Semi-Annual Report for the Period
July 1, 1977 through December 31, 1977
Pursuant to
Section 5.6.1.2A of Appendix B
to
Facility Operating License
Indian Point Nuclear Generating
Units Numbers 1, 2 and 3

a. Effects of Chlorine and Other Chemical Discharges on the Ecosystem of the Hudson River

As reported in the Semiannual Report of July 1976, results of experiments relative to this subject were reported in the New York University report entitled:

> "The Effects of Temperature and Chlorine on Entrained Hudson River Organisms-Progress Report for 1975"

Analysis of the effects of chlorine on plant and plume entrained organisms and the results of simulated plant conditions on phytoplankton, zooplankton and ichthyoplankton are contained in this report. This report was filed with the Commission on July 2, 1976.

Con Edison considers the results presented as completing the requirements for studies on the effects of chlorine and other chemical discharges on aquatic biota.

b. Reduction in Frequency of Chlorinations and Concentrations of Free and Combined Chlorine

Chlorinations were not performed during the entire reporting period based on the results of periodic condenser inspections. Current plans do not call for chlorinations unless condenser inspections indicate that chlorination is necessary.

c. Thermal Plume Model Verification and Mapping (Near and Far Field

During 1977 routine surveys of the Indian Point station thermal plume were conducted during the months of May, June, August, and September. No surveys were conducted during the months of April, July, October and November

because either Unit No. 2 or Unit No. 3 was not operating. Surveys are not required during the winter months of December through March. The results of the 1977 surveys are being analyzed and will be presented in forthcoming reports for each survey. Preliminary evaluation of the May survey data is presented below.

During the May 1977 routine thermal survey, conducted from May 24-26, Units No. 2 and 3 were operating with a combined average electrical generation of from 1300 to 1900 MW(e) gross. The salient results for the maximum extent of the plume during the most severe tidal phases were as follows:

	Maximum Extent of $4^{o}F$ excess temperature isotherm with respect to	Tidal Phase of Maximum Extent	Survey Results	NYS Criteria on $4^{o}F$ excess temperature isotherm
(a)	Lateral Width	High Water	30%	67%
(b)	Cross-Section Area	Slack Flood	12%	50%

As seen from the above tabulation, the extent of the $4^{o}F$ excess temperature isotherm was within the New York State Thermal Criteria.

d. Ecological Effects of Thermal Discharges

Laboratory studies of thermal effects on EPA designated Representative Important Species for the Indian Point Nuclear Generating Station have been completed. These studies are in response to EPA guidelines related to FWPCA Section 316(a) demonstrations and include thermal tolerance, optimum temperature for growth, upper avoidance temperature, maximum temperature for development, and cold shock. The data collected are currently being analyzed and interpreted. A report on the conclusions drawn from this work is expected to be ready in late March, 1978, at which time it will be filed with NRC.

e. Potential Reduction in Dissolved Oxygen Through the Plant

During 1977, dissolved oxygen (D.O.) measurements were taken on a daily basis from May 23-27, June 27-July 1, August 22-26, and September 26-30 at both the northernmost and southernmost intake bays of Unit Nos. 2 and 3

and at a cross section in the discharge canal. Attachments I through IV summarize the dissolved oxygen data. As observed with the previously completed dissolved oxygen study for Units 1 and 2 there is no discernible difference between intake forebay and discharge canal D.O. measurements for Units 2 and 3.

f. An Assessment of Performance of Fish Pumps as Installed

As reported in the July 1976 Semiannual Report, Con Edison considers the experimental program for fish pumps as completed.

g. Results of the General Ecological Survey

(1) A summarization and integration of a number of ecological studies carried out in the Hudson River, principally between 1969 and 1976, and an assessment of the significance of the impact of power plants using once-through cooling on the aquatic ecosystem are contained in the report entitled:

"Influence of Indian Point Unit 2 and Other Steam Electric Generating Plants on the Hudson River Estuary with Emphasis on Striped Bass and Other Fish Populations"

This report was submitted to the Commission on February 18, 1977. Additional relevant material and revisions to this report for Indian Point Unit No. 2 are contained in a supplementary document entitled:

"Supplement I
to
Influence of Indian Point Unit 2
and Other Steam Electric Generating
Plants on the Hudson River Estuary
with Emphasis on Striped Bass and
Other Fish Populations"

This report was filed with the Commission on July 29, 1977.

(2) The results of the 1976 ecological studies of the Hudson River conducted by Texas Instruments will be contained in the report which is expected to be available and filed with the Commission shortly.

h. Ecological Effects of Entrainment of Organisms

(1) An analysis of the effects of entrainment of organisms at the Indian Point plant in 1976 will be contained in the report being prepared by New York University, which is expected to be finalized and submitted to the Commission this spring.

