters apart, and will discharge radioactive materials to the same water and air environment.

Estimates for gaseous releases from Indian Point Unit 2 are based on a 45-day holdup. We believe that this capacity should be expanded to 60 days and that the applicant should commit himself to utilize this capacity to its fullest extent at all times. A 60-day holdup time was selected to achieve a reduction of short-lived nuclides such as I-131 to essentially zero. The remainder of the waste disposal system should be utilized to its fullest capacity in order to keep both liquid and gaseous releases from the plant to as low a level as practicable. This position is taken because: 1) gaseous releases during normal operations at Indian Point Unit 1 have been much higher than at other similar operating PWR's which could be interpreted to indicate that gaseous waste holdup was not used to its fullest extent,[4,5] and 2) the potential expansion of nuclear capacity at this location warrants a full commitment to use all systems for each unit to their capacity to keep the cumulative population doses as low as practicable.

RADIOACTIVE WASTE DISCHARGES

The applicant's estimate of liquid radioactive discharges indicates that with 1 percent defective fuel elements, a total of 0.0252 curies (exclusive of ^{3}H) will be discharged annually. This estimate cannot be substantiated based on data available from present operating plants. According to AEC reports on 1969 waste discharges from licensed facilities, San Onofre, Indian Point 1, Connecticut Yankee, and Yankee-Rowe discharged 8, 28, 12, and 0.019 curies, respectively, of liquid wastes exclusive of ^{3}H.(4) It is our understanding that none of these plants approached 1 percent defective fuel, and all of these PWR's operated at power levels much lower than that proposed for Indian Point Unit 2.

The Environmental Report estimates that liquid effluents at the point of discharge from Indian Point Unit 2 will be 0.002 percent of MPC. This appears to be underestimated even if the annual discharge estimates are assumed to be correct. Our estimates of liquid effluent levels are considerably higher.

The discussion of the gaseous discharge limit in the proposed technical specifications is not clear, and the equation for calculating the site limit appears to be incorrect. If the equation shown in the FSAR were used in calculating this limit, the resulting discharge limit would be too high. The equation should be modified to read as follows:

$$\sum_{u=1}^{u=3} \left[f_u (\chi/Q)_u \times \Sigma \frac{R_i Q_{ui}}{MPC_i} \right] \leq 1$$

where u = an index for each of the three units onsite

Q_{ui} = the average release rate from unit u of radioisotope i

f_u = the fraction of the allowable site release limit assigned to unit u. For only units 1 and 2 operating the technical specifications assign $f_1 = .1$, $f_2 = .9$

R_i = a factor which accounts for reconcentration in the environs. For halogens and particulates with half-lives greater than 8 days $R_i = 700$, for all other radioisotopes $R_i = 1$

ENVIRONMENTAL SURVEILLANCE

In general the operational surveillance program submitted by the applicant is adequate, however, it is suggested that a gamma scan be performed on all drinking, Hudson River, and lake water samples collected. In addition, ^3H measurements should be made on drinking water samples. The gamma scan is recommended because identification of radionuclides and determination of their individual concentrations is essential to the interpretation of environmental surveillance data in terms of population radiation exposure.

A minimum sensitivity of 1 mr/hr as proposed by the applicant for integrating dosimeters employed in the surveillance program is not feasible since during normal operation dose levels of this magnitude

would not be reached, nor is monthly collection of ionization chambers with an upper limit of 10 mr (this is probably the expected monthly background level). In order to avoid this problem we recommend the use of a TLD system with a minimum sensitivity of 5-10 mr/month.

REFERENCES

1. "Indian Point Nuclear Generating Unit 2--Final Facility Description and Safety Analysis Report," Vols. 1-4, Docket No. 50-247, Public Document Room, U.S. Atomic Energy Commission, Washington, D.C., October 15, 1968.

2. "Indian Point Nuclear Generating Unit 2 - Technical Specifications," Ibid., July 1970.

3. "Applicant's Environmental Report--Operating License Stage," Ibid., August 6, 1970.

4. Rogers, L.R. and C. Gamertsfelder, "U.S. Regulations for Control of Releases of Radioactivity to the Environment from Nuclear Facilities," Division of Radiation Protection Standards, U.S. Atomic Energy Commission, Washington, D.C., August 1970.

5. Logsdon, J.E., R.I. Chissler, "Radioactive Waste Discharges to the Environment From Nuclear Power Facilities," BRH/DER 70-2, U.S. Department of Health, Education, and Welfare, Public Health Service, Environmental Health Service, Bureau of Radiological Health, Rockville, Maryland, March 1970.

6. Goldman, Morton, Jr., "United States Experience in Management of Gaseous Wastes from Nuclear Power Stations," NUS Corporation, Rockville, Maryland, August 30, 1968.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

October 9, 1970

Dear Mr. Price:

This is in response to your letter of August 17, transmitting the draft environmental statement prepared by the Consolidated Edison Company of New York, Inc. for the Indian Point Nuclear Generating Station Unit 2, AEC Docket: 50-247. We have reviewed the statement and other material available on the project and offer the following comments for your consideration.

Consolidated Edison Indian Point Unit No. 2 was licensed for construction by the Atomic Energy Commission in 1966, three years before the National Environmental Policy Act of 1969 was enacted. The subject statement was prepared in response to the Company's request of AEC for an operating license. Construction of Unit 2 is almost complete and is scheduled to go into operation in June 1971. Consequently, most of the environmental effects of construction have occurred so our concern is mostly with plant operation. Indian Point Unit No. 1 is in operation and the construction license application for Unit No. 3 is pending.

We are pleased that the applicant has made a firm commitment in its environmental statement to incorporate tapered steel poles for transmitting power from Unit No. 2 to the Buchanan substation, increased development of the 80 acre forested area and small lake for public recreation, the 2,000 foot marked hiking trail, and an expanded visitor center. We recognize Consolidated Edison Company's effort at the Indian Point site to provide public recreation and hope that its public use plans will be finalized and fully implemented at the earliest possible time.

We are also aware of the cooperative effort the applicant is making to solve the fishery problems resulting from the operation of the present facility. Their support of studies to solve these problems is commendable.

The draft environmental statement provides in detail information relative to most of the issues set forth in Section 102(2)(C) of the National Environmental Policy Act of 1969. We offer the following comments for use in completing this statement:

1. We believe it premature for the applicant to conclude (pages 33 and 34) that on the basis of investigations and studies conducted to date that Unit No. 2 will have no significant adverse impact on the ecology of the Hudson River.

Fish kills in the vicinity of Unit No. 1 were covered extensively in the Statement. Considerable difficulty has been experienced with fish being impinged on cooling water intake screens and the company acknowledges that fish protection at the cooling water intake facilities could be a continuing problem. A problem also exists when small organisms, plankton and fish eggs and larvae are carried through the system with cooling water heated significantly before being discharged. Studies to solve these problems are not completed. It would be better to wait until they are completed and new intake facilities built and tested before such a statement would have validity. Unit No. 2 operated independently may have no impact but there may be an accumulative effect from the three units.

2. Additional information should be included on cost and effects of possible alternative measures and supplementary facilities to alleviate the problems similar to those experienced in the operation of Unit No. 1. Information should also be included on the observational programs established to monitor the effectiveness of waste controls, thermal discharges, and chemical releases.

3. The environmental statement should describe the volumes of fresh water flowing past the plant and the interaction of fresh water flows with tidal flows. The statement that 80 million gallons of water per minute flow past the plant during peak tidal flow is misleading.

4. The Company acknowledged the fact that fish protection at the cooling water intake facilities could be a continuing problem. The statement should note that other problems could arise in connection with the radioactive, thermal, and chemical waste control facilities of the units. With the establishment of more stringent water quality

standards or as a result of the environmental surveys and monitoring and sampling programs, it may be necessary to incorporate alternate or additional waste control measures. For these reasons, the processes must provide sufficient flexibility that additional controls can be added if later found to be needed.

5. The identified monitoring programs and studies were of the type that are necessary to adequately apprise the effect of the Plant's operation on the environment. The statement should include information on the locations of monitoring stations (identifying them on a sketch or map) and the frequency of sampling for the various parameters.

6. The Company has stated that water quality standards will be met, the environment in the vicinity of the Plant will be protected, and there will be continuing radiological, biological, thermal, and chemical studies and surveys to verify these commitments. To confirm this, other data such as the following will need to be presented: maximum temperatures and temperature rises in the receiving waters, mixing zone size, evaporative losses, and equilibrium temperatures. Critical years of extreme meteorological conditions and minimum river flows should be considered in determining the effects of the Plant's operation on water quality and the environment. Information (including procedures, environmental concentrations, and effects on biota) should be presented on condenser cleaning practices and other uses of chemicals in which the Company will be involved.

7. The draft statement does not discuss the hypothetical accidental escape of radionuclides from the reactor. Of particular significance at this site would be a catastrophic accident in which long-lived radionuclides from the core would vaporise and escape the containment structure to the atmosphere. The site location in the deeply incised Hudson River Valley north of the broad reach including Tappan Zee, would favor subsequent deposition or rainout of these radionuclides directly into the river. Unless the accidental escape of long-lived radionuclides from the reactor core can be ruled out as impossible, an analysis of the consequences of such a catastrophic accident should include consideration of its effects on the Hudson River estuary and the New York bight.

We appreciate the opportunity of commenting upon this statement.

Sincerely yours,

Assistant to the Secretary
for Policy Planning and
Research

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

APPENDIX H

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

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.

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.

STATE

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.

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

APPENDIX B

William J. Cahill, Jr.
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-3619

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.

Geology

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.

Attachment A

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-[illegible]

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 430×10^9 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 $14^{\circ}F$, rather than the $17^{\circ}F$ 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		April 1967	
	Measured	Predicted	Measured	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 "moth-ball" 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 simulting 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

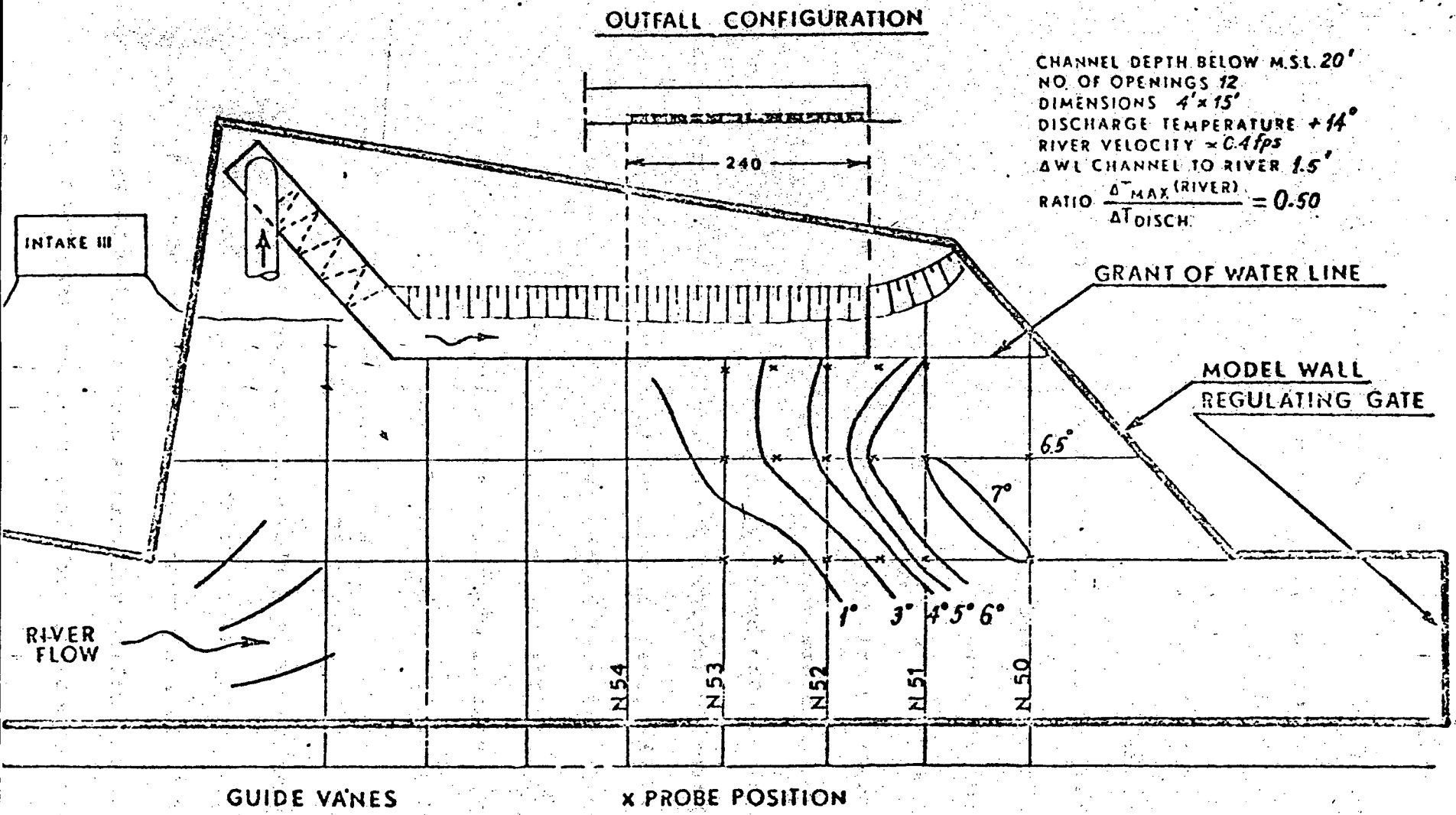
simulate the large-scale effects of the heated discharge of two and three nuclear units on the Hudson River temperature.

