Docket File

JUL 14 1972

Docket No. 50-286

ENVIRON, FILE (NEPA)

D. Muller, Assistant Director for Reactor Projects
Directorate of Licensing

RADWASTE SECTION FOR ENVIRONMENTAL STATEMENT FOR INDIAN POINT NUCLEAR GENERATING PLANT, UNIT 3

Plant Name - Indian Point Nuclear Generating Plant, Unit 3
Licensing stage - OL
Docket number - 50-286
Responsible Branch - Environmental Projects Branch #1
  Project Leader - M. J. Oestmann
Requested completion date - not available
Description of response - Radwaste Section for ES
Review status - Completed

In response to your request, we have prepared and attached to this memo the Radwaste Section for Indian Point Nuclear Generating Plant, Unit 3. The numerical source terms were transmitted to you informally on May 15, 1972.

It is noted that information regarding Indian Point Units 1 and 2 is also included. The source terms for Unit 1 are based on 1971 operating experience. The source terms for Unit 2 are assumed to be the same as calculated for Unit 3, since these units have similar reactors and waste management systems. The radioactivity releases based on the operating experience for Unit 2 in 1971 supports our calculated values.

The source terms were prepared by W. K. Eister, Effluent Treatment Systems Branch, from data supplied by ORNL. The principal assumptions used are documented in the writeup, other assumptions are those transmitted to H. R. Denton, Assistant Director for Site Safety, by memo of May 25, 1972.

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The schematic flow sheets provided will be revised by ORNL. Please provide the date by which you will require glossies.

Original signed by:
R. L. Tedesco
Robert L. Tedesco, Assistant Director
for Containment Safety
Directorate of Licensing

Enclosures:
As stated above

cc: w/o enclosures
A. Giambusso
W. McDonald

w/enclosures
S. Hanauer
J. Hendrie
TR Branch Chiefs
D. Vassallo
G. Knighton
C. Hale
M. Oestmann
W. Eister

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RADWASTE SECTIONS FOR ENVIRONMENTAL STATEMENT
INDIAN POINT NUCLEAR GENERATING PLANT UNIT NO. 3

3.5 Radioactive Waste

The operation of Indian Point Nuclear Generating Plant Unit 3 will result in the production of radioactive fission products, the bulk of which will remain within the cladding of the fuel rods. Small amounts of these fission products will escape from the fuel cladding into the primary coolant. In addition, some radioactive materials will be produced as a result of neutron activation of corrosion products in the coolant. Some of these materials in low concentrations may be released in liquids to the Hudson River or released into the atmosphere as gases under controlled conditions after appropriate treatment, sampling and monitoring. The radioactivity that may be released during operation of the Plant at full power will be in accordance with the Commission's regulations, as set forth in 10 CFR Part 20 and 10 CFR Part 50.

At the Indian Point Nuclear Generating Plant, Units 1 and 2 are now in operation. Each unit has independent waste handling and treatment facilities except for a common laundry facility provided by Unit 1. Modifications, scheduled by the applicant to be operating by June 1973, will provide for the treatment of the steam generator blowdown from Units 1, 2 and 3 at Unit 1. The waste handling and treatment systems for Unit 1 are described in the applicant's Hazards Summary Report for Unit 1 dated January 1960 and supplement dated August 1960 and in the AEC Draft Environmental Statement for Unit 2 dated April 13, 1972. The waste handling and treatment systems installed in Unit 2 are described in the applicant's Final Facility Description and Safety Analysis Report and supplements dated September 9, and October 15, 1971.

The radioactive waste handling and treatment systems for the Indian Point Nuclear Generating Unit 3 are described in the Final Safety Analysis Report and the applicant's Environmental Report dated June 14, 1971, and Supplement 1 dated December 8, 1971. These systems are designed to collect and process the liquid, gaseous and solid wastes that might contain radioactive materials. Unit 3 will have separate radioactive waste handling and treatment facilities except for steam generator blowdown and laundry services which will be provided by Unit 1. The principal conditions and assumptions used in determining the releases of radioactivity from Unit 3 are summarized in Table 3.5.1 and 2, and were based on the systems as described in the following paragraphs and on experience with similar operating PWR's. The waste treatment facilities for Unit 3 are similar in all respects to those provided for Indian Point Unit 2.

3.5.1 Liquid Wastes

The liquid radioactive waste treatment systems for Unit 3 will provide for boron recycle and waste disposal. In addition, the steam generator blowdown will be routed to the modified blowdown purification system installed in Unit 1 as shown in Figure 3.5-1.

The boron recycle system is part of the chemical and volume control system (CVCS). The CVCS will also continuously process a portion of the primary reactor coolant to remove fission and corrosion products. This coolant cleanup system will use non-regenerable deep mixed bed demineralizers.

Periodically a portion of the let down stream will be processed through a cation demineralizer for removal of lithium and cesium. Near the end of the fuel cycle, anion demineralization following mixed bed demineralization will be used to remove the boron from the reactor coolant. After demineralization the effluent will be sprayed into the volume control tank to adjust the hydrogen concentration and then pumped back to the reactor coolant loop for reuse. During cold shutdowns and refueling, the fission gases will be stripped from the coolant in the volume control tank and sent to gaseous waste treatment system. We assumed that no liquid wastes will be released from this system.

The boron recycle subsystem will adjust the boron conditions as required for reactor operation. A portion of the reactor coolant will be intermittently letdown to the holdup tank. Batches will be processed by cation demineralization, filtration, gas stripping and evaporation. The condensate from the evaporator will be processed tand routed to the monitoring tanks. After sampling and analysis the waste will be either recycled through an anion demineralizer for additional treatment returned to the reactor coolant system for reuse or released to the condenser circulating water duct. The boron concentrate from the evaporator will either be recycled to the reactor coolant system or pumped to the solid waste system and packaged as solid waste. In our analysis we assumed that 10% of the condensate will be released through the condensate circulating water duct to the Hudson River and that 90% will be returned to the plant for reuse.