(2) The results of simultaneous sampling conducted by New York University at the Indian Point plant and in the Hudson River in the area of the plant will be presented in a report which will be filed with the Commission in the spring. This data will be used by our consultant, Lawler, Matusky & Skelly Engineers, in the computation of "f" factors for use in the striped bass model.

(3) A report on the results of the 1977 studies performed by Ecological Analysts Inc. to determine the survival of organisms passing through the Indian Point plant using larval tables will be filed with the Commission in the spring.

i. Evaluation of Head Loss Across the Fixed Intake Screens as a Function of Velocity Through the Screens and Fish Collected

As reported in the July 1976 Semiannual Report, an evaluation of the relationship between head loss and approach velocities as they relate to fish impingement is presented in the Texas Instrument Incorporated report entitled:

> "Indian Point Impingement Study Report for the Period 1 January 1974 through 31 December 1974"

which was filed with the Commission on 17 December 1975. The methodology used to evaluate this relationship is presented on pages III-2 through III-4, and the results of this evaluation are discussed on pages III-28 through III-34 of the report. This work is complete and no further analyses are planned.

j. Ecological Effects of Fish Impingement

Analysis and interpretation of impingement monitoring data collected in 1976 at Indian Point will appear in

the Texas Instruments Incorporated 1976 Annual Report (see g.2 above) which will be filed with the Commission shortly.

k. Operational Experience of Air Bubblers at Units Nos. 1 and 2 to Prevent Fish Impingement

As reported in the Semiannual Report of January 28, 1977, an evaluation of the relationship between air bubbler operation and fish impingement is contained in the Texas Instrument Incorporated report entitled:

> "Indian Point Impingement Study Report for the Period 1 January 1974 through 31 December 1974"

which was filed with the Commission on 17 December 1975. These results indicated that the air bubbler was not effective in reducing fish impingement at Indian Point. A New York State Department of Environmental Conservation consent order dated December 17, 1976 rescinded the condition in an April 28, 1972 consent order which required the use of air curtains at Indian Point Units 1 and 2.

l. Other Ecological Effects

(1) The artificial production of striped bass eggs and larvae for distribution to various research agencies for experimental purposes related to mitigation of power plant impact is summarized in the report prepared by Texas Instruments, Inc. entitled:

Production of Striped Bass
for Power Plant Entrainment Studies
1977 Hatchery Report

This report was sent to the Commission by letter dated January 12, 1978.

(2) The results of a study conducted by Ecological Analysts to determine the efficiency of a fine-mesh traveling screen in reducing entrainment at the Indian Point plant are described in the report entitled:

Preliminary Investigation
Into The Use of A Continuously Operating
Fine Mesh Traveling Screen
To Reduce Ichthyoplankton Entrainment
At Indian Point Generating Station

This report was sent to the Commission by letter dated January 12, 1978.

m. Evaluation of Entrainment Data

An evaluation of entrainment data will be presented in the 3 reports described in items h (1), h (2) and h (3) above.

LIST OF ATTACHMENTS FOR

INDIAN POINT STATION UNITS 2 AND 3

DISSOLVED OXYGEN SUMMARY DATA

Attachment I	May, 1977
Attachment II	June, 1977
Attachment III	August, 1977
Attachment IV	September, 1977

ATTACHMENT I

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SUMMARY DATA(1)
MONTHLY THERMAL SURVEY FOR MAY, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	EAST	MID	WEST
May 23	1505	62.5	9.53	9.01	1605	61.8	8.69	8.76	1745	79.7	8.83	8.63	8.31
May 24	1235	62.8	8.60	9.08	1135	63.0	8.67	9.10	1100	81.1	8.85	8.63	8.55
May 25	1425	63.0	8.53	8.62	1145	63.6	8.97	9.15	1115	81.8	9.37	8.80	8.72
May 26	1355	63.7	9.38	8.94	1220	63.9	9.07	9.07	1205	78.2	9.50	9.17	9.17
May 27	1140	67.4	10.50	10.42	1230	66.6	9.92	9.75	1210	84.3	9.82	9.39	9.61

1) All temperature and dissolved oxygen values presented in this table are weighted averages for the entire water column at each location unless otherwise noted. Readings were taken at the surface, bottom and three intermediate positions at approximately 1/4 depth, 1/2 depth and 3/4 depth.