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.



ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE
INDIAN POINT II SUB-MODEL
MODEL SCALE 1:50 (UNDISTORTED)
SURFACE ISOTHERMS
TEST DATE MAR '69

FIGURE 1

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

Model 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:

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

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

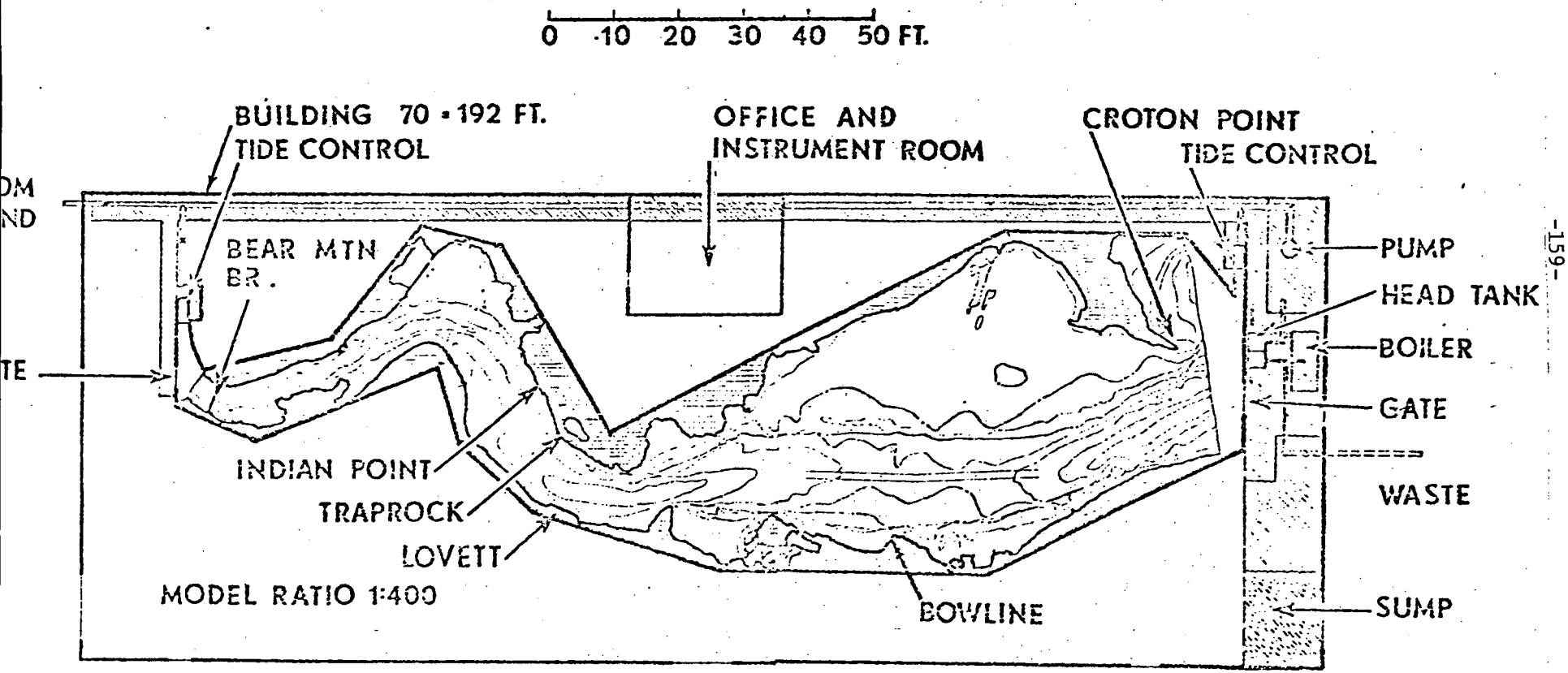


FIGURE 2.

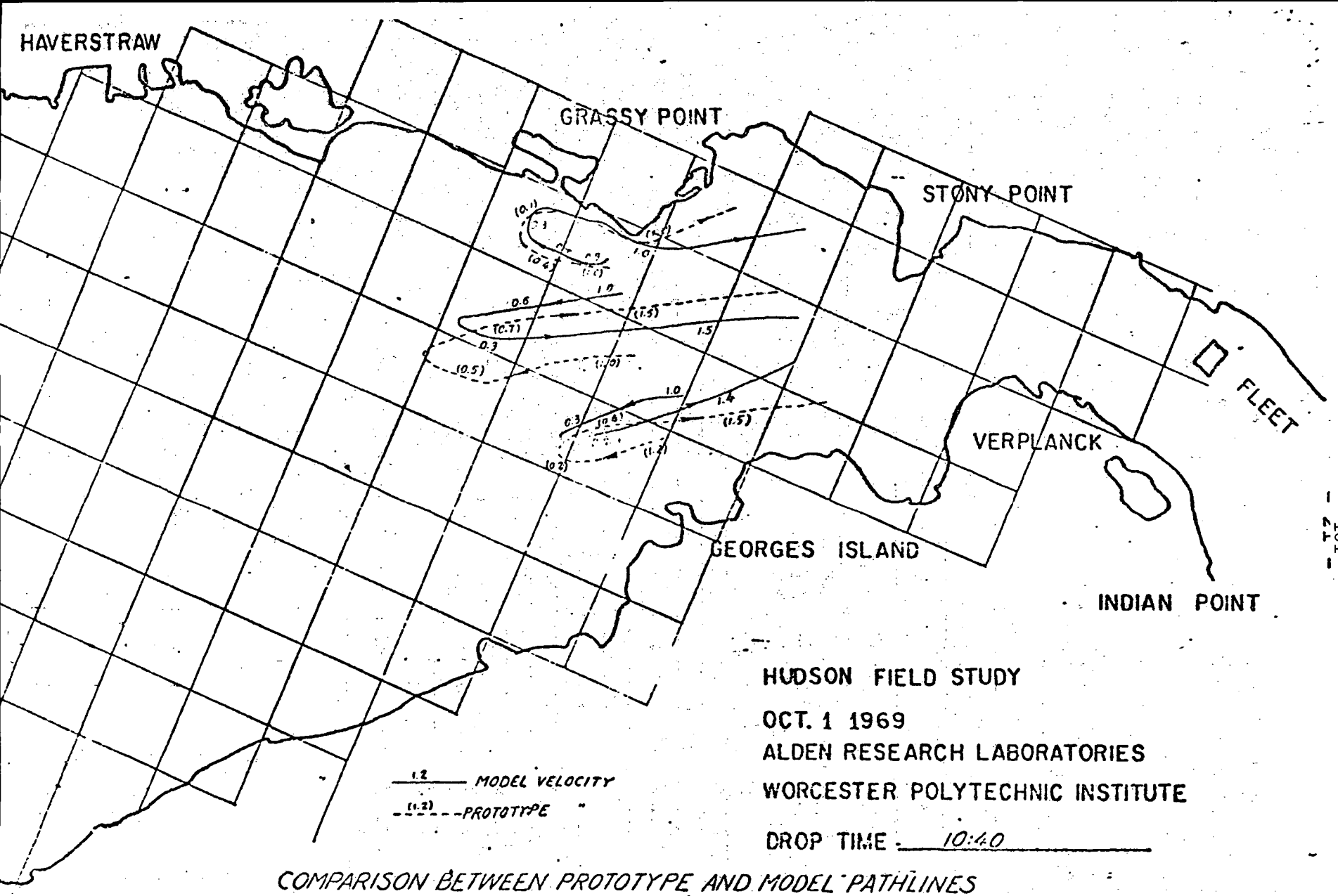
Report). The only way to validate such a model is to compare it with the prototype conditions. Extensive field measurements of velocity and temperature in the modeled section of the prototype river have been made (see February, 1970 Alden Report).

Primary concern is for reproduction of velocities and sheaxs 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.

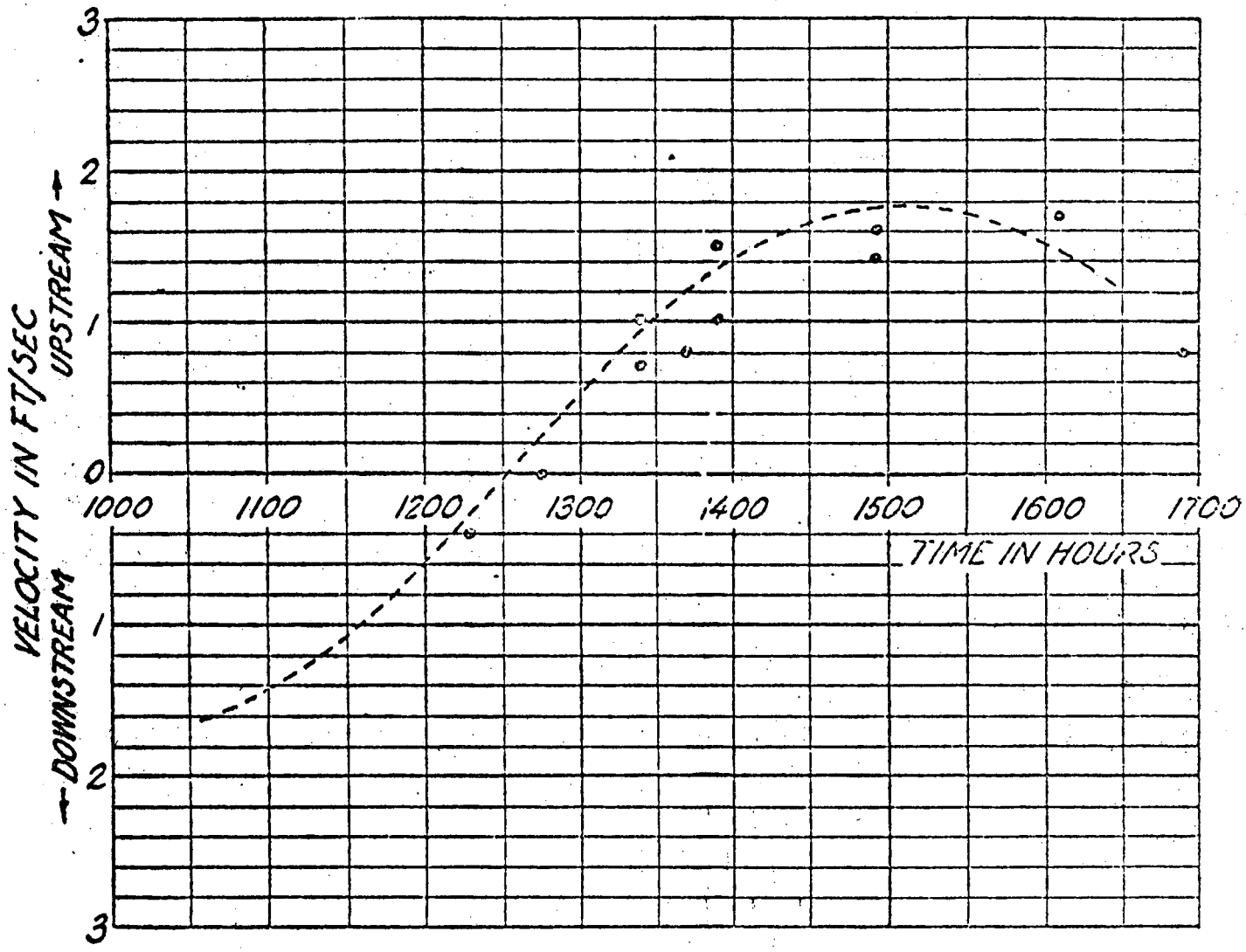
Model III cannot simulate temperatures near the outfall because this model is vertically distorted. The distortion is necessary to achieve vertical resolution while modeling an extensive distance along the river. Since the model was constructed to simulate the large-scale thermal effects, the surface 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.