The liquid waste treatment system will process the equipment floor drains, laboratory and sampling drains, demineralizer regenerant and decontamination solutions. These waste will be collected in the waste holdup tank and batched processed through a filter and a 2-gpm evaporator. The condensate will be collected in the waste condensate tanks and recycled if required. After sampling and analysis the condensate will be released to the condenser circulating water duct. The evaporator concentrate will be sent to solid waste.

The steam generator blowdown from Unit 3 will be processed through Unit 1 Steam Generator Purification System. The system will consist of a flash tank, condenser and mixed bed demineralizer. Effluent will be released to the condenser circulating water duct. The steam and noncondensibles from the flash tank will be routed to the main condenser in Unit 1. The discharge line to the water duct will be monitored.

The turbine building drains will be discharged to the condenser circulating water duct without treatment. In our evaluation the radioactivity from this source was estimated to be a small fraction of the total released from the liquid waste treatment system.

Based on our evaluation of the liquid waste treatment systems for Unit 3, annual releases of radioactive materials in liquid effluents discharged to the Hudson River were estimated to be a fraction of those shown in Table 3.5-3 excluding tritium. However to compensate for expected operational occurrences and equipment downtime the values have been normalized to 5 Ci/yr. Based on the experience of operating PWR type nuclear reactors the tritium releases from Unit 3 were estimated to be about 1000 Ci/yr. The applicant's estimated releases for Unit 3 were 4200 Ci/yr of tritium and 0.025 Ci/yr for all other radionuclides.

Combined Releases of Radioactive Materials In Liquid Wastes From Unit 1, 2 and 3

The total radioactivity released from the liquid waste treatment systems to the Hudson River for Indian Point Units 1, 2 and 3, have been calculated to be less than 15 Ci/yr for all radionuclides except tritium. As we assumed for Unit 3, the steam generator blowdown for Units 1 and 2 will flow to the modified Unit 1 system for treatment of the blowdown from all three units. This will reduce the release of all radionuclides except tritium in the steam generator blowdown from Units 1 and 2 to a fraction of 5 Ci/yr/unit. The releases from Units 1, 2 and 3 of radionuclides except tritium were normalized to 5 Ci/yr/unit to allow for expected operational occurrences and equipment downtime. Based on the experience of similar operating PWR's we have estimated the total tritium release from all three units will be about 3500 Ci/yr (see Tables 3.5-5, 6 & 7). The applicant's estimated releases for radioactive material in liquid waste from all three units were 9200 Ci/yr of tritium and 0.087 Ci/yr for all other radionuclides. The applicant's higher estimate was due to its assumption of fuel leaks equivalent to 1% of the operating power fission product source term.

3.5.2 Gaseous Waste

During power operation of Indian Point Unit 3, radioactive materials released to the atmosphere in gaseous effluents will include low concentrations of fission product noble gases (krypton and xenon), halogens (mostly iodines), tritium contained in water vapor, and particulate material including both fission products and activated corrosion products. The gaseous waste treatment systems will provide for the processing of coolant gas ventilation air from reactor containment building, offgases from the main condenser air ejector, the steam generator blowdown vent, the turbine steam gland, and the turbine auxiliary and fuel storage buildings. The gaseous waste treatment system and ventilation paths are shown schematically in Figure 3.5-2.

The coolant gas processing system will provide treatment for the gases stripped from the reactor coolant along with the displaced cover gases from equipment in the CVCS system and the waste evaporator. In addition the total CVCS and reactor coolant system will be degassed prior to refueling, and occasionally during cold shutdowns. According to the applicant the collected gases will be compressed to 110 psig and held in four large (525 cubic feet each) storage tanks for 45 days decay before release. A portion of the gas will be returned to the CVCS holdup tanks. The gases stripped prior to refueling or during a cold shutdown will be compressed and stored in six small (40 cubic feet each) storage tanks. The gas released from the decay tanks will be combined with ventilation air exhausted from the auxiliary building and discharged to the atmosphere through the unit vent. Assuming normal operation and two complete system degassings per year we have determined that the gas processing system is adequate to provide a holdup time of 45 days.

The ventilation systems for the reactor containment building, auxiliary buildings, and spent fuel storage buildings have been designed to ensure that air flow will be from areas of low potential to areas having a greater potential for accidental release of airborne radioactivity. The reactor containment with a volume of 2.6 million cubic feet will accumulate small amounts of radioactive gases from the reactor coolant leakage. In our evaluation we assumed a need to purge the reactor containment building four times per year. Prior to purging the containment air will be recirculated for 16 hours through an internal cleanup system consisting of HEPA filters and charcoal adsorbers at the rate of 16,000 SCFM to reduce the iodine concentration. Following this, the gas will be released to the plant vent through HEPA filters.

The auxiliary building exhaust system will draw air from the equipment rooms and open areas of the building through HEPA filters and charcoal adsorbers, and released to the atmosphere through the reactor building vent. The ventilation air from the fuel storage buildings will be drawn through HEPA filters before being discharged through the reactor building ventilation system.

Ventilation air from the turbine building will be released through wall and roof exhaust fans without treatment.

Offgas from the turbine condenser air ejectors containing radioactivity from primary to secondary system leakage in the steam generator will be vented directly to the atmosphere without treatment.

The offgas from the steam generator blowdown will be released through the flash tank and main condenser in Unit 1 to the Unit 1 superheater stack. When Unit 1 is not operating, the flash tank vapor will be released directly to the atmosphere through the existing Unit 1 roof vent. Based on the operating history of the Unit 1 we assumed that the steam generator blowdown vapor from Unit 3 will be released directly to the atmosphere 33% of the time.