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ATTACHMENT II

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SURVEY DATA(1)
MONTHLY THERMAL SURVEY FOR JUNE, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(°F)	NORTH BAY	SOUTH BAY	TIME	(°F)	NORTH BAY	SOUTH BAY	TIME	(°F)	EAST	MID	WEST
June 27	1950	75.5	6.26	6.15	2020	75.0	6.02	6.46	2050	90.6	6.60	6.34	6.44
June 28	1215	74.3	6.48	6.16	1230	74.3	6.14	5.81	1250	89.5	6.59	6.47	6.53
June 29	1320	75.0	5.99	6.16	1310	75.0	6.11	6.04	1250	90.2	7.08	7.16	6.57
June 30	1250	75.0	6.27	6.26	1325	74.8	5.78	5.35	1315	90.2	6.52	6.37	6.64
July 1	0920	73.8	6.34	6.27	0950	75.2	5.64	5.98	1015	90.8	6.13	5.97	6.01

1) All temperature and dissolved oxygen values presented in this table are weighted averages for the entire water column at each location unless otherwise noted. Readings were taken at the surface, bottom and three intermediate positions at approximately 1/4 depth, 1/2 depth and 3/4 depth.

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ATTACHMENT III

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SUMMARY DATA(1)
MONTHLY THERMAL SURVEY FOR AUGUST, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	EAST	MID	WEST
August 22	1145	77.9	5.91	5.41	1220	77.9	5.93	5.36	1240	92.2	6.35	6.40	6.51
August 23	0945	77.3	5.96	5.97	0925	77.4	5.84	5.69	0905	93.5	6.40	6.35	6.30
August 24	1120	77.2	6.07	6.25	1045	77.2	6.18	5.91	1030	93.7	6.83	6.33	6.60
August 25	1230	77.0	6.78	6.15	1215	77.0	6.39	5.78	1200	93.2	7.22	6.70	7.37
August 26	1050	79.0	5.97	5.85	1105	78.1	6.44	6.30	1120	94.7	6.72	6.35	6.72

1) All temperature and dissolved oxygen values presented in this table are weighted averages for the entire water column at each location unless otherwise noted. Readings were taken at the surface, bottom and three intermediate positions at approximately 1/4 depth, 1/2 depth and 3/4 depth wherever possible.

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ATTACHMENT IV

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SUMMARY DATA(1)
MONTHLY THERMAL SURVEY FOR SEPTEMBER, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	EAST	MID	WEST
September 26	1500	71.4	6.31	6.27	1520	71.6	6.41	6.23	1550	72.2	6.71	6.84	6.85
September 27	1500	70.6	6.96	7.01	1445	72.4	6.57	6.64	1430	82.3	6.59	6.58	6.96
September 28	1530	69.8	6.68	7.04	1555	70.0	7.10	7.21	1630	84.8	7.11	7.08	7.54
September 29	1400	70.4	7.15	6.67	1330	69.4	6.87	6.66	1315	85.7	7.61	7.01	7.10
September 30	1040	68.1	7.28	7.27	1100	68.8	6.82	6.63	1100	83.9	7.09	7.03	6.99

1) All temperature and dissolved oxygen values presented in this table are weighted averages for the entire water column at each location unless otherwise noted. Readings were taken at the surface, bottom and three intermediate positions at approximately 1/4 depth, 1/2 depth and 3/4 depth wherever possible.

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ATTACHMENT II

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SUMMARY DATA(1)
MONTHLY THERMAL SURVEY FOR JUNE, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	EAST	MID	WEST
June 27	1950	75.5	6.26	6.15	2020	75.0	6.02	6.46	2050	90.6	6.60	6.34	6.44
June 28	1215	74.3	6.48	6.16	1230	74.3	6.14	5.81	1250	89.5	6.59	6.47	6.53
June 29	1320	75.0	5.99	6.16	1310	75.0	6.11	6.04	1250	90.2	7.48	7.18	6.57
June 30	1250	75.0	6.27	6.26	1325	74.8	5.78	5.35	1315	90.2	6.52	6.37	6.64
July 1	0920	73.8	6.34	6.27	0950	75.2	5.64	5.98	1015	90.8	6.13	5.97	6.01

1) All temperature and dissolved oxygen values presented in this table are weighted averages for the entire water column at each location unless otherwise noted. Readings were taken at the surface, bottom and three intermediate positions at approximately 1/4 depth, 1/2 depth and 3/4 depth.

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ATTACHMENT I

INDIAN POINT STATION UNITS 2 AND 3
DISSOLVED OXYGEN SUMMARY DATA(1)
MONTHLY THERMAL SURVEY FOR MAY, 1977

(IP3 401 CERTIFICATE CONDITION B4)

	UNIT 2 INTAKE				UNIT 3 INTAKE				DISCHARGE CANAL				
		TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)			TEMP	DISS. OXYGEN (ppm)		
DATE	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	NORTH BAY	SOUTH BAY	TIME	(F)	EAST	MID	WEST
May 23	1505	62.5	9.53	9.01	1605	61.8	8.69	8.76	1745	79.7	8.83	8.63	8.31
May 24	1235	62.8	8.60	9.08	1135	63.0	8.67	9.10	1100	81.1	8.85	8.63	8.55
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