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

• • • — " — MODEL DATA TAKEN -"- — " —

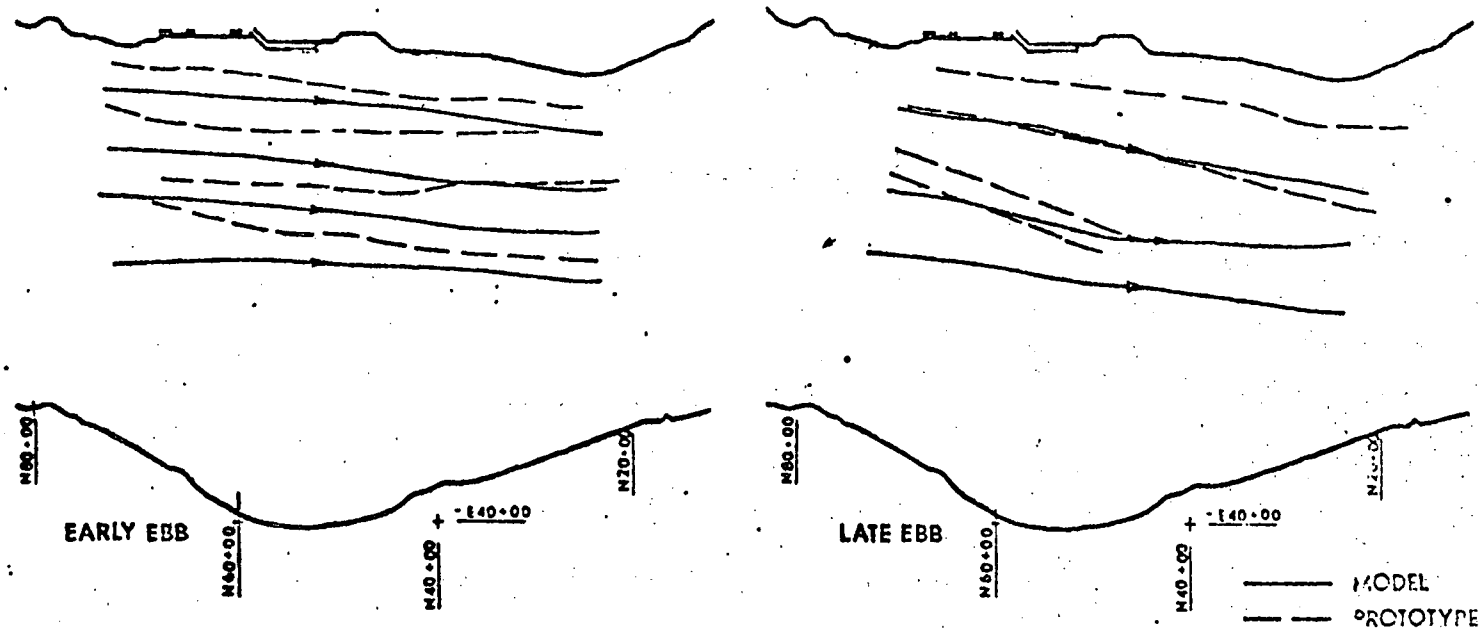
HUDSON RIVER
FIELD STUDIES OCT 1, 1969.

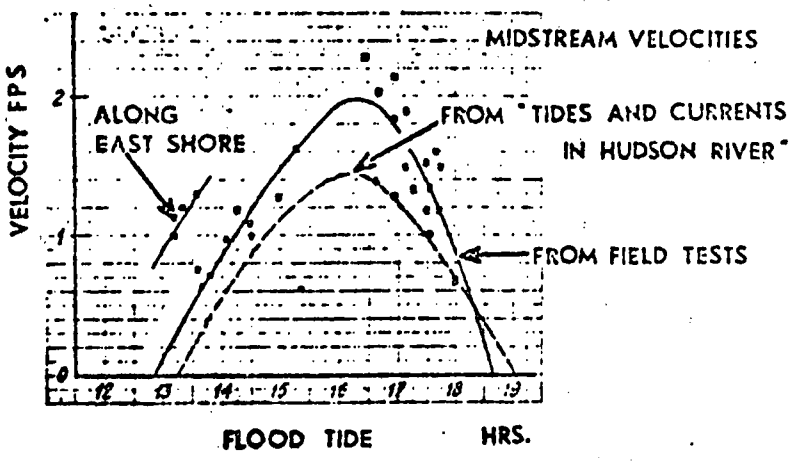
COMPARISON OF FIELD AND
MODEL VELOCITIES

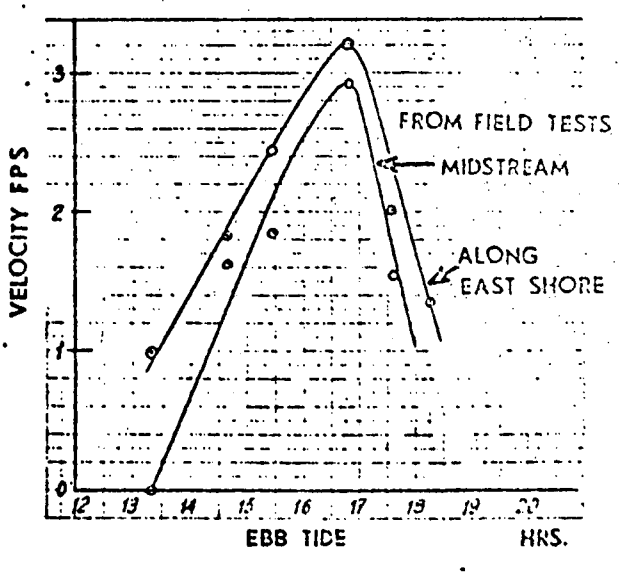
ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE

FIGURE 5.

COMPARISON BETWEEN PATH LINES OFF INDIAN POINT







ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE
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.

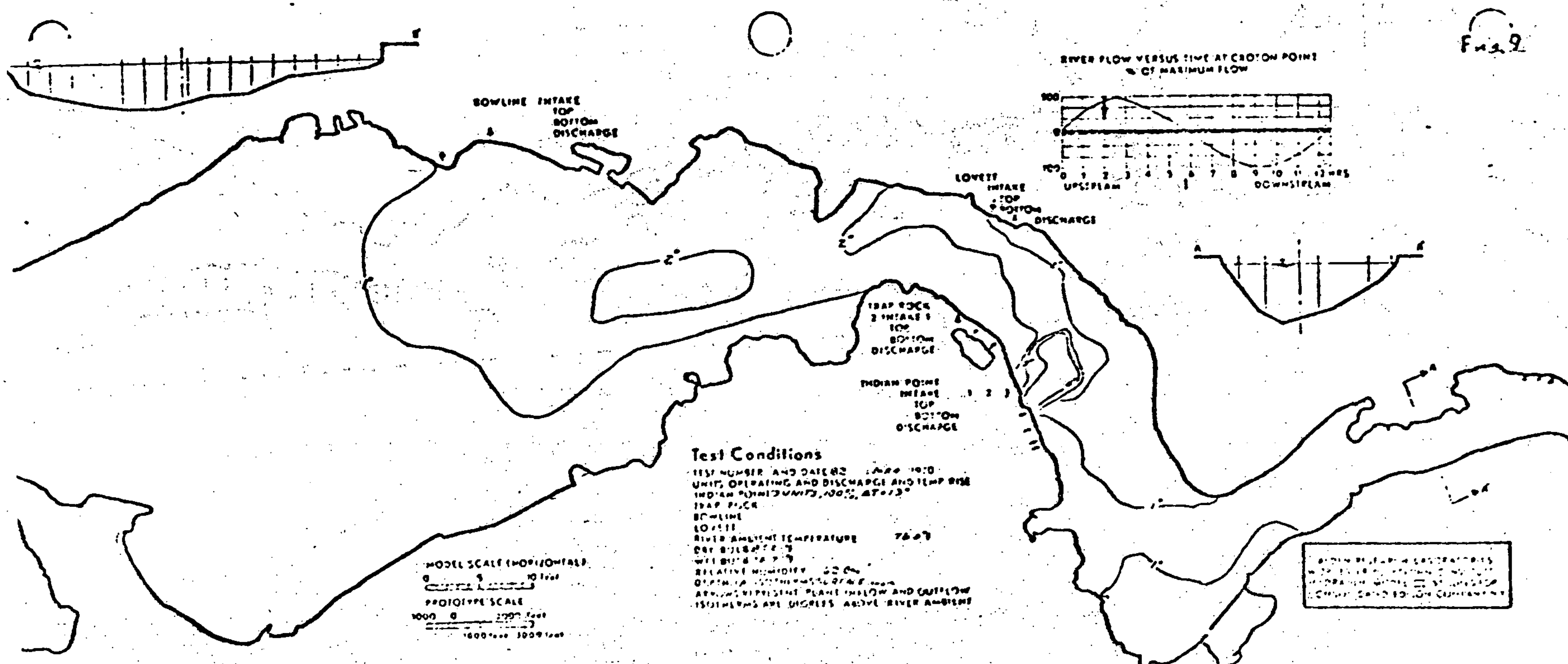


Fig 9
RIVER FLOW VERSUS TIME AT CROTON POINT
% OF MAXIMUM FLOW
0 1 2 3 4 5 6 7 8 9 10 11 12 HRS
UPSTREAM
DOWNSTREAM
BOWLINE INTAKE
TOP
BOTTOM
DISCHARGE
LOVETT
INTAKE
TOP
BOTTOM
DISCHARGE
TRAP ROCK
TOP
BOTTOM
DISCHARGE
INDIAN POINT
INTAKE 1 2 3
TOP
BOTTOM
DISCHARGE
Test Conditions
TEST NUMBER AND DATE
UNITS OPERATING AND DISCHARGE AND TEMP RISE
TRAP ROCK
BOWLINE
LOVETT
RIVER AMBIENT TEMPERATURE
RELATIVE HUMIDITY
ARROWS REPRESENT PLANE INFLOW AND OUTFLOW
ISOTHERMS ARE DEGREES ABOVE RIVER AMBIENT
MODEL SCALE (HORIZONTAL)
0 5 10 feet
PROTOTYPE SCALE
1000 0 2000 feet

FIGURE 6.