Based on our evaluation of the Indian Point Unit 3 gaseous waste treatment system, we have estimated the annual releases of radioactivity discharged to the atmosphere will be approximately 2700 Ci/yr of noble gases and 0.36 Ci/yr of iodine-131. As shown in

Table 3.5-3, the applicant's reported calculations indicate approximately 10,000 Ci/yr noble gases and 0.03 Ci/yr iodine-131.

Unit 1, 2 and 3 Releases of Radioactive Gaseous Wastes

The total radioactivity released from the gaseous waste treatment systems to the atmosphere for Indian Point Nuclear Generating Plants Units 1, 2 and 3 have been calculated to be approximately 6600 Ci/yr noble gases and 0.78 Ci/yr iodine-131. As we assumed for Unit 3, the steam generator blowdown vent for Units 1 and 2 will also be intertied with the modified Unit 1 system and discharged through the Unit 1 main condenser to the superheater stack (see Tables 3.5-5, 8 and 9). The applicant estimated 20,000 Ci/yr of noble gases with no estimate of iodine. Its higher estimate resulted from its assumed fuel leak equivalent to 1% of the operating power fission product source term.

3.5.3 Solid Waste

The solid wastes from the reactor operations include the evaporator concentrates from the liquid waste processing system along with spent resins and filter sludge and air filters, miscellaneous paper, and rags. The evaporator concentrates will be solidified by mixing with vermiculite and cement in 55-gallon drums. The spent resins will be stored for one to six months for decay of short life activity; thus washed, dewatered and mixed with cement in 55-gallon drums for solidification. The wash water will be returned to the waste holdup tank for treatment and disposal. Paper, rags and protective clothing will be compressed in 55-gallon drums. Other solid wastes including spent air filters will be packaged in approved containers. After a suitable period of storage to allow for decay, the packaged wastes will be shipped to a licensed burial facility in accordance with AEC and DOT regulations. It is estimated that 90 to 150 drums of solid wastes containing approximately 10,000 curies of radioactivity will be shipped annually.

Table 3.5-1

PRINCIPAL ASSUMPTIONS AND PARAMETERS USED IN CALCULATING RELEASES OF RADIOACTIVE EFFLUENTS FOR INDIAN POINT NUCLEAR GENERATING PLANT UNIT NO. 3

Reactor Power	3216 MWt
Plant Factor	0.8
Failed Fuel*	0.25%
Primary Coolant System	
Total Mass	520,000 lb
Flowrate to Boron Recovery	14,000 gpd
Leak to Secondary Coolant	20 gpd
Leak to Containment Bldg.	40 gpd
Leak to Auxiliary Bldg.	20 gpd
System Volume	12,000 ft^3
System Degassing	2 yr
Secondary Coolant System	
Number of Steam Generators	4
Steam in Each Generator	4,800 lb
Liquid in Each Generator	82,000 lb
Total Coolant Mass	3,700,000 lb
Steam Generator Blowdown Rate	10 gpm
Condensate Flowrate	13,000,000 lb/hr
Steam Leak to Turbine Bldg.	5 gpm
Condenser Circulating Water Flowrate	870,000 gpm
Containment	
Volume	2,600,000 ft^3
Purges	4 yr
Kidney Charcoal Adsorber Flowrate	16,000 cfm

*This value is constant and corresponds to 0.25% of the operating power fission product source term.

Table 3.5-1 (continued)

Iodine Partition Coefficients (Gas/Liquid)	
Primary Coolant	
Leakage to Containment	0.1
Leakage to Auxiliary Bldg.	0.0001
Secondary Coolant	
Steam Generator	0.01
Condenser Air Ejector	0.0005
Iodine Decontamination Factor	
Reactor Bldg. Vent - Charcoal Adsorber	10

Table 3.5-2

PRINCIPAL ASSUMPTIONS AND PARAMETERS FOR LIQUID WASTE TREATMENT SYSTEMS FOR INDIAN POINT NUCLEAR GENERATING PLANT UNIT NO. 3

System	Waste Feed (gpd)	Rad Conc (% PCA)	Capacity: Holdup Tanks (gal)	Capacity: Process[a] (gpd)	Delay Time (days)	Decontamination Factors: I	Cs,Rb	Cation	Anion	Processed Effluent Released (%)
Primary Coolant System[b]										
CVCS	110,000	100			-	10	1	10	10	0
Boron Recovery	15,000	10	229,000	43,000	3	10^4	$2x10^3$	10^5	10^5	10
Dirty Waste	470	100	29,000	2,900	3	10^3	10^4	10^4	10^4	100
Steam Generator Blowdown	14,000	10	300,000[c]	35,000[c]	-	10^2	2	10^2	10^2	100
Turbine Bldg Drain	7,200	0.1	-	none	-	-	-	-	-	100

a/ Rated capacity; practical operating capacity reduced by filter backwashing, demineralizer regeneration, evaporator bottoms discharge, and recycling off-specification products.
b/ Holdup decontamination factors in reactor coolant system for Mo and Tc (100), for Y(10).
c/ Modified Unit 1 system providing service for Units 1, 2 and 3.