FIG. 2

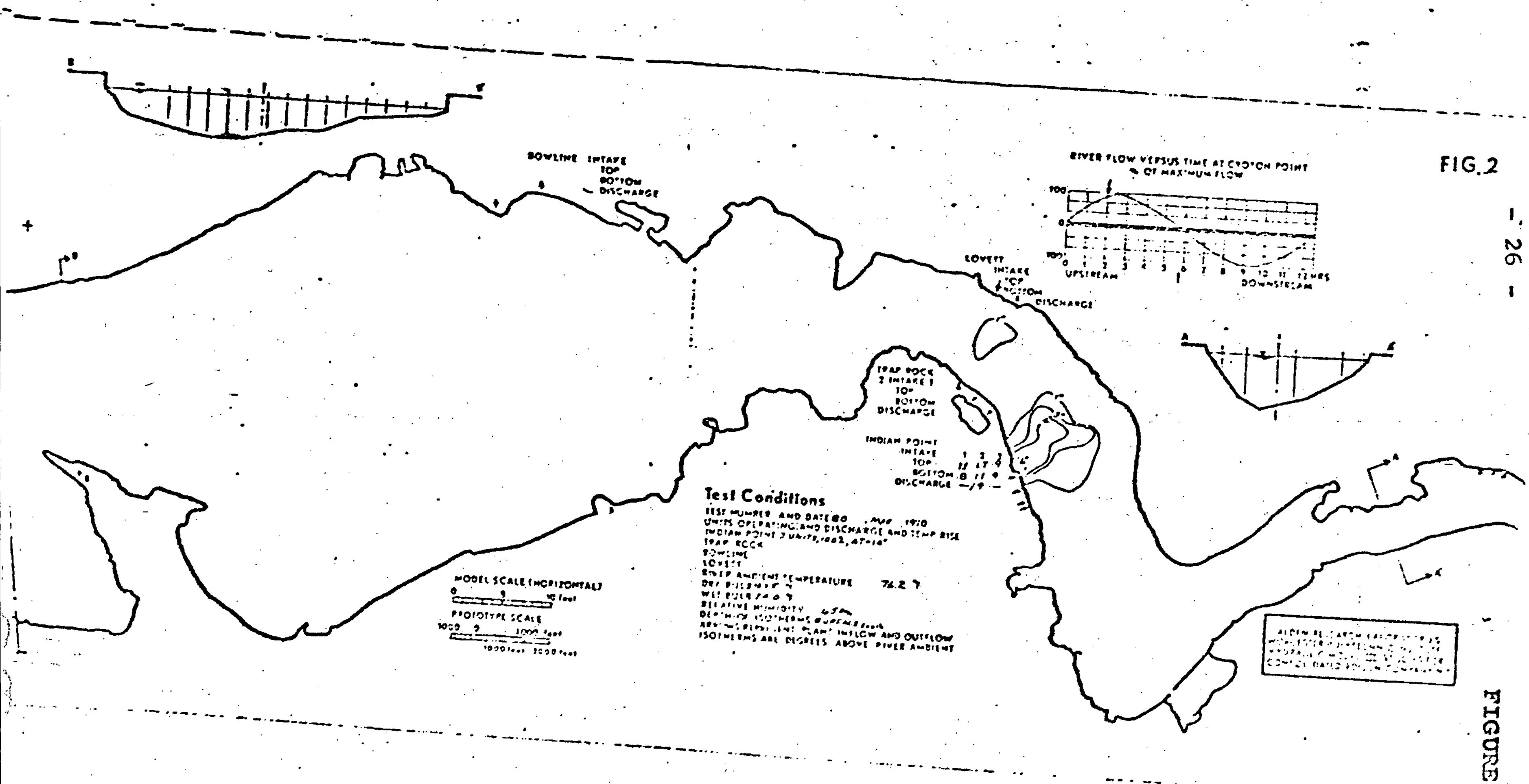
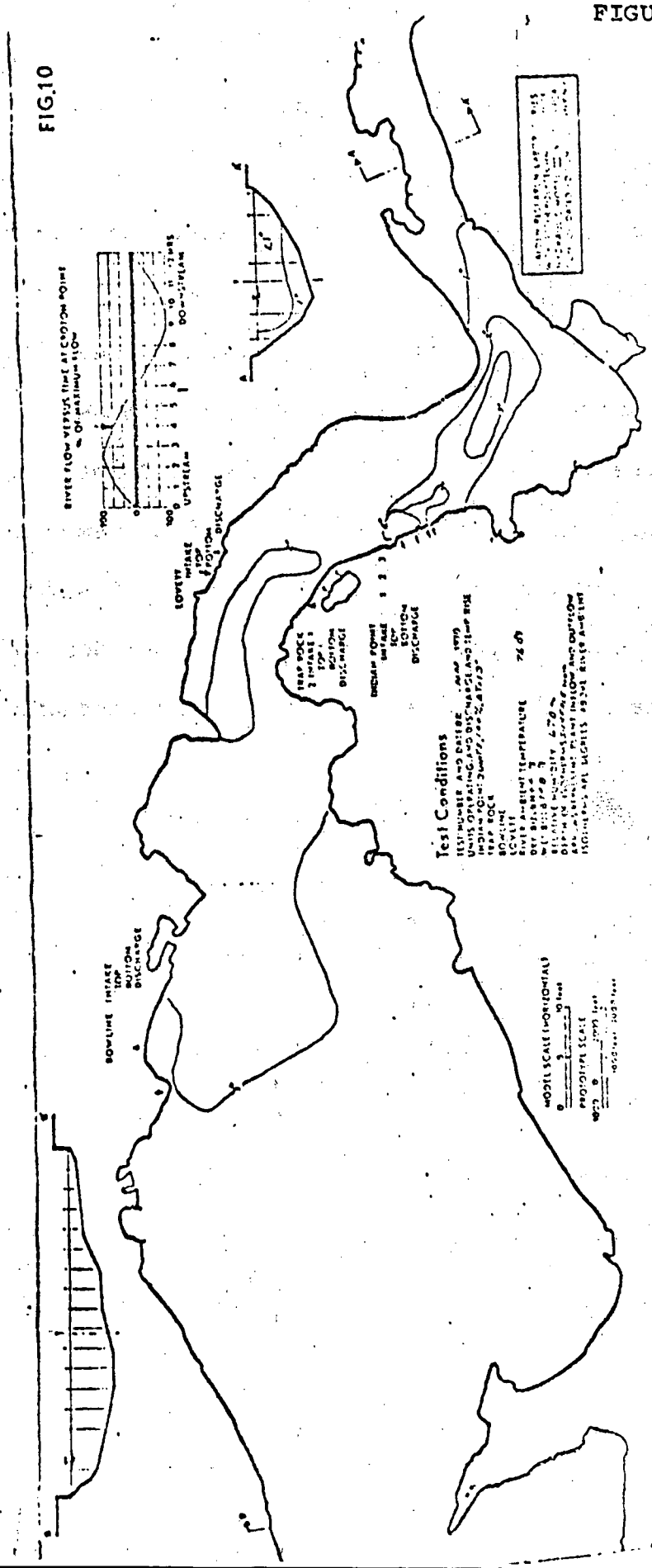


FIGURE 7.

- 26 -

-166-

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. Boric Acid - 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. For the remaining 40 minutes, the diluted concentration

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
[illegible] River Hydraulic [illegible] (1967-69)	90,000.00	86,323.86
[illegible] Hudson River Hydraulic Model No. III (1969-70)	230,000.00	230,033.18
QIM - 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 (Potts & 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

APPENDIX D

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

Kenneth E. Wich
New York State Department of Environmental Conservation

Paul R. Nichols
U. S. Bureau of Commercial Fisheries***

---

* 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.

APPENDIX I

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

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

TJC:rl

WESTCHESTER COUNTY DEPARTMENT OF PLANNING

PETER Q. ESCHWEILER, A.I.P., COMMISSIONER
JOSEPH R. POTENZA, ASSOC. A.I.P., CHIEF PLANNER
910 COUNTY OFFICE BUILDING — WHITE PLAINS, N. Y. 10601 — 914 WHITE PLAINS 9-12...

November 9, 1970

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

50-3
50-247
50-286

Re: Indian Point Nuclear Generating Station

Dear Mr. Price:

The Consolidated Edison Company of New York, Inc., had advised us that you have received a letter from the Department of Housing and Urban Development stating that the "Westchester County Planning Agency" should be contacted with respect to the relationship of the planning of the nuclear power generating station at Indian Point (Units 1, 2, and 3) in Westchester County, New York to overall county planning concepts.

This is to advise you that this Department is the official planning agency for the County of Westchester. We have consulted with Con Edison on numerous occasions over the years and have been kept informed of the development at the Indian Point site. The site is zoned for industrial use, and the use of this site for nuclear power generation is consistent with the over-all land use and development plan of the Department for Westchester County.

We note that the present proceeding relates to Indian Point No. 2. Since Unit No. 1 was already in existence at this site when Unit No. 2 was planned, we believe that proper planning favored the location of additional units at the same site, since the area was already committed to industrial use, and since any modifications of development patterns in the immediate area because of the presence of the reactor, for whatever reasons, have already taken place and the community has adjusted to this new industrial use.

Maintenance of access to the Hudson River shore for public recreational purposes has been encouraged by the Planning Department wherever possible. It is our understanding that Consolidated Edison has provided and intends to provide such recreation areas on suitable portions of lands owned as part of these generating facility locations. This policy is strongly endorsed for its consistency with both County and local planning objectives.

Very truly yours,

Peter Q. Eschweiler
Commissioner

PQE:hw
cc: Mr. Joseph C. Swidler, Chairman

Rec'd Off. Dir. of Reg.
Date 11/12/70

William J. Cahill, Jr.
Vice President

APPENDIX K

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

November 12, 1970

Mr. Peter A. Morris, Director
Division of Reactor Licensing
Atomic Energy Commission
Washington, D. C. 20545

Re: Environmental Report for Indian Point 2
Docket No. 50-247

Dear Mr. Morris:

The Consolidated Edison Company of New York, Inc. (Con Edison) would like to furnish you with the following comments in response to the letters from Federal agencies enclosed with your letter to me dated October 27, 1970.

1. Department of Housing and Urban Development

Con Edison welcomes the view expressed by the Department of Housing and Urban Development that the electrical needs of the New York Metropolitan area should not be met with only fossil-fuel generating plants.

HUD expressed concern about the proximity of the plant to populated areas and said that this matter "should be discussed carefully before the license is approved." Again, we agree that this matter should be discussed and assure HUD that this has been done at the time of the issuance of construction permits. Development of the Indian Point site for nuclear power was based on a conclusion reached by Con Edison, and approved by the Atomic Energy Commission and its Advisory Committee on Reactor Safeguards, that nuclear power plants can be built at this site without undue risk to the health and safety of the public. This conclusion has been confirmed by three Atomic Safety and Licensing Boards in connection with the issuance of the construction permits for Indian Point 1, 2 and 3 after public hearings, the last of which was contested.

The ecological studies referred to by HUD are continuing, and Con Edison has not yet received final reports. Con Edison is keeping the cognizant Federal and State agencies advised of progress on these reports.

We agree with HUD's comment that coordination with local planning bodies is desirable. Con Edison cooperated closely in planning with the Village of Buchanan, which has favored the construction of the plant. The Westchester County Planning Board, the appropriate County agency, has been consulted and kept advised of the developments at the site.

The Hudson River Valley Commission was not in existence at the time of commencement of the construction of Indian Point 2. It has been kept advised of developments with respect to Indian Point 3.

The Tri-State Transportation Commission has not been consulted. It is our understanding that this commission is concerned with the transportation problems of New York, New Jersey and Connecticut and has not been involved with utility planning.

2. Department of Defense

The Department of Defense requested additional information on the environmental monitoring program. The present program, together with sampling frequency, is set forth in the table annexed hereto as Appendix A. The sampling frequency will be increased with the initial operation of Indian Point 2, as described in the environmental monitoring survey annexed hereto as Appendix B. We also call your attention to the maps annexed as Appendices C and D which indicate environmental sampling sites.

The Department of Defense inquired about emissions from service boilers. Indian Point 2 will have two "package boilers" with steaming rates of 50,000 pounds/hour each, to produce auxiliary service steam for plant startup and service heating. The amount of combustion products released per year resulting from the addition of these boilers will be insignificant. Estimated emissions are as follows:

Estimated Millions of Pounds of Pollutants Per Year
Based on 6500 Hour Operation Per Year
With #6 Fuel Oil

Item	Quantity
Particulates	0.012
SO_2	0.332
NO_2	0.292
CO	-

A permit has been obtained from the New York State Department of Health (now Department of Environmental Conservation) to operate these boilers at Indian Point.

3. Department of Agriculture

We make no comment on the letter from the Department of Agriculture.