TABLE 3.5-3

CALCULATED ANNUAL RELEASE OF RADIOACTIVITY IN LIQUID EFFLUENT FROM INDIAN POINT NUCLEAR GENERATING PLANT UNIT NO. 3

Nuclide	Ci/yr
Rb-86	.0033
Rb-88	.081
Sr-89	.00041
Sr-90	.000015
Sr-91	.00014
Y-90	.00011
Y-91m	.00074
Y-91	.033
Y-93	.00024
Zr-95	.000068
Zr-97	.000013
Nb-95	.000066
Nb-97m	.000013
Nb-97	.000015
Mo-99	.4
Tc-99m	.33
Ru-103	.000049
Ru-106	.000015
Rh-103m	.000049
Rh-105	.000015
Rh-106	.000015
Te-125m	.000041
Te-127m	.00032
Te-127	.00044
Te-129m	.0032
Te-129	.0021
Te-131m	.0012
Te-131	.00023
Te-132	.021
I-130	.0015
I-131	.89
I-132	.084
I-133	.48
I-135	.096
Cs-134	1.17
Cs-136	.48
Cs-137	.89
Ba-137m	.022
Ba-140	.00046
La-140	.00031

Nuclide	Ci/yr
Ce-141	.000075
Ce-143	.000024
Ce-144	.000043
Pr-143	.000060
Pr-144	.000043
Nd-147	.000024
Pm-147	.000006
Cr-51	.0012
Mn-54	.00043
Fe-55	.0013
Fe-59	.00041
Co-58	.012
Co-60	.0013
Np-239	.00039

Total ∿ 5 Ci/yr

H-3 ∿ 1000 Ci/yr

TABLE 3.5-4
CALCULATED ANNUAL RELEASE OF RADIOACTIVE NUCLIDES IN GASEOUS EFFLUENT FROM INDIAN POINT NUCLEAR GENERATING UNIT 3

	Discharge Rate (Ci/year)					
			Gas Processing System	Steam Generator Leak		
Isotope	Containment Purge	Auxiliary Building	for 45-Day Decay[a/]	Air Ejector	Blowdown Tank Vent	Total
Kr-83m	-	1	-	1	-	2
Kr-85m	-	6	-	6	-	12
Kr-85	2	1	870	1	-	870
Kr-87	-	3	-	3	-	6
Kr-88	-	11	-	11	-	22
Xe-131m	1	2	81	2	-	86
Xe-133m	-	9	-	9	-	18
Xe-133	88	530	470	530	-	1600
Xe-135m	-	1	-	1	-	2
Xe-135	-	17	-	17	-	34
Xe-137	-	1	-	1	-	2
Xe-138	-	2	-	2	-	4
Total Noble Gases	91	580	1500	580	-	2700
I-131	0.027	0.001	-	0.13	0.20	0.36
I-133	0.027	0.001	-	0.066	0.10	0.19

a/ - means less than 0.5 Ci of noble gas per year or less than 0.0005 Ci of iodine per year.

TABLE 3.5-5

CALCULATED RADIOACTIVITY RELEASES IN EFFLUENTS FROM INDIAN POINT NUCLEAR GENERATING PLANTS UNITS 1, 2, AND 3

Unit No.	Power (MWt)	Effluent Radioactivity (Ci/yr)			
		Liquids		Gases	
		Tritium	All Others	Noble Gases	Iodine-131
		Present Process			
1	615	1500	40	1200	0.37
2	3216	1000	41	4100	0.67*
Total		2500	81	5300	1.0
		Modified Process Basis			
1	615	1500	5	1200	0.06
2	3216	1000	5	2700	0.36 *
3	3216	1000	5	2700	0.36 *
Total		3500	15	6600	0.78

* Limited to 0.18 Ci/yr by the Technical Specification.

Table 3.5-6

CALCULATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL
IN LIQUID EFFLUENT FROM INDIAN POINT NUCLEAR GENERATING PLANT, UNIT 1
(PRESENT PROCESS)

Isotope		Ci/Yr
I-131		15.5
I-132		1.0
I-133		6.6
I-134		0.79
I-135		3.5
Cs-137		0.71
Sr-89		0.05
Sr-90		0.01
Co-58		1.2
Co-60		0.49
F-18		3.4
Na-24		5.0
Cu-64		0.42
Mn-54		1.6
	Total	∿ 40 Ci/yr
H-3		1500 Ci/yr

TABLE 3.5-7

CALCULATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL IN LIQUID EFFLUENT FROM INDIAN POINT NUCLEAR GENERATING PLANT, UNIT 2 (PRESENT PROCESS)

Nuclide	Steam Generator Blowdown (Ci/yr)*	Chemical Volume Control (Ci/yr)*	Waste Disposal System (Ci/yr)*
Rb	0.018		
Sr-89	0.015		
Sr-90	0.0005		
Y-91	0.019		
Zr-95	0.002		
Nb-95	0.002		
Mo-99	5.5	0.005	0.018
Tc-99m	0.61	0.004	0.016
Ru-103	0.002		
Te-127m	0.012		
Te-129m	0.11		
I-130	0.009	0.002	0.006
Te-131	0.031		
I-131	8.1	0.59	2.06
Te-132	0.62		0.002
I-132	0.12	0.056	0.19
I-133	3.5	0.56	1.9
Cs-134	7.1	0.004	
I-135	0.62	0.14	0.45
Cs-136	2.05	0.001	0.005
Cs-137	6.0	0.003	0.012
Ba-140	0.016		
Ca-140	0.003		
Ce-141	0.003		
Ca-144	0.002		
Pr-143	0.002		
Co-60	0.019		
Cr-51	0.018		
Mn-54	0.015		
Mn-56	0.045		
Fe-55	0.048		
Fe-59	0.019		
Co-58	0.47		
Total	35	1.4	4.7 Ci/yr
H-3			∿ 1000 Ci/yr

*Isotopes with computed amounts less than 0.001 curies per year were not reported but are included in the total.