4. Federal Power Commission

We agree with the conclusions expressed by the Federal Power Commission and consider its comments an excellent analysis of the problem of alternatives to Indian Point 2.

5. Department of Health, Education and Welfare

The Department of Health, Education and Welfare (HEW) questioned the estimate of liquid radioactive discharges. This estimate was based on the design criteria for the plant. Until the plant operates, it is impossible to state a number for the possible variance of the plant from design criteria. The estimate is so low that ample margin exists for confidence that these discharges will be well within allowable limits. The current PWR operating experience confirms that liquid discharges, even if above design criteria, are small percentages of maximum permissible concentrations.

With respect to radioactive waste treatment and holdup systems, the final technical specification and bases for Indian Point Unit No. 2 (Specification 3.9 Effluent Release) contains the following commitment in regards to use of radioactive waste treatment which was added subsequent to the HEW review:

> "Plant equipment shall be used in conjunction with developed operating procedures to maintain surveillance of radioactive gaseous and liquid effluents produced during normal reactor operations and expected operational occurrences in an effort to maintain radioactive releases to unrestricted areas as low as practicable."

HEW suggested that the gaseous waste holdup capacity should be expanded to 60 days minimum. The final technical specification required a minimum of 20 days holdup in the gas decay tanks, except for low radioactivity gaseous waste resulting from operations associated with refueling and startup. The design capacity of the tanks allows a 40 day holdup based on design flow rates. Variation in those rates may permit a longer holdup time. However, the 20 day minimum required by the technical specifications results in discharges that constitute a very small percentage of maximum permissible concentrations. The construction of these tanks was approved in connection with the issuance of the construction permit. Expansion of the tanks would be extremely difficult at this time, and we do not believe it is reasonable to require such work.

With respect to the site gaseous waste discharge limit, a typographical error appeared in the equation for the allowable gaseous release rate from the Indian Point site as first submitted to the AEC in the FSAR. Subsequent to the HEW review, the error was corrected and the equation rewritten to avoid misinterpretation. The correct equation is as follows:

$$\left(\frac{\chi}{Q}\right)_1 \sum_i \frac{Q_{1i}}{(MPC)_i} + \left(\frac{\chi}{Q}\right)_2 \sum_i \frac{Q_{2i}}{(MPC)_i} \leq 1.0$$

where: i refers to any radioisotope.

Q_{1i} and Q_{2i} are the release rates (Ci/sec) of any radioisotope i from Unit No. 1 and Unit No. 2 respectively.

(MPC) is in units of μCi/cc as listed in column 1, Table II of Appendix B 10 CFR 20, except that for isotopes of iodine and particulates with half lives greater than 8 days, the values of $(MPC)_i$ shall be reduced by a factor of 700.

The above specification applies to the entire Indian Point Site and will be modified to accommodate Unit No. 3 when it is completed and in operation.

HEW commented on the environmental surveillance program. TLD's (thermo-luminescent-dosimeters) are now employed to measure gamma background at 11 points on the site boundary, as indicated in Appendix C. This dosimetry has a minimum sensitivity of 10 millirems per month. Gamma spectroscopy of water is now performed where indicated by gross beta measurements. When Indian Point 2 commences operation, gamma spectroscopy of drinking water, Hudson River water and lake water will be routinely performed under Programs 2 and 3 of the environmental monitoring survey annexed as Appendix B. Tritium, ^3H, measurements are currently made on samples of drinking water.

Con Edison has already indicated that Indian Point Units 1, 2, and 3 should be treated as a single facility in establishing discharge limits. Nuclear Units 4 and 5 are not under review in this context.

HEW commented on the gaseous releases from Indian Point 1. Most of the gaseous radioactivity released from the Indian Point 1 plant was due to the ventilation of the containment. Small amounts of radioactive gasses collect in containment due to leakage of primary coolant. Since it is not possible to process the containment atmosphere through the gaseous radwaste system, these small amounts of radioactivity are eventually released. Differences in leakage rates, fuel defects, and many other factors could result in the differences in releases between different generating PWR's noted. These differences are in no way due to failure to use the radwaste processing system at Indian Point 1. It should be noted that while total releases from Indian Point 1 are higher than from other operating PWR's these releases are still well below 1% of the allowable amount.

6. Department of Interior

The Department of the Interior notes that it is premature to conclude that Indian Point 2 will have no significant adverse impact on the ecology of the Hudson River. Con Edison agrees that it cannot be known with absolute, 100% accuracy, that the plant will have no significant adverse impact on the Hudson River until after the plant has operated and post-operational ecological studies have been completed. However, we believe that Con Edison has approached this problem with due regard for the protection of the environment, has conducted extensive investigations and studies and is justified in its belief, on the basis of the best evidence now available, that Unit No. 2 will have no significant adverse impact on the ecology of the Hudson River.

The Department of the Interior requested information on possible alternative measures and supplementary facilities to alleviate the fish problems similar to those experienced in the operation of Unit No. 1. This matter is presently under review by the Fish Advisory Board referred to in the Environmental Report. Con Edison is doing everything possible to alleviate this problem and

feels that the interim and long range measures outlined in the Environmental Report embody the best approach to a final resolution of the problem incorporating the latest design criteria gained both from actual operating plant experience and laboratory tests. Numerous alternatives were considered, and as can be seen from the scope of the recommended measures, cost was made secondary to the solution of the problem. The concept for a new intake structure described in the Environmental Report is a very expensive alternative.

The Department of the Interior requested information on programs to monitor the effectiveness of waste controls, thermal discharges and chemical releases. Radioactive waste controls are monitored by the extensive environmental monitoring program described in the Environmental Report, and, in more detail, in the above response to the letter of the Department of Defense and in Appendices A - D.

Programs have been established to monitor thermal discharges. Instrumentation is available to measure the thermal discharges in the discharge canal and in the river. The thermal sensors consist of 4 stations in the river with 4 thermistors per station placed at different water depths. Also, a thermistor is located in the discharge canal. Temperatures are recorded every 30 minutes on an Automated Environmental Systems unit. Aerial overflights at a frequency of 6 per year at three different ambient temperatures have been made in the past year and are proposed as part of the ecology study for the coming year.

Samples are taken from the discharge canal during every chlorination procedure and analyzed for chlorine. Except for a few non-routine discharges, chemical discharges other than chlorine are not monitored, and the Company has never been requested to monitor such discharges.

The Department of the Interior requested information on river flows. Flow in the Hudson River at Indian Point is affected more by the tides than the run off of the tributary water shed. The tidal flow at Indian Point is approximately 150,000 cfs (68 million gpm: the fresh

water runoff varies from 4000 cfs in August to 38,000 cfs in April. The attached figurelshows the variation of the tidal flow with location above the Battery and figure 2 presents the seasonal variation of the fresh water run off. The peak tidal flow past the plant will vary from 70 million gpm in August to about 80 million gpm in April. This does not suggest that all this volume rate of flow is available for dilution possibilities. The dilution capability is measured in terms of fresh water flow and the tidal and salinity parameters. However, the significant factor in terms of dilution in this region of the river is associated with the tides and the resulting saline intrusion.

We agree with the Department of the Interior that, during operation of the plant, problems could arise which are not foreseen prior to construction of the plant. Con Edison is legally required to comply with all applicable Federal and state laws and regulations concerning radioactive, thermal and chemical wastes and will have to take whatever measures may be required to correct unforeseen problems which may, if not corrected, result in a violation of applicable laws and regulations, as they exist from time to time.

Sufficient flexibility exists in waste controls to allow for the prevention of exceeding presently applicable limits. We believe that all reasonable provisions exist for later plant modifications, if necessary.

The Department of the Interior requested additional information on the location of environmental monitoring stations and the frequency of sampling. This information is provided above in response to the letter of the Department of Defense, and the information is set forth in Appendices A - D.

Information concerning water quality standards requested by the Department of the Interior has not been included in the Environmental Report in view of the Atomic Energy Commission's guidelines which provide that such matters should not be discussed in the Environmental Report. This is based on the view that,pursuant to the Water Quality Act of 1970, water quality is subject to state control. Water quality information has been furnished to the New York State Department of Environmental Conservation in connection with an application for the certificate required pursuant to the Federal Water Pollution Control Act, as amended by the Water Quality Act of 1970. This information appears as Appendix C to the comments of the New York State Atomic