TABLE 3.5-8

CALCULATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL IN GASEOUS EFFLUENT FROM INDIAN POINT NUCLEAR GENERATING UNIT #1 (PRESENT PROCESS)

Isotope	Ci/yr
Kr-85	180
Kr-87	1.7
Kr-88	5.6
Xe-133m	8.4
Xe-133	1000
Xe-135	2.0
Xe-138	1.2
Total Noble Gases	1200
Iodine + Particulates*	0.37

* Radioactive half lives of 8 days or more

TABLE 3.5-9

CALCULATED ANNUAL RELEASE OF RADIOACTIVE MATERIAL IN GASEOUS EFFLUENT FROM
INDIAN POINT NUCLEAR GENERATING UNIT#2
(PRESENT PROCESS)

Isotope	Containment Purge (Ci/yr)	Gas Processing System (45-Day Holdup) (Ci/yr)	Steam Generator Blowdown (Ci/yr)	Total
Kr-85	13	790	2.1	810
Kr-87	0.044	--	2.9	3
Kr-88	0.31	--	9.4	10
Xe-131m	9.6	63	3.4	76
Xe-133	1000	1500	680	3200
Xe-135	0.35	--	3.2	3.6
Xe-138	0.007	--	2.2	2.2
Total Noble Gases	1000	2400	700	4100
I-131	0.018	--	0.62	0.64*