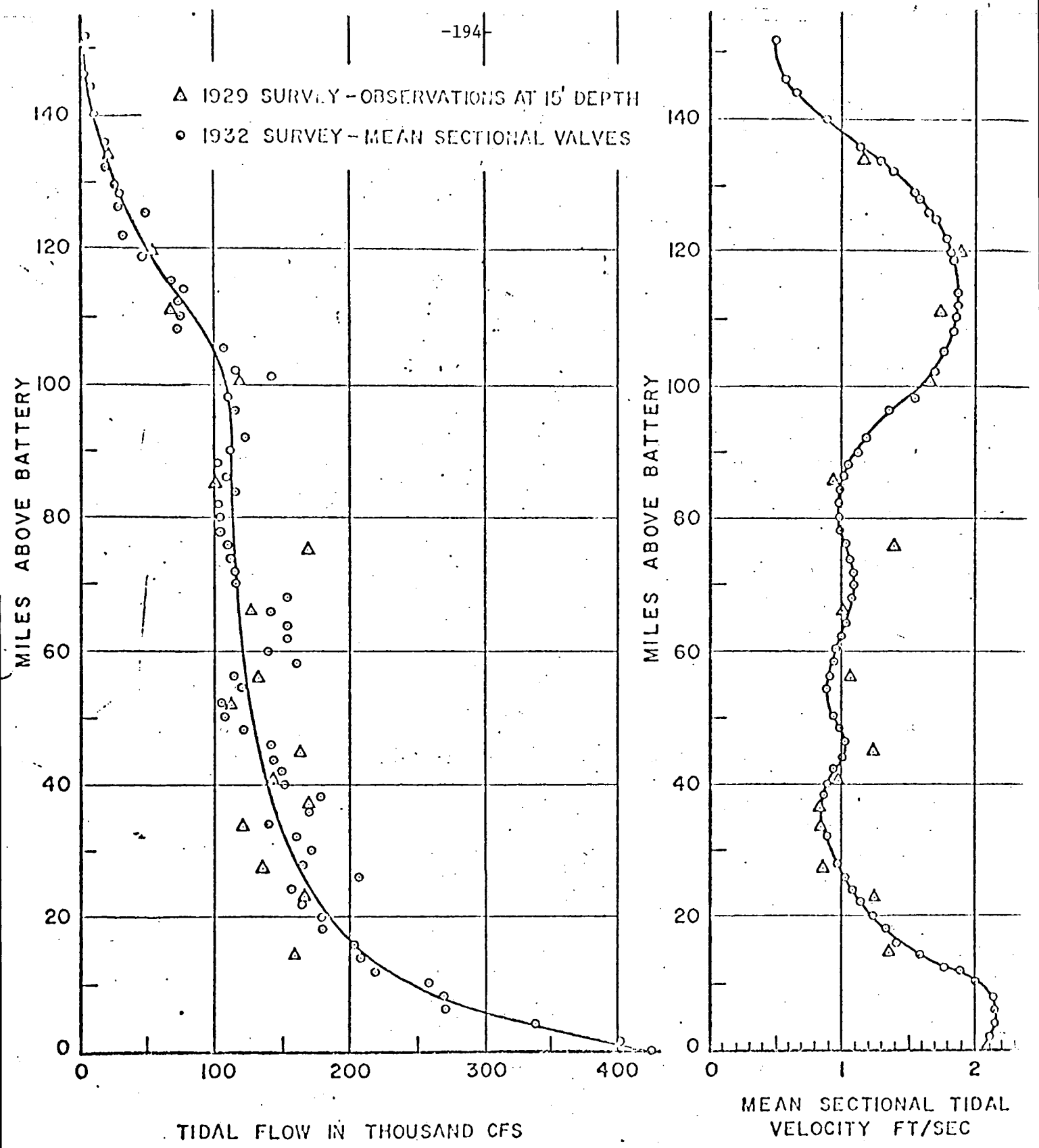
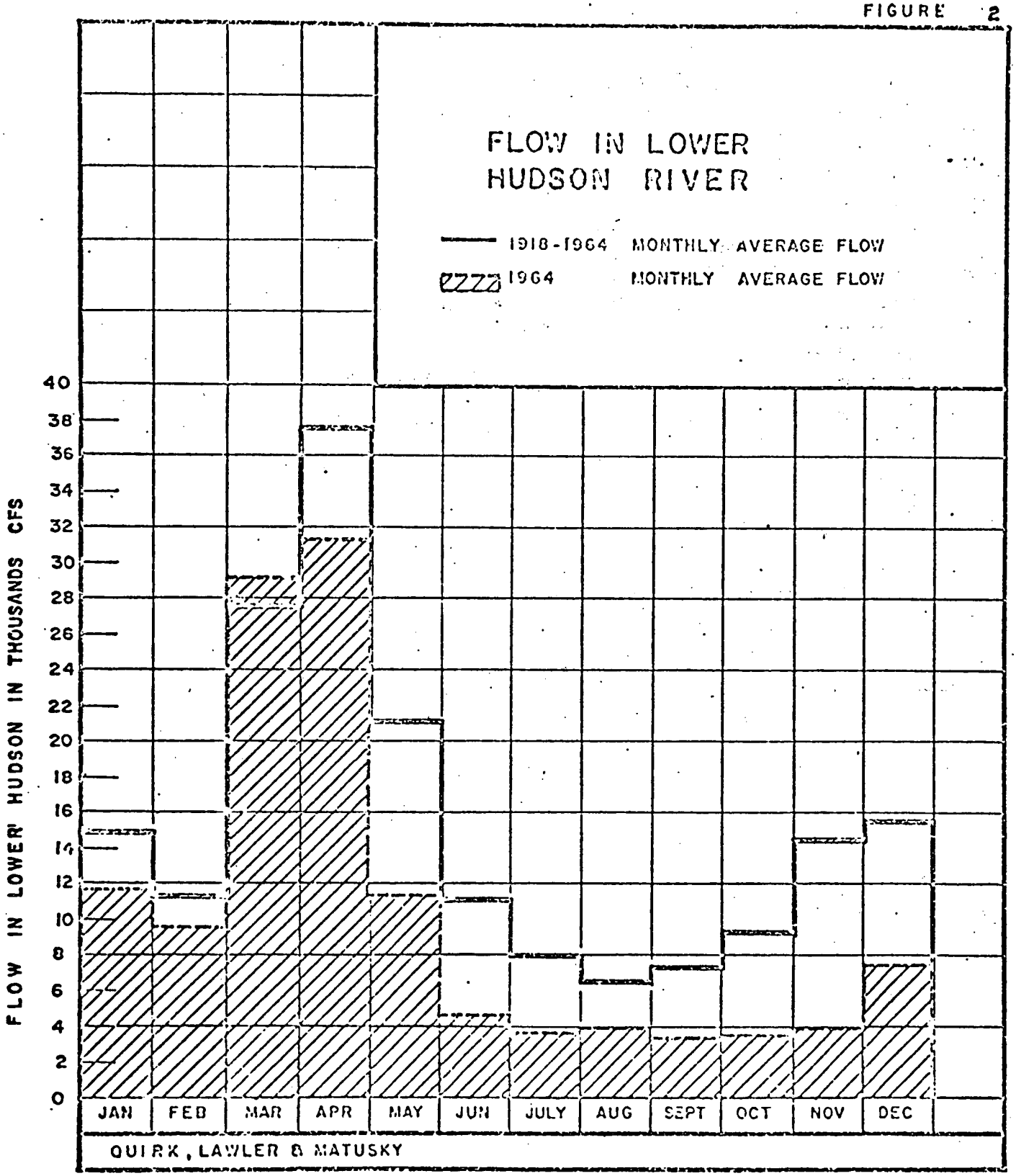


FIGURE 1

HUDSON RIVER

TIDAL FLOW AND VELOCITY

FIGURE 2


FLOW IN LOWER HUDSON RIVER
1918-1964 MONTHLY AVERAGE FLOW
1964 MONTHLY AVERAGE FLOW
FLOW IN LOWER HUDSON IN THOUSANDS CFS
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
JAN
FEB
MAR
APR
MAY
JUN
JULY
AUG
SEPT
OCT
NOV
DEC
QUIRK, LAWLER & MATUSKY

Energy Council transmitted to the AEC by letter dated October 29, 1970.

The Department of the Interior refers to a "catastrophic accident" involving a breach of containment. Con Edison believes that this accident should be ruled out as impossible. This is the subject of the most comprehensive and detailed considerations in the design of a nuclear power plant and is subject to detailed review by the Atomic Energy Commission and its Advisory Committee on Reactor Safeguards. Numerous features are included in the design of the plant to assure that this type of accident cannot occur, even in the event of simultaneous malfunctions of various types. We refer to Section 14 of the Final Safety Analysis Report for the detailed analysis that justifies this conclusion.

I am enclosing extra copies of this letter in case you wish to forward them to the departments which submitted comments on the Environmental Report.

Very truly yours,

William J. Cahill, Jr.

William J. Cahill, Jr.
Vice President

Enc.

Appendix A

INDIAN POINT STATION ENVIRONMENTAL SURVEY

	Media	Type	Sampling Frequency	Method of Collection	Locations	Analysis	Minimum Sensitivities	Measurement Instrumentation	Remarks
1	Fallout	Continuous	Monthly	Open Pot type rain collector	Point 1 and 15 miles south of site at Eastview	Gross beta and tritium	1 picocurie per liter for gross beta	Gas flow, windowless proportional counter for gross beta Nuclear Measurement Corp. Type PC 3A Type PC 11A Type PC 11T	Measurements made 48 hours after collection to allow for decay of radon daughters
							3000 picocuries per liter for tritium		
2	Air Particulate and Organic Iodide	Continuous at 1 CFM.	Weekly	Two fixed membrane filters (0.8 micron size) preceding a charcoal filter	Points 1, 2, 3, 4 and 5. In addition off-site at points in Peekskill, Buchanan, and Verplanck for one week periods consecutively.	Gross beta and gamma spectrum	0.1 picocuries per cubic meter for gross beta	Same as 1 for gross beta	Measurements made soon after collection and 48 hours later to allow for decay of radon daughters
							2 picocuries per cubic meter for I-131	Gamma spectrum with 3" x 3" NaI crystal with 400 channel analyzer Radiation Instruments Development Laboratories Model 3412 Gamma Spectrometer	
3	Reservoir Water	Grab	Monthly		Points 6, 7 and 8	Same as 1	Same as 1	Same as 1	Same as 1
4	Hudson River Water	Continuous	Weekly	Continuous flow regulated to fill 2 gallon containers. Representative sample taken once a week and containers emptied.	Hudson River inlet pipe into the plant, and at plant discharge canal. Points 9 and 10.	Same as 1 and tritium on monthly composite	Same as 1	Same as 1	Same as 1

INDIAN POINT STATION ENVIRONMENTAL SURVEY

	Media	Type	Sampling Frequency	Method Collection	Locations	Analysis	Minimum Sensitivities	Measurement Instrumentation	Remarks
5	Lake Water	Grab	Monthly	1 liter sample off-shore	Points 11, 12 and 13	Same as 1	Same as 1	Same as 1	Same as 1
6	Well Water	Grab	Monthly	From deep-well pumps	Points 6, 14 and Verplanck	Same as 1	Same as 1	Same as 1	Same as 1
7	Lake Aquatic Vegetation	Grab	Once each in Spring, Summer and Fall	Along the lake shore	Same as 5	Same as 2	1 picocurie per gram for gross beta 2 picocuries per gram for I-131	Same as 2	Dry weight for spectrum soon after collection. Sample ashed and counted 48 hours after collection for gross beta
8	Hudson River Aquatic Vegetation	Grab	Same as 7	Along river shore	Points 10, 15, 16, 17 & 22. At mouth of discharge canal, Peekskill Bay, Tompkins Cove, off Verplanck and at the Lovett plant of Orange and Rockland Utilities.	Same as 2	Same as 7	Same as 2	Same as 7
9	Hudson River Bottom Sediment	Grab	Same as 7	Same as 8	Same as 8	Same as 2	Same as 7	Same as 2	Mud dried for both measurements
10	Hudson River Fish	Catch	Monthly	Same as 8	Where available near site	Same as 2	Same as 7	Same as 2	Sample ashed and counted 48 hours after collection for gross beta and gamma spectrum taken
11	Vegetation	Grab	Same as 7	Grab samples with 100 ft^2 area	Points 6, 18, 19, 20 and 21	Same as 2	Same as 7	Same as 2	
12	Soil	Grab	1 per year	Grab samples 2" in diameter by 2" deep	Same as 11	Same as 2	Same as 7	Same as 2	Soil dried for spectrum and measured soon after collection. Gross beta of dried soil made 48 hours after collection

INDIAN POINT STATION ENVIRONMENTAL SURVEY

	Media	Type	Sampling Frequency	Method of Collection	Locations	Analysis	Minimum Sensitivities	Measurement Instrumentation	Remarks
13	Direct Gamma	Spot Readings	Once a year		Along principal roads within a 5 mile radius of plant	Gross gamma background	2.2×10^6 counts per minute in a Cesium-137 field of 1 mr/hr. Minimum sensitivity 1 ur/hr.	Franklin Systems, Inc. Model 15-2	Instrument readings in counts per minute measured at approximately 1/10 mile intervals. Readings converted to microrem per hour.
14	Direct Gamma	Continuous	Monthly		Selected locations in Buchanan, Verplanck, Montrose, Peekskill, and at a number of points on-site at the plant perimeter	Same as 13	1 mr	Victoreen Ionization Chamber Model 239 0-10 mr or Film badges or TLD-Thermoluminescent dosimeters	

4.10 ENVIRONMENTAL MONITORING SURVEY

Applicability

Applies to routine testing of the plant environs.

Objective

To establish a sampling schedule which will recognize changes in radioactivity in the environs and assure that effluent releases are kept as low as practicable and within allowable limits.

Specification

1. Liquid Discharges

   The survey for liquid discharges shall be conducted in accordance with Table 4.10-1 as specified below:

   a. If the gross beta-gamma activity of the station releases to the river is less than 1% of MPC during the month just ended, the environmental survey shall be conducted in accordance with Program 1 for the subsequent month.

   b. If the gross beta-gamma activity of the station releases to the river is greater than 1% of MPC but less than 10% of MPC during the month just ended, the environmental survey shall be conducted in accordance with Program 2 for the subsequent month. If the samples taken under Program 2 do not indicate any significant increase in environmental radioactivity, the survey shall revert to Program 1.

   c. If the gross beta-gamma activity of the station releases to the river is greater than 10% of MPC during the month just ended, the environmental survey shall be conducted in accordance with

c. Program 3 for the subsequent month. If the samples taken under Program do not indicate any significant increase in environmental radioactivity, the survey shall revert to Program 2.

d. Irrespective of release levels, once each year the survey shall be taken under Program 3 for a 3 month continuous period.

2. Gaseous Discharges

The survey for the gaseous discharges shall be conducted in accordance with Table 4.10-2 as specified below:

a. If the average release rate from the plant vent is less than 1% if the annual allowable release rate as specified in Paragraph 3.9-C1 during the month just ended, the environmental survey shall be conducted in accordance with Program 1 for the subsequent month.

b. If the average release rate from the plant vent is greater than 1% but less than 10% of the annual allowable release rate as specified in Paragraph 3.9-C1 during the month just ended, the environmental survey shall be conducted in accordance with Program 2 for the subsequent month. If the samples taken under Program 2 do not indicate any significant increase in environmental radioactivity, the survey shall revert to Program 1.

c. If the average release rate from the plant vent is greater than 10% of the annual allowable release rate as specified in Paragraph 3.9-C1 during the month just ended, the environmental survey shall be conducted in accordance with Program 3 for the subsequent month. If the samples taken under Program 3 do not indicate

c. any significant increase in environmental radioactivity, the survey shall revert to Program 2.

d. Irrespective of release levels, once each year the survey shall be taken under Program 3 for a 3 month continuous period.

Basis

Programs for monitoring the adjacent area of the Hudson River will be conducted by the Consolidated Edison Company, by the New York State Department of Health, and by the New York University Institute of Environmental Medicine. The New York State program includes measurement of samples of air, water, milk and wildlife. The New York University Medical Center research program includes the biology of the Hudson River, the distribution and abundance of fish in the river, pesticides and radio-ecological studies.

A nineteen month study whcih began in June, 1969, is being conducted by Raytheon for the Hudson River Policy Committee. The Committee consists of the New York State Conservation Department, the New Jersey Department of Conversation and Economic Development, the U. S. Bureau of Sport Fisheries and Wildlife, the U. S. Bureau of Commercial Fisheries, and the Connecticut Conservation Department. The objectives of the study are; (1) to determine the seasonal distribution of fish and key organisms within and outside of the areas to be exposed to the heated and otherwise altered discharge form Units 1, 2, and 3; (2) to determine the effects of temperature rise and chemical additives on the survival and behavior of screenable and non-screenable fish and organisms in the area; (3) to catalog physical and chemical characteristics

of the estuary often associated with observed changes in the biota; i.e., temperature, salinity, conductivity, dissolved and suspended solids, dissolved oxygen, and physical alternations.

The various studies mentioned above include measurements of radioactivity in fresh water, river water, river sediments, fish, milk, aquatic vegetation, soil, and air in the vicinity of the Indian Point Station.

The environmental monitoring program conducted by the Consolidated Edison Company will supply sufficient data to determine the compliance of the Indian Point Station with the requirements of 10CFR20. The schedules for liquid and gaseous discharges will insure that changes in the environmental radioactivity will be detected.

Although the design of the proposed facility and administrative controls will be such that gaseous and liquid effluents will be released in accordance with the requirements of 10CFR20, the environmental monitoring program of the Consolidated Edison Company provides a redundant means of insuring that the operation of the proposed facility does not pose any undue risk to the health and safety of the Public. The New York State and New York University programs provide an independent means of verifying the proposed facilities compliance with 10CFR20.

Table 4.10-1

Environmental Monitoring Survey - Liquid Discharges+

Media of Sample	No. of Samples/ Collection	Programs 1 Collection Frequency	1 Analysis*	2 Collection Frequency	2 Analysis*	3 Collection Frequency	3 Analysis
Hudson River Water	2	W	GBG	TW	GBG	D	GBG
	1	MC	T		GSA		GSA
				MC	T	MC	RA
							T
Hudson River Aquatic Vegetation	15	SSF	GBG	MDGS	GBG	MDGS	GBG
					GSA		GSA
							RA
Hudson River Bottom Sediment	5	SSF	GBG	M	GBG	M	GBG
					GSA		GSA
							RA
Hudson River Fish	1	M	GBG	TM	GBG	W	GBG
					GSA		GSA
							RA

+Samples will be taken whenever biologically available.

*Minimum equipment sensitivity shall be those given in FSAR Table 11.11-1.

Nomenclature for Sample Frequency

W - Weekly
TW - Twice Weekly
D - Daily
M - Monthly
MC - Monthly Composite
TM - Twice Monthly
SSF - Once each in Spring, Summer and Fall
MDGS - Monthly During the Growing Season

Nomenclature for Analysis

GBG - Gross Beta-Gamma GSA - Gamma Spectrometer Analysis T - Tritium
RA - Radiochemical Analysis to determine biologically important isotopes.

Table 4.10-2

Environmental Monitoring Survey - Gaseous Discharges+

Media of Sample	No. of Samples/ Collection	PROGRAMS 1 Collection Frequency	1 Analysis*	2 Collection Frequency	2 Analysis**	3 Collection Frequency	3 Analysis
Fallout	2	M	GBG T*	M	GBG GSA T*	TM MC	GBG GSA RA T*
Air Particulate & Organic Iodide	9	W	GBG GSA	TW	GBG GSA	TW	GBG GSA RA
Drinking Water Supplies	3	M	GBG T	TM MC	GBG GSA T	W MC	GBG GSA RA T
Lake Water & Well Water	6	M	GBG T	TM MC	GBG GSA T	W MC	GBG GSA RA T
Lake Aquatic & Vegetation & Land Vegetation	8	SSF	GBG	MDGS	GBG GSA	MDGS	GBG GSA RA
Soil	5	A	GBG	M	GBG GSA	M	GBG GSA RA
Direct Gamma (Spot Readings)	180	A	GGB	MSL	GGB	WSL	GGB

Table 4.10-2
(Continued)

Media of Sample	No. of Samples/ Collection	PROGRAMS 1 Collection Frequency	1 Analysis*	2 Collection Frequency	2 Analysis**	3 Collection Frequency	3 Analysis
Direct Gamma (Peripheral Monitoring)	15	M	GGB	TM	GGB	W	GGB
Milk	1					M	GBG GSA RA

+Samples will be taken whenever biologically available.

*Tritium analysis will be performed provided sufficient wet deposition occurs.

**Minimum equipment sensitivities shall be those given in FSAR Table 11.11-1

Table 4.10-2 (Continued)

Environmental Monitoring Survey - Gaseous Discharge

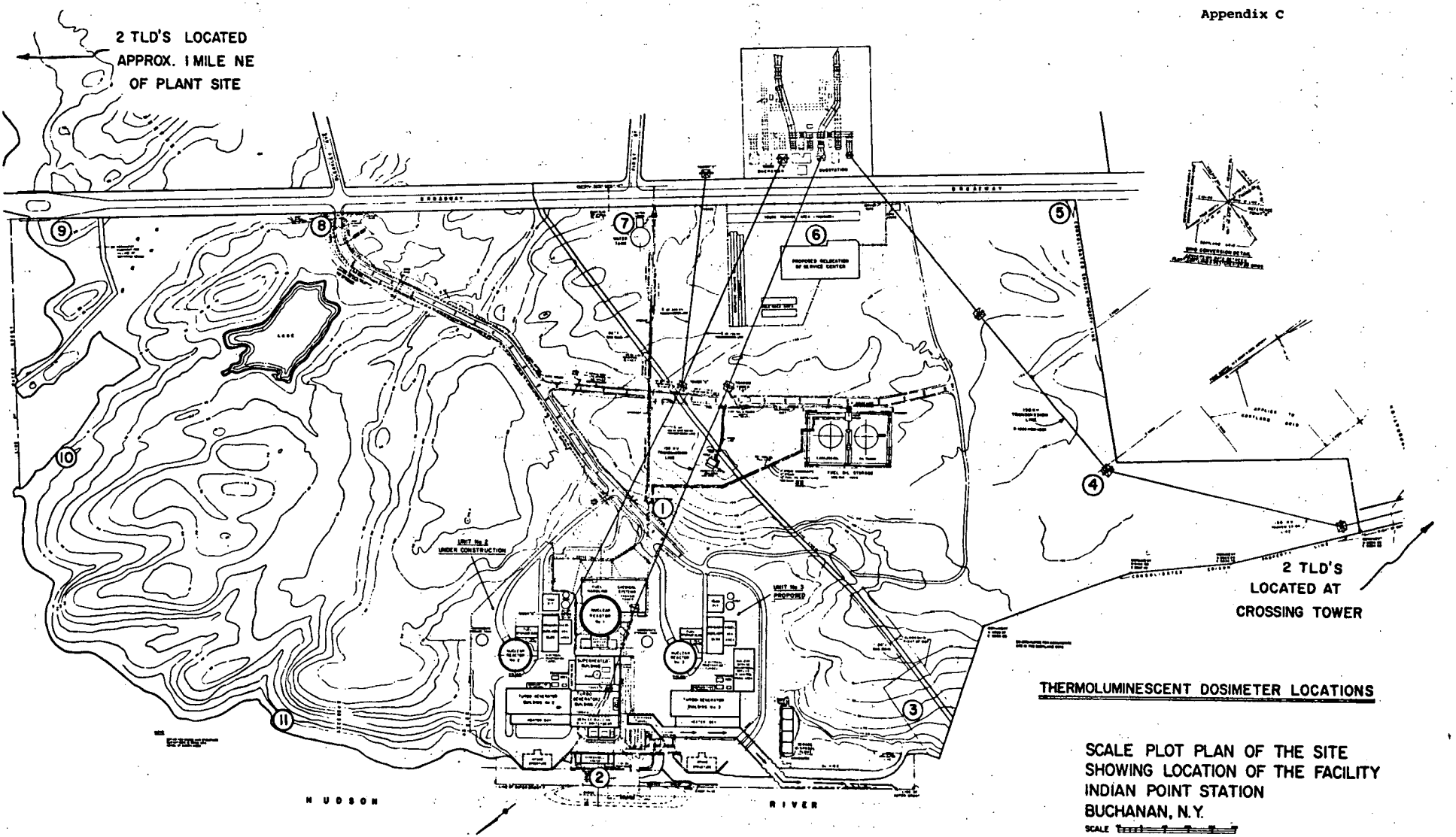
Nomenclature for Sample Frequency

M - Monthly
TM - Twice Monthly
W - Weekly
TW - Twice Weekly
MC - Monthly Composite
A - Annually
SSF - Once each in Spring, Summer and Fall
MDGS - Monthly During the Growing Season
MSL - Monthly at Selected Locations
WSL - Weekly at Selected Locations

Nomenclature for Analysis

GBG - Gross Beta-Gamma
GSA - Gamma Spectrometer Analysis
RA - Radiochemical Analysis to determine biologically important isotopes
T - Tritium
GGB - Gross Gamma Background

Appendix C



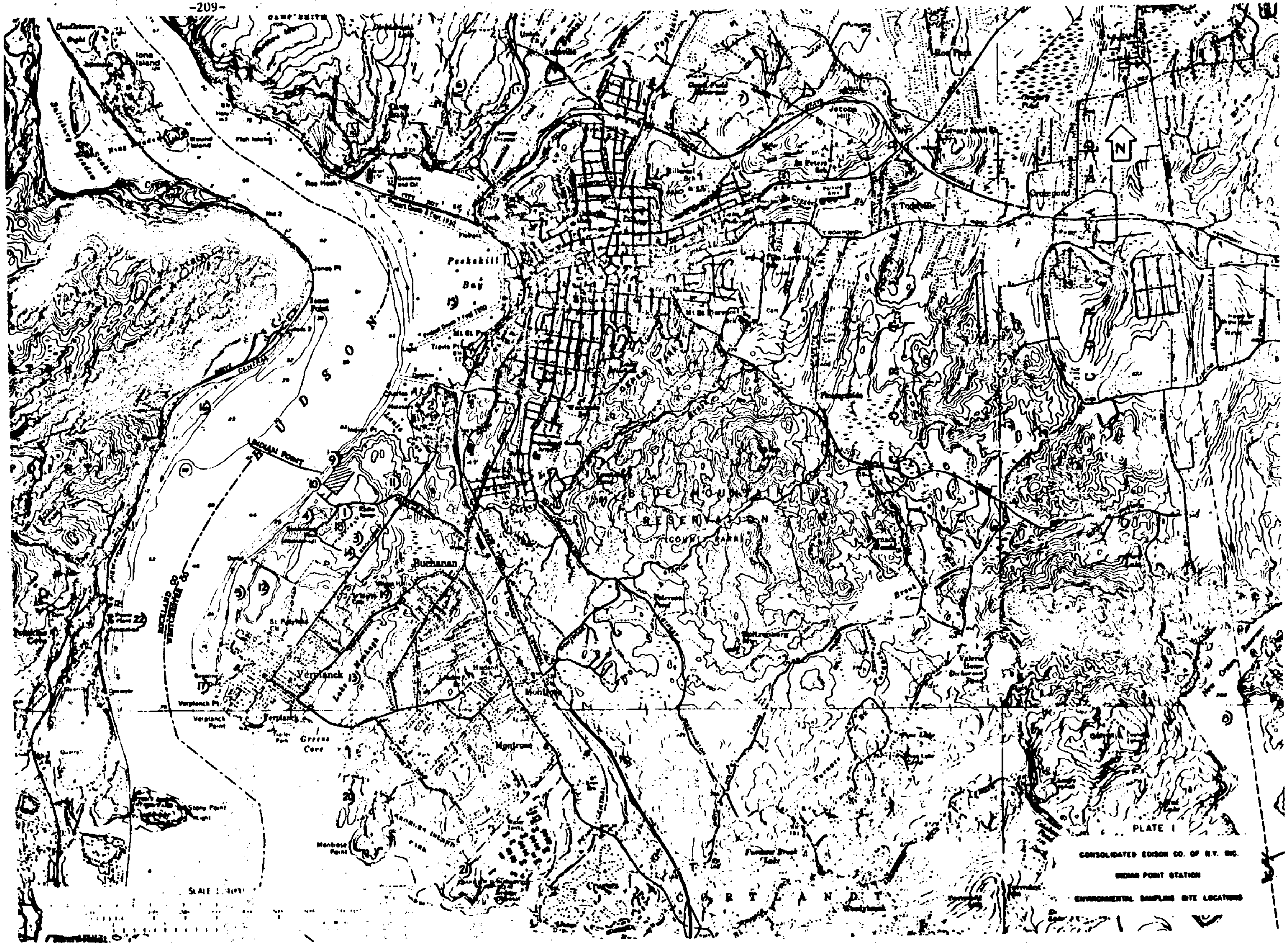
THERMOLUMINESCENT DOSIMETER LOCATIONS

SCALE PLOT PLAN OF THE SITE
SHOWING LOCATION OF THE FACILITY
INDIAN POINT STATION
BUCHANAN, N.Y.