*This release will be limited to 0.18 Ci/yr by the Technical Specifications

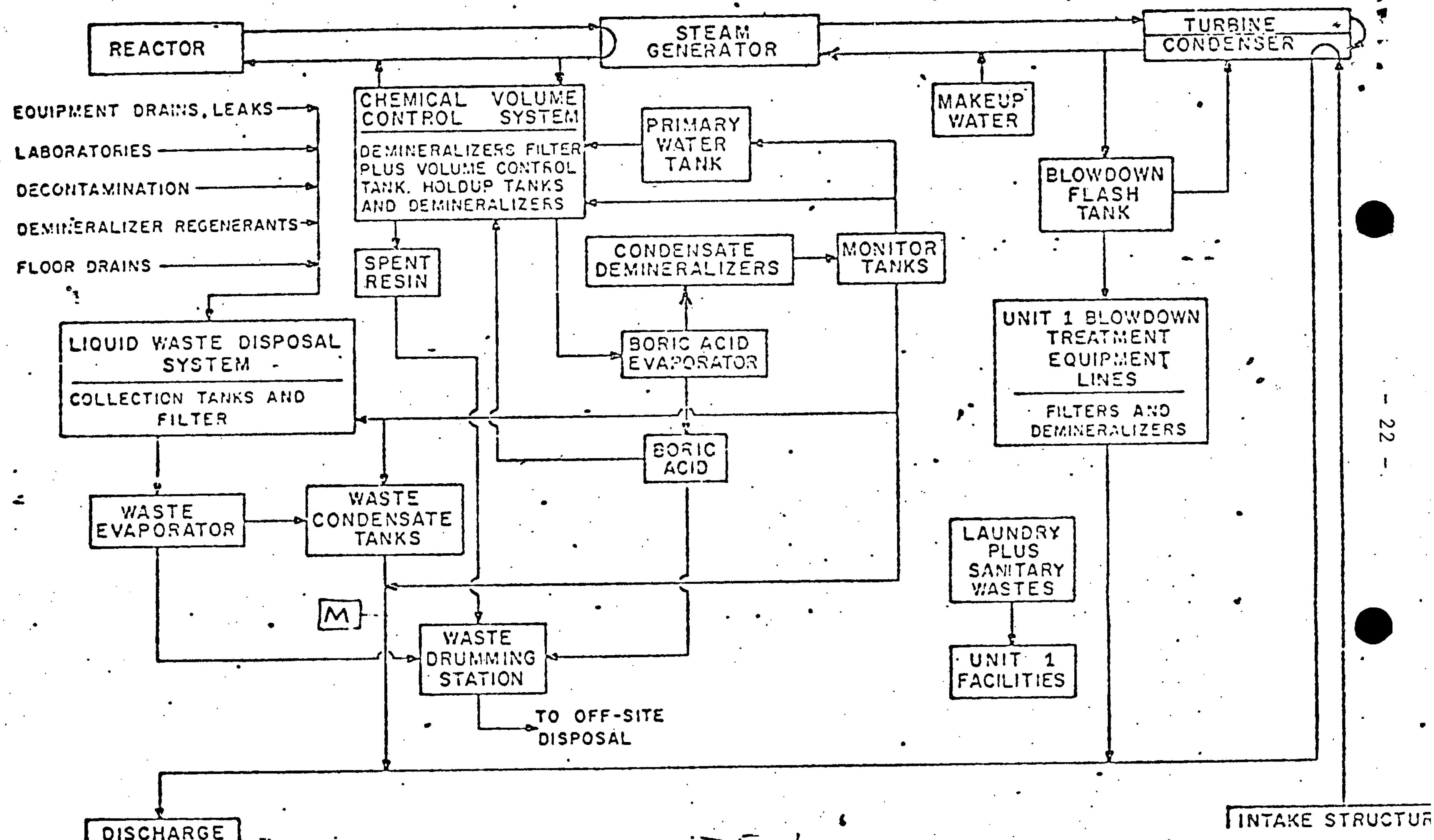

Figure 3.5-1

INDIAN POINT NUMBER 3

Radioactive Liquid Waste Systems for Indian Point Nuclear Generating Unit 3

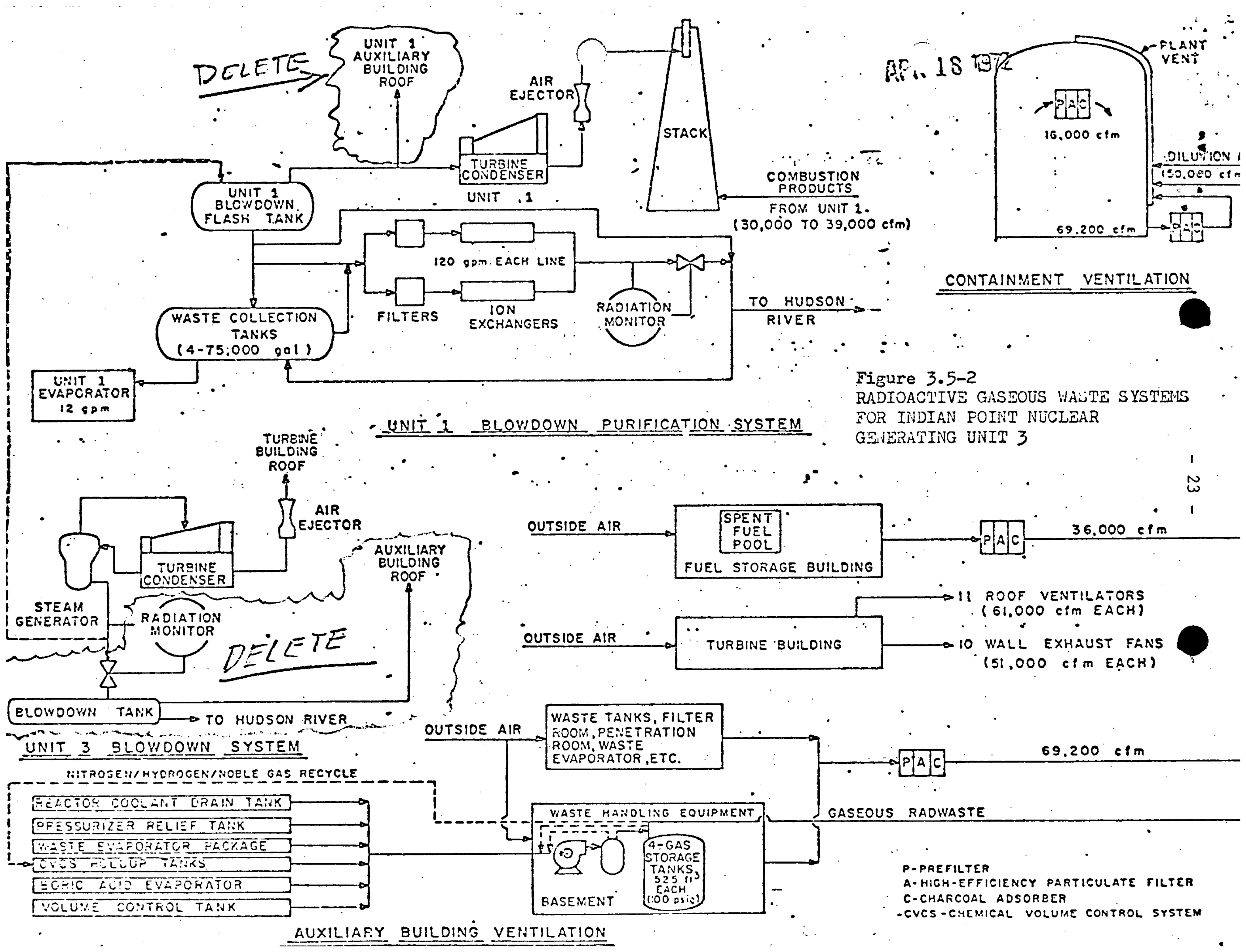

Figure 3.5-2
RADIOACTIVE GASEOUS WASTE SYSTEMS FOR INDIAN POINT NUCLEAR GENERATING UNIT 3

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MAY 23 1972

Docket No. 50-247
50-3
50-286 ✓

Daniel R. Muller, Assistant Director for Environmental Projects, L
Thru: George Knighton, Chief, Projects Branch No. 1, L

MEETING WITH THE WATER RESOURCES DIVISION OF THE U.S. GEOLOGICAL SURVEY TO DISCUSS THERMAL DISCHARGE MODELING IN CONNECTION WITH CONSOLIDATED EDISON'S INDIAN POINT UNIT NO. 2

On May 10, 1972, W. Yee, Team Leader for Indian Point and its members from Oak Ridge National Laboratory, and I met with representatives from the Water Resources Division of the U. S. Geological Survey at the U.S.G.S. offices, Arlington, Virginia.

Purpose of Meeting

To discuss mathematical model of thermal discharges, particularly in relation to the thermal models for heat dissipation from Indian Point Units Nos. 1, 2, and 3.

Conclusions

U.S.G.S. stated that no reliable three-dimensional model is available for modeling discharges in an estuarine such as the Hudson River. U.S.G.S. agreed that the information supplied by Consolidated Edison to develop its thermal models was sketchy; and a limited amount of data gathered by Consolidated Edison from its original surface discharge structure was extrapolated for the thermal models. However, U.S.G.S. felt that, although Consolidated Edison's models were not the most accurate, they did represent an approximation as to the mechanism of heat dissipation that probably was occurring. We all agreed it would be worthwhile to have another meeting to continue discussion on different thermal models.

Summary of Discussion Highlights

The major items of discussion are listed below:

1. M.J. Oestmann presented a general orientation of the reorganization of the Regulatory Staff of the AEC and the responsibilities of the Office for Environmental Projects to prepare environmental impact statements.

2. The Radiohydrology Section of the Water Resources Division contributes to the reactor branches (PWRs, BWRs) in the area of dispersion of

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radioactive effluents in water bodies. Mr. George DeBuchananne is the major AEC consultant in radiohydrology. This office plans to comment on the Indian Point Draft Environmental Statement.

3. M. Siman-Tov, ORNL, discussed the details of the Quirk, Lawler and Matusky thermal models used by Consolidated Edison and pointed out the deficiencies in the models and the meager data used by Consolidated Edison to check the thermal models.

4. M. Siman-Tov also pointed out the problem of the thermal discharges meeting the New York State Thermal Criteria, particularly in regard to the change in the depth of the discharge jets from 18 feet to 12 feet.

5. U.S.G.S. thought that the critical point is the case of the static condition where the salt intrusion point is just a few feet south of the Indian Point site.

6. U.S.G.S., when asked if other thermal discharge models were appropriate, said that it was hard to find a good two-dimensional model, let alone a three-dimensional model, especially in regard to the estuarine nature of the Hudson River.

7. U.S.G.S. recommended tag studies be made of the thermal discharges especially to note the dispersion of the water jets through the multiport discharge structure. Also it stated that flow measurements during the tidal cycle be taken at different cross sections even though these flow measurements would be difficult and expensive to do.

8. U.S.G.S. thought the fresh water layer could be a thin layer (not at mid depth as suggested by Consolidated Edison) and the salt water layer would be curved as a wedge - not at an even horizontal thickness as depicted by Consolidated Edison in its calculations.

9. We recommended that another meeting would be beneficial in exchanging ideas on thermal models, particularly in relation to all three units in operation simultaneously.

Attendance

M. J. Oestmann, L:EP
W. Yee, ORNL
M. Siman-Tov, ORNL

R. P. Baltzer, U.S.G.S.
F. A. Kilpatrick, U.S.G.S.
N. Yotsukura, U.S.G.S.
E. L. Meyer, U.S.G.S.

/S/

M. J. Oestmann, Project Leader
Indian Point Units Nos. 1, 2, 3.

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MC #218-202, etc
5/20/72

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Docket Nos. 50-247
50-3
50-286

MAY 23 1972

Daniel R. Muller, Assistant Director for Environmental Projects, L
THRU: George C. Knighton, Chief, Project Branch No. 1, L

MEETING WITH THE NATURAL RESOURCES DEFENSE COUNCIL AND THE HUDSON RIVER FISHERMEN'S ASSOCIATION, INTERVENORS, ON CONSOLIDATED EDISON'S INDIAN POINT UNIT NO. 2

A meeting was held on May 11, 1972 at AEC Headquarters at the request of the Natural Resources Defense Council and the Hudson River Fishermen's Association, representatives from the New York State Attorney's Office and the Public Service Commission. A list of attendees and an agenda submitted by the Intervenors are enclosed.

The conclusions reached are as follows:

1. The HRFA believes that the Draft Environmental Statement is good, and includes extensive information on the environmental impact of Indian Point Plants, but it has serious omissions. The HRFA and the NRDC disagree with the conclusions reached in the DES.

2. The NRDC and the HRFA are placing emphasis on the regional cumulative effects on the aquatic biota in the Hudson River, primarily from Roseton and Bowline Point Units as well as Indian Point Plants.

3. The NYS officials believe that the State has overall control over fish and wildlife management of the Hudson River.

4. The NYS opposes issuance of the 50% testing license for Unit No. 2.

5. A fair discussion on specific topics was exchanged between all parties. Much of the information presented by the HRFA was already presented in testimony at the April 5, 1972 Hearing on Indian Point Unit No. 2.

6. The Intervenors are emphasizing the use of cooling towers as alternatives to the present once-through cooling system since they believe

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Form AEC-318 (Rev. 9-53) AECM 0240 ☆ U S GOVERNMENT PRINTING OFFICE 1971 -446 -154 that no ecological monitoring program will provide a solution to the adverse impact from operation of Indian Point Units Nos. 1, 2, and 3.

/s/

M. J. Oestmann
Project Leader
Project Branch #1

Enclosures:
1. Summary of Meeting
2. List of Attendees
3. Agenda

DISTRIBUTION:
Docket File (Environ) (3)
EP Reading
EP File
A. Giambusso, RP,L
M. Ernst, RP, L
R. C. DeYoung, PWR, L
R. Boyd, BWR, L
D. Skovholt, OR, L
G. Knighton, EP-1, L
M. J. Oestmann, EP-1, L
G. Dicker, EP-2, L
K. Kniel, PWR-2, L
M. Karman, OGC
W. Yee, ORNL (5)
E. Struxness, ORNL
J. Swinebroad, ES, L
J. Bolen, ES, L

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MC 223-958
MC #1, pf
5-20-72

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ATTENDANCE AT MEETING ON INDIAN POINT
AEC HEADQUARTERS, BETHESDA, MD.
MAY 11, 1972

AEC - A. Giambusso
G. Knighton
M. J. Oestmann
M. Karman
J. Bolen
J. Swinebroad

ORNL - W. Yee
C. Coutant
C. P. Goodyear
M. Siman-Tov
R. Wichner

NRDC - A. MacBeth
E. Habicht

HRFA - J. Clark

N.Y.S. Attorney's Office - P. Skinner

Public Service Commission - P. A. Isaacson

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SUMMARY OF MEETING

Purpose of Meeting: To discuss the predicted effects upon the fish populations of the Hudson River from operation of Indian Point Units Nos. 1, 2, and 3 and to comment on the Draft Environmental Statement.

Items of Discussion

The major points of discussion are listed below:

1. A. Giambusso outlined the ground rules for the day's discussion, namely, identification of fact and data and separation of fact from methodology and judgment or interpretation of the data.

2. The HRFA and the NRDC commented on the Draft Environmental Statement and wanted to learn what progress had been made on the AEC's analytical effort regarding damage to aquatic biota since the DES was issued.

3. The HRFA and the NRDC have taken a strong position regarding the cumulative effects of all power plants on the Hudson River, primarily Bowline Point Units 1 and 2 and Roseton Units 1 and 2 and Indian Point Plants. They believe that it will be impossible to distinguish how each plant will cause a reduction of fish population. The baseline fish population is hard to determine, let alone to see the effect each plant has on the population. The AEC countered by stating that the cumlative effects of all plants in a geographical area can't be determined since no one knows the absolute number of fish population and the AEC is mainly concerned with licensing the Indian Point Plants. The AEC recognizes the existence of other plants but has no control over the licensing of fossil-fueled plants.