SCALE

APRIL 1967

Appendix D



Peekskill
Bay
HUDSON
Buchanan
Verplanck
Montrose
Iona Island
Stony Point
Verplanck Point
Green Cove
Montrose Point
Jones Pt
INDIAN POINT
Orangeburg
Jacobs Hill
CORTLANDT
PLATE I
CONSOLIDATED EDISON CO. OF N.Y. INC.
INDIAN POINT STATION
ENVIRONMENTAL SAMPLING SITE LOCATIONS

APPENDIX L

CHRONOLOGY - ENVIRONMENTAL DATA

INDIAN POINT NUCLEAR GENERATING UNIT NO. 2

DOCKET NO. 50-247

5/7/70	AEC letter requesting environmental data pursuant to the provisions of the National Environmental Policy Act of 1969.
8/6/70	Applicant's environmental report submitted.
8/17/70	Copies of applicant's environmental report sent to the Governor of New York, the Council on Environmental Quality, and the Federal Agencies requesting comments.
8/25/70	Notice of availability of applicant's environmental report published in the Federal Register (35 F.R. 10530).
9/14/70	Comments from Department of Housing and Urban Development (HUD).
9/17/70	Comments from the Department of Defense (DOD).
9/24/70	Comments from the Federal Power Commission.
10/5/70	Comments from Department of Health, Education, and Welfare (HEW).
10/9/70	Comments for U. S. Department of the Interior (DOI).
10/19/70	AEC letter to Dept. of Transportation and Dept. of Commerce advising that since no comments have been received from the respective agencies, it is presumed that no comments are forthcoming, and AEC is proceeding with the preparation of a detailed environmental statement.

10/27/70	AEC letter to Consolidated Edison Company transmitting comments from DOD, DOI, HUD, HEW, FPC, and DA.
10/29/70	Comments received from the New York State Atomic Energy Council and the New York State Department of Environmental Conservation.
11/9/70	Comments received from Westchester County Department of Planning.
11/12/70	Letter from Consolidated Edison Company to AEC in response to the comments of DOD, DOI, HUD, HEW, FPC, and DA.
11/13/70	AEC letter to Consolidated Edison Company transmitting the comments received from the New York State Atomic Energy Council and New York State Department of Environmental Conservation.

3.9 EFFLUENT RELEASE

Applicability

Applies to the release of radioactive liquids and gases from the plant.

Objective

To define the conditions for release of radioactive wastes to the circulating water discharge and to the plant vent to assure that any radioactive material released is kept as low as practicable and, in any event within the limits of 10CFR20.

Specification

A. General

1. It is expected that releases of radioactive material in effluents will be kept at small fractions of the limits specified in 20.106 of 10CFR20. At the same time the licensee is permitted the flexibility of operation, compatible with considerations of health and safety, to assure that the Public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such small fractions, but still within limits specified in 20.106 of 10CFR20. It is expected that in using this operational flexibility under unusual operating conditions the licensee will exert his best efforts to keep levels of radioactive material in effluents as low as practicable.

2. Plant equipment shall be used in conjuction with developed operating procedures to maintain surveillance of radioactive gaseous and liquid effluents produced during normal reactor operations and expected operational occurences in an effort to maintain radioactive releases to unrestricted areas as low as practicable.

3. A report shall be submitted to the Commission at the end of each six-months' period of operation as required under Specification

6.6.4. If quantities of radioactive material released during the reporting period are unusual for normal reactor operations, including expected operational occurences, the report shall cover this specifically. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

B. Liquid Effluents

1. The maximum release rate of radioactive liquid effluents from the site shall be such that the concentration of radionuclides in the circulating water discharge does not exceed the limits specified in 10CFR20, Appendix B, for unrestricted areas.

2. Prior to release of radioactive effluents, a sample shall be taken, and analyzed to provide the data necessary to assure compliance with B.(1) above.

3. During release of radioactive liquid effluents, at least one condenser circulating water pump shall be in operation.

4. During release of radioactive liquid effluents, the gross activity liquid discharge monitor shall be in operation, except that the monitor may be out-of-service for 48 hours, provided that a sample shall be taken during release of each batch of discharge line effluent and analyzed.

C. Gaseous Effluents

1. The maximum release rate of gaseous effluents for the site shall be limited as follows:

$$\left(\frac{\chi}{Q}\right)_1 \sum_i \frac{Q_{1i}}{(MPC)_i} + \left(\frac{\chi}{Q}\right)_2 \sum_i \frac{Q_{2i}}{(MPC)_i} \leq 1.0$$

where:

i refers to any radioisotope

Q_{1i} is the release rate (Ci/sec) of any radioisotope i from Unit No. 1

Q_{2i} is the release rate (Ci/sec) of any radioisotope i from Unit No. 2

$(MPC)_i$ in units of μCi/cc as listed in Column 1, Table II of Appendix B 10CFR20, except that for isotopes of iodine and particulates with half lives greater than 8 days, the values of $(MPC)_i$ shall be reduced by a factor of 700.

$(\frac{X}{Q})_1$ and $(\frac{X}{Q})_2$ are the meterological dispersion coefficients (Sec/m^3) for Units No. 1 and No. 2 respectively at the site releasing the effluent from the plant vent, air ejector discharge, and blowdown tank vent when applicable.

$(\frac{X}{Q})_1 = 5.88 \times 10^{-7}$ sec/m^3

$(\frac{X}{Q})_2 = 2.5 \times 10^{-5}$ sec/m^3

2. Prior to release of gaseous effluents, the contents of the gas holdup tank shall be sampled and analyzed to provide the necessary data to assure compliance with Specifications 3.9.C.1 and 3.9.C.2, above.

3. During release of gaseous effluent to the plant vent, the following conditions shall be met:

   a. At least one auxiliary building exhaust fan shall be in operation.

   b. The plant vent monitor shall be in operation and the vent halogen particulate monitor shall be in operation except that the plant vent monitor may be out-of-service for 48 hours. Should the vent monitor fail immediate action to stop gas decay tank release will be made.

4. The inventory of noble gases in any gas tank shall not exceed 16,500 curies of equivalent Xe-133.

5. Gaseous waste in the gas decay tank shall have as a mininum 20 days of decay time except for low radioactivity gaseous waste resulting from purge and fill operations associated with refueling and reactor startup.

6. During power operation the air ejector discharge monitor may be inoperable for 48 hours. When the monitor is inoperable ssmples shall be taken from the air ejector discharge and analyzed for gross activity on a daily basis, except when there is indication of primary to secondary leakage the sample shall be taken and analyzed for gross activity once per shift.

7. During the first indication of primary to secondary leakage, a determination of the partition factor for the blowdown tank shall be made. Whenever there is indication of primary to secondary leakage and any steam generator is being blown down, the blowdown line monitor shall be operable, except that it may be inoperable for 48 hours provided samples shall be taken once per shift of the blowdown effluent and analyzed for gross activity.

Basis

Liquid wastes from the radioactive Waste Disposal System are diluted in the Circulating Water System discharge prior to release to the river.(1) With all six pumps operating, the rated capacity of the Circulating Water System is 840,000 gpm. Operation of one circulating water pump reduces the nominal flow rate of about 20%. The actual circulating water flow under various operating conditions will be calculated from the head differential across the pumps and the manufacturer's head-capacity curves. The concentrations in the circulating water discharge will be calculated from the measured concentration in the waste condensate tank, the flow rate of the waste condensate pumps, and the flow in the Circulating Water System.

It is expected that the Plant Operating Procedures will allow releases of radioactive material and effluents to be small fractions of the limits specified in 10CFR20 and it is expected that the actual liquid release rates will result in a concentration in the circulating water discharge of less than 1/10 MPC. Thus, discharge of liquid wastes at the specified concentrations will not result in significant exposure to members of the Public as a result of consumption of drinking water from the river, even if the effects of potable water treatment systems on reducing radioactive concentration of the water supply is neglected.

Buildup of long-lived radioisotopes in the river and reconcentration by aquatic organisms in the human food chain has also been considered. Using conservatively high estimates of reconcentration of radioisotopes in fish and of human consumption of fish, it is concluded that the release of liquid wastes may equal the 10CFR20 guidelines without causing any identificable problems. While some species of rooted vegetation, and filter feeding molluscs, concentrate some of the radioactive components of a reactor effluent in the Hudson, none of these species are used for human or animal consumption. Fish, on the other hand, while possible sources of food, do not demonstrate accumulation of the nuclides in question. For both maganese and cobalt there is a natural barrier to absorption in the gut of fish which restricts their uptake of these elements. In fact, much of the reported concentration of the radio elements may be located only in undigested gut residues rather than in the fish flesh which may be consumed. Hence, the potential contamination of diet from this source is miniscule.[4] This will be continually monitored by the environmental surveillance program (as defined in Specification 4.10). However, because of the flow in the Hudson River[2], it is not anticipated that any appreciable reconcentration will occur.

Prior to release to the atmosphere, gaseous wastes from the radioactive Waste Disposal System are mixed in the plant vent with the flow from at least one of two auxiliary building exhaust fans. Further dilution then occurs in the atmosphere.

The formula prescribed in Specification 3.9.C.1 takes into account combined releases from the site, and assures that at any point on or beyond the site boundary the requirements of 10CFR20 will be satisfied. Atmospheric dilution

AE-12

is taken into account with the χ/Q's for Indian Point Units No. 1 and No. 2 being based on the worst combination of sector yearly average meteorology and sector distance to the site boundary. For Indian Point Unit No. 1 alone, the value of χ/Q of 5.88×10^{-7} Sec/m^3 would result in just achieving 10CFR20 limits at the site boundary. For Indian Point Unit No. 2 alone, the value of χ/Q of 2.05×10^{-5} sec/m^3 would result in just achieving 10CFR20 limits at the site boundary. The combined formula in Specification 3.9.C.1, however, would require the release rates for any radioisotope, Q_{1i} and Q_{2i}, to be limited for consideration of joint releases being limited to 10CFR20 from the site.

Restricting the maximum inventory of noble gases in any gas or liquid tank to 16,500 curies equivalent Xe-133 (or 15% of the total maximum Reactor Coolant System inventory), will result in a total off-site exposure of less than 0.5 rem for complete release of the noble gas activity stored in the tank.(3)

References

(1) FSAR Section 10.2.4

(2) FSAR Section 2.5

(3) FSAR Section 14.2.3

(4) Development of a biological monitoring system and pesticide residues in the lower Hudson River. - M. Eisenbud and G. P. Howells - Institute of Environmental Medicine New York University Medical Center - October 10, 1969.