4. The HRFA and the NRDC are emphasizing the use of cooling towers as an alternative to the once-through cooling mode of operation because of the significant impact on fish from the Indian Point once-through cooling system. However, the salt water cooling tower technology is not yet available. The alternative selected depends on what technology is presently available to provide an immediate solution to the problem of the significant impact on the aquatic biota in the Hudson River.

5. The representative from the N. Y. State Attorney's Office was concerned with the State's prerogatives in managing fish and wildlife as an effort distinct from that by the Federal government.

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6. In regards to entrainment of biota, the DES states the possibility of 25% of the fish eggs and larvae passing the plant being damaged or killed by withdrawal of water into the intake system of Unit No. 2. The vulnerable time period for spawning of striped bass is about 5 weeks in the month of June. The HRFA estimates about 20% mortality during this 5-week period. Recycling of the cooling water also causes added damage to the eggs and larvae.

7. The question was raised as to the estimated fish population available for spawning. A large population of fish exist in the spawning and nursery areas upstream from the plant about 24-45% of the eggs laid could be damaged. A lot depends on the age distribution of the reproducing female, and what size class and what the population size are estimated to be. This female fish population is estimated to be equivalent to about 2 million pounds of the stablized crop.

8. P. Goodyear reported that the formation of a thermal block or bar and its effect on fish migration would be no problem. The HRFA questioned whether Indian Point thermal discharges can meet the New York State thermal criteria. Since the thermal discharges disperse on the surface, then most of the river depth, where the fish are, is unaffected by the Δ t°F of the thermal discharge. The HRFA also believes the thermal models Con Ed uses are inadequate. A discussion followed on some of the inadequacies of the Con Ed's thermal models, as described in the DES.

9. On the subject of impingement, the HRFA questioned the intake velocity calculations. P. Goodyear explained how the values shown in the DES were calculated. Goodyear also discussed a model he is developing which shows the comparison of various factors which cause increased mortality of juvenile fish by the Indian Point operation. The fish kill problem on the screens at Indian Point was discussed by the N.Y. State officials. The HRFA questioned the inadequate records Con Ed has kept on the number of fish killed during operation of Unit No. 1 over the last 10 Years.

10. The subject of effects on fish populations and compensatory mechanisms included a discussion of density dependence and age of fish, natural mortality, population size, growth effects, mortality effects, food competition, and carrying capacity. Goodyear reported that the estimated fish population could be 20 million fish at the end of first growing period. The carrying capacity is estimated to be about 40 sq. ft. per fish. N.Y.S. officials and others agreed it was difficult to get

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a good estimate of the standing crop. Con Ed estimated about 4% of the fish impinged on the screens to be striped bass, but HRFA estimates it to be closer to 10%. P. Goodyear said that the number of fish is so great that one can't reduce the population to any significant degree through impingement. In regards to naturality mortality, the compensatory factors do not operate except the first year of a fish's life. The time of the year also is important when the fish kills occur. The HRFA also showed a graph on fish population versus age in which during the first 3 weeks a rapid decrease in population occurs from naturality mortality factors, and after 3 weeks, density dependent factors affect the fish population's survival. In its Supplement No. 3, Con Ed reported about 19.5 lbs. of fish per acre; and ORNL and the HRFA estimated much larger values - in the range of 250 lbs. per acre. If the low values were accurate, then the Hudson River estuary would not be considered to be a rich fertile area and would not be over crowded. However, this does not appear to be the case. Data on the population safety factor for the Hudson River striped bass as presented by the HRFA is enclosed.

11. Hatcheries were considered to be no solution to compensate for the significant damage to existing fish life.

12. The HRFA and the NRDC are concerned regarding whether the Con Ed's ecological monitoring program will provide answers to questions on long-term adverse effects from plant operation. The HRFA feels that no ecological monitoring program will provide solutions to the potential long-term damage to aquatic biota of the Hudson River without changing the present once-through cooling system.

13. The subject of reduction of dissolved oxygen (D.O.) was also of concern. The staff is requiring Con Ed to use an aeration system at the discharge outfall to compensate for low D.O.

14. Both parties expressed concern on the subject of toxic effects of chlorine. The Intervenors were told that the Technical Specifications would spell out limitations of all effluent releases.

15. The Intervenors questioned the environmental costs and acceptable impact limits. The applicant would be limited through the Technical Specifications on effluent releases and surveillance requirements. The Intervenors had several comments on the Cost-Benefit Chapter in the DES.

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AGENDA

INDIAN POINT

DISCUSSION MEETING BETWEEN INTERVENORS AND ORNL AND AEC STAFF --- MAY 11, 1972

1. Introduction of Subject
2. Entrainment
3. Impingement
4. Effects on Populations and Compensatory Mechanisms

   Density dependence and age of fish
   Natural mortality
   Population size
   Growth effects
   Mortality effects
   Food competition
   Carrying capacity

5. Reduction of Dissolved Oxygen
6. Toxic Effects of Residual Chlorine
7. Thermal Block
8. Hatcheries
9. Environmental Costs and Acceptable Limits
10. Other items

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Population Safety Factor Analysis - - Hudson Striped Bass

Present Recruitment Population[1/]	1.4×10^6
Twenty - Year Maximum Recruitment Population[2/]	3.5×10^6

Escape Population to Produce Maximum Recruitment Population:

1) With a safety factor (larvae/recruit ratio) of 10	35.0×10^6
2) With a safety factor (1/c ratio) of 7	24.5×10^6

1/ Average Hudson population at 1.0 years of age; from Clark April 5th testimony.

2/ From Chesapeake Bay Data Analysis (Hollis): Maximum population in 16 years = 2.5 x average population.

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